Agro-Climatic Resilience in Semi-Arid Landscapes (ACReSAL) Project
Federal Capital Territory Project Management Unit (FCT PMU)

FINAL REPORT

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)
FOR

GULLY EROSION CONTROL PROJECT
IN GWAGWALADA AND ZUBA
FEDERAL CAPITAL TERRITORY,
ABUJA, NIGERIA

MARCH 2026

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LIST OF ACRONYMS

Acronym	Meaning
ACReSAL	Agro Climatic Resilience in Semi Arid Landscapes
ARAP	Abbreviated Resettlement Action Plan
AEPB	Abuja Environmental Protection Board
AGIS	Abuja Geographic Information Systems
BEME	Bill of Engineering Measurement and Evaluation
BMP	Best Management Practices
CBO	Community Based Organization
CESMP	Contractor Environmental and Social Management Plan
CGRC	Community Grievance Redress Committee
CHMP	Cultural Heritage Management Plan
CIP	Community Involvement Program
CMP	Chemical Management Plan
DDC	Department of Development Control (FCTA)
DRC	Department of Resettlement & Compensation (FCTA)
E&S	Environmental and Social
EIA	Environmental Impact Assessment
ERIP	Emergency Response and Incident Plan
ESIA	Environmental and Social Impact Assessment
ESHS	Environmental, Social, Health and Safety
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESMMP	Environmental and Social Management and Monitoring Plan
ESO	Environmental Safeguards Officer
FCDA	Federal Capital Development Authority
FCT ACReSAL	FCT Agro Climatic Resilience in Semi Arid Landscapes (SPMU)
FCTA	Federal Capital Territory Administration
FCTWB	FCT Water Board
FEMA	FCT Emergency Management Agency
FBO	Faith Based Organization
FEPA	Federal Environmental Protection Agency
FGD	Focus Group Discussion
FGN	Federal Government of Nigeria
FMAFS	Federal Ministry of Agriculture and Food Security
FMEnv	Federal Ministry of Environment
FMWRS	Federal Ministry of Water Resources and Sanitation
FoNGO	Focal Non Governmental Organization
FPMU	Federal Project Management Unit
GBV	Gender Based Violence
GEF	Global Environment Facility

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GIIP	Good International Industry Practice
GIS	Geographic Information System
GRASS	Gully Rapid Action and Slope Stabilization
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
GRRM	Grievance Redress and Referral Mechanism
GPS	Global Positioning System
HSE	Health, Safety, and Environment
IDF	International Development Fund
ISDS	Integrated Safeguards Data Sheet
IUCN	International Union for Conservation of Nature
LGA	Local Government Area (Area Council in FCT)
MEnv	Ministry of Environment
NA	Not Available
NEMA	National Emergency Management Agency
NESREA	National Environmental Standards and Regulations Enforcement Agency
NGO	Non Governmental Organization
NIS	Nigeria Industrial Standard
NPE	National Policy on the Environment
NRO	Natural Resources Officer
OSHA	Occupational Safety and Health Administration
PAD	Project Appraisal Document
PAH	Project Affected Household
PAP	Project Affected Person
PC	Project Coordinator
PCC	Project Complaints Committee
PE	Project Engineer
PRS	Poverty Reduction Strategy
RAP	Resettlement Action Plan
SCCF	Special Climate Change Fund
SEA	Sexual Exploitation and Abuse
SEA/SH	Sexual Exploitation and Abuse/Sexual Harassment
SLO	Social and Livelihood Officer
SPMU	State (FCT) Project Management Unit
STDD	Satellite Towns Development Department (FCTA)
STDs	Sexually Transmitted Diseases
ToR	Terms of Reference
UN	United Nations
VIO	Vehicle Inspection Office
WB	World Bank
WHO	World Health Organization
WMP	Waste Management Plan

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EXECUTIVE SUMMARY

ES-1: Project Background

The Government of Nigeria, with financing support from the World Bank (WB) and the Federal Government of Nigeria (FGN), is implementing the Agro-Climatic Resilience in Semi-Arid Landscapes (ACReSAL) Project. The initiative addresses pressing challenges of desertification control and integrated landscape management across Northern Nigeria.

The Project Development Objective (PDO) is to increase the adoption of climate-resilient landscape management practices in targeted watersheds and to strengthen Nigeria's long-term framework for integrated climate-resilient landscape management. The project covers nineteen (19) States and the Federal Capital Territory (FCT), spanning the Sahel, Sudan–Guinea Savanna, and Southern Guinea ecological zones. These areas are characterized by dry to semi-arid conditions, low precipitation, and sparse vegetative cover. Through sustainable natural resource management, ACReSAL seeks to reduce climate risks, curb land degradation, and enhance community resilience.

Project Components

ACReSAL is structured around four components:

Component A: Dryland Management

- A1: Strategic Watershed Planning
- A2: Landscape Infrastructure
- A3: Special Ecosystems

Component B: Community Climate Resilience

- B1: Community Strengthening
- B2: Community Investments

Component C: Institutional Strengthening and Project Management

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- C1: Institutional & Policy Strengthening
- C2: Project Management

Component D: Contingency Emergency Response (CERC)

- Rapid deployment of uncommitted funds to eligible crises

At the federal level, the Federal Ministry of Environment (FMEnv) leads implementation in collaboration with relevant Ministries, Departments, and Agencies (MDAs), including those responsible for Planning/Economy, Agriculture, Environment, Water Resources and Sanitation, Finance, Works/Transport/Power, Emergency Management, and Climate/Hydrology/Basin authorities. In the FCT, implementation is coordinated by the FCT-ACReSAL State Project Management Unit (SPMU) under the Federal Capital Territory Administration (FCTA).

FCT Subprojects

Within the FCT, this ESMP supports gully-erosion risk-reduction subprojects in Gwagwalada Area Council and Zuba. These corridors are active erosion systems impacting built-up neighborhoods, access routes, and public utilities. Based on field coordinates:

- Gwagwalada Corridor (A–D): Approx. 2.61 km, with downstream discharge toward the Usuma River.
- Zuba Corridor (A–E): Approx. 3.26 km.

Purpose of the ESMP

The FCT-ACReSAL intervention aims to remediate and rehabilitate the Gwagwalada/Zuba gully systems to reduce flood impacts and restore degraded landscapes. This Environmental and Social Management Plan (ESMP) establishes clear, documented actions and guidelines for all stakeholders—including contractors, project managers, and government agencies—on integrating environmental and social considerations into the implementation of gully control civil works. The ESMP provides planning-stage mitigation, monitoring, and institutional measures to guide subsequent detailed design,

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procurement, and implementation in line with the World Bank Environmental and Social Framework (ESF) and Good International Industry Practice (GIIP).

ES-2: Project Location

The Federal Capital Territory (FCT), Abuja, situated in Nigeria's North-Central geopolitical zone, is increasingly vulnerable to severe flooding and erosion. Within the Territory, Gwagwalada and Zuba have been identified as major gully-affected locations requiring urgent intervention under the ACReSAL Project.

Gwagwalada Project Area

This corridor represents a critical erosion system threatening residential areas, access routes, and public utilities.

- **Coordinates:** Latitude 8°55′49.4″ N, Longitude 7°03′36″ E
- **Location Context:** Situated along Old Kutunku Road, approximately 3 m from the Aguma of Gwagwalada's palace.
- **Extent:** The gully stretches about 2,024.52 m downstream to the Gurara River, with an average width of 15.33 m.
- **Administrative Coverage:**
  - Upstream section: Quarters Ward
  - Downstream section: Gwagwalada Central

Zuba Project Area

This gully poses significant risks to community infrastructure, livelihoods, and safety, underscoring the need for targeted remediation and rehabilitation measures.

- **Coordinates**: Latitude 9°05′43.5″ N, Longitude 7°12′46.2″ E
- **Location** Context: Approximately 31 km from central Abuja, traversing a densely built-up community on steep slopes.
- **Drivers**: Stormwater concentration from the Madalla hillside exacerbates erosion.

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- **Extent**: The gully measures about 3.26 km in length, with an average width of 9.28 m.
- **Proximity** to Facilities: A church and a privately owned secondary school are located within 2 m of the corridor.
- **Administrative** Coverage: Lies within Zuba Ward.

ES-3: Description of Proposed Intervention

The proposed intervention within the Gwagwalada and Zuba corridors is designed to control active gully erosion, improve stormwater conveyance, and protect surrounding infrastructure and livelihoods in high-density urban settings. The project integrates structural and bio-engineering measures, all aligned with the approved design drawings. The works will stabilize gully heads and side slopes, prevent further expansion, improve hydraulic efficiency, and restore ecological function along the affected corridors.

Structural Measures

Structural interventions, as defined in the design drawings, include:

- Reinforced-concrete (RC) rectangular channel linings sized to accommodate peak flows.
- Hydraulic drops and stilling basins at critical gradients.
- Gabion-lined and riprap-protected sections in erosion-prone areas.
- Energy-dissipation outlets to reduce flow velocity.
- Retaining walls at constrained locations to safeguard nearby assets.
- Cross-drainage structures (box culverts, chutes, vertical drops) constructed or upgraded at specific chainages, particularly where gullies intersect major access roads.

All structural elements—including channel widths, depths, drop structures, and terminal outfall specifications—will strictly follow the design drawings.

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Bio-Engineering Measures

Bank stabilization and erosion control will incorporate vegetation planting along shallower and upper banks after civil works. Selected species include:

1. Vetiver grass (Chrysopogon zizanioides)
2. Gamba grass (Andropogon gayanus)
3. Napier grass (Pennisetum purpureum)
4. Neem (Azadirachta indica)
5. Acacia species (Acacia nilotica, Acacia senegal)

These species are locally available, widely used under ACReSAL and earlier NEWMAP projects, and well-adapted to the Northern Guinea Savanna zone. Planting zones and setbacks will follow bio-engineering specifications in the design drawings.

Implementation Phases

The intervention will be executed in four phases:

1. Pre-Construction (≈3 months)

6. Final site demarcation and survey confirmation.
7. Securing land access and implementing compensation measures under ESS5.
8. Relocation of utilities and establishment of temporary drainage controls.
9. Mobilization of equipment, stakeholder engagement, and worker ESHS induction.

2. Construction & Bio-Engineering (≈12 months)

10. Earthworks along defined gully corridors.
11. Casting of RC channels, installation of hydraulic drops, stilling basins, retaining walls, gabion/riprap support, and culvert upgrades.
12. Bio-stabilization of banks with grasses and trees.

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13. Reinstatement of urban interfaces (roads, footpaths, property boundaries).

3. Demobilization & commissioning (≈3 months)

14. Removal of temporary works and reinstatement of haul routes.

15. Topsoil dressing, final planting, and preparation of as-built documentation.

16. Training of local maintenance teams and formal handover.

4. Operation & Maintenance (continuous)

17. Routine desilting of culverts and channels.

18. Vegetation trimming and replanting.

19. Pre-rainy season inspection of structural components.

20. Community monitoring and engagement.

Workforce Requirements

21. Pre-construction: ~30–40 personnel.

22. Peak construction: ~180–220 personnel (engineers, contractors, artisans, laborers, safety officers, stabilization teams).

23. Demobilization/restoration: ~60–80 personnel.

24. Post-construction maintenance: smaller teams under Area Council/community supervision.

Waste Management

Waste streams will include:

25. Excavated spoil (reused for backfilling or disposed at approved sites).

26. Concrete wash-out and formwork waste (hardened and handled appropriately).

27. Steel off-cuts and packaging waste (recycled or properly disposed).

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28. Vegetative waste (mulched or safely disposed).

29. Domestic waste from workers.

30. Desilted sediments (dewatered, tested, reused or disposed in compliance with ESS3).

Pollution prevention measures will include dust suppression, spill prevention, and controlled disposal.

Right-of-Way (RoW) Requirements

- Operational clearance: ~2.0 m (1.0 m each side) for access, inspection, and maintenance.
- Main Gwagwalada gully (MG): Channel widths from 5.5 m to 12.0 m, widening to 14–19 m near the terminal outfall.
- Finger gullies (FG1–FG3): Widths between 3.0 m and 4.0 m.
- Total designed lengths: ~2.72 km (main gully) and ~1.04 km (finger gullies).
- Estimated land take: ~3.7 hectares, including working space and localized widening.

Final land demarcation will be confirmed on-site prior to civil works.

Applicable Environmental and Social Standards

The following World Bank Environmental and Social Standards (ESS) are triggered:

- ESS1: Assessment and Management of Environmental & Social Risks
- ESS2: Labor and Working Conditions
- ESS3: Resource Efficiency and Pollution Prevention
- ESS4: Community Health and Safety
- ESS5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement
- ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

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- ESS8: Cultural Heritage (including chance find procedures)

A Resettlement Action Plan (RAP) will be prepared and implemented prior to construction to address land acquisition, physical displacement, or economic disruption.

ES-04: Rationale for ACReSAL Intervention

The Gwagwalada and Zuba communities in the Federal Capital Territory (FCT) experience recurrent flooding each year due to heavy rainfall and deteriorating drainage corridors caused by soil erosion and gullying. The project sites comprise active gullies running close to residential buildings and fences along the corridors. These channels continue to expand in depth and width, posing significant threats to human lives, properties, and the environment.

As the gullies encounter obstacles, stormwater flows meander, eroding banks, creating deeper channels, and expanding laterally. At locations where water stagnates and ponds form—particularly during the dry season—conditions become breeding grounds for mosquitoes and other water-borne vectors, thereby increasing health risks for community members. Beyond physical impacts, psychosocial issues arise from restricted movement, safety concerns, and reduced accessibility. Deep gullies sometimes serve as hideouts for illegal activities, further undermining community security.

The intervention is therefore essential not only to protect lives, property, and the environment but also to improve livelihoods and restore community confidence in government. In response, the Federal Capital Territory Administration (FCTA), through the FCT ACReSAL State Project Management Unit (SPMU), has prioritized the rehabilitation and redevelopment of drainage and gully systems under the ACReSAL framework.

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ES-05: Rationale for the ESMP

The World Bank safeguard requirements are designed to ensure that projects financed are environmentally and socially sustainable, while improving the decision-making process associated with project implementation.

The Gwagwalada and Zuba subprojects involve remedial structural and non-structural interventions, including civil and earth works, complemented by vegetative/bio-engineering measures. These interventions aim to prevent further flooding, soil erosion, and land degradation, while enhancing aesthetics along the gully corridors. Such activities inevitably generate environmental and social impacts that must be carefully managed to avoid unreasonable degradation of the environment or disruption of socio-economic life.

In compliance with the World Bank Environmental and Social Framework (ESF) and the Environmental Impact Assessment (EIA) Act Cap E12 LFN 2004, which mandates environmental assessment for major developmental projects, this Environmental and Social Management Plan (ESMP) serves as the safeguard instrument for the Gwagwalada and Zuba interventions.

The ESMP documents:

- Potential environmental and social impacts.
- Required mitigation, monitoring, and institutional actions to reduce adverse effects to acceptable levels.
- Measures aligned with the phases of intervention: pre-construction, construction, and operation & maintenance (O&M).

ES-06: Legal and Administrative Framework

This ESMP is guided by the World Bank safeguard requirements and relevant national and FCT regulations, guidelines, conventions, and good international industry practices applicable to the ACReSAL Project.

Applicable World Bank Environmental and Social Standards (ESSs)

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- ESS1: Assessment and Management of Environmental and Social Risks and Impacts
- ESS2: Labour and Working Conditions
- ESS3: Resource Efficiency and Pollution Prevention and Management
- ESS4: Community Health and Safety
- ESS5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement
- ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- ESS8: Cultural Heritage
- ESS10: Stakeholder Engagement and Information Disclosure

Nigerian Regulatory Framework

Key national instruments include:

- National Policy on the Environment (NPE)
- Environmental Impact Assessment (EIA) Act Cap E12 LFN 2004
- National Guidelines and Standards for Environmental Pollution Control in Nigeria (1991)
- NESREA (Establishment) Act 2007 and associated regulations
- National Waste Management Policy
- Land Use Act 1978 (as modified 1990)

Federal oversight is provided by the Federal Ministry of Environment (FMEnv) and the National Environmental Standards and Regulations Enforcement Agency (NESREA).

FCT Administrative Framework

Relevant agencies and instruments within the FCT include:

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- Abuja Environmental Protection Board (AEPB): Environmental sanitation and waste services.
- Satellite Towns Development Department (STDD): Planning and development of satellite towns.
- Development Control/Resettlement and Compensation (DDC/DRC): Land use, resettlement, and compensation.
- Federal Emergency Management Agency (FEMA): Emergency preparedness and response.

ES-07: Existing Safeguard Instruments

The implementation of subprojects under ACReSAL is guided by two key safeguard instruments prepared for the Project:

1. Environmental and Social Management Framework (ESMF)
2. Resettlement Policy Framework (RPF)

The ESMF establishes that ACReSAL is classified by the World Bank as a Category A Project, given the potentially sensitive, diverse, and wide-ranging environmental and social impacts that may extend beyond the immediate project environment and, in some cases, may be irreversible.

In line with the ESMF, each subproject is subjected to site-specific screening to determine its individual environmental and social risk category (A, B, or C) based on its scale, location, and anticipated impacts.

For the Gwagwalada and Zuba subprojects, screening confirmed that the level of construction activity and associated disturbance within the defined corridors warrants preparation of a site-specific Environmental and Social Management Plan (ESMP).

This ESMP therefore provides:

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- Mitigation measures to address identified risks.
- Monitoring mechanisms to ensure compliance.
- Institutional arrangements to guide implementation.

All measures are consistent with the provisions of both the ESMF and the RPF, ensuring that environmental and social considerations are fully integrated into project planning and execution.

ES-08: Biophysical Environment

I. Climate and Hydrology

The Federal Capital Territory (FCT), Abuja lies within the Guinea Savanna belt of North-Central Nigeria on gently undulating terrain. The climate is tropical savanna with two distinct seasons:

- Wet season: April–October, peaking in August.
- Dry season: November–March, influenced by harmattan winds.

Temperatures are uniformly high, and the project corridors experience pronounced wet–dry contrasts that drive seasonal runoff and channel incision. The Gwagwalada–Zuba gullies drain toward the Gurara River system. Intense, short-duration storms produce high-velocity overland flow, rapid concentration in streets and drains, and flash flooding that exacerbates bank erosion and sediment delivery to receiving channels.

II. Vegetation

Vegetation surveys within and around the Gwagwalada and Zuba corridors characterized health, composition, diversity, and economic value. The subproject areas are urban/peri-urban savanna mosaics with fragmented natural cover, scattered shrubs/trees, and riparian strips along drainage lines. Land-use pressures from settlement, markets, and transport

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have simplified habitat structure. Vegetation on gully banks is frequently disturbed, though patches of herbaceous grasses suitable for bio-stabilization (e.g., vetiver) were identified at select reaches

III Air Quality

Air quality monitoring was conducted at: Gwagwalada (4 locations), Zuba (5 locations) Monitoring stations were deployed at representative receptor locations, including markets, schools/clinics, residential areas, and background sites.

At the Gwagwalada gully site, air quality is primarily compromised by significant particulate and sulphur dioxide levels, whereas standard combustion gases remain within safe or negligible ranges.

Significant Exceedances & Concerns

1. Sulphur Dioxide (): Levels ranged from to ppm, drastically exceeding the FEPA reference value of ppm. This is likely due to diesel machinery and traffic.
2. Suspended Particulate Matter (SPM): At Points C and D, concentrations reached –, surpassing the FEPA limit of .
3. Fine Particulates (): Ranging from to , these levels exceeded the WHO 24-hour guideline of at every single monitoring point.
4. Coarse Particulates (): Levels reached up to , hitting the ceiling of the WHO safety limit, particularly near unpaved roads and active work zones.

Stable & Within-Limit Values

1. Nitrogen Oxides (): Measured between and ppm, staying largely within or at the ppm benchmark.

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2. Carbon Dioxide (): Concentrations of – ppm are well within the normal outdoor background range of – ppm.
3. Carbon Monoxide (): Levels were nearly non-existent at – ppm, indicating a lack of significant incomplete combustion at the time of the study.

At the Zuba gully site, air quality monitoring indicates that particulate matter and sulphur dioxide are the primary pollutants of concern, while most other gases remain within safe thresholds.

Significant Exceedances & Concerns

1. Particulate Matter (): Recorded at 27–70 µg/m³, frequently exceeding the WHO limit of 45 µg/m³.
2. Fine Particulates (): Measured at 24–36 µg/m³, which is consistently higher than the WHO 24-hour guideline of 15 µg/m³.
3. Suspended Particulate Matter (SPM): At certain points (D–E), levels reached 265–278 µg/m³, surpassing the FEPA screening level of 250 µg/m³ due to construction and soil exposure.
4. Sulphur Dioxide (): Ranged from 0.05 to 0.07 ppm, notably higher than the WHO reference of 0.01 ppm, likely due to diesel-powered machinery.

Stable & Within-Limit Values

1. Nitrogen Oxides (): Stayed within limits at 0.40–0.48 ppm (Benchmark: 0.5 ppm).
2. Carbon Dioxide (): Normal background levels of 411–420 ppm.
3. TVOCs & Formaldehyde (): Both remained very low (0.012–0.015 mg/m³ and 0.005–0.006 mg/m³ respectively), indicating minimal solvent or chemical emissions.
4. Carbon Monoxide (): Negligible presence at 0.00–0.01 ppm.

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III. Surface Water Quality

Surface water sampling was conducted at (Zuba - 5 locations) and (Gwagwalada - 4 locations). Parameters assessed included physical (temperature, turbidity), chemical (pH, dissolved oxygen, conductivity, major ions), and biological indicators (e.g., algae/phytoplankton). Short-term turbidity pulses following storms are characteristic of the catchment and will be managed through construction-phase controls.

Results were compared against NIS National Water Quality Standards (e.g., pH 6.5–8.5, turbidity ≤ 10 NTU, BOD_5 ≤ 6 mg/L, nitrate ≤ 50 mg/L) and were within acceptable limits at the time of sampling.

Water chemistry analysis at both the Gwagwalada and Zuba sites reveals significant contamination issues, particularly regarding heavy metals, turbidity, and microbial presence, despite acceptable pH and salinity levels.

Gwagwalada Site (Locations A–D)

The water here is struggling with low oxygen and high metal toxicity.

1. **Heavy Metal Risks:** Lead () at locations A and D (– mg/L) and Cadmium () at all points (– mg/L) significantly exceed safety limits.
2. **Oxygen & Organic Loading:** Dissolved Oxygen () is critically low (– mg/L), likely due to organic loading (up to mg/L) and stagnant water.
3. **Physical Properties:** pH is neutral and TDS is safe (mg/L), but **Turbidity** is double to quadruple the recommended NTU limit due to erosion.
4. **Contamination:** Total coliforms (– CFU) confirm the water is unsafe for consumption.

Zuba Site (Locations A–E)

Zuba shows similar metallic "red flags" but with even higher turbidity and downstream mineralization.

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1. **Heavy Metal Risks:** Lead () levels are dangerously high (– mg/L), and Cadmium () remains well above limits. Arsenic () also marginally exceeds limits at Points A and B.
2. **Turbidity Spike:** Turbidity reached as high as **NTU** (Location C), indicating severe bank disturbance and sediment runoff.
3. **Mineralization:** TDS and Conductivity () increase downstream, signaling a buildup of dissolved solids along the corridor.
4. **Contamination:** Significant faecal/microbial risk at Points D and E (– CFU).

IV. Baseline Soil Conditions

Soil quality assessments emphasized properties affecting erodibility and bank stability. The corridors exhibit lateritic profiles with silty clay to sandy clay horizons on gully walls and beds. Analytical indicators of soil quality were not within relevant regulatory thresholds at baseline.

The soil profiles at the Gwagwalada and Zuba sites are characterized by a **weakly structured, non-cohesive composition** that makes them highly susceptible to hydraulic failure. With a -factor rating of –, these soils are officially classified as **"Highly Erodible."**

Soil Horizon Breakdown

1. **Horizon A (– cm): Surface Stripping Zone**
    - **Composition:** Loose sandy loam/silt (sand).
    - **Vulnerability:** Lacks organic matter (), meaning there is no "glue" to hold the soil together. It is easily washed away by rain and surface runoff.
2. **Horizon B (– cm): Undercutting Zone**
    - **Composition:** Non-plastic silty sands and saprolite.

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- **Vulnerability:** This layer is granular and highly porous but lacks cohesion. Water scours the base (the "toe") of the slope, creating hollows that lead to the collapse of the layers above.
- The combination of surface stripping in Horizon A and base undercutting in Horizon B confirms that the gully cannot stabilize naturally. This technical data justifies the **Environmental and Social Management Plan (ESMP)**

ES-09: Socioeconomic Characteristics

I. Population

The Gwagwalada Area Council (including Zuba) is predominantly urban/peri-urban, with dense residential clusters, markets, institutions, and transport services. Households are composed largely of civil servants, traders, artisans, transport operators, and small business owners. A socioeconomic survey conducted between August–October 2025 revealed a male/female distribution of 51%/49%, consistent with urban FCT patterns. The project spans two wards in Gwagwalada (Quarters and Gwagwalada Central) and one ward in Zuba (Zuba Ward).

Sociocultural Context The project area reflects FCT's diversity:

- **Ethnic groups**: Gbagyi, Hausa-Fulani, and other Nigerian groups.
- **Languages:** Hausa and English dominate commerce and administration, while Gbagyi is widely spoken locally.
- **Religion:** Residents practice predominantly Islam and Christianity, with places of worship for both faiths present within the communities.

II. Land Use System

Land tenure systems include individual holdings, family holdings and communal holdings. These operate alongside statutory titles administered through FCTA/AGIS. Urban land is

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largely built-up (residential, markets, small industries, institutions), with pockets of peri-urban agriculture along drainage corridors and fringes. Family lands are commonly inherited, while communal lands are allocated for development under STDD/DDC controls.

III. Gender, Age and Household Size of Respondents

- **Age structure:** Youth-skewed, with a high share ≤21 years, a substantial 22–45 years working-age group, and a smaller elderly cohort.
- **Household size:** Ranges from 1–10 persons, averaging ~6 persons per household.

IV. Literacy and Employment

Literacy is moderate to high in urban clusters, supported by schools and tertiary institutions. However, education gaps persist among low-income and migrant groups. Under-/unemployment is notable among youths and low-skill workers, representing a potential social risk if unaddressed during construction (e.g., labor influx management, local hiring, livelihood support).

V. Solid Waste Management

Indiscriminate dumping at informal points obstructs stormwater drains, aggravating flood risks. Common morbidities include malaria, typhoid, diarrheal diseases, respiratory infections, and skin conditions, linked to poor drainage, vector breeding, and hygiene gaps. Health-care access varies, with reliance on medicine shops and primary facilities. Potable water supply is mixed: FCT Water Board reticulation is supplemented by boreholes and vendor supply. Grid power is intermittent. Strengthening AEPB-aligned waste services drain maintenance, and hygiene promotion is essential to reduce public-health risks during and after works.

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ES-10: Public Consultations and Concerns

Consultation Approach

Stakeholder and public consultations adopted a qualitative–quantitative mixed method, enabling broad interaction with the general public and stakeholder groups in the subproject areas. Five broad stakeholder categories were identified based on degree of effect or involvement:

1. Project-affected persons (PAPs) and adjoining households/businesses.
2. Community/traditional leaders and ward committees.
3. Market/transport unions and youth/women groups.
4. Service MDAs (FCTA departments, schools, clinics).
5. Civil society organizations (CSOs)/community-based organizations (CBOs).

Individual PAPs were engaged during ESMP preparation. Local consultative fora served as community voices to ensure PAPs' rights and interests are considered throughout the project cycle.

Key Issues and Concerns Raised

During consultations, stakeholders highlighted the following environmental and social concerns:

- Community safety: Apprehension over worsening floods and risks to homes and lives ahead of the rainy season.
- Property and livelihood losses: Damage to household assets, small livestock, and increased public-health risks (typhoid, cholera/diarrhea, malaria) from stagnant water.
- Access and mobility: Loss of roadways/footpaths and temporary disruption of business and transport during construction works.

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- Displacement risks: Potential physical or economic displacement of vulnerable persons in constrained corridor sections.

Mitigation Measures

These concerns were addressed during consultations, with specific mitigation measures integrated into the ESMP impact-mitigation matrix, including:

- Traffic management and provision of safe crossings.
- Drainage desilting and waste control.
- Staged works with advance notice to communities.
- Public-health awareness campaigns, including GBV prevention.
- Compensation and assistance where required.
- Functional grievance redress mechanisms (GRM/GRRM).

ES-11: Summary of Positive Impacts of the Project

This project will effectively:

- Develop new stormwater drainage systems for Gwagwalada and Zuba, including reconstruction/upgrade of ineffective corridors.
- Control perennial flooding in the communities and improve traffic flow in and out of the affected areas.
- Enable return of persons displaced by flooding to safer, serviced settlements.
- Reduce transport costs and travel-time delays.
- Improve livelihoods through increased enterprise activity and lower logistics costs.
- Enhance the landscape/vista of the project corridors and adjoining neighborhoods.
- Provide temporary job opportunities for both skilled and unskilled labor during construction.
- Increase property values within and around the improved corridors.

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ES-12: Summary of Potential Adverse Impacts and Mitigation Measures

The measures designed to mitigate the identified significant adverse impacts are included in the table below:

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Environmental and Social Issues	Anticipated Risk/Impact	Mitigation Measures
Air Quality	Increase in dust generation and spread of dust	▪ Regular damping of unpaved roads or exposed soils/ground to control dust/particulate matter particularly during the dry season. ▪ Locate material stockpile areas as far as practicable away from sensitive receptors.
	Increase in emission of air pollutants from vehicles, plants and equipment, machinery	▪ Ensure vehicles/machines are switched off when not in use. ▪ Ensure only vehicles required to undertake work are operated on-site. ▪ Ensure all construction vehicles, plants and machinery are well maintained and in full operating condition
Waste Management	Oil and other potential contaminants are not properly collected, managed and/or disposed	▪ Proper storage, transport and disposal of hazardous waste (oily waste, used batteries, fuel drums) in the designated landfill sites by the national authorities
	Demolition and Construction waste and solid waste generated are not properly managed or disposed Waste resulting from packaging materials	▪ Operate a waste management strategy based on principles of reduction, recovery, recycle and reuse ▪ Ensure use of PPE by staff when handling all forms of waste ▪ Recyclable waste (including oil and some construction waste) collected separately and disposed of correctly and/or approved facility as per the EPA requirements ▪ Dispose of solid waste in the most environmentally sound manner possible in the designated landfill sites by the national authorities.
Noise and Vibration	Public nuisance caused by construction/operation activities	▪ Minimize site-generated noise to the greatest possible extent especially around schools, health care centers etc ▪ All equipment should be maintained as per the manufacturers' recommendations and operated as per original specifications. ▪ Install noise reduction devices such as silencers and mufflers as appropriate to mobile plants and equipment.

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		▪ Limit construction activities to daylight hours. Schedule noisy construction activities during specific times in the day especially near the sensitive receptors. ▪ Identify and avoid subjecting the adjacent highly sensitive receptors to vibrations ▪ Ensure that residents and road users are given advance notice on timing and scale of civil works, as well as details of the GRM in the event of complaints.
Localized Flooding	Inadequate or poorly designed diversions and bypasses during slope lining construction may disrupt water flow, cause localized flooding, and pose safety hazards to the community and project workers, including the potential risk of drowning.	▪ The contractor shall ensure that adequately sized and properly engineered diversions are provided to maintain the natural flow of watercourses throughout construction. ▪ The diversion channels must remain functional and actively managed at all times during construction. ▪ Adequate planning, supervision, and maintenance shall be undertaken to prevent flooding or erosion due to improper diversion or blockage.
Flora and Fauna	The possible introduction of new flora and weed species	▪ Ensure that any manure or soil applied are free of seeds, and that the seeds used for the catchment rehabilitation are weed free
	destruction or disturbance of flora and fauna and their habitat	▪ Avoid unnecessary clearance of vegetation and indiscriminate destruction of habitats.
Land Degradation	Blockages of drains and waterways due to construction activities	▪ Proper stockpiling of construction materials, spoils (on flat areas and away from drainage routes
	Erosion and sedimentation caused by construction works	▪ Silt fences grassed buffer strips and bioengineering measures to be installed to reduce water velocity. ▪ Avoid long exposure of opened excavated/cut areas
Social Management	Lack of Stakeholders Engagement	▪ Conduct stakeholder engagement in line with the project Stakeholders Engagement Plan (SEP).

	Limited participation and involvement of women, youth, people with disabilities (PWD) and other vulnerable people	▪ Apply the requirements of project Gender Action Plan (GAP)
	Involuntary resettlement, relocation or households or associated impacts	▪ Screening of sub-project using the WB E&S Screening Form and ensure that the sub-project does not result in significant involuntary resettlement or associated impacts.
	Lack of employment opportunities for residents due to the influx of migrant workers	▪ Ensure that the contractor hires local workers (especially unskilled workers) from the host community
	The exclusion of women, youths and other vulnerable people from project activities	▪ Gender and Action Plan developed and implemented ▪ Compliance with the GRM
Cultural Heritage	Work activities executed close to Archaeological and/or Cultural Heritage sites	▪ Undertaking screening of sub-project. ▪ Engage the Monument and Relics Commission to identify existing cultural heritage, monuments and artifacts within the communities ▪ Implement work activities in areas that are away from known cultural heritage sites. ▪ Prepare and adopt a Chance-Find Procedure (CFP) in case unknown artifacts are discovered during works
Public safety/ Occupational Health, safety and security	Community Health and safety of road users and community	▪ Training provided for construction workers, adequate signage and warnings to road users to be in place. ▪ Adequate information provided to the host community about the safety measures and emergency protocols ▪ Provide proper signages and cordon off work areas and excavated pits lined with reflective tapes and road sections that are vulnerable ▪ Ensure that workplaces, machinery, equipment and processes are safe without risks to health

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	Occupational Health and Safety	▪ implement the health and safety plan, and will include but not limited to Install reflective signages on all sites (culvert/hydraulic structures/ approach roads, blind spots and along road routes, provide speed breakers, especially on sloppy terrains, Install pedestrian bridges (where applicable) Install warning lights around the construction sites, especially in high-risk zones, Install safety instructions at the entrances (laydown yard/offices etc). ▪ Prepare and adhere to OHS Policy and procedures ▪ Provide construction workers with personal protective equipment ▪ Emergency prevention and preparedness and response arrangements to emergency situations
	Risk of increased SEA/SH and GBV particularly due to the influx of workers	▪ Implementation of GBVAP ▪ Code of Conduct to include SEA/SH and GBV prevention ▪ PMU will request that contractors, suppliers and partners adhere to zero tolerance for SEAH and GBV and commit to taking adequate action if faced with SEAH allegations ▪ Contractual arrangements can be terminated if breaches confirmed
	Given the level of GBV tendencies (Water for Water) within the communities, there is a risk that labour influx might exacerbate GBV concerns	▪ Gender issues to be included in the ESIA/ESMP ▪ Implementation of GAP ▪ Code of Conduct to include SEAH and GBV prevention ▪ PMU will request that contractors, suppliers and partners adhere to zero tolerance for SEAH and GBV and commit to taking adequate action if faced with SEAH allegations.
Risk of flooding and runoff impacts on downstream	• Increased flash flooding in urban areas. •Damage to homes, roads, and infrastructure.	▪ Ensure to control waterflow downstream and avoid alterations of existing flow channels and unnecessary water diversions

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population and communities	• Higher risk of waterborne diseases due to stagnant water. • Economic losses from disrupted businesses and agriculture.	
Water Diversion impacts		▪ Proper water diversion before the demolition of culverts and side drains should be implemented to prevent flooding, erosion, and land degradation in low-lying areas
Failed Borehole	Drilling of dry boreholes	▪ Conduct geohydrological assessment to determine groundwater availability
Traffic and Road Safety	Increased traffic on public roads Use of public roads by project machinery increases the rate of accidents	▪ implement the site-specific traffic management plan ▪ Provide notification about the construction activities to affected communities ▪ Provide adequate alternative arrangements to minimize impacts on motorists and pedestrians ▪ Maintain close liaison with government traffic control agencies. ▪ Undertake regular driving safety awareness campaigns to ensure safe driving.
Exposure to health issues	Poor construction practices	▪ Use dust suppressants to mitigate the dust levels ▪ Use proper hoarding and flash tapes to demarcate dangerous areas such as pits etc. ▪ Recruit local labour to avoid the possible outbreak of communicable diseases resulting from labour influx
Public Utility (water, electricity, telecommunications)	Public infrastructure damage and disruptions of services during excavation	▪ Engagement with the public utilities companies to identify possible locations of their facilities and relocate them out of the working areas

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Labour and working conditions	Poor working conditions and workers' health, work related incidents and injuries	▪ Prepare and implement the OHSMP ▪ Train all staff in emergency preparedness and response. ▪ Keep a First Aid Kit on site and ensure that drinking water is provided. ▪ Personal Protection Equipment (PPEs) is provided to workers
Resource efficiency and pollution prevention	Sourcing of local construction materials	▪ Set up management systems and contingency plans to respond to incidents and accidents with proper documentation in the C-ESMP. ▪ Ensure proper management of hazardous and non-hazardous wastes and materials. ▪ Optimize energy usage, to the extent technically and financially feasible. ▪ Measures to eliminate, substitute, ▪ Adopt measures to reduce construction material use base on good industrial practice as found in the General EHSGs, and in the Industry Sector Guidelines

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ES-13: Analysis of Alternatives

The Gully Erosion Control Project in Gwagwalada and Zuba requires a sustainable solution to protect lives, infrastructure, and livelihoods from escalating erosion risks. An alternatives analysis was conducted to compare technical, environmental, social, economic, and institutional dimensions.

Key Alternatives Considered

1. No Action: Not viable; erosion will worsen, causing asset loss and safety hazards.
2. Grey/Hard Engineering Only: Provides rapid stabilization but risks downstream impacts and high maintenance costs.
3. Nature-Based Solutions Only: Enhances infiltration and biodiversity but insufficient for deep, active gullies.
4. Hybrid Grey–Green Approach: Combines engineered drainage with bioengineering and upstream detention; offers comprehensive risk control and long-term resilience.
5. Upstream Catchment Management: Reduces inflow energy and peak flows; effective when paired with downstream stabilization.
6. Managed Retreat/Relocation: Suitable for extreme-risk segments but socially complex and costly.

Preferred Strategy

- Hybrid Grey–Green Approach integrated with Upstream Catchment Management, and selective Managed Retreat where engineering is infeasible.
- This blend delivers the highest technical effectiveness, climate resilience, and social co-benefits at manageable lifecycle costs.
- It balances immediate stabilization with long-term sustainability, while embedding community participation and institutional accountability.

ES-14: Project Sustainability Consideration

The Gully Erosion Control Project in Gwagwalada and Zuba addresses severe land degradation threatening lives, infrastructure, and livelihoods. This sustainability

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assessment evaluates the project's long-term viability across environmental, social, economic, institutional, and climate dimensions.

Key Findings

- **Environmental Sustainability:** Engineered drainage, slope stabilization, and bioengineering (vetiver, native species) will reduce erosion, protect water quality, and restore ecosystems. Sediment traps and vegetated buffers are critical to maintaining hydrologic integrity.
- **Climate Resilience**: Designs incorporate updated rainfall projections, overflow paths, and nature-based solutions to withstand extreme weather events. Resilient culverts and energy dissipation structures protect critical assets.
- **Social Inclusion:** Community participation in design and monitoring ensures local ownership. Safety features (barriers, signage, lighting) and livelihood-sensitive planning minimize disruption and enhance equity.
- **Economic Viability**: Lifecycle costing over 20 years highlights the need for dedicated O&M budgets. Performance-based maintenance contracts and local green jobs (nurseries, waste management) strengthen financial sustainability.
- **Institutional Capacity:** Clear mandates for FCTA and Area Councils, training for municipal engineers, and community stewardship programs embed accountability and technical sustainability.

Risks and Mitigation

- **Hydraulic underperformance**: To be addressed through robust hydrologic design and routine inspections.
- **Slope failure:** Mitigated by combining structural and bioengineering measures.
- **Solid waste clogging drains:** To be controlled via litter screens, desilting schedules, and community waste campaigns.
- **Funding gaps:** To be prevented by protected O&M budget lines and transparent performance reviews.

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Indicators

Performance shall be tracked through measurable indicators such as drain functionality, slope stability, sediment trap maintenance, community participation rates, and O&M budget execution. Independent verification and geotagged inspections will ensure transparency.

Conclusion

The project is sustainable if implemented with a blend of grey and green infrastructure, strong community engagement, and reliable O&M financing. It will deliver long-term resilience against erosion, safeguard infrastructure, and improve environmental and social outcomes in Gwagwalada and Zuba.

ES-15: Environmental and Social Monitoring and Management Plan

The Environmental and Social Management Plan (ESMP) provides a proactive framework to address anticipated environmental and social risks associated with the Gwagwalada and Zuba subprojects. It ensures compliance with statutory requirements, Nigeria's E&S policies, and the World Bank Environmental and Social Framework (ESF).

Objectives:

- Manage the identified project significant environmental and social risks and impacts due to project interventions,
- Implement, supervise and monitor, the mitigation measures by the responsible parties
- Build capacity and training required to support the implementation and mitigation measures
- Provide cost estimates showing phasing and coordination with overall project implementation plans and
- Improve environmental and social performance of the Project.

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Implementation & Monitoring:

- **Key actors:** Contractor, Supervision Consultant, Project Management Unit (PMU), and relevant government agencies.
- **Contractor's role:** Primary responsibility for mitigation measures, with costs included as a separate line item in the Bill of Quantities (BOQs).
- **Success factors:** Commitment and capacity of PMU, Contractors, and Supervising Consultants.

Budget:

An indicative budget of ₦148,834,018.75 has been allocated to cover:

- Routine E&S duties of the SPMU.
- Capacity building for stakeholders.
- Engagement of Environmental and Social Specialists.
- Due diligence investigations and audits.
- Monitoring and evaluation activities by SPMU and regulatory agencies.

Grievance Mechanism (GM):

A multi-tier grievance redress system is established, beginning at the community level and escalating to the SPMU and higher authorities as needed. Accessible, anonymous channels (comment boxes, phone, WhatsApp, email) will be provided at no cost. The GM is GBV-sensitive, ensuring confidentiality, survivor protection, and referral pathways in line with World Bank ESF guidance.

GBV/SEA Safeguards:

Contractors must prepare and implement a GBV/SEA Management Plan, integrated with the project Gender Action Plan (GAP). Measures include Codes of Conduct, worker induction, toolbox talks, confidential reporting channels, and survivor-centred referral pathways. Community awareness campaigns will be conducted in Gwagwalada and Zuba.

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Training Programmes:

- Workers: Occupational Health & Safety (OHS) and environmental awareness training (induction and refreshers).
- Community: Health, Safety, and Environment (HSE) sensitization for residents, unions, schools, and clinics near project sites.

Contractor's ESMP (C-ESMP):

Contractors must prepare a project-specific C-ESMP covering pre-construction, construction, and demobilization phases. This plan must detail procedures, resources, roles, schedules, and monitoring arrangements. Costs for ESMP management, monitoring, and training must be included in the Bill of Engineering Measurement and Evaluation (BEME). Approval by the SPMU is required prior to mobilization, and compliance will be enforced throughout implementation.

ES-15: Disclosure of the ESMP

In line with World Bank Environmental and Social Framework (ESF) requirements and Nigeria's regulatory provisions, this ESMP is subject to public review and disclosure. The disclosure process ensures transparency, accountability, and stakeholder participation in environmental and social risk management.

Purpose of Disclosure

- Facilitate public access to ESMP information.
- Enable community feedback and stakeholder engagement.
- Strengthen transparency and accountability in project implementation.
- Ensure compliance with World Bank ESF and Nigerian E&S policies.

Public Disclosure Arrangements

The ESMP will be made available for public comment at designated locations within the Federal Capital Territory (FCT) and on the World Bank website. Display centres will include:

- FCT-ACReSAL SPMU Office (Abuja)
- ACReSAL FPMU Office
- Environmental Assessment Department of FMEnv
- Federal Capital Territory Administration (FCTA)
- Abuja Environmental Protection Board (AEPB)
- Ministry of Environment / relevant Secretariat, Department, or Agency
- Area Council Liaison Offices (Gwagwalada Area Council, Zuba District)
- Project Community Notice Boards
- Office of the FCT Administration

CHAPTER 1: INTRODUCTION

1.1 Background

The Government of Nigeria is implementing the Agro-Climatic Resilience in Semi-Arid Landscapes (ACReSAL) Project with financing from the World Bank (WB), the International Development Fund (IDF), and the Federal Government of Nigeria (FGN). The Project is being implemented across nineteen (19) States and the Federal Capital Territory (FCT) within landscapes vulnerable to land degradation and climate stress. In the FCT, interventions are situated within the **Southern Guinea Savanna** ecological belt, which is characterized by a distinct wet–dry seasonality (approximately May–October rains followed by a dry Harmattan period), mean annual rainfall of about **1,100–1,600 mm**, warm temperatures, and a savanna woodland vegetation structure. These biophysical conditions, combined with rapid urbanization and land-use pressure in Area Councils such as Gwagwalada, contribute to increased runoff, erosion, gully formation, and flood hazards, further justifying the need for ACReSAL's erosion control, drainage, and landscape restoration interventions.

Under the ACReSAL Environmental and Social Management Framework (ESMF), the overall program is classified as a **Category A project**, due to the potential for sensitive, diverse, and wide-ranging environmental and social impacts. However, each subproject is further subjected to site-specific screening to determine its E&S risk category in accordance with the World Bank ESF. Following screening and risk assessment conducted by the FCT State Project Management Unit (SPMU), the proposed gully rehabilitation and flood control intervention in Gwagwalada (including Zuba) is classified as a **Category B subproject**, as its potential adverse impacts are localized, site-specific, reversible, and can be mitigated through established measures. Accordingly, a site-specific Environmental and Social Management Plan (ESMP) has been prepared to guide implementation in compliance with the ACReSAL ESMF and relevant World Bank Environmental and Social Standards (ESSs).

1.2 Project Delivery Objective

The Project Development Objective (PDO) is to increase the adoption of sustainable landscape management practices in targeted watersheds in Northern Nigeria and to strengthen Nigeria's long-term framework for integrated climate-resilient landscape management.

Component A: Dryland Management

Implements integrated watershed management planning and addresses large-scale watershed degradation in Northern Nigeria through:

- **A1:** Strategic Watershed Planning
- **A2:** Landscape Infrastructure
- **A3:** Special Ecosystems

Component B: Community Climate Resilience

Addresses dryland management challenges at the local level and supports communities and households in targeted watersheds with investments and approaches to become climate-resilient through:

- **B1: Community Strengthening** – builds community capacity for sustainable natural resource use and management; supports vulnerable and marginalized groups; addresses inequality; and promotes peace-building and ownership.
- **B2: Community Investments** – finances community-level infrastructure and landscape restoration in selected degraded areas; supports households to optimize climate-smart rain-fed agriculture and farmer-led irrigation.

Component C: Institutional Strengthening and Project Management
Improves the enabling institutional and policy foundation for multi-sectoral integrated landscape management and climate resilience and supports project management through:

- **C1:** Institutional & Policy Strengthening
- **C2:** Project Management

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Component D: Contingency Emergency Response (CERC)

A financing mechanism within Investment Project Financing (IPF) operations that enables rapid deployment of uncommitted funds in response to an eligible crisis or emergency.

1.3 FCT Subproject Objective (Gwagwalada, including Zuba)

Within the Southern Guinea Savanna context of the Federal Capital Territory, the specific objective of the FCT subproject is to reduce gully erosion and flood risk and protect people, assets, and critical access in Gwagwalada (including Zuba) by:

1. rehabilitating and stabilizing existing gully corridors and associated stormwater conveyance **as shown in the design drawings**;(FCT ACRESAL PROJECT, Detail Engineering Design Report,p5 May, 2025)
2. restoring vulnerable banks through targeted bio-engineering integrated with compatible structural measures;
3. improving community resilience and livelihoods via safer access, minimized disruption, and local participation in implementation and O&M; and
4. Strengthening institutional capacity for climate-resilient drainage planning, monitoring, and maintenance within the FCT.

Consistent with the ACReSAL ESMF screening process, the FCT subproject has been classified as **Category B**, with site-specific, localized, and reversible impacts to be managed through this ESMP.

1.4 Project Location

The Federal Capital Territory (FCT) lies in North-Central Nigeria. The Federal Capital Territory (FCT) is bounded to the west and northwest by Niger State, to the northeast by Kaduna State, to the east and south by Nasarawa State, and to the southwest by Kogi State. Gwagwalada Area Council (including Zuba) experiences localized gully-erosion and flood risks driven by intense rainfall events, rapid runoff, inadequate drainage capacity, and siltation of natural channels. The proposed subprojects in Gwagwalada and Zuba target priority corridors with documented erosion/flood impacts affecting access routes, markets,

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schools, and residences. This study area (Zuba and Gwagwalada), as shown in Figure 1.1 and Figure 1.2, defines the location and extent of the study area in the Federal Capital Territory (FCT), corresponding Area councils, and sampling points. The study captures the drainage network and watershed catchment areas by applying Advanced Land Observing Satellite (ALOS) Phased Array type L-band Synthetic Aperture Radar (PALSAR) Digital Elevation Model (DEM) having spatial resolution of 12.5 × 12.5 m obtained from the Alaska Satellite Facility (ASF) Distributed Active Archive Center (DAAC) from 2006 to 2011. Data analysis was conducted with ArcMap 10.8 software environment, and hydrological analysis was carried out by using the Arc Hydro toolset to derive catchment and drainage features. The steps involved DEM preprocessing, hydro conditioning, stream network extraction, and defining contributing catchments to gullies.

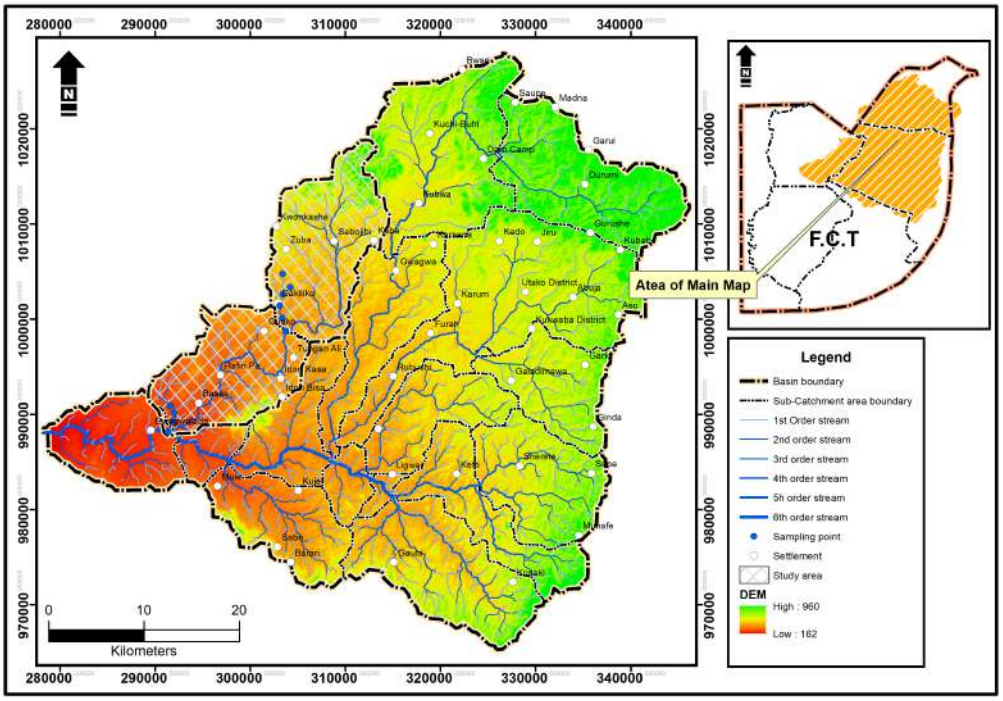


Figure 1.1: Location of Study watershed in the main Basin.

The process went through a series of procedures beginning with importing the DEM data into ArcMap 10.8, followed by the execution of sink filling to remove spurious depressions. Flow direction and flow accumulation grids were generated to map drainage

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routes and contributing areas. Stream definition and watershed delineation were then performed to delineate hydrological structures and catchments.

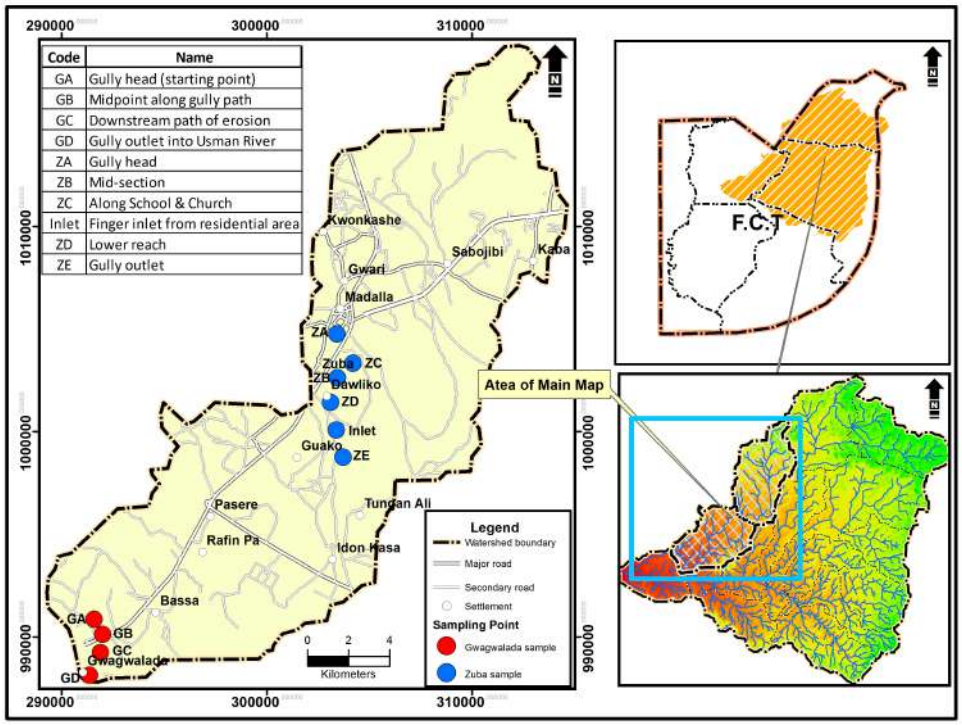


Figure 1.2: Study Area (Gwagwalada and Zuba).Location Map with Sampling Points

1.4 Site Location and General Description

Table 1.1 Gully Area General Characterization

No	Name of site	Location	Intervention type	N (Latitude)	E (Longitude)
1	Zuba erosion site	Zuba, Gwagwalada Area Council	Gully erosion control	9°05'43.5"	7°12'46.2"
2	Gwagwalada gully erosion site	Gwagwalada Area Council	Gully erosion control	8°55'49.4"	7°03'36.0"

1.4.1 Gwagwalada Project Area Description

The Gwagwalada gully and storm-water corridor cuts through densely built urban neighborhoods with significant populations and critical infrastructure. Recurrent high-energy runoff during the rainy season has undermined road pavements, scoured ad-hoc

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drains, and damaged private properties across the contributing catchment. As shown in Plate 1.1, filling stations and residential buildings are directly flanked by the gully with minimal protective setback, and seasonal inundation routinely enters nearby carpentry workshops, disrupting business operations and damaging materials.



Plate 1.1: **Filling stations and residential buildings are directly flanked by the gully.**

Similarly, building were built along Gwagwalada main gully which is an extensive erosion channel with several tributary fingers feeding into it, intensifying runoff concentration and erosion processes creating further risks. Numerous residential buildings are located dangerously close to the gully edge, increasing vulnerability to collapse and displacement. Stormwater from this interconnected gully system ultimately drains into the Usuma River, where it contributes to downstream sedimentation and flood risk as presented in Plate 1.2

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Plate 1.2: Aerial view of the Gwagwalada main gully residential buildings located very close to the edge

1.4.2 Zuba Project Area Description

In Zuba, the active gully corridor threads through a tightly built neighborhood on the downslope of the Madalla hillside, where concentrated stormwater accelerates incision and bank collapse. A place of worship and a privately owned secondary school are situated within approximately 20 metres of the gully edge, exposing congregants and pupils to heightened safety risks during peak rains. The corridor also borders residential plots, small shops, and local access roads, where episodic overflow undermines fences, erodes plot boundaries, and disrupts movement and livelihoods. Some public utilities like electric poles will be required to be moved during constructions.



Plate 1.3: Aerial view of the main gully site of Zuba.

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1.5 Drainage Network and Morphometric Parameter Derivation

Morphometric values were derived from the interpolated DEM to quantify catchment size and shape, stream slope, stream length, and land-surface slope. These values provide information about the hydrological and geomorphological response of the study area (Strahler, 1964; Horton, 1945). The parameters and their respective computational formulas are presented in Table 1.2.

Table 1.2: Study Areas Morphometric Parameters

Morphometric Parameter	Formula	Description
Catchment Area (A)	$A = \Sigma$ (cell area contributing to outlet)	Total surface area contributing flow (km^2)
Catchment Perimeter (P)	$P = \Sigma$ (boundary length of catchment)	Length of the catchment boundary (km)
Form Factor (Ff)	$Ff = A / L^2$	Indicates catchment shape (dimensionless)
Elongation Ratio (Re)	$Re = 1.128 \times (A)^{1/2} / Lb$	Describes shape relative to a circle
Compactness Index (Cc)	$Cc = P / (2 * \sqrt{(\pi * A)})$	
Stream Length (L)	$L = \Sigma$ (length of stream segments)	Total stream length (km)
Stream Slope (Ss)	$Ss = (Hmax - Hmin) / L \times 100$	Average slope along the main stream (%)
Mean Basin Slope (Sb)	$Sb = \Sigma (\tan^{-1} (\Delta H/\Delta L)) / n$	Average surface slope of basin (%)

Source: Author's compilation, 2025

1.5.1 Zuba Gully Erosion Control Site

The erosion site is in Zuba, Gwagwalada Area Council (FCT) at approximately 9°05′43.5″ N, 7°12′46.2″ E. The gully cuts across a densely settled part of Zuba and poses continuing threats to lives and property. Steep local slopes accelerate storm-water flow, stripping topsoil and undermining structures and livelihoods along the corridor. The active gully is about 3.26 Km long and 9.28 m wide. It is fed by storm water descending from the foothills around Madalla, where the soil texture and high porosity enable rapid saturation and overland flow; during intense rainfall, runoff follows multiple undefined paths, exacerbating land degradation. Progressive widening has displaced households and businesses along the alignment. The proposed works include concrete and gabion drainage

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structures to safely convey runoff to downstream channels/watercourses and stabilize the corridor.

1.5.2 Gwagwalada Gully Erosion Site

This site is within Gwagwalada Area Council (FCT), near Old Kutunku Road, approximately 3 m from the Aguma of Gwagwalada's palace. Its location is about 8°55′49.4″ N, 7°03′36.0″ E. The main gully extends roughly 2,024.52 m with an average width of about 15.33 m and ultimately discharges toward the Gurara River. Several tributary "fingers" feed the main channel, accelerating head-cut migration and bank failures and leading to progressive destruction of adjoining properties. The project will construct concrete and gabion drainage structures to intercept and channel runoff away from vulnerable areas and into appropriate receiving waters.

1.6 Project Area Terrain Features

Both corridors (Zuba and Gwagwalada) lie in built-up terrain with short, steep fall lines that concentrate stormwater. The channels are actively eroding, with bank undercutting, head-cut migration, and multiple feeder "fingers" from residential areas. Impervious surfaces, blocked drains, and intense rainfall amplify peak flows and sediment transport, causing damage to roads, drains, and properties and creating seasonal public-health risks (stagnant water, vectors) and access/safety concerns. 3.26 km (Zuba: A to E).

1.6.1 Gwagwalada Site (Old Kutunku Road corridor to Usuma River)

- **Relief & flow:** The surveyed profile shows a **~75.2 ft (≈22.9 m)** drops from the gully head (Point A) to the outlet (Point D), indicating a consistently **downhill gradient** that accelerates runoff and promotes incision.
- **Erosion state:** Active head-cut, widening banks, and tributary fingers joining the main thalweg. Debris and ad-hoc structures locally deflect flow, inducing bank scour and side-channel formation.
- **Setting:** Dense urban frontage with properties, community roads, and places of worship close to the brink; high exposure during the rainy season.

1.6.2 Zuba Site (Zuba town corridor to downstream channel)

- **Relief & flow:** From gully head (A) to outlet (E), the corridor **drops ≈52.0 m**, yielding **steep local slopes** and high unit stream power in storms.
- **Controls:** Steep topography, **porous soils** and **rapid saturation** from the Madalla foothills concentrate overland flow; one residential **finger inlet** augments peak discharge.
- **Erosion state:** Active bank retreat and bed incision along built-up frontages; displacement risk for houses and businesses on the margins.

Table 1.3: Georeferenced survey points for Gwagwalada and Zuba gully corridors/points (latitude, longitude, altitude)

Site	Point	Description	Latitude (N)	Longitude (E)	Altitude (m)	Cumulative Distance (m)
Gwagwalada	A	Gully head (starting point)	08°57.34910′	007°05.19342′	211.6	0
Gwagwalada	B	Midpoint along gully path	08°56.65870′	007°05.05842′	199.3	1,303.1
Gwagwalada	C	Downstream path of erosion	08°56.44986′	007°04.94142′	193.9	1,745.4
Gwagwalada	D	Gully outlet into Usuma River	08°56.91586′	007°04.91640′	188.7	2,610.3
Gwagwalada	—	**Total corridor length (A→D)**				**2,610.3**
Zuba	A	Gully head	09°06.21834′	007°12.60438′	393.9	0
Zuba	B	Mid-section	09°06.13830′	007°12.61770′	389.4	150.3
Zuba	C	Along School & Church	09°05.99568′	007°12.64044′	384.0	417.9
Zuba	Inlet	Finger inlet from residential area	09°05.88780′	007°12.65390′	389.3	842.8

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Zuba	D	Lower reach	09°05.76906′	007°12.60516′	380.5	842.8
Zuba	E	Gully outlet	09°04.46640′	007°12.65490′	341.9	3,258.7
Zuba	—	**Total corridor length (A→E)**				**3,258.7**

1.7 Perimeter of Project Influence

Any buildings/structures, farmlands, economic trees/crops, fences, business frontages, and utilities that fall within the adopted right-of-way (ROW)/setback may be affected during construction or stabilization and must be addressed through appropriate mitigation, access management, and, if triggered, ARAP/RAP procedures.

- **Zuba corridor:** The gully initiates near the residential uplands and traverses built-up Zuba before discharging to the downstream channel (A–B–C–D–E). Settlement density, steep local gradients, and inflows from a finger inlet within residential lanes contribute to high peak discharges. Existing minor drains/culverts and informal channels are hydraulically inadequate, leading to overtopping, bank undercutting, and avulsions during intense storms.
- **Gwagwalada corridor (Old Kutunku Road/Palace vicinity):** The main gully runs through densely occupied frontages and intersects community roads and footpaths before out falling to the Usuma River. Tributary "fingers" and blocked inlets create flow deflection, bank scour, and side-channel formation. Current ad-hoc conveyance and undersized/access-constrained crossings are insufficient for design storms.

1.7.1 Implications for DIA/IIA

- **Direct Impact Area (DIA):** Construction footprint along the mapped alignments (including work fronts, temporary diversions, laydown, stockpile/spoil areas) plus the top-of-bank setback required for safe access and stabilization.
- **Indirect Influence Area (IIA):** Adjacent properties, streets, markets, schools/clinics, places of worship and utilities generally within **100–250 m** of the works, subject to temporary traffic delays, noise/dust, and drainage re-routing during construction.

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- **Sensitive receptors:** School/church cluster (Zuba Point C); residences/shops along Old Kutunku Road; the Aguma of Gwagwalada's palace vicinity; informal pedestrian crossings.
- **Seasonality:** Rainy-season peaks elevate the bank.

1.8 Morphometric Parameter Derivation

Morphometric values were derived from the interpolated DEM to quantify catchment size and shape, stream slope, stream length, and land-surface slope. These values provide information about the hydrological and geomorphological response of the study area (Strahler, 1964; Horton, 1945). The parameters and their respective computational formulas are presented in Table 1.4.

Table 1.4: Morphometric parameters for the study areas

Morphometric Parameter	Formula	Description
Catchment Area (A)	$A = \Sigma$ (cell area contributing to outlet)	Total surface area contributing flow (km^2)
Catchment Perimeter (P)	$P = \Sigma$ (boundary length of catchment)	Length of the catchment boundary (km)
Form Factor (Ff)	$Ff = A / L^2$	Indicates catchment shape (dimensionless)
Elongation Ratio (Re)	$Re = 1.128 \times (A)^{1/2} / Lb$	Describes shape relative to a circle
Compactness Index (Cc)	$Cc = P / (2 * \sqrt{(\pi * A)})$	
Stream Length (L)	$L = \Sigma$ (length of stream segments)	Total stream length (km)
Stream Slope (Ss)	$Ss = (Hmax - Hmin) / L \times 100$	Average slope along the main stream (%)
Mean Basin Slope (Sb)	$Sb = \Sigma (\tan^{-1} (\Delta H/\Delta L)) / n$	Average surface slope of basin (%)

(Source: Author's compilation, 2025).

1.9 Rationale for Gwagwalada/Zuba Intervention

Gwagwalada and Zuba lie within rapidly urbanizing catchments where steep local relief, intense convective rainfall, and increasing impervious cover combine to generate fast, concentrated runoff. Historic drainage paths have been constricted by informal construction, undersized culverts, and silted roadside channels, causing storm flows to overtop banks, cut new alignments, and entrain large sediment loads. Field observations

and community reports indicate progressive head-cutting, lateral bank retreat, toe scour at bends/outfalls, and frequent blockage by refuse, conditions that accelerate channel enlargement and undermine foundations of adjacent properties and fences.

The consequences are multi-dimensional. Physically, recurrent floods degrade road pavements, collapse ad-hoc drains, and sever pedestrian and vehicular access, especially at market corridors and school fronts. Socially, deep, steep-sided gullies fragment neighborhoods, extensive travel times, and elevated injury risk for children and the elderly. Economically, repairs to damaged access routes, loss of trading days, and property devaluation impose recurring costs on households and small businesses. From a public-health perspective, ponded stormwater in blocked reaches becomes breeding habitat for vectors during inter-storm periods; dust, noise, and unsafe crossings compound everyday risks. Environmentally, high sediment yields, and trash conveyance degrade downstream channels, reduce conveyance capacity, and increase turbidity in receiving waters.

Without targeted intervention, three trends are expected to worsen: (i) more frequent exceedance of existing drainage capacity as intense storm events occur during the rainy season; (ii) faster head-cut migration and collapse of over steepened banks as settlements densify at the corridor edge; and (iii) cost escalation for reactive maintenance and emergency works. Inaction would also erode public confidence and strain limited Area Council budgets.

The intervention aligns with ACReSAL's objective to build climate resilience through integrated landscape management by reducing chronic exposure to flood/erosion hazards, safeguarding vulnerable households and public assets, and lowering sediment delivery to downstream watercourses. It also supports FCTA priorities on safe mobility and public health by improving connectivity across the corridors and removing hazardous crossings. Implementation will be guided by good international industry practice, stakeholder engagement with directly affected communities, and, shall land or access impacts be confirmed at detailed design, application of proportionate ARAP/RAP measures in line with applicable standards.

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In sum, proactive rehabilitation of the Zuba and Gwagwalada corridors is the most effective path to arrest ongoing degradation, protect life and property, reduce recurrent maintenance burdens, and restore a functional, safer urban drainage system that can be sustained by local authorities and communities.

1.10 Description of Intervention Activities

The Gwagwalada and Zuba subprojects comprise remedial structural and non-structural measures, civil works and vegetative/bio-engineering to rehabilitate degraded gully corridors, restore storm-water conveyance, and prevent further flooding, soil erosion, and land degradation. At this planning (ESMP) stage, before detailed engineering, the rehabilitation concept is expected to provide reinforced concrete (RC) drains for main and secondary channels, with flexible end sections (gabions/Reno mattresses) for energy dissipation and bank protection.

The activities include reclamation and stabilization along the active gully corridors within Zuba and Gwagwalada communities. Specifically (to be finalized at detailed design), works will include construction of drainage channels, retaining walls, culverts/cross-drainage, and stabilization of degraded lands along both banks of the corridors.

Designs shall adopt a hybrid system, predominantly rigid reinforced concrete (RC) sections on high-shear reaches transitioning to flexible systems with bioremediation near outfalls and erodible bends. Indicative characteristics of protective elements are:

i) Main drain alignment sections: RC rectangular open channels (final width/height to be set by hydraulic design and geotechnical review).

ii) Gully-corridor alignment sections: RC rectangular open channels sized to local flow and footprint constraints (variable widths/heights by reach).

iii) Side-drain alignment sections: RC rectangular side drains to intercept street/compound runoff and connect to the main corridor.

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iv) Bio-remediation at natural stream ends: vegetated slopes and flexible armoring (gabions/Reno mattresses) with energy dissipation to achieve non-erosive discharge.

Setbacks and right-of-way will be guided strictly by the drainage and gully stabilization footprint defined in the approved design drawings, which incorporate a designated 10 m setback from the channel to accommodate the structural works, bank protection measures, and space for inspection and maintenance access. The corridor will be physically demarcated during site preparation and validated through consultations with affected stakeholders. In locations where space constraints exist, the design provisions allow for adaptive treatment to ensure structural stability and public safety while minimizing displacement and maintaining access. Temporary working areas will remain within the designated setback limits and will be reinstated upon completion of construction.

1.11 Objectives of the ESMP

The proposed gully erosion control interventions are part of the degraded watershed rehabilitation activities under the ACReSAL Project. These interventions aim to stabilize gullies, reduce runoff velocity, protect properties, and restore degraded land, thereby improving the resilience of communities in the FCT. Both the World Bank Environmental and Social Standard 1 (ESS1) on Assessment and Management of Environmental and Social Risks and Impacts and the Nigerian Environmental Impact Assessment (EIA) Act provide the regulatory framework for these activities, emphasizing the need for proactive assessment and management of environmental and social risks.

Developing a site-specific Environmental and Social Management Plan (ESMP) is therefore essential to ensure that the project achieves its objectives while minimizing adverse impacts.

The ESMP:

- Identifies potential environmental and social risks and hazards associated with gully stabilization and channelization works, including impacts on soil, water, biodiversity, and local communities.

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- Developed practical and costed mitigation measures to prevent or minimize adverse environmental and social outcomes during both construction and operational phases.
- Established monitoring frameworks and assign institutional responsibilities, ensuring continuous oversight and accountability throughout project implementation.
- Promote community engagement and inclusion, ensuring that all stakeholders, particularly vulnerable groups, are consulted and their concerns integrated into project planning.
- Enhance project sustainability and compliance, aligning interventions with national legislation, international best practices, and World Bank safeguards.

The ESMP is therefore critical for guiding the gully erosion control works in Zuba and Gwagwalada. It will ensure that the proposed construction and channelization activities are implemented safely and responsibly, that environmental and social impacts are mitigated, and that the benefits of gully stabilization, such as protection of lives, property, and livelihoods, are realized in a sustainable and socially responsible manner.

1.12 Overview and Scope of the Consultancy Services

This ESMP is prepared in line with Good International Industry Practice (GIIP) and the World Bank Environmental and Social Framework (ESF), with due consideration of applicable national/FCT environmental legislation. The Plan is guided by World Bank safeguards standards and relevant state, national, and international regulations, guidelines, and best-practice conventions applicable to the ACReSAL Project in the Federal Capital Territory (FCT).

Applicable Environmental and Social Standards (planning-stage assumption) Based on the anticipated environmental and social effects of the proposed Gwagwalada and Zuba subprojects, the following eight WB Environmental and Social Standards are relevant to manage the project E& risks:

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- **ESS1:** Assessment and Management of Environmental and Social Risks and Impacts
- **ESS2:** Labor and Working Conditions
- **ESS3:** Resource Efficiency and Pollution Prevention and Management
- **ESS4:** Community Health and Safety
- **ESS5:** Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement
- **ESS6:** Biodiversity Conservation and Sustainable Management of Living Natural Resources
- **ESS8:** Cultural Heritage
- **ESS10:** Stakeholder Engagement and Information Disclosure

In fulfilment of these safeguard requirements, and considering the potential significance of environmental and social risks, the ESMP serves as the planning-stage instrument documenting mitigation, monitoring, and institutional actions to avoid, minimize, or reduce adverse impacts to acceptable levels once works are designed and implemented. Potential impacts across pre-construction, construction, and operation & maintenance (O&M) are outlined in generic form, with proportionate mitigation measures to be refined at detailed design. The ESMP includes measures needed to implement identified actions and addresses the adequacy of monitoring and institutional arrangements for the upper and lower watersheds at the intervention sites on a sustainable basis. It provides the institutional framework and monitoring actions to be taken before, during, and after construction.

The mitigation measures are aligned with and consistent with recommendations in the updated ACReSAL Environmental and Social Management Framework (ESMF).

Background documents reviewed (planning-stage basis)

(i) ACReSAL Environmental and Social Management Framework (ESMF)
(ii) ACReSAL Project Appraisal Document (PAD)
(iii) ACReSAL Project Implementation Manual (PIM)
(iv) World Bank Environmental and Social Framework (ESF)

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(v) ACReSAL Stakeholder Engagement Plan (SEP)

(vi) Terms of Reference (ToR) for this ESMP

The study draws on quantitative and qualitative inputs: desk review of historical environmental/social information for the sites, and field-based observations and community feedback. Information-gathering tools include Focus Group Discussions (FGDs), community meetings, and key informant interviews with persons knowledgeable about local flood/erosion history and site conditions. These inputs inform the planning-stage impact register and the management/monitoring procedures that establish a sound basis for mitigation, monitoring, and institutional coordination at project level.

1.13 Existing Environmental Conditions and Proposed Scope of Works

The project locations are affected by advanced land degradation and gully erosion, posing serious risks to physical infrastructure, livelihoods, and community safety. Uncontrolled surface runoff, fragile soil conditions, and steep terrain have accelerated erosion processes, necessitating urgent and integrated intervention measures.

1.13.1 Zuba Project Site

The Zuba gully erosion site is classified as a high-risk erosion zone, characterized by steep slopes and poorly defined drainage pathways that generate high-velocity runoff. Soil conditions are predominantly porous, with localized impermeable layers that intensify surface flow concentration during rainfall events. These conditions have resulted in the following impacts:

- Severe loss of topsoil, with rapid removal of fertile soil layers critical for vegetation and land stability;
- Encroachment on residential areas, forcing affected households to abandon properties as the gully advances;
- Restricted access and safety hazards, as former access roads have been transformed into deep, unstable drainage channels during storm events.

1.13.2 Gwagwalada Project Site

The Gwagwalada gully erosion site is significantly larger and more complex and is located within the core of the community, near the palace of the Aguma of Gwagwalada. The site

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presents heightened environmental and social risks due to its scale and proximity to culturally and economically important assets. Key characteristics include:

- Complex hydrology, with multiple secondary gullies ("fingers") feeding into the main gully channel, accelerating erosion and lateral expansion;
- High infrastructure vulnerability, as the gully threatens traditional institutions, residential neighborhoods, and key access corridors, making it a priority intervention area to prevent further property damage and displacement.

1.5 Site Comparison and Key Data Summary

Parameter	Zuba Gully Site	Gwagwalada Gully Site
Location	Zuba, Gwagwalada Area Council	Old Kutunku Road (Near Aguma's Palace)
Coordinates	9°05'43.5" N; 7°12'46.2" E	8°55'49.4" N; 7°03'36" E
Approximate Length	127.78 m	2,024.52 m
Approximate Width	9.28 m	15.33 m
Primary Erosion Drivers	Runoff from Madalla hill foot	Multiple feeder gullies and stormwater runoff
Receiving Water Body	Local streams and rivers	Gurara River

1.13.4 Proposed Scope of Works

The proposed intervention adopts an integrated erosion control approach, combining structural civil engineering measures with bioengineering and land restoration techniques to achieve long-term stability and climate resilience.

A. Structural (Civil Engineering) Measures

The objective of the structural works is to safely convey runoff to natural receiving water bodies while stabilizing the gully system and protecting adjacent infrastructure. Proposed measures include:

- Main and secondary gully stabilization channels (MSC/GSC) constructed as reinforced concrete rectangular open channels of varying dimensions;
- Secondary and tertiary drainage structures to restore and protect access roads and surrounding areas;

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- Energy dissipation structures, including stilling basins and riprap aprons at discharge points, to reduce flow velocity and prevent downstream erosion;
- Pedestrian and vehicular crossings, including culverts and small bridges, to restore safe community connectivity;
- Flexible erosion control structures, such as gabions and Reno mattresses at terminal sections, to accommodate ground movement and enhance drainage performance.

B. Bioengineering and Land Restoration Measures

To rehabilitate degraded land and prevent future erosion, the following nature-based solutions will be implemented:

- Green belt development, involving the planting of Vetiver grass and Bahamas grass along gully shoulders, slopes, and discharge channels;
- Soil improvement and surface protection, using a mixture of topsoil and organic manure to promote rapid vegetation establishment;
- Biological slope stabilization, utilizing plant root systems to bind soil, reduce runoff velocity, and enhance long-term slope stability.

C. Environmental and Social Safeguards

Given the scale of earthworks and the proximity of settlements, the project will be implemented in compliance with the World Bank Environmental and Social Framework (ESF), particularly relevant Environmental and Social Standards (ESS). Key safeguard commitments include:

- Prevention and control of sediment discharge and siltation of inland water bodies during construction;
- Management of involuntary resettlement and livelihood impacts for project-affected persons located along the gully corridor, in line with ESS5;
- Restoration of degraded watershed ecosystems and protection of biodiversity within the project area.

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1.14 Summary of the Structure of the ESMP Report

- Executive Summary
- Chapter 1: Introduction
- Chapter 2: Institutional and Legal Framework
- Chapter 3: Biophysical Environment
- Chapter 4: Socio-Economic Characteristics and Stakeholder Consultations
- Chapter 5: Assessment of Potential Impacts and Analysis of Alternatives
- Chapter 6: Environmental and Social Management Plan (mitigation, monitoring, roles, budget)
- Chapter 7: Conclusions and Recommendations
- References
- Annexures (maps, checklists, GRM templates, minutes/photos, chance-find procedure, sample contract clauses, etc.).

CHAPTER 2: INSTITUTIONAL AND LEGAL FRAMEWORK

This ESMP is guided by the requirements of relevant state, national, and international regulations, guidelines, conventions, and best-management practices, including the World Bank safeguard standards, that are triggered by the Gwagwalada and Zuba subprojects. The applicable legal and institutional framework for ACReSAL is elaborated in the ACReSAL ESMF; key requirements are summarized below.

2.1 International Laws and Regulations

2.1.1 The World Bank Environmental and Social Framework (ESF)

The World Bank's ESF sets out Environmental and Social Standards (ESS1–ESS10) to ensure Bank-financed activities are environmentally and socially sustainable and to strengthen decision-making. ESS1 requires an environmental and social assessment proportionate to project risks and impacts; ESS2–ESS10 specify the Borrower's

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obligations for particular risk areas. The Standards establish objectives and requirements to avoid, minimize, reduce, and mitigate risks and impacts, and where significant residual impacts remain, to offset/compensate them.

Based on the anticipated scope of rehabilitation and stabilization works for the Gwagwalada/Zuba interventions (planning stage), the following eight ESS are expected to apply, as outlined below.

- **ESS1:** Assessment and Management of Environmental and Social Risks and Impacts.
- **ESS2:** Labor and Working Conditions.
- **ESS3:** Resource Efficiency and Pollution Prevention and Management.
- **ESS4:** Community Health and Safety.
- **ESS5:** Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement (potentially, if future ROW/setbacks affect assets).
- **ESS6:** Biodiversity Conservation and Sustainable Management of Living Natural Resources.
- **ESS8:** Cultural Heritage.
- **ESS10:** Stakeholder Engagement and Information Disclosure.

In line with these requirements and given the potential significance of E&S risks for gully-stabilization works, this ESMP serves as the safeguard instrument at the planning stage, documenting the mitigation, monitoring, and institutional actions that will be carried forward into detailed design, bidding documents, and the Contractor's C-ESMP to ensure adverse impacts are avoided or reduced to acceptable levels.

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Table 2.1: Applicability of World Bank Environmental and Social Standards (ESS1–ESS10) to ACReSAL and the Gwagwalada/Zuba Subprojects

WB Environmental and Social Standard	Triggered by ACReSAL?	Triggered by Gwagwalada/ Zuba Subprojects?	Applicable To Project Due To	How Project Addresses Policy Requirements
ESS1: Assessment and Management of Environmental and Social Risks and Impacts	Yes	Yes	Anticipated construction/rehabilitation works with E&S risks and impacts; need to assess, manage, and monitor risks across all phases	This planning-stage ESMP is prepared for the Gwagwalada/Z-uba subprojects with specific mitigation and monitoring measures to meet **ESS1**.
ESS2: Labor and Working Conditions	Yes	Yes	Employment of contractor/workers; worker–management relations; OHS risks; potential labor influx	ESMP aligns with ACReSAL LMP; defines OHS requirements, Codes of Conduct, GBV/SEA-SH measures, and C-ESMP sub-plans to meet **ESS2**.
ESS3: Resource Efficiency and Pollution Prevention and Management	Yes	Yes	Potential air/noise/water pollution; spoil/waste; fuel/chemical handling; resource use (water, materials)	ESMP prescribes erosion/sediment control, waste management, spill prevention/response, and efficient resource use consistent with **ESS3**.
ESS4: Community Health and Safety	Yes	Yes	Community exposure to construction traffic, excavations, access constraints; proximity to schools/markets; emergencies	Traffic Management Plans, safe pedestrian routes, fencing/signage, emergency preparedness, and a GBV-sensitive GRM per **ESS4**.

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ESS5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement	Yes	Yes	Possible future ROW/setbacks may affect assets/access (to be confirmed at detailed design)	If screening confirms impacts, ARAP/RAP will be prepared and implemented per **ESS5**; this ESMP sets triggers and principles (*potential—design-dependent*).
ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Yes	Yes	Corridor clearing/vegetation disturbance; risk to nearby natural receptors	Habitat protection, timing of works, restoration/planting (bio-engineering), and controls to prevent downstream sedimentation per **ESS6**.
ESS7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	No	No	ESS7 criteria not met in the project context	Not applicable.
ESS8: Cultural Heritage	Yes	Yes	Chance finds during excavation; potential impacts to local cultural resources	Chance-Find Procedure, worker induction, and notification protocols included to comply with **ESS8**.
ESS9: Financial Intermediaries	No	No	Project not implemented through financial intermediaries	Not applicable.
ESS10: Stakeholder Engagement	Yesk	Yesk	Development of strong, constructive and responsive relationships are important for successful management of a project's environmental and social risks	This ESMP is developed for Gwagwalada and Zuba subproject & includes a Stakeholder Engagement Plan (SEP) prepared to meet the requirements of this ESS10.

2.1.2 World Bank Group EHS Guidelines

The Environmental, Health, and Safety (EHS) Guidelines of the World Bank Group (WBG) are technical reference documents with general and industry - specific examples of Good International Industry Practice (GIIP). The EHS Guidelines that are relevant and applicable to the ACReSAL project include the following:

- General EHSG;

2.2 Other Relevant International Acts and Legislations

Nigeria subscribes to a number of international regulations and conventions relating to environmental protection. These international protocols signed by Nigeria, that are relevant to the ACRESAL project include:

1 International Union for Conservation of Nature and Natural Resources (IUCN) Guidelines

2 Convention of Biological Diversity

3 Convention Concerning the Protection of the World Cultural and National Heritage Sites (World Heritage Convention)

4 United Nations Framework Convention on Climate Change (1992)

5 UN Convention to Combat Desertification

6 Forced Labour Convention, 1930

7 Freedom of Association and Protection of Right to Organize Convention, 1948

8 Right to Organize and Collective Bargaining Convention, 1957

9 Equal Remuneration Convention, 1951.

10 Abolition of Forced Labour Convention, 1957

11 Discrimination (Employment` and Occupation) Convention, 1958

12 Minimum Age Convention, 1973

13 Worst Forms of Child Labour Convention, 1999

14 Labour Inspection Convention, 1947

15 Tripartite Consultation (International Labour Standards) Convention, 1976

16 Right of Association (Agriculture) Convention, 1921;

17 Protection against Accidents (Dockers) Convention.

Some of these guidelines/conventions/treaties to which Nigeria is a signatory are summarized below.

2.2.1 Convention on Biological Diversity

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.

2.2.2 Convention Concerning the Protection of the World Cultural and Natural Heritage Sites (or World Heritage Convention)

The convention sets aside areas of cultural and natural heritage for protection. The latter is defined as areas with outstanding universal value from the aesthetic, scientific and conservation points of view.

2.2.3 The Basel Convention on the Control of Transboundary Movement of Hazardous Waste and Disposal, 1989

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

The agreement aims to address the problems and challenges posed by hazardous waste and to protect human health and the environment by minimizing hazardous waste production whenever possible through an “integrated life-cycle approach”, which involves strong controls from the generation of a hazardous waste to its storage, transport, treatment, reuse, recycling, recovery and final disposal. The key objectives of the Basel Convention are:

1 To minimize the generation of hazardous wastes in terms of quantity and hazardousness; and,

2 To reduce the movement of hazardous wastes by disposing off as close as possible to the source.

2.2.4 UN Framework Convention on Climate Change – Kyoto Protocol (1992)

In order to achieve sustainable social and economic development, energy consumption for developing countries needs to grow taking into account the possibilities for achieving

greater energy efficiency and for controlling greenhouse gas emissions in general. This also includes the application of new technologies on terms which make such an application economically and social beneficial, determined to protect the climate system for present and future generations.

2.2.5 Agenda 21 - UN Conference on Environment and Development

At the United Nations Conference on Environment (also the Earth Summit) – held in Rio de Janeiro (1992), with recommendations from the WHO Commission, more than 150 member states adopted Agenda 21 - an action plan to guide future strategies for health and environment activities on a national and international level. This fact provided the background for FEPA's EIA framework to ensure environmental sustainability of all types of activities in the oil and gas industry (FEPA, 1995).

2.2.6 Public Health Legislations and regulations

Several countries have legislation and regulations that stipulate the administrative and policy framework for conducting health impact assessment for a development project, whether as part of an EIA or a standalone study. In addition, a number of international agencies have endorsed this process, such as the World Banks, Asian Development Commission, and the World Health Organizations. In Nigeria, the Public Health Law (L.N47 of 1955, Cap 103) provides justification for the execution of developmental projects under guidelines that promote health by protecting the environment and safeguarding the health of humans.

2.2.7 WHO Health and Safety Component of EIA, 1987

WHO in its report on health and safety component of environment impact assessment (EIA) to protect human health indicates that:

i. One of the fundamental considerations in the approval of projects, policies and plans shall be the health of communities affected by them; greater consideration shall be given to the consequence of development policies/programs for human health;

ii. Environmental Impact Assessment shall provide the best available factual information on the consequence for health of projects, policies and plan; and

iii. Information on health impact shall be available to the public.

2.2.8 Convention on Conservation of Migratory Species of Wild Animals, Bonn, 1979

The Bonn convention concerns the promotion of measures for the conservation (including habitat conservation especial for endangered species and management of migratory species.)

2.2.9 United Nations Guiding Principle on the Human Environmental

The United Nation (UN) published the concept of guiding principles on the Human Environment in 1972. Ten of these Guiding Principles were defined as formal declarations that express the basis on which an environmental policy can be built and which provide a foundation for action.

2.2.10 The Rio Declaration on Environmental and Development

The UN Conference on Environment and development met at Rio de Janeiro in June 1992, at which time it reaffirmed the 1972 declaration on the Human Environment, and sought to build upon it. This was done with the goal of establishing a new and equitable global partnership through the creation of new levels of cooperation among states, key sectors of societies and people. It was also to aid work towards international agreements, which respect the interest of all, protect the integrity of the global environmental development system, and recognize the integral and interdependent nature of the earth.

Other relevant international conventions include:

1 Africa Convention on the Conservation of Natural Resources of 1969

2 Convention on the Law of the Seas of 1982

3 The Ramsar Convention on Wetlands of 1971

2.3 Federal Policy, Legal, Regulatory and Administrative Frameworks

Pursuant to Section 20 of the Nigerian 1999 Constitution, the state is empowered to protect and improve the environment and safeguard the water, air, and land, forest, and wildlife of Nigeria. The power to regulate all environmental matters in Nigeria is vested in the Federal Ministry of Environment (FMEnv) – a mandate that previously rested with the now defunct Federal Environmental Protection Agency (FEPA) set up by Federal Act 88, of 1988.

The applicable environmental laws include the Environmental Impact Assessment Act No. 86 of 1992; the National Guidelines and Standards for Environmental Pollution Control in Nigeria (March 1991); the National Environmental Standards and Regulations Enforcement Agency (establishment) Act 2007 (NESREA), the Land Use Act 1978 (modified in 1990); the Forestry Act 1958; and the National Agricultural Policy 1988.

2.3.1 National Policy on Environment

The national policy on environment, 1989 (revised 1999), provides for "a viable national mechanism for cooperation, coordination and regular consultation, as well as harmonious management of the policy formulation and implementation process which required the establishment of effective institutions and linkages within and among the various tiers of government – federal, state and local government". The defined guideline and strategies provide for the effective management of the environment in the following 14 major areas: Human population; Land use and soil conservation; Water resource management; Forestry; Wildlife and protected areas; Marine and coastal area resources; Toxic and hazardous substances; Energy production and use; Air pollution; Noise pollution; Toxic and hazardous substances; Recreational space; Greenbelts movements; and, Cultural property.

2.3.2 National Environmental Impact Assessment Act 1992

National EIA Act 1992, Clause 2 provides that public or private sector of the economy shall not undertake or embark on or authorize projects or activities without prior consideration of the effects on the environment. The act makes an EIA mandatory for any development project, and prescribes the procedures for conducting and reporting EIA studies. As part of the effective utilization of the EIA tool, the ministry has produced sectoral guidelines.

2.3.3 Nigerian Land Use Matters

The basic legal framework for the acquisition of land in Nigeria is the Land Use Act 1978 as amended under the Amended Land Use Act of 2004, Chapter L5 under the laws of the Federation of Nigeria. The Part 1 of the amended Act 2004 vests all land within the urban areas of any Nigerian State in the Executive Governor of that state. Land within the rural areas of the state is vested on the Local Government. The Part VI, Section 29 of the law provides for compensation to the holder of any land title when such land is to be acquired

for public purposes. For developed land, the Governor (in the case of urban areas) or Local Government (in the case of rural areas) may, in lieu of compensation, offer resettlement in any other place as a reasonable alternative accommodation and in acceptance of resettlement, the holder's right to compensation shall be deemed to have been duly satisfied. Although the Land Use Act is not strictly an Act for environmental protection, protection of the environment is one of the considerations which a holder of certificate of occupancy has to observe.

2.3.4 National Erosion and Flood Control Policy 2005:

The general soil erosion & flood control guidelines provide necessary instructions for soil and water resources users to develop, implement and monitor plans that are to assure erosion and flood hazard mitigation. The maintenance of levees and other protective structures are also to be developed at areas with potential impacts. In addition to this, all requests for project plan approvals must include soil type and drainage pattern/structures in and around project area and the likely impact of the project on these duly certified.

2.3.5 NESREA Establishment Act, 2007.

The National Environmental Standards and Regulations Enforcement Agency (NESREA) has responsibility for the enforcement of the environment regulations and biodiversity conservation, including coordination and liaison with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines.

The following NESREA National Environmental Regulations are considered relevant in this study:

- National Environmental (Construction Sector) Regulations. 2011;
- National Environmental (Soil Erosion and Flood Control) Regulations. 2011;
- National Environmental (Desertification Control and Drought Mitigation) Regulations. 2011;
- National Environmental (Surface and Ground Water Control) Regulations. 2011;
- National Environmental (Watershed, Mountainous, Hilly and Catchment Areas) Regulations, 2009.

Official Use Only

2.3.6 National Guidelines and Standards for Environmental Pollution (March, 2001)

The National Guidelines and Standards for environmental pollution control in Nigeria (March, 2001) is the basic instrument for monitoring and controlling industrial and urban pollution.

2.3.7 National Waste Management Regulations of 1991

This regulation which is updated under the National Environmental (Sanitation and Waste Control) Regulations 2009, S.I. No. 28 mandates the collection, treatment, and disposal of solid and hazardous waste from municipal and industrial sources. It provides the legal framework for the adoption of sustainable and environment friendly practices in environmental sanitation and waste management to minimize pollution.

2.3.8 Approved National Forestry Policy 2006

The extant national forest policy which is included within the document "Agricultural Policy for Nigeria" published by the Federal Ministry of Agriculture in 1988 recognized forestry as the management and utilization of forests as renewable natural resources. The policy overall objective is to achieve sustainable forest management that would ensure sustainable increases in the economic, social and environmental benefits from forests and trees for the present and future generations, including the poor and vulnerable groups.

The Forest Policy encourages and supports an aggressive establishment of plantations of economic trees of both exotic and indigenous species. It provides for the preservation of forests and the setting up of forest reserves, and also provides goals, targets and implementation strategies for the management, development and use of forests and their resources and products. Nigeria is at present a wood-deficient nation. The policy on forest resources management and sustainable use is aimed at achieving self-sufficiency in all aspects of forest product using sound forest management techniques as well as the mobilization of human and material resources. The overall objectives of forest policy are to prevent further deforestation and to recreate forest cover, either for productive or for protective purposes, on already deforested land.

The national biodiversity conservation strategy continues to be based on a system of Protected Areas, including Forest Reserves, National Parks and Game Reserves. In recognition of the fact that the local communities must share in the benefits of these

Protected Areas, there must be a meaningful participation of these communities in their management. Efforts to safeguard biodiversity in private forests and to improve agricultural biodiversity through farm forestry initiatives must be supported.

The government has signed several international agreements and conservators that are relevant to the forestry development. It is obligatory that Government shall honour these agreements and instruments through domestic legislation and action. Intergovernmental, bilateral and multilateral cooperation will be upheld to promote sustainable development of forest resources.

Summary Table of the Applicable Laws

Table 2.2: National Policies and Laws (with relevance to this subproject)

Policy/Act	Relevance to the Proposed Project
National Policy on Climate Change (NPCC, 2021)	Guides climate-resilient infrastructure design; promotes adaptation measures such as stormwater management and landscape restoration, which are central to the gully rehabilitation works.
National Emergency Management Agency (NEMA) Act, 1999	Provides the mandate for emergency response to disasters such as flooding or gully collapse; relevant for construction-phase risk preparedness and integration with FCT emergency response protocols.
Labour Act, Cap L1 LFN 2004	Regulates employment conditions, wages, working hours, and protection against forced and child labour; directly supports ESS2 compliance during contractor and subcontractor engagement.
Penal Code (Northern Nigeria, applicable in FCT)	Criminalizes acts such as assault, theft, violence, vandalism, harassment, and exploitation, including gender-based violence—particularly relevant to community safety, SEA/SH prevention, and contractor conduct.
Environmental Impact Assessment (EIA) Act, Cap E12 LFN 2004	Requires environmental assessment for major projects; this ESMP aligns with EIA requirements under national law.
NESREA (Establishment) Act 2007 and subsidiary regulations	Provides enforceable national environmental standards for air, water, waste, noise, and ecosystem protection during construction and operation.
National Guidelines and Standards for Environmental	Sets enforceable ambient limits for air and noise quality, relevant for construction-phase monitoring.

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Pollution Control in Nigeria (1991)	
Land Use Act, 1978 (as modified 1990)	Governs land ownership, acquisition, compensation, and rights-of-way; applicable to setback demarcation and ESS5 compliance.

Table 2.3 FCT Laws, Agencies, and Applicable Institutional Roles

FCT Law/Agency	Role and Relevance to the Subproject
FCDA Act (Establishing the Federal Capital Development Authority)	Provides the legal basis for land administration, urban development, and approval of infrastructure interventions within the FCT.
AEPB Act (Abuja Environmental Protection Board Act)	Mandates regulation of waste management, sanitation, and environmental compliance in the FCT; applicable to construction waste handling and community hygiene.
Department of Development Control (DDC), FCTA	Responsible for building/site permits, right-of-way (ROW) clearance, setback enforcement, and relocation/resettlement guidance in line with ESS5.
Satellite Towns Development Department (STDD)	Oversees development and infrastructure planning in satellite urban settlements such as Gwagwalada and Zuba.
FCT Emergency Management Authority (FEMA)	Coordinates disaster preparedness and response, including flood-risk management during construction.
Abuja Metropolitan Management Council (AMMC)(if relevant)	May support rehabilitation measures affecting transport corridors and urban infrastructure.

Table 2.4: International Treaties and Conventions (Relevant to ACReSAL and WB ESF Compliance)

Convention	Relevance
Convention on Biological Diversity (CBD)	Informs biodiversity conservation under ESS6 and bio-engineering measures.
United Nations Framework Convention on Climate Change (UNFCCC, 1992)	Supports climate adaptation through flood control and erosion management.
UN Convention to Combat Desertification (UNCCD)	Aligns with landscape restoration objectives.
World Heritage Convention	Provides context for chance-find procedures under ESS8.

Core ILO Labour Conventions (Forced Labour, Equal Remuneration, Worst Forms of Child Labour, etc.)	Guide labour standards and working conditions under ESS2.

CHAPTER 3: BIOPHYSICAL ENVIRONMENT

3.1 Introduction

This section describes the project area of influence and the baseline environmental conditions of the subproject areas. It is organized into three parts: (i) the project area of influence; (ii) general environmental conditions; and (iii) site-specific environmental conditions focusing on the Gwagwalada and Zuba flood/gully-erosion corridors.

A field study was conducted to establish the biodiversity baseline (flora and fauna) within the subproject area. The vegetation survey employed transect walks followed by the identification, classification, and quantification of species diversity. Systematic field observations were recorded. In addition, in-depth interviews were held with key stakeholders, elders, youths, farmers, and hunters, to document species distribution and abundance, including taxa not directly observed in the field. The interviews also captured local (Hausa) names and the economic uses of the species encountered. The survey employed transects walks with species identification, classification, and abundance estimation, complemented by systematic field observations. In-depth interviews were conducted with local stakeholders, including elders, youths, farmers, and hunters, to confirm species distribution, local (Hausa) names, and economic relevance, including species not directly encountered during field observations. A biodiversity baseline (flora and fauna) was established through a field study conducted between August and October 2025, over multiple site visits covering the peak rainy period and early transition to dry conditions. The assessment was undertaken within a 500 m buffer on either side of the mapped drainage and gully alignments, as well as adjacent riparian zones and built-up edge habitats. Laboratory confirmation of select samples was undertaken by Layusa Integrated Services Limited, an FMEnv-accredited environmental laboratory and certified consulting firm.

Table 3.1: Gull Erosion Sites Location and Features

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S/N	Location	Description	Features	Remark
1	Zuba	Gully erosion intervention site	Peri-urban corridor with scattered trees, shrubs, and grasses; active gully fingers near school/church frontage; home-gardens and smallholder plots (maize, sorghum/guinea corn, millet).	Guinea Savanna (Southern Guinea)
2	Gwagwalada	Gully erosion intervention site	Main corridor through built-up areas near Old Kutunku Road; open woodland/grass mosaic with shrubs; proximity to utilities/road crossings; downstream discharge toward Usuma River.	Guinea Savanna (Southern Guinea)

3.2 Watershed Characteristics

3.2.1 Morphometric Parameter Derivation

Morphometric values were derived from the interpolated DEM to quantify catchment size and shape, stream slope, stream length, and land-surface slope. These values provide information about the hydrological and geomorphological response of the study area (Strahler, 1964; Horton, 1945). The study captures the drainage network and watershed catchment areas applied Advanced Land Observing Satellite (ALOS) Phased Array type L-band Synthetic Aperture Radar (PALSAR) Digital Elevation Model (DEM) having spatial resolution of 12.5 × 12.5 m obtained from the Alaska Satellite Facility (ASF) Distributed Active Archive Center (DAAC) from 2006 to 2011. Data analysis was conducted with ArcMap 10.8 software environment, and hydrological analysis was carried out by using the Arc Hydro toolset to derive catchment and drainage features. The steps involved DEM preprocessing, hydro conditioning, stream network extraction, and defining contributing catchments to gullies. The processing process went through a series of processes beginning with importing the DEM data into ArcMap 10.8, followed by the execution of sink filling to remove spurious depressions. Flow direction and flow accumulation grids were generated to map drainage routes and contributing areas. Stream definition and watershed delineation were then performed to delineate hydrological structures and catchments. The parameters and their respective computational formulas are presented in Table 3.2.

Table 3.2: Morphometric parameters for the study areas

Morphometric Parameter	Formula	Description

Catchment Area (A)	A = Σ (cell area contributing to outlet)	Total surface area contributing flow (km²)
Catchment Perimeter (P)	P = Σ (boundary length of catchment)	Length of the catchment boundary (km)
Form Factor (Ff)	$Ff = A / L^2$	Indicates catchment shape (dimensionless)
Elongation Ratio (Re)	$Re = 1.128 \times (A)^{1/2} / Lb$	Describes shape relative to a circle
Compactness Index (Cc)	$Cc = P / (2 * \sqrt{(\pi * A)})$	
Stream Length (L)	L = Σ (length of stream segments)	Total stream length (km)
Stream Slope (Ss)	Ss = (Hmax – Hmin) / L × 100	Average slope along the main stream (%)
Mean Basin Slope (Sb)	$Sb = \Sigma (\tan^{-1} (\Delta H/\Delta L)) / n$	Average surface slope of basin (%)

Source: Author's compilation, 2025)

3.2.2 Discussion of the Watershed Characteristics

Nigerian peri-urban and urban gullies are a significant source of infrastructure loss, sediment yield, and environmental degradation. Catchment morphometric characteristics (shape, slope, stream network) exert a dominant control on peak flows, erosion rates, and thus stabilization needs (Songu et al., 2019; Aigbadon, Ocheli & Akudo, 2021). In this case, Gwagwalada corridor (WS11) and Zuba corridor (WS8) are compared based on morphometric parameters of contributing catchments (WS1–WS10) for inferring planning-level hydraulic implications and proposing stabilization measures suitable under Nigerian climatic, land use, and soil conditions. The result of the study, catchment areas (Zuba and Gwagwalada) as well as their contributing sub-catchments (WS1–WS10) show a range in shape, slope, and drainage network density. The result of the contributing catchment areas therefore, influence how Zuba (WS8) and Gwagwalada (WS11) respond hydrologically. Table 3.3 shows the morphometric parameters for all the catchment areas.

Table 3.3: Result of Catchment/Watershed characteristics of Zuba and Gwagwalada corridors

Name of watershed	Area (km2)	Watershed Length (km)	Perimeter (km)	Stream Length (km)	Total No. of Stream	Mean Slope (%)	Form Factor (Ff)	Elongation Ratio	Compactness Index (Cc)
WS1	23.197684	5.672303	23.197684	12.114	7	10.12	0.720984	0.958115	2.7173612
WS2	34.117956	13.499218	34.117956	21.195	13	10.01	0.1872258	0.488245	3.2954639
WS3	8.190412	4.399258	8.190412	5.034	3	20.09	0.4232011	0.734054	1.6146482
WS4	35.964636	15.399555	46.655181	20.555	12	7.8	0.1516559	0.439424	4.3892175
WS5	31.75196	11.340305	31.75196	14.386	5	7.4	0.2468999	0.5606806	3.1791449
WS6	21.585964	9.467933	21.585964	12.455	5	8.04	0.2408026	0.5537141	2.621264
WS7	41.613716	10.924153	41.613716	23.399	37	6.12	0.3487073	0.666324	3.639513
WS8	49.986187	11.49795	49.986187	4.811	14	6.29	0.3781022	0.6938405	3.9888718
WS9	9.617765	5.555979	9.617765	8.459	14	10.82	0.3115681	0.6298418	1.7496941
WS10	25.671732	8.863052	25.671732	23.246	63	7.3	0.3268049	0.6450588	2.8585951
WS11	26.678292	8.638465	26.678292	23.585	46	6.01	0.357507	0.6746794	2.9140975

Table 3.4: Summary of morphometric characteristics of Zuba and Gwagwalada corridors

Morphometric Parameters	WS8 (Zuba)	WS11 (Gwagwalada)
Area (km^2)	49.99	26.68
Watershed Length (km)	11.50	8.64
Stream Length (km)	4.81	23.585
Total Number of Streams	14	46
Mean Slope (%)	6.29	6.01
Form Factor (Ff)	≈ 0.378	≈ 0.358
Elongation Ratio (Re)	≈ 0.694	≈ 0.675
Compactness Index (Cc)	≈ 3.989	≈ 2.914

Catchment area Characteristics: Slope, Stream Network, Catchment Area

Both Zuba (WS8) and Gwagwalada (WS11) possess average slopes of around 6%, which is gentle to moderate when compared to that of other contributing catchment areas. This would suggest that runoff velocity does not have to be very significant in general, but local slope variation (steep upstream, more gentle downstream) can produce erosive sections. Specifically, one of the contributing catchment area (WS3) has a significantly steeper slope (~20%) which may result in localized erosion feeding into both corridors.

With respect to Stream network density WS11 also has many more streams (46) and more cumulative stream length (~23.59 km) than Zuba (~14 streams, 4.81 km). This will imply higher drainage density in that contributing catchment area (WS11). Generally, high drainage density will reduce infiltration, increase surface runoff, lead to more concentrated flows, and higher hydraulic connectivity. In addition, many small tributaries will create many small-scale gullies or rills that merge, which will contribute to sediment input.

The result further shows that the Catchment area of Zuba (WS8) is roughly double the size of Gwagwalada (WS11), indicating potentially greater runoff volume (for the same rain and land cover), but the longer stream length and high stream number of WS11 are perhaps an indication that for a given rain, catchment area (WS11) will therefore have greater relative peak flows per area (because of many contributing channels, short travel distances) than would be anticipated on a simple per-area basis. This is of particular importance to gully head stabilization and outlet design (Figure 3.1).

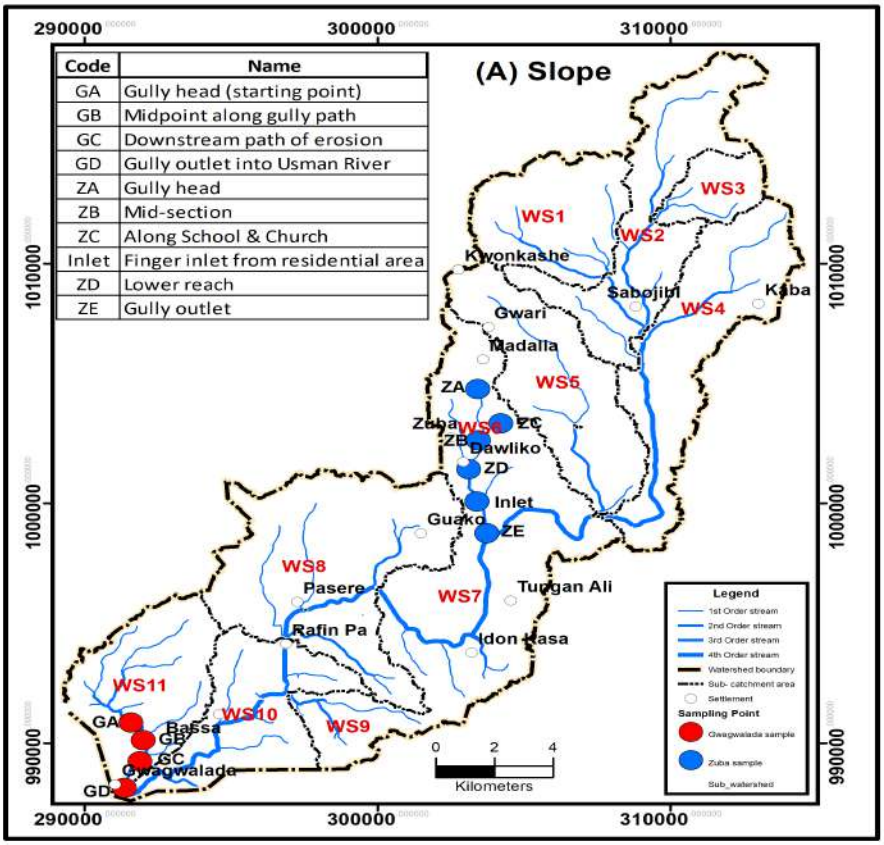


Figure 3.1: Drainage Network of study areas.

Shape characteristics of the study area

The shape parameters considered for analysis in this study include: Form Factor (Ff), Elongation Ratio (Re), and Compactness Index (Cc). Both Zuba corridor (WS8) and Gwagwalada (WS11) Form Factor and elongation ratio revealed a moderately elongated catchment area (Ff ≈ 0.35–0.38; Re ≈ 0.67–0.70). This result shows that they are not circular; indicating that runoff produced within the two corridors will arrive at the outlet over a more extended period, leading to lower and broader hydrograph peaks than for circular basins. This indicates that elongated basins produce longer lag times, flatter peaks, which can decrease. Morphometric analysis reveals that a form factor of less than approximately 0.3 correlates with long basins, resulting in flatter hydrograph peaks and extended flow durations, which suggests a lower risk of sudden flooding but a longer tail of flow (Altaf et al. 2013). Additionally, research indicates that runoff behavior is influenced by Re values between 0.6 and 0.8, indicating intermediate relief, while a Re value around 1 indicates a circular shape; specifically, WS8 and WS11 have Re values of approximately 0.67–0.70, placing them in the intermediate elongated category.

Zuba's compactness index (Cc) is higher (≈3.99) than that of Gwagwalada (≈2.91). Greater Compactness Index is equivalent to more irregular border or more perimeter for a given area, which may result in irregular flow paths, maybe more dispersion, but also in more vulnerability to localized faster flows along parts of the border. In normal morphometric terminology, lower compactness would mean a more circular shape, but the situation of Zuba and Gwagwalada, as shown in this study, revealed that both are intermediate. Studies on compactness and circularity have shown that more circular sub-catchments yield more synchronous flow, increasing the risk of flash floods, whereas elongated basins with a high perimeter-to-area ratio can buffer flow but may still experience localized peaks in steep tributaries (Erena et al., 2018). The average slope is about 6%, and most erosion studies indicate that slopes of 5–10% with poor land cover can produce substantial sediment yields, particularly in areas with dense drainage networks (Figure 3.2).

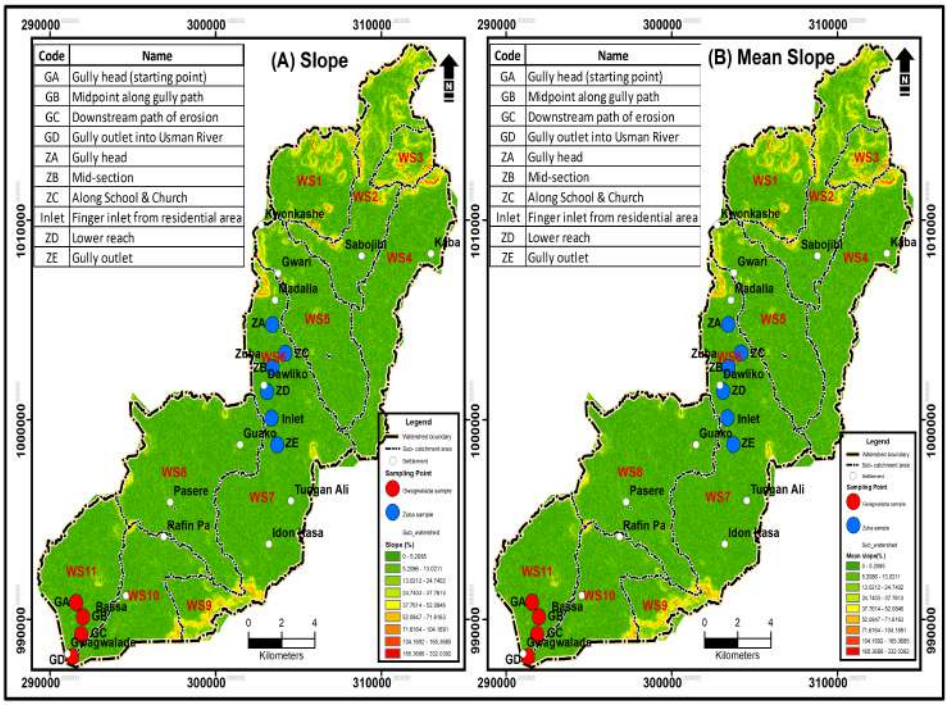


Figure 3.2: Mean surface slope of the study area.

Impacts on Gullying, Erosion, and Hydraulic Design

The differences between Zuba and Gwagwalada with respect to the generation of erosion, gully susceptibility, will impact on the planning level hydraulics. For example, Peak discharge timing of Zuba corridor shows that there will be more delayed arrival of runoff due to elongated shape and low stream density with longer time to peak; flows more attenuated. However, large catchment area means large total runoff.

In the case of Gwagwalada there are much more integrated network, larger number of tributaries leading to faster response for small storms while peak may be earlier, with possible superposition of tributary flows.

Furthermore, Zuba has less erosivity potential, due to more gradual slope and fewer streams. However, where slope increases in upstream sections, local erosive sites is likely.

Gwagwalada has greater erosivity potential overall due to higher network density; even a moderate slope can produce high local shear stresses in channels; headward erosion, gully enlargement potential.

Based on morphometry and hydrologic behavior, stabilization measures differ between the two corridors. Due to the elongated shape, moderate slope, and lesser drainage density, Zuba stabilization efforts shall be focused on upstream source control, land cover improvement (reforestation, grasses), slope stabilization of steeper headwaters, contour farming, retention structures. Channel stabilization will be required where tributaries converge, with particular focus on gully heads that form in steeper sub-catchments. Stormwater control (culverts, drains) needs to have sufficient capacity, but also detention/retention/infiltration structures to slow down runoff and sediment load.

As a result of higher drainage density and many small streams, Gwagwalada stabilization has to be more intensive leading to treating of many small gullies, rills. Sensitive months of heavy rainfall must therefore be mapped and flow routes traced so that vulnerable channels, especially stretches of locally steeper slope, can be armored.

In conclusion, the morphometric evidence indicates that WS11 (Gwagwalada) corridor on the one hand, is more vulnerable to rapid, frequent runoff, erosive flows, and sediment delivery due to high drainage density and shorter flow paths, despite similar average slope to Zuba (WS8).

On the other hand, WS8 (Zuba), though larger and having larger contributing area, with fewer stream channels, resulting in longer lag times. However, Zuba still has the potential for high volume flows in storm events.

General Environmental Conditions

The environmental setting along the Gwagwalada and Zuba gully corridors is summarized in Sections 3.3.1–3.3.7. The discussion covers geology and soils and the extent to which proposed interventions could be influenced by natural environmental factors, including climate and vegetation, topography and landforms, and hydrogeology/hydrologic patterns. Sources of

information include relevant literature, publicly available datasets, and field observations recorded during site visits.

Prevailing climatic conditions (rainfall regime, ambient temperature, wind direction/speed, atmospheric pressure, and relative humidity) were compiled from literature and online datasets and corroborated with field notes for the subproject area. Data on vegetation cover, topography, geology, hydrogeology, surface hydrology, and basic hydraulics were integrated to characterize the sub-watersheds draining to the Gwagwalada and Zuba corridors and to guide the planning-stage ESMP.

3.3 Climate

The study area lies within the tropical continental climatic zone with two distinct seasons. The rainy season extends from April to October, while the dry season spans November to March. Within the dry season, two sub-phases occur: the harmattan (November–February), characterized by cold, dust-laden north-easterly trade winds from the Sahara, and a hot season typically in March–April.

3.3.1.1 Temperature

Skies are generally cloudless on many days. Maximum daily temperatures of 32–38 °C are usually recorded between March and May, while minimum temperatures of 18–24 °C occur in December–January (Oguntoyinbo et al., 1987). The mean daily temperature ranges from 21–32 °C, occasionally rising to ~38 °C around March/April. Relative humidity varies from ~40% in the dry season to ~90% in the wet season.

3.3.1.2. Rainfall

Rainfall data were obtained from the Nigerian Meteorological Agency (NiMet), which operates meteorological stations nationwide (including airports and aerodromes). The dataset is considered adequate for the design of flood and erosion-control structures under this project. Spatial rainfall analysis followed the methodology in the Federal Ministry of Works Drainage Manual (2013): catchments were segmented along the main channels, accounting for segment lengths and contributing tributary inflows.

Rainfall in the FCT (including Gwagwalada/Zuba) is strongly seasonal, with most precipitation between March–November and a pronounced peak in August. Typical annual totals for Abuja are about 1,400–1,500 mm (e.g., ~1,469 mm/yr), with August averaging around ~249 mm for the month. The dry season (roughly mid-November to early March) has negligible rain (Aondoakaa, 2012; Ibilewa et al., 2021). Variability in temperature and rainfall contributes

significantly to gully erosion by increasing rainfall intensity, storm frequency, and surface runoff, which accelerate soil detachment and channel enlargement. Rising temperatures may reduce vegetation cover, dry out soil structure, and weaken ground stability, thereby exposing surfaces to erosive forces and promoting the initiation and rapid expansion of gullies over time as presented in Fig 3.3

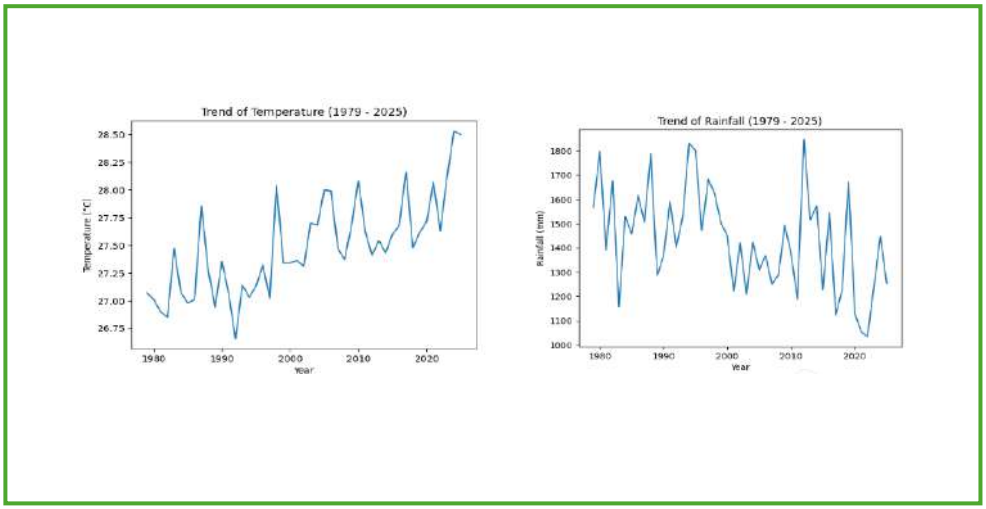


Figure 3.3: Temperature and Rainfall trend in Abuja Project Area (Source: nimet.gov.ng).

For hydraulic design (flood/erosion control), intensity–duration–frequency (IDF) relationships are used to quantify short-duration storm bursts that drive runoff and gully enlargement. Recent Abuja-specific IDF work reports a 3-parameter form, for example, $I = 37 \cdot Tr^{0.2} \cdot (t + 0.1)^{-0.9}$, where *I* is intensity (mm/hr), *Tr* is return period (years), and *t* is storm duration (hr). Using Abuja stations, studies indicate that 1-hour design intensities commonly range from ~60–120 mm/hr for return periods in the 2–25 year range, rising toward 160 –170 mm/hr for rarer events.

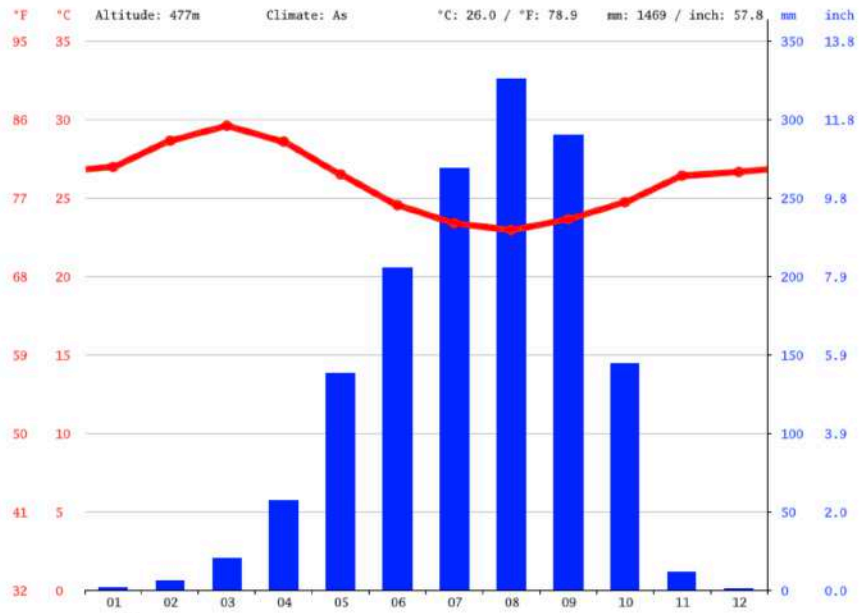


Figure 3.4: Temperature and Rainfall Distribution in Abuja Project Area (Source: climate- data.org).

3.3.1.3. Relative Humidity

Relative humidity in the project area varies strongly with season. Monthly averages are highest in August (~86–87%) and lowest in January (~21–26%). Diurnally, values are typically higher near dawn and lower by afternoon in both wet and dry seasons. These magnitudes reflect Abuja/FCT climatology and align with NiMet-based summaries for the area (Ige et al., 2017).

3.3.1.4 Winds and Visibility

Seasonal wind regimes are dominated by the northeast (Harmattan) flow during the dry season (roughly late Oct/Nov–Feb) and south–west to west monsoonal flow during the rainy season (about May–Oct). At 10 m height, Abuja's average hourly wind speeds range from about 6.4 km/h (≈ 1.8 m/s) in October to 10.3 km/h (≈ 2.9 m/s) in January; instantaneous gusts can be higher (Akpootu et al., 2017). During Harmattan, dust haze can reduce daytime visibility; conditions often improve at night when inversions allow particulates to settle.

3.4 Topographic Context

The subproject corridors lie on the undulating plains of the FCT with local relief increasing toward inselbergs and rocky hills north and east of the metropolis (e.g., Aso/Zuma areas). Zuba sits around ~390 m above sea level, while Gwagwalada local elevations commonly range from ~186 to 250 m above sea level. Within the town and valley floor, consistent with your surveyed points (≈ 212 to 189 m along the gully) (Ayadiuno et al., 2021).

3.4.1 Geology and Hydrology

The geology and soils of the Gwagwalada/Zuba project area—and how they may influence implementation of the proposed subprojects—are summarized below. Natural environmental factors considered include climate and vegetation, topography and landforms, hydrogeology, and surface-water hydrologic patterns. Information sources comprise published literature and field observations recorded during site visits for this Consultancy.

3.4.2. Regional Geology

The Federal Capital Territory (including Gwagwalada and Zuba) is underlain by the Precambrian Basement Complex, dominated by migmatite–gneiss suites and Pan-African granitoids (granites, granodiorites), with local occurrences of schists and quartzites. Deep tropical weathering has produced a mantle of lateritic regolith (laterite, ferricrete), grading downward into mottled clays, saprolite, and fresh bedrock. These materials commonly yield sandy to sandy-loam topsoils on interfluves and finer, more cohesive colluvium in valley bottoms.

3.4.3. Local Geology and Soils (Project Corridors)

Along the gully alignments, soils are typically lateritic/sandy with variable clay content. When denuded of vegetation, these horizons exhibit moderate to high erodibility, especially on steeper slopes or where flows are concentrated by roadside drains and paved areas. Bank materials in actively eroding reaches show signs of undercutting and slumping, reflecting alternating layers of more/less cohesive soils within the weathered profile. Bouldery/gravelly lenses appear locally where the saprolite transitions to less weathered granitoids.

3.5. Hydrogeology

Groundwater occurs mainly within the weathered regolith and fractured bedrock of the Basement Complex. Yields are variable (generally low–moderate) and strongly dependent on fracture density and regolith thickness. Seasonal water-table rise during the rainy season can increase seepage faces on gully banks, reducing stability; conversely, drawdown in the dry season may leave tension cracks that prime slopes for collapse at the onset of rains.

3.5.1. Surface Hydrology

Catchments draining the corridors are flashy, with short response times to intense convective storms. Overland flow from impervious and compacted surfaces is rapidly conveyed into the channels, driving high shear stresses that deepen and widen gullies. Downstream flows ultimately discharge toward the Usuma (Gwagwalada)/Usuma (Zuba) River system. Historical

blockage by refuse and undersized/poorly aligned culverts has periodically diverted flow, promoting avulsions and new incision points.

3.6. Soil Types (Gwagwalada & Zuba, FCT)

The soil investigation for the Gwagwalada and Zuba corridors was undertaken at SCC (Nig.) Ltd., an accredited construction materials testing laboratory. The scope of work comprised natural moisture content determination, particle-size distribution (sieve analysis), Atterberg limits (liquid limit, plastic limit, and plasticity index for USCS classification), Standard Proctor compaction (to establish Maximum Dry Density, *MDD*, and Optimum Moisture Content, *OMC*), and California Bearing Ratio (CBR) testing on specimens molded at moisture contents bracketing *OMC*. The resulting dataset provides the engineering basis for evaluating soil erodibility, workability, and bearing capacity, and informs the ESMP specifications for material selection, compaction control, and drainage/erosion management across the subproject corridors.

3.6.1. Compaction Test

This test establishes the moisture density, strength relationship needed to set compaction targets and predict the in-service performance of fills and subgrades along the corridors. The soil test was carried out at the lab of SCC (NIG) LTD, a reputable construction material testing lab. A laboratory compaction/CBR test on a dark-coloured, humic soil from Gwagwalada/Zuba (0.5 m depth; natural moisture ≈ 18%) shows an OMC of 14.8% and MDD of 1.705 Mg/m³; dry density rises from 1.616 to 1.701 Mg/m³ as moisture increases from ≈ 11.2 to 15.1%, then drops to 1.661 and 1.586 Mg/m³ at 16.8% and 19.5%, respectively, with CBR peaking near OMC (Top 38%, Bottom 34%) and falling sharply when wetter (~6–7% at 16.8%; ~4–5% at 19.5%). For field acceptance, this implies ≥ 95% MDD ≈ 1.620 Mg/m³ (or ≥ 98% MDD ≈ 1.672 Mg/m³) compacted as close as practicable to OMC (≈ 14.8%). Because the in-situ moisture is above OMC, the soil is moisture-sensitive: without conditioning, it will compact poorly and exhibit low strength under traffic or seepage. Practical solutions are to condition moisture (scarify and aerate; windrow and sun-dry; add drier lateritic borrow; or lightly dose with lime/cement after quick index testing), compact in thin lifts (≤ 200–250 mm loose) with appropriate rollers (sheepsfoot to knead, smooth drum to finish) and verify each lift by in-situ density/MC testing; stage works in dry weather windows, protect scarified areas from rain, and install temporary drainage (cut-off ditches, sumps, pumps) so water cannot pond; strip organics/topsoil from structural zones and use the richer material only for turfing/bio-engineering; at structures and steep banks, add filters/drainage layers and energy-dissipating

aprons/gabions to prevent saturation and scour; finally, implement QA/QC hold points (re-work any lot < 95/98% MDD) and restrict construction traffic until compaction is verified. These measures will allow the material to perform satisfactorily in the gully-rehabilitation works despite its sensitivity to excess moisture (Results sheets attached in the Appendices).

Table 3.5: Laboratory Compaction and California Bearing Ratio (CBR) Results (0.5 m Depth)

Point	Water Added (%)	Avg Moisture (%)	Dry Density (Mg/m³)	CBR – Top (%)	CBR – Bottom (%)
1	10	11.2	1.616	13	15
2	12	12.8	1.670	26	22
3	14	15.1	1.701	38	34
4	16	16.8	1.661	6	7
5	18	19.5	1.586	4	5

3.6.2. In-situ Density Test

The in-situ density (sand-replacement) test provides objective verification of field compaction, ensuring the subgrade and backfill achieve the densities needed for the long-term performance of the drainage and slope works. The in-situ density (sand-replacement) tests carried out on the compacted layer at Gwagwalada and Zuba (after topsoil removal) confirm that the placed material is well compacted and fit for purpose. Three locations tested at natural field moistures of about 18.5%, 17.2% and 16.0% yielded dry densities of 1.733, 1.985 and 1.819 Mg/m³, respectively, with an average dry density of 1.846 Mg/m³. When compared with the laboratory Proctor reference (MDD = 1.705 Mg/m³; OMC = 14.8%), the corresponding degrees of compaction are ~101.6%, 116.4% and 106.7% (average ≈ 108.3%), i.e., all test points exceed the common acceptance thresholds of ≥95–98% MDD. Because densities above 100% of the laboratory MDD can occur when the field material is slightly different/cleaner than the Proctor specimen, when the field effort is closer to Modified Proctor, or from minor test-calibration effects (e.g., sand bulk density, cone volume, moisture determination), it is prudent to confirm the reference Proctor on a representative bulk sample of the placed material and to spot-check moisture by oven-dry. Subject to that confirmation, the layer meets specification: compaction close to OMC (±2%), thin lifts (≤200–250 mm), continued in-situ density/moisture checks per lot, and temporary drainage/cover to prevent post-construction wetting will maintain the achieved stiffness and strength for the gully-rehabilitation works.



Plate 3.1: Field test of the moisture content using the in-situ density testing.

Table 3.6: In-Situ Density (Sand-Replacement) Results Gwagwalada/Zuba (As-Found, Pre-Construction; Reference MDD = 1.705 Mg/m³)

Test	Moisture, *w*(%)	Wet density (Mg/m³)	Dry density (Mg/m³)	Degree of compaction vs lab MDD 1.705 Mg/m³
1	18.5	2.054	1.733	101.6%
2	17.2	2.327	1.985	116.4%
3	16.0	2.110	1.819	106.7%
Average	**17.2**	—	1.846	108.3%

3.6.3. Atterberg Limits

The Atterberg limits (LL, PL, PI) quantify the soil's plasticity and moisture sensitivity, directly indicating workability, shrink–swell risk, and whether treatment or granular replacement is needed for durable drainage works. The laboratory index testing gives a Liquid Limit (LL) = 59.5%, Plastic Limit (PL) = 18.7%, and Plasticity Index (PI) = 40.8% (natural moisture noted ≈ 18%). These values indicate a high-plasticity fine soil; if the fraction passing 0.425 mm exceeds 50% (as is typical for this material), it is classified as CH under USCS (Unified Soil Classification System) and likely A-7-5 / A-7-6 under AASHTO. Such soils have low permeability, high moisture sensitivity, and significant shrink/swell potential, with workability that deteriorates rapidly when wet below the optimum. For the proposed drainage works, the material is unsuitable as untreated structural backfill or bedding and shall not be placed adjacent to hard structures without treatment. Practical measures are to: (i) use clean granular material for bedding, filter and backfill zones; (ii) where on-site reuse is desired, stabilize the high-plasticity soil (trial mix design) with lime or lime–cement to reduce PI (<12%), increase strength, and improve durability; (iii) blend with lateritic/granular borrow to lower plasticity;

(iv) compact treated/reused soil at OMC ±2% in thin lifts with strict QC (in-situ density and moisture checks); and (v) provide positive drainage and surface protection to prevent re-wetting. Untreated high-PI soil is best reserved for non-structural uses (e.g., landscaping/topsoil cover) rather than for load-bearing backfill around culverts, headwalls, or channel linings.

3.6.4. Sieve Analysis

The particle-size distribution shows a fines-rich material with 63.9% passing the No. 200 (0.075 mm) sieve, confirming a fine-grained soil. The sand fraction is dominated by fine sand (≈30.7%), with medium sand ≈4.1% and coarse sand ≈0.3%; gravel content is negligible (≤0.8% combined). Percent passing at key sieves is: 1″ 100%, ¾″ 100%, ½″ 99.6%, 3/8″ 99.4%, ¼″ 99.1%, 3/16″ 99.0%, No. 7 (2.36 mm) 98.6%, No. 14 (1.18 mm) 97.6%, No. 25 (0.60 mm) 94.6%, No. 52 (0.30 mm) 83.0%, No. 100 (0.15 mm) 71.6%, No. 200 (0.075 mm) 63.9%. The steep, high-fines gradation curve indicates poor drainage characteristics and limited suitability as untreated structural backfill. When combined with the Atterberg limits (LL ≈ 59.5%, PL ≈ 18.7%, PI ≈ 40.8%), the soil classifies as CH, Inorganic clay of high plasticity (fat clay) under USCS, with high moisture sensitivity, low permeability, and shrink–swell potential. Implications for the drainage works: use clean granular material (well-graded sand/gravel) for bedding, filters, and structural backfill around culverts, headwalls, and channel linings; where site reuse is desired, reduce plasticity by lime or lime–cement stabilization or by blending with lateritic/granular borrow, targeting PI < 12% and meeting gradation/filter criteria. Place in thin lifts at OMC±2% with in-situ density/moisture control, provide separation/filter geotextiles where fines could migrate, and ensure positive surface/subsurface drainage to prevent re-wetting and loss of strength.

Table 3.7: Particle-Size Distribution by Fraction (Average of values from the two sites)

Fraction	% by Weight
Coarse aggregate	0.4
Medium gravel	0.4
Fine gravel	≤0.2
Coarse sands	0.3
Medium sands	4.1
Fine sands	30.7
Silts & clays (Passing No.200)	63.9

Table 3.8: Sieve Analysis Results (Average of values from the two sites)

Test Sieve	Aperture (mm)	Weight Retained (g)	% Retained	% Passing (Cumulative)
1″	25.40	–	–	100.0
¾″	19.05	4.3	0.4	99.6
½″	12.70	1.5	0.2	99.4
3/8″	9.50	1.5	0.2	99.4
¼″	6.30	2.8	0.3	99.1
3/16″	4.75	2.3	0.2	99.0
No. 7	2.36	10.9	1.1	97.6
No. 14	1.18	29.6	3.0	94.6
No. 25	0.600	29.6	3.0	94.6
No. 52	0.300	115.6	11.6	83.0
No. 100	0.150	114.7	11.5	71.6
No. 200	0.075	76.8	7.7	63.9

3.7. Biodiversity

The ecological appraisal of the immediate sub-project corridors (drainage/gully alignments and adjoining buffer) provides baseline information on vegetation cover and fauna, which is essential for understanding local ecosystem dynamics and for monitoring construction and post-construction performance. The landscape is predominantly modified habitat—a mosaic of built-up areas, roads/footpaths, refuse points, active farms and fallows, school/church compounds, and small riparian strips. Within this matrix, fauna occur at low densities due to disturbance, habitat fragmentation, and hunting/collection pressure. During rapid field reconnaissance and community interviews, commonly observed or reported fauna included agamas and skinks, ground squirrels, common savanna birds such as cattle egret (*Bubulcus ibis*), herons (*Ardea/Egretta* spp.), weavers (*Ploceus* spp.), doves/pigeons, and occasional black kites (*Milvus migrans*); Nile monitor lizard (*Varanus niloticus*) was anecdotally reported near wetter reaches. No critical habitat was identified inside the work footprint. To avoid overstating sensitivity, references to "threatened species" are treated as potential occurrences only; any chance findings during site clearing will be managed through a Chance-Find/Stop-Work procedure, with avoidance, reporting, and engagement of FMEnv/FCT authorities as required. All fauna are indirectly at risk from further habitat loss, vegetation removal, and disturbance; therefore, the ESMP prescribes selective clearing, timing of works (outside peak nesting where feasible), and waste/traffic controls to reduce mortality and displacement.

Further, impact local fisheries by altering natural water flows, increasing sedimentation, and modifying aquatic habitats. For example, diverted runoff or deposited sediments could cover

spawning grounds, reducing fish breeding success. Communities relying on small streams or ponds for fishing may experience restricted access or reduced fish abundance. Productivity of species such as tilapia and catfish could decline, affecting livelihoods. To mitigate impacts, measures like maintaining stream connectivity, protecting critical breeding areas, regulating water diversion, and providing alternative fishing zones should be implemented to sustain both fisheries and community livelihoods.

3.7.1. Vegetation

The project area lies within the Southern Guinea Savanna belt, characterized by a long dry season (≈5–6 months) and a vegetation structure comprising a grass layer with scattered shrubs and trees. Decades of cultivation, grazing, fuel-wood harvest, and settlement expansion have converted most native woodland into modified savanna, mixed home-gardens, and fallows. The herbaceous layer is dominated by grasses (Poaceae), notably *Panicum maximum, Andropogon gayanus, Hyparrhenia spp., Cynodon dactylon, Digitaria spp., Eragrostis spp., Setaria spp., and Pennisetum pedicellatum, with seasonal forbs common along disturbed verges. Woody elements recorded around fields, compounds, and riparian pockets include Vitellaria paradoxa (shea), Parkia biglobosa (locust bean), Daniellia oliveri, Anogeissus leiocarpus, Isoberlinia doka, Terminalia avicennioides, Lannea 84fricana84a, Sclerocarya birrea, Tamarindus indica, Khaya senegalensis (*locally*),* and *Ficus spp. Planted/exotic trees such as Azadirachta indica (neem), Mangifera indica(mango),* and *Moringa oleifera* are widespread around institutions and residences. The vertical structure typically comprises a discontinuous tree stratum (≈8–18 m), a patchy shrub layer (≈3–7 m), and a 0.5–2.5 m herb layer, reflecting strong anthropogenic modification.

Within adjoining communities, farms are diverse and largely intercropped, with maize, sorghum/guinea-corn, millet, groundnut, cowpea/beans, sesame (beni-seed), okra, peppers and leafy vegetables; in low-lying plots with a high-water table or seasonal inundation, small pockets of rice are cultivated during suitable seasons. Farmers maintain species and spatial heterogeneity through crop mixtures and planting patterns; useful indigenous trees (e.g., shea, locust bean, tamarind) are frequently retained on fields for food and shade, while fruit and multipurpose exotics (neem, mango, moringa) are planted near homesteads. Vegetation of high conservation concern was not encountered within the corridor; however, riparian strips and fallows provide local biodiversity value and shall be protected where practicable.



Plate 3.2: Some species of plants Devil's Horsewhip(chaff-flower) (*Achyranthes aspera)* Found in Gwagwalada Site.



Plate 3.3: Some species of plants Spiked pepper (*Piper aduncum)* found in Zuba site.

3.7.2 Representative and Indicator Plant Species (Gwagwalada Corridor)

The Gwagwalada corridor contains a mixture of Southern Guinea Savanna tree species, riparian shrubs, and herbaceous ground cover influenced by seasonal runoff and gully erosion processes. The area includes both degraded lands undergoing natural succession and sections with agricultural and agroforestry practices. Species composition reflects a blend of resilient savanna trees (*Vitellaria paradoxa, Parkia biglobosa*), riparian indicators (*Nauclea latifolia*), shrubs (*Guiera senegalensis*), and herbaceous pioneers (*Imperata cylindrica*). Some species also occur in the Zuba corridor due to shared climatic conditions and anthropogenic pressure.

Table 3.9: Gwagwalada Corridor Representative Species

S/N	Scientific Name	Family	Life Form	Common Name	Hausa Name	Remark
1	*Vitellaria paradoxa*	-	Tree	Shea butter	Kadanya	Abundant in savanna areas
2	*Parkia biglobosa*	*Fabaceae*	Tree	African locust bean	Dorowa	Common in farmlands
3	*Adansonia digitata*	*Malvaceae*	Tree	Baobab	Kuka	Widespread savanna indicator
4	*Tamarindus indica*	*Fabaceae*	Tree	Tamarind	Tsamiya	Found near settlements
5	*Piliostigma thonningii*	*Fabaceae*	Tree	Camel's foot	Kalgo	Common in transition zones
6	*Anogeissus leiocarpus*	*Combretaceae*	Tree	Axlewood	Marke	Common dryland species
7	*Guiera senegalensis*	*Combretaceae*	Shrub	Guiera	Sabara	Common savanna shrub
8	*Combretum nigricans*	*Combretaceae*	Shrub	Combretum	Tsiriri	Woody shrub, common
9	*Combretum micranthum*	*Combretaceae*	Shrub	Kinkeliba	Geza	Present in shrubland
10	*Senegalia senegal*	*Fabaceae*	Tree	Gum arabic	Farar kaya	Abundant
11	*Vachellia nilotica*	*Fabaceae*	Tree	Acacia	Bagaruwa	Common
12	*Daniellia oliveri*	*Fabaceae*	Tree	African copaiba	Maje	Widespread
13	*Isoberlinia doka*	*Fabaceae*	Tree	Doka tree	Doka	Dominant in woodlands
14	*Detarium microcarpum*	*Fabaceae*	Tree	Tallow tree	Taura	Occasional
15	*Ficus thonningii*	*Moraceae*	Tree	Strangler fig	Chediya	Riparian/stable soils
16	*Nauclea latifolia*	*Rubiaceae*	Shrub/Small tree	African peach	Tafashiya	Riparian indicator
17	*Diospyros mespiliformis*	*Ebenaceae*	Tree	African ebony	Kanya	Found in deeper soils
18	*Lannea microcarpa*	*Anacardiaceae*	Tree	African grape	Faru	Common in farmlands
19	*Mangifera indica*	*Anacardiaceae*	Tree	Mango	Mangwaro	Widely cultivated
20	*Azadirachta indica*	*Meliaceae*	Tree	Neem	Dogon yaro	Planted for shade

21	*Moringa oleifera*	*Moringaceae*	Tree	Moringa	Zogale	Cultivated
22	*Psidium guajava*	*Myrtaceae*	Tree	Guava	Gwava	Common
23	*Phoenix dactylifera*	*Arecaceae*	Tree	Date palm	Dabino	Planted
24	*Borassus aethiopum*	*Arecaceae*	Tree	Fan palm	Giginya	Scattered
25	*Hyphaene thebaica*	*Arecaceae*	Tree	Doum palm	Goruba	Riparian zones
26	*Khaya senegalensis*	*Meliaceae*	Tree	African mahogany	Madaci	Planted near waterlines
27	*Annona senegalensis*	*Annonaceae*	Shrub	Wild custard apple	Gwandar daji	Common in bushland
28	*Guiera senegalensis*	*Combretaceae*	Shrub	Sabara	Sabara	Abundant shrub
29	*Calotropis procera*	*Apocynaceae*	Shrub	Apple of Sodom	Tumfafiya	Roadside/common
30	*Asparagus africanus*	*Asparagaceae*	Climber/Shrub	Asparagus	Sarka	Found near shrubland
31	*Aspilia africana*	*Asteraceae*	Herb	Haemorrhage plant	Yunyun	Common herb
32	*Imperata cylindrica*	*Poaceae*	Herb	Spear grass	Tofa	Abundant grass cover
33	*Andropogon gayanus*	*Poaceae*	Herb	Gamba grass	Gabaa	Dominant in grassland patches
34	*Tridax procumbens*	*Asteraceae*	Herb	Tridax daisy	—	Common weed
35	*Ageratum conyzoides*	*Asteraceae*	Herb	Goat weed	—	Disturbed soils
36	*Vernonia amygdalina*	*Asteraceae*	Shrub	Bitter leaf	Shuwaka	Near homes
37	*Achyranthes bidentata*	*Amaranthaceae*	Herb	Achyranthes	—	Recently observed, riparian/proximal
38	*Hyptis suaveolens*	*Lamiaceae*	Herb	Bush tea	—	Common after rains
39	*Chromolaena odorata*	*Asteraceae*	Shrub	Siam weed	—	Colonizer of moist soils
40	*Nauclea latifolia*	*Rubiaceae*	Shrub	African peach	Tafashiya	Common riparian

3.7.3. Representative and Indicator Plant Species (Zuba Corridor)

The Zuba corridor presents a more heavily built-up and disturbed vegetation profile compared to Gwagwalada. As the gully runs through densely populated areas close to a school and religious facility, the vegetation consists largely of opportunistic pioneer species, weeds, shrubs, and cultivated trees found around residential zones. Species commonly found in anthropogenically impacted areas, such as Chromolaena odorata, Aspilia 88fricana, Ageratum conyzoides, and Sida acuta, are prevalent. Planted trees such as Neem (Azadirachta indica), Mango (Mangifera indica), and Pawpaw (Carica papaya) are also present. Some savanna species seen in Gwagwalada also appear in Zuba, these have been marked as "Common to both corridors."

Table 3.10: Zuba Corridor Representative Species

S/N	Scientific Name	Family	Life Form	Common Name	Hausa Name	Remark
1	*Azadirachta indica*	*Meliaceae*	Tree	Neem	Dogon yaro	Planted; common to both corridors
2	*Mangifera indica*	*Anacardiaceae*	Tree	Mango	Mangwaro	Common to both corridors
3	*Carica papaya*	*Caricaceae*	Tree	Pawpaw	Gwanda	Often near homes
4	*Psidium guajava*	*Myrtaceae*	Tree	Guava	Gwava	Commonly cultivated
5	*Moringa oleifera*	*Moringaceae*	Tree	Moringa	Zogale	Home gardens
6	*Ziziphus mauritiana*	*Rhamnaceae*	Tree	Jujube	Magarya	Semi-cultivated
7	*Vitex doniana*	*Lamiaceae*	Tree	Black plum	Dinya	Present near settlements
8	*Hibiscus sabdariffa*	*Malvaceae*	Shrub	Roselle	Yakuwa	Seasonal crop gardens
9	*Arachis hypogaea*	*Fabaceae*	Herb	Groundnut	Gyada	Cultivated
10	*Vigna unguiculata*	*Fabaceae*	Herb	Cowpea	Wake	Cultivated
11	*Imperata cylindrica*	*Poaceae*	Herb	Spear grass	Tofa	Common to both corridors
12	*Andropogon gayanus*	*Poaceae*	Herb	Gamba grass	Gabaa	Present in open patches
13	*Tridax procumbens*	*Asteraceae*	Herb	Tridax daisy	—	Very common weed
14	*Ageratum conyzoides*	*Asteraceae*	Herb	Goat weed	—	Common roadside weed

15	*Aspilia africana*	*Asteraceae*	Herb	Haemorrhage plant	Yunyun	Common mower-resistant weed
16	*Sida acuta*	*Malvaceae*	Shrub	Wire weed	—	Roadside/corridor weed
17	*Senna occidentalis*	*Fabaceae*	Shrub	Coffee senna	Rama-rama	Disturbed soils
18	*Calotropis procera*	*Apocynaceae*	Shrub	Apple of Sodom	Tumfafiya	Common to both corridors
19	*Hyptis suaveolens*	*Lamiaceae*	Herb	Bush tea	—	Common rainy season weed
20	*Chromolaena odorata*	*Asteraceae*	Shrub	Siam weed	—	Aggressive colonizer
21	*Achyranthes bidentata*	*Amaranthaceae*	Herb	Achyranthes	—	Found near gully edges
22	*Bidens pilosa*	*Asteraceae*	Herb	Blackjack	—	Produces burrs; gully margins
23	*Xanthium strumarium*	*Asteraceae*	Herb	Cocklebur	—	Damp final sections
24	*Ipomoea asarifolia*	*Convolvulaceae*	Herb	Morning glory	Duman K'adda	Moist disturbed areas
25	*Cyperus rotundus*	*Cyperaceae*	Sedge	Nut sedge	—	Wet spots
26	*Ricinus communis*	*Euphorbiaceae*	Shrub	Castor oil plant	—	Waste areas
27	*Jatropha curcas*	*Euphorbiaceae*	Shrub	Physic nut	—	Boundary hedges
28	*Vernonia amygdalina*	*Asteraceae*	Shrub	Bitter leaf	Shuwaka	Grown in home compounds
29	*Leptadenia hastata*	*Apocynaceae*	Liana	Leptadenia	Dan-barawo	Climber in open patches
30	*Guiera senegalensis*	*Combretaceae*	Shrub	Guiera	Sabara	Lower density; common to both
31	*Piliostigma thonningii*	*Fabaceae*	Tree	Camel's foot	Kalgo	Scattered; common to both
32	*Nauclea latifolia*	*Rubiaceae*	Shrub	African peach	Tafashiya	Moist gully sections
33	*Ficus thonningii*	*Moraceae*	Tree	Strangler fig	Chediya	Planted/shade tree
34	*Annona senegalensis*	*Annonaceae*	Shrub	Wild custard apple	Gwandar daji	Semi-wild areas
35	*Calotropis procera*	*Apocynaceae*	Shrub	Apple of Sodom	Tumfafiya	Common roadside
36	*Aspilia africana*	*Asteraceae*	Herb	Yunyun	Yanyun	Widespread ruderal herb
37	*Senna siamea*	*Fabaceae*	Tree	Siamese cassia	—	Roadside planted
38	*Eucalyptus camaldulensis*	*Myrtaceae*	Tree	Eucalyptus	—	Road verge planting

39	*Gmelina arborea*	*Lamiaceae*	Tree	Gmelina	—	Plantation tree
40	*Tectona grandis*	*Lamiaceae*	Tree	Teak	—	Often in compounds
41	*Phoenix dactylifera*	*Arecaceae*	Tree	Date palm	Dabino	Planted

3.8 General Geomorphology

Slope Instability and Subsidence

Slope condition in the subproject corridors is governed by local gradient, moisture regime, vegetation cover, and anthropogenic loading. Along the active gully margins in Gwagwalada (Old Kutunku axis) and Zuba, steepened banks, undercut toes, and seasonal saturation combine to reduce shear strength, especially where clayey/lateritic soils are exposed and vegetation has been cleared. Any further disturbance (e.g., uncontrolled excavation, stockpiles near edges, or construction traffic) can accelerate slumping and head-cut retreat. Stabilization will therefore prioritize careful earthworks sequencing, temporary drainage, and rapid revegetation/armoring of banks. With respect to land subsidence (regional lowering of ground surface), there is no evidence of subsidence in the project area and the geologic/hydrogeologic conditions typically associated with it (e.g., deep aquifer over-abstraction, evaporite dissolution) are not known to occur here; subsidence risk is considered low.

Natural Drainage Corridors

Interpretation of recent satellite imagery, field reconnaissance, and local topographic breaks (≈5 m contours where available) delineates convergent overland flow paths feeding the project gullies. In both Zuba and Gwagwalada, runoff is concentrated by road crowns, yard drains, and bare compacted surfaces, then conveyed through ad-hoc channels into the main erosional corridors. The ultimate receiving water is the Usuma River, where the Gwagwalada gully discharges. For design and mitigation planning, all swales, ephemeral channels, and man-made outlets that focus stormwater into the gullies are treated as part of the project's drainage network.

Archaeology and Cultural Heritage

No World Heritage Sites or formally designated cultural properties are mapped within the works footprint. Nevertheless, chance discoveries (e.g., artifacts, shrines, graves) are possible in peri-urban settings. The ESMP adopts a Chance-Find Procedure: immediate stop-work, cordon and protect the find, notify the SPMU/Area Council and relevant FCTA authorities, and

proceed only after clearance and agreed mitigation. Site personnel will receive induction on cultural sensitivity and reporting lines.

3.9 Traffic and Transport Infrastructure

Access to the corridors is via local streets and community roads (notably Old Kutunku Road in Gwagwalada and internal streets in Zuba). Present traffic is low to moderate but becomes disrupted during rains due to ponding, eroded verges, and blocked drains. During construction, temporary traffic impacts (lane narrowing, short-term closures, haul movements) are expected. The ESMP requires a Traffic Management Plan (TMP): signage and flagging, safe pedestrian routes near schools/markets/places of worship, restricted haul timings, dust/noise control, and community notifications. Post-intervention, improved drainage is expected to enhance pass ability and reduce seasonal damage to adjoining roads.

3.10 Waste Management

Solid-waste services in the subproject communities are inadequate. Households commonly burn refuse, bury small quantities, or dump into nearby drains/gully heads, which blocks flows and exacerbates erosion/flooding. Open defecation occurs along some corridor margins; there is no sewer network, and sanitation relies on pit latrines and on-plot facilities. To address public and construction-phase risks, the ESMP stipulates: (i) engagement of AEPB/FCTA-accredited waste vendors for regular collection; (ii) provision of covered skips at strategic points during works; (iii) prohibition and enforcement against dumping in waterways; (iv) Contractor's Waste Management Plan (segregation, safe storage, licensed disposal; no on-site burning); (v) hygiene/sanitation awareness with community leaders; and (vi) routine desilting of inlets and traps to keep the corridors hydraulically efficient. These measures are essential to protect public health and sustain the functionality of the storm-water drainage improvements.

3.10.1 Environmental Quality

Surface Water (Gwagwalada)

Table 3.11: Result of Surface Water Analysis with Regulatory Standard at the Gwagwalada Gully Site

Parameter	Sample				Allowable Limit (NIS/WHO)
	A	B	C	D	
Temperature (^{0}C)	27.8	28.0	28.0	29.5	Ambient
Turbidity (NTU)	20	10	10	20	5
pH	7.11	6.97	7.3	6.65	6.5 – 8.5

EC (µS/cm)	276	322	224	360	1000
TDS (ppm)	138	161	112	180	500
Salinity (%)	0.02	0.01	0.01	0.01	N/A
TSS (ppm)	45	32	39	41	1000
Nitrate (mg/l)	5	13	16	28	50
Sulphate (mg/l)	30	32	37	47	100
DO (mg/l)	4	3	2	2	6-8
TOC (mg/l)	3	5	7	7	5
Pb (mg/l)	0.07	0.015	0.005	0.044	0.01
Cd (mg/l)	0.017	0.019	0.024	0.018	0.003
As (mg/l)	0.002	0.005	0.003	0.010	0.01
Total Coliform Count(0 CFU/100 mL)	10	11	11	15	0

Field chemistry at four locations (A–D) indicates generally neutral pH (6.65–7.30; within 6.5–8.5), modest salinity (0.01–0.02%) and low–moderate TDS (112–180 mg/L; below 500 mg/L). However, turbidity is elevated (10–20 NTU vs. 5 NTU guideline), consistent with fine-sediment entrainment from bank/gully erosion and traffic on unsealed surfaces. Dissolved oxygen (DO) is low at all points (2–4 mg/L vs. 6–8 mg/L desirable range), suggesting organic loading and limited reaeration in slow/stagnant reaches. TOC is ≤7 mg/L, with C–D above the 5 mg/L screening level, corroborating the depressed DO. Heavy-metal screening shows exceedances for lead (Pb) at A (0.070 mg/L), D (0.044 mg/L) and cadmium (Cd) at all points (0.017–0.024 mg/L) relative to the 0.01 mg/L (Pb) and 0.003 mg/L (Cd) thresholds; arsenic (As) remains within the 0.01 mg/L limit (0.002–0.010 mg/L). Elevated lead and cadmium levels, combined with low dissolved oxygen and high turbidity, pose cumulative ecological and human health risks. Aquatic organisms may experience toxicity, reduced growth, and reproductive impairment, while bioaccumulation of heavy metals in fish could threaten local communities relying on these resources for food, raising potential health concerns.

Total coliforms are detected at 10–15 CFU/100 mL, exceeding the drinking-water benchmark of 0 CFU/100 mL (none detectable), and indicating faecal/microbial contamination risk. The implications and ESMP actions prioritize erosion/sediment controls (check dams, vegetative buffer strips, staged works) to reduce turbidity; exclude runoff from waste/concrete areas; implement source tracing for Pb/Cd (legacy waste, batteries, paint residues, roadside dust) and adopt good housekeeping/spill prevention; provide public-risk messaging that surface water is

not safe for drinking without treatment; and continue periodic monitoring (turbidity/TSS, DO/BOD/TOC, metals, microbiology) during works.

Surface Water (Zuba)

Table 3.12: Result of Surface Water Analysis with Regulatory Standard at the Zuba Gully Site

Parameter	**Sample**					**Allowable Limit (NIS/WHO)**
	A	**B**	**C**	**D**	**E**	
Temperature (^{0}C)	30	30.3	30	31.7	32.5	Ambient
Turbidity (NTU)	5	10	50	45	20	5
pH	6.8	7.01	6.9	7.18	7.38	6.5 – 8.5
EC (µS/cm)	289	335	337	402	582	1000
TDS (ppm)	148	167	169	201	291	500
Salinity (%)	0.01	0.01	0.01	0.02	0.03	N/A
TSS (ppm)	25	43	47	65	72	1000
Nitrate (mg/l)	41	44	44	48	50	50
Sulphate (mg/l)	21	22	31	37	39	100
DO (mg/l)	2	4	7	7	6	6-8
TOC	3	3	5	7	9	5
Pb (ppm)	0.06	0.16	0.18	0.18	0.21	0.01
Cd (ppm)	0.011	0.013	0.025	0.019	0.020	0.003
As (ppm)	0.011	0.014	0.003	0.003	0.002	0.01
Total Coliform Count (0 CFU/100 mL)	6	6	10	15	16	0

Five locations (A–E) show ambient temperatures (30.0–32.5 °C) and acceptable pH (6.8–7.38). TDS rises downstream (148 to 291 mg/L; still <500 mg/L) with EC 289 to 582 µS/cm, indicating mineralization along the corridor. Turbidity is frequently high, A is at the limit (5 NTU), B =10, C =50, D =45, E =20 NTU, reflecting active bank disturbance and bed fines. DO ranges 2–7 mg/L (suboptimal at A; adequate at C–E), while TOC increases to 9 mg/L at E (>5 mg/L screen). Metals show systematic exceedances: Pb = 0.06–0.21 mg/L, Cd = 0.011–0.025 mg/L (both above 0.01 and 0.003 mg/L limits, respectively), and As is marginally above the 0.01 mg/L limit at A–B (0.011–0.014 mg/L) but below at C–E. Total coliforms are detected at D–E (15–16 CFU/100 mL), exceeding the drinking-water benchmark of 0 CFU/100 mL (none detectable). Implications & ESMP actions: the Zuba corridor requires robust sediment control plus targeted source investigation for Pb/Cd (e.g., informal dumps, e-waste, battery workshops, paint/metal works). Maintain no-use advisory for raw surface water; segregate construction

runoff; add downstream bio-filters (reed/grass swales) where feasible; increase sampling frequency at C–E during wet season peaks.

3.10.2. Air Quality & Meteorology (Gwagwalada)

Table 3.13: Result of Air Quality Measurement with Regulatory Standard at the Gwagwalada Gully Site

Point	**A**	**B**	**C**	**D**	**Allowable limit (WHO/FEPA/OHSA)**
Parameter					
CO_2 (ppm)	412	501	413	410	400 - 800
CO (ppm)	0.01	000	000	000	10 -20
HCHO(mg/m^3)	0.005	0.006	0.005	0.006	0.92
$PM_{2.5}$(µg/m^3)	028	039	021	030	15
PM_{10} (µg/m^3)	023	045	034	039	45
SPM(µg/m^3)	200	223	261	270	250
TVOC(mg/m^3)	0.012	0.013	0.011	0.012	0.3 – 0.5
Nox (ppm)	0.40	0.38	0.47	0.51	0.5
SO_2 (ppm)	0.06	0.10	0.14	0.16	0.01

Air quality at the Gwagwalada gully site is broadly acceptable for most gases but shows notable issues with particulates and sulphur dioxide emissions. CO_2 values (410–501 ppm) fall within the expected outdoor range of 400–800 ppm, and CO was almost negligible (0–0.01 ppm), indicating no significant incomplete-combustion sources at the time of monitoring. However, fine particulate matter ($PM_{2.5}$) ranged from 21 to 39 µg/m³, exceeding the WHO 24-hour guideline of 15 µg/m³ at all points, while PM_{10} values of 23–45 µg/m³ were close to the 45 µg/m³ limit, especially at points B–D, suggesting active dust generation from exposed surfaces, traffic on unpaved access roads, or construction activities. Suspended particulate matter (SPM) also surpassed the FEPA screening level of 250 µg/m³ at points C (261 µg/m³) and D (270 µg/m³), confirming localized dust build-up within the gully corridor. Nitrogen oxides were generally within or just at the 0.5 ppm benchmark (0.38–0.51 ppm), but SO_2 was clearly elevated (0.06–0.16 ppm) above the 0.01 ppm FEPA reference, likely reflecting diesel equipment exhaust, nearby burning, or short-term traffic plumes, and may also be affected by differences in averaging time between the instrument and the guideline values. Because these are **spot** (instantaneous) measurements, they should be treated as screening indicators rather than strict compliance evidence; nonetheless, they justify the ESMP measures already proposed, regular watering of active areas and haul routes, covering and proper siting of stockpiles, speed control, housekeeping, and use/maintenance of low-sulphur diesel equipment, plus follow-up monitoring using 24-hour or logged datasets to align with WHO/FEPA averaging periods.

Air Quality & Meteorology (Zuba)

Table 3.14: Result of Air Quality Measurement with Regulatory Standard at the Zuba Gully Site

Zuba						
Point	**A**	**B**	**C**	**D**	**E**	**Allowable limit (WHO/FEPA/OSHA)**
CO_2 (ppm)	420	413	412	419	411	400 - 800
CO (ppm)	0.01	001	000	000	001	**10 -20**
HCHO(mg/m^3)	0.005	0.005	0.005	0.005	0.006	**0.92**
$PM_{2.5}$($\mu g/m^3$)	028	030	036	024	030	**15**
PM_{10} ($\mu g/m^3$)	0.27	031	0.70	038	039	**45**
SPM	189	210	211	265	278	**250**
TVOC(mg/m^3)	0.012	0.013	0.014	0.013	0.015	**0.3 – 0.5**
NOx(ppm)	0.45	0.45	0.48	0.42	0.40	**0.5**
SO_2(ppm)	0.05	0.07	0.07	0.07	0.07	**0.01**

Air quality monitoring at the Zuba gully site showed generally good background conditions for gases, with CO_2 (411–420 ppm), CO (0.00–0.01 ppm), HCHO (0.005–0.006 mg/m^3), TVOC (0.012–0.015 mg/m^3), and NO_x (0.40–0.48 ppm) all within WHO/FEPA/OSHA allowable limits, indicating minimal combustion or solvent-related emissions during the survey. However, particulate matter was the main concern: $PM_{2.5}$ values of 24–36 $\mu g/m^3$ exceeded the WHO 24-h guideline of 15 $\mu g/m^3$, and the reported PM_{10} values (likely 27–70 $\mu g/m^3$, not 0.27–0.70) approached or exceeded the 45 $\mu g/m^3$ limit, while SPM reached 265–278 $\mu g/m^3$ at points D–E, slightly above the 250 $\mu g/m^3$ screening level, reflecting dust from exposed soils, unpaved access, and construction activities. SO_2 (0.05–0.07 ppm) was also above the WHO reference (0.01 ppm), suggesting contributions from diesel-powered equipment or nearby burning and should be tracked in subsequent campaigns. The prevailing meteorological conditions, light winds, high humidity, and stable air, favored poor dispersion and likely amplified the observed particulate levels. Accordingly, the ESMP should emphasize dust suppression (watering, stockpile covering, windbreaks), good housekeeping, and equipment maintenance, and future monitoring should use 24-hour/logged data to allow direct comparison with international guidelines.

Noise (Gwagwalada)

Spot checks recorded 32, 68, 58, 44 dB(A) across four locations, i.e., quiet residential background (low 30s–40s) and traffic-influenced frontage (high 50s–60s). Peaks can exceed the 55 dB daytime residential benchmark. The ESMP controls shall require the Contractor Traffic & Noise Management Plan, daytime scheduling of loud activities,

mufflers/maintenance, temporary barriers near schools/clinics, off-peak deliveries, and community notices; verify with periodic meter readings.

Noise (Zuba)

The time-stamped spot readings (47.2, 53.3 @11:55, 44.5 @12:16, 60.0 @13:00, 61.6 dB @13:27) show a clear midday rise with two measurements ≥60 dB, indicating periods when activity and traffic elevate ambient levels above the typical 55 dB daytime residential benchmark. Although these are instantaneous values (not time-averaged), they flag a credible risk of nuisance and speech interference near schools, clinics, markets, and dense frontages during peak hours. Accordingly, the ESMP requires: (i) a Noise & Vibration Management Plan with hour-of-work windows (e.g., 08:00–17:00), no high-noise tasks during school exams/services, and strict plant mufflers/maintenance; (ii) traffic management, reroute heavy trucks away from sensitive streets at school start/close times, impose site speed limits ≤20 km/h, and stagger deliveries; (iii) engineering controls (temporary barriers/hoarding, enclosure of stationary equipment, rubber pads for plant, quiet reverse alarms); (iv) operational good practice (no idling, locate gensets/compressors away from receptors, orient exhausts away from dwellings); and (v) monitoring & accountability, weekly spot checks with a Class 2 meter at fixed sentinel points, trigger level = 55 dB LAeq,1h (residential day) and action level = 60 dB, with corrective actions logged; plus a GBV-sensitive GRM to capture noise complaints and adjust method statements within 48 hours. Together, these measures reduce peak exposures, protect sensitive receptors, and provide a transparent feedback loop to keep construction noise ALARP (as low as reasonably practicable).

3.11. Overall Conclusions and Required Actions

Water quality across both corridors shows elevated turbidity/sediment and microbial indicators, with lead and cadmium detected at concerning levels, not potable without treatment, warranting immediate sediment controls, metal source-tracking, and routine wet-season monitoring; ambient air data indicate $PM_{2.5}$ frequently above WHO 24-h guidance at both sites, so comprehensive dust suppression and a shift to time-averaged compliance monitoring are required; and noise exhibits intermittent peaks near traffic and active work fronts, justifying strict implementation of the TMP/Noise Plan and ongoing communication with sensitive receptors. Collectively, these findings reinforce the ESMP's focus on erosion control, pollution prevention, monitoring, and community health & safety for the yet-to-commence works, while flagging data gaps (e.g., PM_{10} unit confirmation, 24-h averages) to be closed in the construction-stage monitoring plan.

CHAPTER 4: SOCIOECONOMIC CHARACTERISTICS AND CONSULTATION WITH STAKEHOLDERS

4.1 Description of Socio-Economic Environment

4.1.1 Introduction

The socio-economic baseline for the Gwagwalada (Quarters ward and Gwagwalada central ward) and Zuba (Zuba ward) subprojects (FCT) was developed from a blend of quantitative and qualitative sources. Quantitative inputs comprised a review of available secondary socio-economic statistics and an integrated census/socio-economic household survey specifically administered in the subproject corridors. Qualitative inputs were obtained through community consultations and key-informant interviews with potentially affected persons (PAPs), community leaders, market associations, women/youth groups, and relevant FCTA agencies. The integrated questionnaire approach (merging census and socio-economic modules) enhanced efficiency, consistency, and data quality. In line with the participatory ethos of ACReSAL, the FCT-ACReSAL SPMU and the Gwagwalada Area Council mobilized stakeholders to support data collection and to encourage future community stewardship of the completed works.

The characterization covers population and demographics, land use and tenure, social organization, livelihoods and income sources, education, vulnerability and gender dimensions, religion, settlement/mobility patterns, and access to health and basic services for the Gwagwalada and Zuba communities within the project's area of influence.

4.1.2 Socio-Economic Study

An integrated census and socio-economic survey instrument were designed and administered to households and enterprises located within, or functionally connected to, the gully/drainage corridors. The objectives were to (i) establish a baseline profile of households and assets potentially exposed to flood/erosion risk and (ii) provide inputs for screening potential displacement/economic impacts shall a right-of-way (ROW) be defined at later design stages.

The census captured: age, sex, household size, education, occupation, income sources and ranges, tenure/years of residence, and dependency structure. The asset inventory recorded landholding and use, housing/structures, fences and business frontage, public utilities, and economic trees/cash crops. The socio-economic module included livelihood strategies (formal/informal), seasonal income variability, access to finance/markets, and coping mechanisms. A basic health impact screening documented access to primary care, water and sanitation practices, and self-reported flood/erosion-related health concerns (e.g., water-borne

diseases, vector exposure). The survey instrument (census and socio-economic forms) is provided in Annexure.

In addition to household surveys, the team conducted Focused Group Discussions (FGDs) (women, men, youths, traders/artisans), community meetings at strategic locations near the corridors, and key-informant interviews (traditional leaders, religious leaders, schools/health facility heads, market leaders, and technical officers from FCTA departments and AEPB). These tools enabled triangulation of data and ensured that vulnerable groups and diverse viewpoints were reflected.

Core information domains captured included:

a) Household bio-data (demography and dependency).

b) Livelihoods and income (employment, enterprises, seasonality, shocks).

c) Inventory of structural and non-structural assets (land, common property resources, housing/business structures, utilities, economic trees/crops).

d) Health and WASH screening (exposure pathways, service access, perceived risks).

4.1.3 Public/Stakeholder Consultation

Stakeholder engagement followed a participatory, inclusive process aimed at identifying perceived risks, priorities, and acceptable mitigation pathways. Public meetings were convened at accessible community venues within Gwagwalada and Zuba, with targeted outreach to women, youths, persons living adjacent to gully edges, and business operators along access routes. Consultation also involved coordination with the FCT-ACReSAL SPMU, Gwagwalada Area Council, and relevant FCTA departments (Environment, AEPB, Water Board, STDD, DRC/DDC as applicable).

A consultation matrix (venues, dates, stakeholder groups, key concerns/expectations, and agreed follow-ups) is presented in Table 4.1, while minutes and signed attendance sheets are provided in Annexures. Salient issues raised included: safety around steep gully margins; access and mobility during works; drainage maintenance and solid-waste control; livelihood continuity for roadside traders; GBV/SEA-SH safeguards; and clarity on grievance redress channels. These inputs informed the ESMP's mitigation, communication, and monitoring measures, and will guide ongoing engagement throughout planning and any future works.

The engagement program in Gwagwalada combined focus group discussions (FGDs) with wider community meetings to ensure broad, inclusive input. Six FGDs were held by stream

position and cohort at the Primary School across 18–19 Aug 2025, drawing 325 participants—138 upstream (42.5%) and 187 downstream (57.5%). Within the FGDs, women accounted for 125 participants (38.5%), men 105 (32.3%), and youth 95 (29.2%). Additional engagements included a District/Leadership consultation (6 attendees) and a community sensitization meeting (110 attendees) on 17 Aug 2025, followed by a household socio-economic/census exercise with 145 respondents on 19 Aug 2025. In total, there were 586 participation instances across activities (not de-duplicated), providing a balanced evidence base to inform the ESMP (Table 4 and 5).

4.1.4 Data Analysis

The questionnaire dataset was cleaned, coded, and analyzed in Python. The analysis uses pandas for data wrangling, NumPy for basic statistics, and matplotlib for charting. Categorical responses were validated and aggregated into frequency and percentage tables; cross-tabs were produced for key variables (e.g., gender × stream position), and visual summaries (bar and pie charts) were generated to support interpretation. All figures in this report are derived directly from these programmatic analyses to ensure transparency and reproducibility.

Gwagwalada Data Analysis

Focus Group Discussions (Table 4.1 and 4.2). Six FGDs were held at the Primary School over two days, covering both upstream (Men 40; Women 53; Youth 45 to 138 participants) and downstream cohorts (Men 65; Women 72; Youth 50 to 187participants). In total, 325 FGD participants provided location-specific insights on flood pathways, gully risk, access constraints, and coping practices. The mix of men, women, and youth ensured that perspectives across livelihood roles and mobility patterns were captured.

Other Engagements (Table 4.2). Complementary activities included a District Head & Leadership consultation (6 attendees) to validate approach and secure buy-in; a large community sensitization session (110 attendees) to brief residents on the ESMP scope and grievance channels; and a household socio-economic/census survey (145 respondents) to generate quantitative baselines. These activities total 261 additional engagement touchpoints (some individuals may have attended multiple sessions). Data quality note. Holding all sessions at a central, neutral venue and sequencing leadership, mass sensitization, FGDs, and the HH survey improved turnout, reduced duplication, and provided triangulation between qualitative and quantitative findings used in the analysis that follows.

Table 4.1: Focus Group Discussions

Stream Position	Cohort	Date	Location	Attendees
Upstream	Men	18 Aug 2025	Primary School	40
	Women	18 Aug 2025	Primary School	53
	Youth	18 Aug 2025	Primary School	45
Downstream	Men	19 Aug 2025	Primary School	65
	Women	19 Aug 2025	Primary School	72
	Youth	19 Aug 2025	Primary School	50

Table 4.2: Other Engagements

Meeting Type	Date	Location	Attendees
District Head & Community Leadership Consultation	17 Aug 2025	Primary School	6
Community Sensitization	17 Aug 2025	Primary School	110
Socioeconomic/Census Documentation (HH survey)	19 Aug 2025	Primary School	145

Gwagwalada Demography

Out of 180 questionnaires distributed, 145 were completed (80.6% response). The Gwagwalada respondent group (n=145) is slightly female-majority (54.5% female, 45.5% male) and skewed toward working-age adults: 18–30 years (35.2%) and 31–50 years (40.0%) together make up ~75% of the sample, with 20.0% aged 51+ and a small youth share <18 (4.8%). More households are located downstream (57.2%) than upstream (42.8%), reflecting the settlement pattern along the corridor. Education is predominantly basic, secondary (37.9%) and primary (28.3%), with 15.9% reporting tertiary education and 17.9% with no formal schooling.

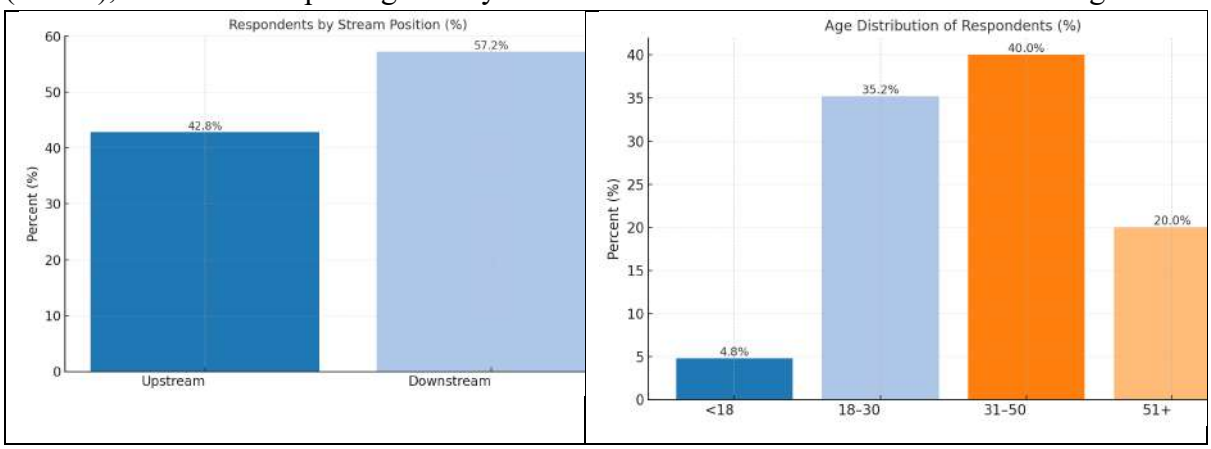


Figure 4.1: Demographic profile of respondents in the Gwagwalada socio-economic survey.

Livelihoods are mixed but led by market-based and land-based activities: traders (30.3%) and farmers (22.1%) are the largest groups, followed by artisans (17.9%), students/apprentices (11.7%), civil servants (8.3%), and other occupations (9.7%).

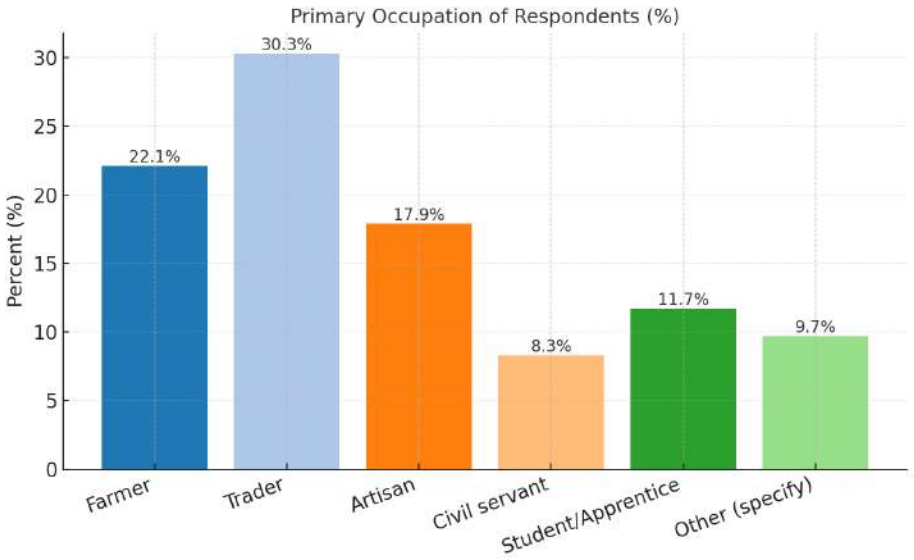


Figure 4.2: Primary occupation of the people of Gwagwalada.

Coping Strategies

Coping is largely self-help, with local drainage works (39.3%) and sandbagging (30.3%) most used, while 41.4% take no action, highlighting resource constraints and the limits of ad-hoc responses. Relocation is rare (6.2%), and other measures (12.4%) reflect improvised, short-term fixes. Overall, the pattern points to pervasive functional disruption rather than widespread structural loss, underscoring the need for organized drainage and access improvements.

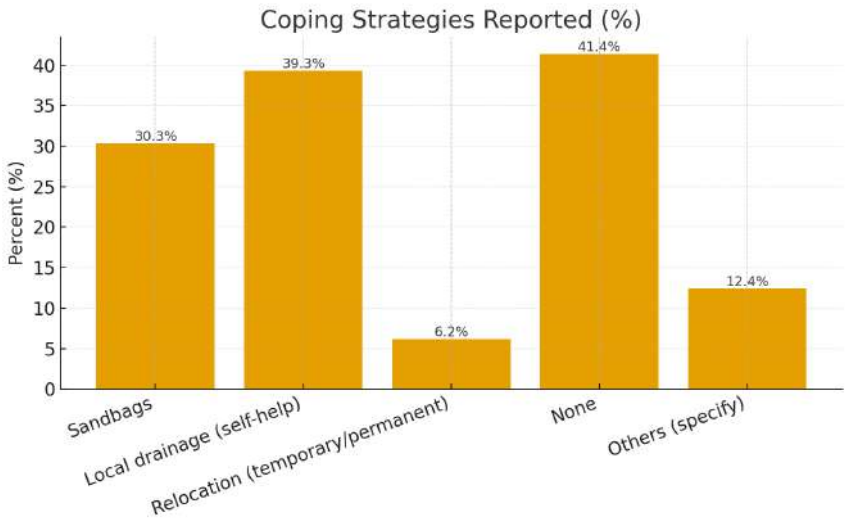


Figure 4.3: The coping strategies of the Gwagwalada community against gully erosion.

Impacted Areas

Road access/transport is the most affected service (62.8% “Yes”), followed by impacts on farmland (49.7%), indicating ongoing constraints to mobility and livelihoods. Fewer

households report house damage (26.2%) or effects on schools/markets (22.8%). Displacement/property loss is comparatively low (8.3%), suggesting disruptions are frequent but not yet translating into widespread relocations. Coping: responses are mainly self-help—local drainage (39.3%) and sandbags (30.3%). Notably, 41.4% take no action, pointing to capacity gaps; relocation is rare (6.2%). This pattern underscores the need for organized drainage upgrades, cleared access routes, and community support (tools, materials, and guidance) to replace ad-hoc measures and reduce transport and farm losses.

Table 4.3: Impact of the gully erosion on the Gwagwalada community

Impact Area	Yes (Count)	Yes (%)	No (Count)	No (%)
Farmland affected	72	49.7	73	50.3
House affected	38	26.2	107	73.8
Road access/transport disrupted	91	62.8	54	37.2
School/market/community facility affected	33	22.8	112	77.2
Household displacement/property loss	12	8.3	133	91.7
Coping strategies (multi-select)	Sandbags	44	30.3	
	Local drainage (self-help)	57	39.3	
	Relocation (temporary/permanent)	9	6.2	
	None	60	41.4	
	Others (specify)	18	12.4	

Community Participation, Perception, Health & Safety

Residents show solid readiness to engage: 65.5% are aware of erosion-control efforts, and 77.2% are willing to participate. Preferred solutions are clear, proper drainage construction (85.5%) leads by a wide margin, followed by tree planting/vegetative cover (52.4%) and awareness campaigns (42.8%); 28.3% emphasize compensation/resettlement. Health concerns are prominent: 70.3% perceive risks, citing vector exposure (45.5%), water-borne disease (40.0%), injuries near gullies/roads (23.4%), and stagnant-water contamination (14.5%). Together, the findings support a community-driven ESMP that prioritizes drainage works, targeted greening, risk communication, and basic public-health safeguards.

Table 4.4: Summary of the perception, participation, health and safety of Gwagwalada participants

Question	Response Option	Count	Percent (%)

Aware of erosion-control projects?	Yes	95	65.5
	No	50	34.5
Willing to participate in community activities?	Yes	112	77.2
	No	33	22.8
Preferred interventions (multi-select)	Proper drainage construction	124	85.5
	Tree planting/vegetative cover	76	52.4
	Awareness campaigns	62	42.8
	Compensation/Resettlement	41	28.3
	Others (specify)	15	10.3
Perceived health risks from erosion/flooding?	Yes	102	70.3
	No	43	29.7
Most common health/safety risks (coded; multi-select)	Water-borne disease	58	40.0
	Vector exposure (mosquitoes, etc.)	66	45.5
	Injuries near gully/roads	34	23.4
	Contamination (stagnant water)	21	14.5

The Figure shows clear preferences for how people want to receive information. Community meetings lead by a wide margin (66%), followed by religious/traditional leaders (57%). Radio is a strong third (42%), while flyers/posters (26%) and social media (19%) are secondary channels; other options are minimal (8%).

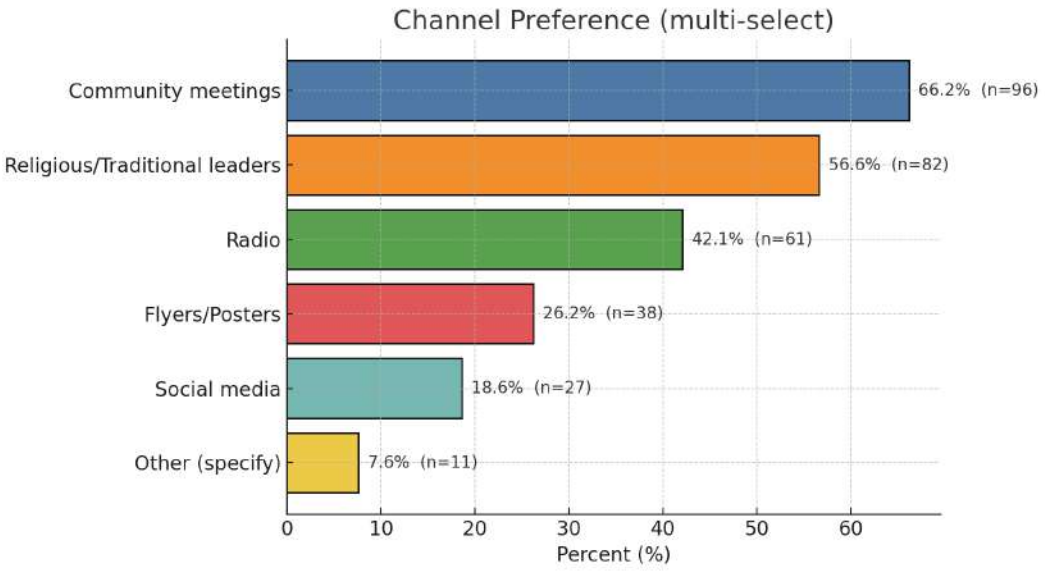


Figure 4.4: Preferred Information Channels among Gwagwalada Residents (multi-select).

Zuba Data Analysis

Focus group discussions (FGDs) were held at the Emir palace (Men 65; Women 72; Youth 50 participants). Participants provided location-specific insights on flood pathways, gully risk, access constraints, and coping practices. The mix of men, women, and youth ensured that perspectives across livelihood roles and mobility patterns were captured.

Other Engagements (Table 4.5 and 4.6). Complementary activities included a District Head & Leadership consultation (5 attendees) to validate approach and secure buy-in; a large community sensitization session (121 attendees) to brief residents on the ESMP scope and grievance channels; and a household socio-economic/census survey (159 respondents) to generate quantitative baselines. These activities total 313 additional engagement touchpoints (some individuals may have attended multiple sessions). Data quality note. Holding all sessions at a central, neutral venue and sequencing leadership, mass sensitization, FGDs, and the HH survey improved turnout, reduced duplication, and provided triangulation between qualitative and quantitative findings used in the analysis that follows.

Table 4.5: Focus Group Discussions

Town	Cohort	Date	Location	Attendees
Zuba	Men	22 Sept 2025	Emir palace	65
	Women	22 Sept 2025	Emir palace	72
	Youth	22 Sept 2025	Emir palace	50

Table 4.6: Other Engagements

Meeting Type	Date	Location	Attendees
District Head & Community Leadership Consultation	17 Aug 2025	Emir palace	5
Community Sensitization	17 Aug 2025	Emir palace	121
Socioeconomic/Census Documentation (HH survey)	19 Aug 2025	Emir palace	159

Zuba Demography

Out of 200 questionnaires distributed, 159 were completed (79.5% response). The Zuba respondent group (n=159) is slightly female-majority (53.5% female, 46.5% male) and skewed toward working-age adults: 18–30 years (35.2%) and 31–50 years (39.6%) together make up 75% of the sample, with 20.1% aged 51+ and a small youth share <18 (5%). Education is predominantly basic, secondary (39.0%) and primary (28.9%), with 18.2% reporting tertiary education and 13.8% with no formal schooling.

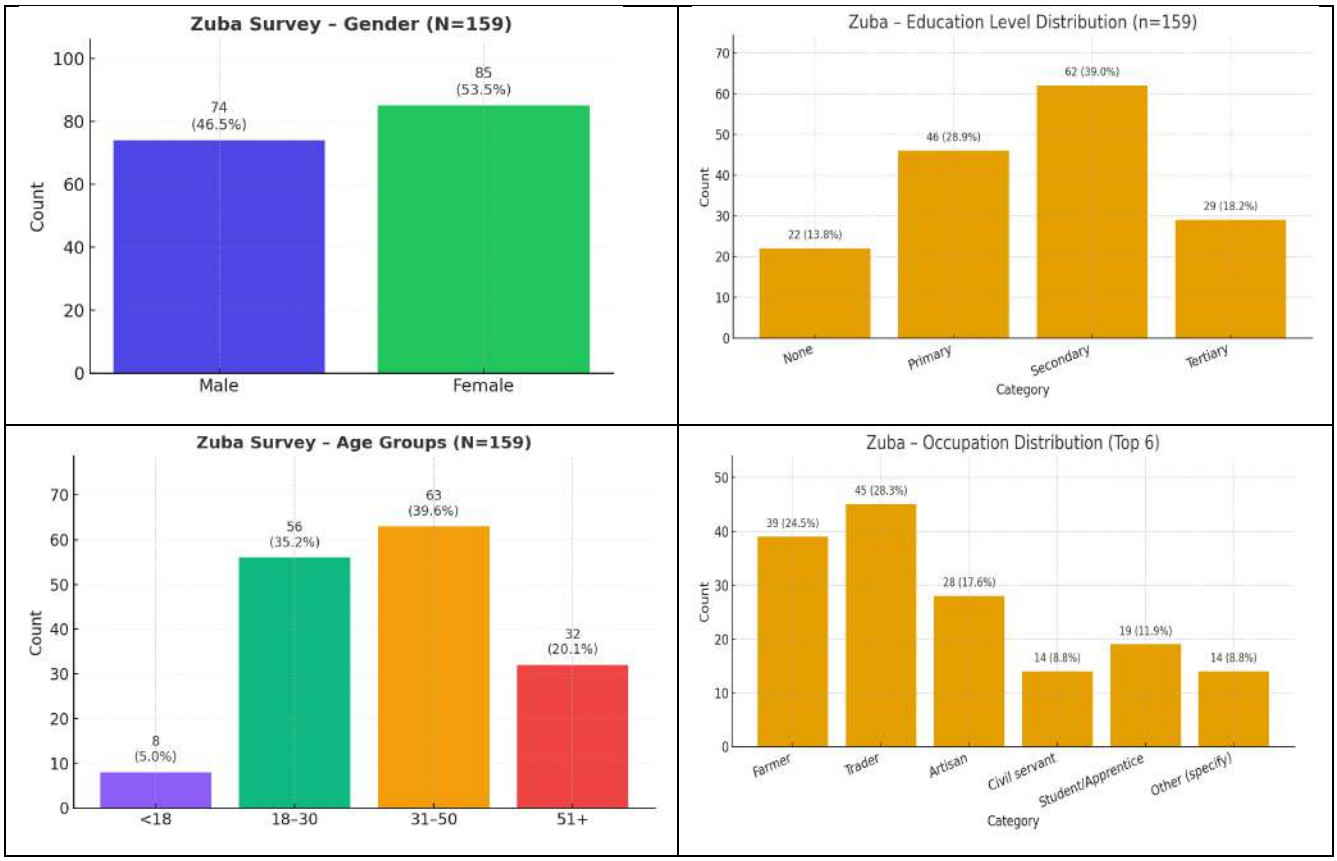


Figure 4.5: Demographic profile of respondents in the Zuba socio-economic survey.

Livelihoods are mixed but led by market-based and land-based activities: traders (28.3%) and farmers (24.5%) are the largest groups, followed by artisans (17.6%), students/apprentices (11.9%), civil servants (8.8%), and other occupations (8.8%).

Coping Strategies

Coping is largely self-help, with local drainage works (43.4%) and sandbagging (32.7%) most used, while 36.5% take no action, highlighting resource constraints and the limits of ad-hoc responses. Relocation is rare (6.9%), and other measures (13.2%) reflect improvised, short-term fixes. Overall, the pattern points to pervasive functional disruption rather than widespread structural loss, underscoring the need for organized drainage and access improvements.

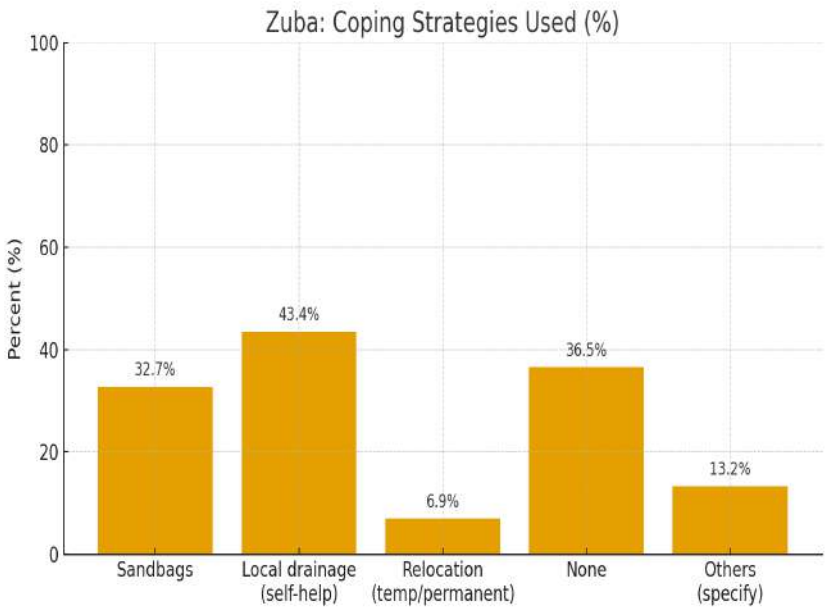


Figure 4.6: The coping strategy of the Zuba community against floods.

Impacted Areas

Road access/transport is the most affected service (60.4% "Yes"), followed by impacts on farmland (50.9%), indicating ongoing constraints to mobility and livelihoods. Fewer households report house damage (25.8%) or effects on schools/markets (22.6%). Displacement/property loss is comparatively low (8.8%), suggesting disruptions are frequent but not yet translating into widespread relocations.

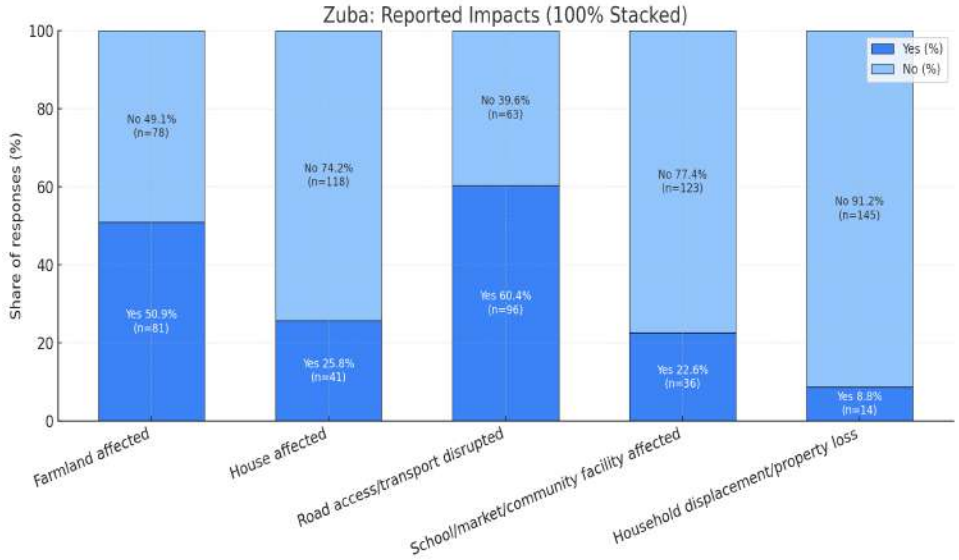


Figure 4.7: The impact of the gully erosion on Zuba community.

Community Participation, Perception, Health & Safety

Residents show solid readiness to engage in any possible solutions that will help them against floods. 86.2% say yes to the proximity of gully erosion to their community and are aware of erosion-control efforts, with more than 80% willing to participate. Preferred solutions are clear, proper drainage construction leads by a wide margin, followed by tree planting/vegetative cover. Health concerns are prominent from the perceived risks, citing vector exposure and water-borne disease. Together, the findings support a community-driven ESMP that prioritizes drainage works, targeted greening, risk communication, and basic public-health safeguards.

Table 4.7: Hazard Perception, Exposure, and Observed Changes

Parameter	Response Option	Count	Percent (%)
Active gully erosion near community?	Yes	137	86.2
	No	22	13.8
Distance to gully from home/farm	<500 m	72	45.3
	500 m–1 km	55	34.6
	>1 km	32	20.1
Most severe challenges *(multi-select)*	Gully erosion	121	76.1
	Flooding	127	79.9
	Poor drainage	104	65.4
	Waste disposal	93	58.5
	Others (specify)	28	17.6
Observable changes (soil/water/vegetation)	Yes	132	83.0
	No	17	10.7
	Not sure	10	6.3
Flood/stormwater frequency	Rarely	23	14.5
	Sometimes	67	42.1
	Frequently	69	43.4

The Table below shows clear preferences for how people want to receive information. Community meetings lead by a wide margin (70.4%), followed by religious/traditional leaders (61%). Radio is a strong third (42.8%), while flyers/posters (27.7%) and social media (20.8%) are secondary channels; other options are minimal (8.2%).

Table 4.8: Preferred Information Channels among Zuba Residents (multi-select)

Parameter	Count	Percent (%)
Community meetings	112	70.4
Religious/Traditional leaders	97	61.0
Radio	68	42.8

Flyers/Posters	44	27.7
Social media	33	20.8
Other	13	8.2

4.1.5 Desirability of the Subproject

All the respondents in the survey (100%) indicated immense desirability for the subproject to proceed. Many of them expressed a clear wish for the subproject to proceed before the next round of rainfall.

4.1.6 Potential Security Risk Challenges

Implementation of the Gwagwalada/Zuba subprojects may attract an influx of job-seekers, informal vendors, and opportunistic actors to the project corridors. Short-term population increases, combined with construction traffic and temporary staging areas, can elevate risks of petty crime, theft of materials, vandalism, and conflicts over access/space. Demand on community policing and informal security networks is therefore likely to rise during peak works. Proactive measures are recommended: contractor site-security plans (lighting, fencing, access control, materials tracking), worker identification and codes of conduct, coordinated patrols with local vigilante groups under police guidance, complaint hotlines within the GRM, and clear communications on work schedules and detours to reduce tensions. Prioritizing local hiring and transparent recruitment can also mitigate security pressures associated with unemployment and perceived exclusion.

4.1.7 Conflict Resolution

Community feedback indicates a strong preference for customary, community-based dispute resolution, through district heads, ward leaders, religious/traditional institutions, and elders' councils, with recourse to formal courts only when customary mechanisms fail. The ESMP therefore embeds a GBV-sensitive, multi-tier Grievance Redress Mechanism (GRM) that interfaces with these local structures, ensures confidentiality where required, and provides escalation pathways to the SPMU and FCTA as needed.

4.2 Public/Stakeholders' Consultation and Participation

Public participation is central to this ESMP. Engagement in Gwagwalada and Zuba began early and will continue throughout planning, construction, and operation phases to foster ownership, reduce conflict, and improve design quality. Consultations targeted potentially affected persons

(PAPs), vulnerable groups, service providers (schools/health/markets), transport unions, religious/traditional leaders, CBOs/CSOs, and relevant FCTA departments. Activities included leadership briefings, community sensitization meetings, focus group discussions (FGDs) upstream and downstream of the corridors, and a household census/socio-economic survey. The process links directly to the GRM, ensuring issues raised are logged, tracked, and closed.

4.2.1 Community/Stakeholders' Participation

Participation improves mutual understanding and decision quality by: (i) aligning design choices (setbacks, access management, safety controls) with local realities; (ii) identifying vulnerable households and livelihood risks early; (iii) co-defining traffic and market-day management; and (iv) agreeing roles for community oversight (e.g., drain-clearing committees). Engagement materials are delivered in English and Hausa, using the community-preferred channels identified in the survey (community meetings, traditional/religious leadership, local FM radio), with meeting times synchronized to prayer and market schedules.

4.2.2 Objectives of the Community Consultations

1. Elicit local knowledge and concerns: Capture site-specific flood paths, sensitive assets, and seasonal access needs to inform design and staging.

2. Strengthen alternatives and mitigation: Co-develop practical measures (temporary crossings, signage, school-zone safety, waste controls) and ensure key impacts are neither overlooked nor underestimated.

3. Reduce conflict and build trust: Identify contentious issues early (land/asset access, traffic, work hours), manage expectations, and maintain transparency through the GRM.

4. Enable meaningful influence on decisions: Provide opportunities for stakeholders, especially PAPs, women, youth, and persons with disabilities, to shape implementation details and monitoring, thereby improving accountability and long-term sustainability.

4.2.3 Public Consultation Methodology

The ESMP adopted a mixed-methods engagement process (qualitative and quantitative) to interact widely with the Gwagwalada and Zuba communities and stakeholder groups. The approach was participatory, combining community meetings, public discussions, and key-informant interviews (District/Area Council leadership, ward heads, councilors,

religious/traditional leaders, market associations, women/youth groups, relevant FCTA departments, and FCT-ACReSAL SPMU officers). The principal methods were:

- **Rapid Assessment Technique:** A rapid professional appraisal of potential impacts based on proximity of residential/commercial assets to gullies and drainage corridors, anticipated nature/intensity of effects, seasonal access constraints, and sensitivity of receptors. Potentially affected asset owners and users were directly engaged to establish a common understanding.
- **Socio-economic Survey:** Administration of structured household questionnaires to profile demographics, livelihoods, asset exposure, service access, and vulnerability; complemented by focus group discussions and semi-structured interviews with traditional/administrative leadership upstream and downstream of the corridors.
- **Public Meetings:** Open forums held at accessible venues within the immediate impact areas to capture community perceptions of gully/flood risks, discuss intervention options, and agree on communication, safety, and access management arrangements. Meetings were conducted in English and Hausa, using locally preferred channels and timings.

4.2.4 Stakeholders' Identification

Five broad categories of stakeholders were identified based on how the subprojects may affect or involve them. All groups were actively consulted and encouraged to participate throughout planning and implementation (see Table 4.2):

- Proximate residents/users: Households, tenants, shop owners, schools, worship centers, and farmers located along/near the gully and drainage corridors.
- Service and infrastructure users: Road/transport unions, utility providers, market associations, school and health facility managements.
- Potentially displaced/asset-affected persons: Individuals/households whose structures, business frontages, economic trees/crops, or access may be affected by any future right-of-way/setback confirmation.
- Administrative/regulatory bodies: FCTA departments (AEPB, STDD, DDC, DRC), FCDA, FCT Water Board, FERMA, NESREA/FMEnv, Area Council authorities, traditional/religious institutions.

- Occasional/seasonal users and CSOs: Pastoral users, waste pickers, youth groups, CBOs/NGOs, and vulnerable groups (women-headed households, elderly, PWDs).

Adopted process:

- Stakeholder mapping: Identify parties whose official, social, economic, or cultural roles intersect with subproject activities (directly or indirectly), including those potentially affected by future drainage rehabilitation works.
- Interest and influence analysis: Establish a stakeholder register and define specific interests/concerns: (a) expected benefits; (b) probable changes to routines/livelihoods; (c) activities that could cause damage, conflict, or risk; and (d) preferred engagement channels. The register informs targeted communication, inclusion of vulnerable groups, and the design of the ESMP's GBV-sensitive GRM and disclosure plan.

Table 4.9: Identified Stakeholder Groups

GROUP	DESCRIPTION	ROLE(S) IN COMMUNITY PROCESS
Group-1	Individuals/households whose day-to-day lives or livelihoods are directly affected by the subproject (residing/operating within the proposed drainage corridor and 5 m setback on both sides).	Primary Project-Affected Persons/Households (PAPs/PAHs); provide asset and vulnerability data; validate impacts; co-design access/mitigation measures.
Group-2	Traditional/administrative authorities with statutory or customary oversight of development within the subproject area.	Mobilization and governance anchors; convene meetings; validate local protocols; facilitate consent, information flow, and grievance referrals.
Group-3	Community members whose activities (e.g., farming, trading, commuting) occur near but outside the corridor/setback within the host communities.	Broader stakeholders and beneficiaries; inform catchment practices; support right-of-way discipline; contribute to operation & maintenance (O&M).
Group-4	Community-Based, Faith-Based, and Non-Governmental Organizations (CBOs/FBOs/NGOs) interfacing regularly with residents.	Social support and advocacy partners; deliver sensitization (H&S, GBV/SEA-SH, waste, hygiene), monitor inclusion, and strengthen community feedback.
Group-5	Elected/appointed political office holders with responsibilities for public services	Policy and resourcing champions; align the project with public programs,

	and development in the Area Council/wards.	facilitate permits/resources, and address escalated grievances.

4.2.5 Community Meetings

Between 17–19 August 2025 (Gwagwalada) and 21–23 September 2025 (Zuba), the ESMP team held structured community meetings to capture local perspectives on stormwater and gully-erosion risks. Sessions were facilitated by the FCT-ACReSAL SPMU with the support of the District Heads (venues: Primary School, Gwagwalada; Zuba Palace, Zuba). At each meeting, the Principal Consultant introduced the study team, outlined the ESMP purpose for the Gwagwalada/Zuba subprojects, summarized objectives, indicative activities, expected outputs, and the indicative work program, and invited questions and suggestions. Attendance included traditional leaders, ward heads, women and youth leaders, and affected households. In addition to plenary meetings, Focus Group Discussions (FGDs) were conducted with men, women, and youth cohorts upstream and downstream of the corridors. Sign-in sheets and minutes are retained in the Annexes.

4.2.6 GBV/SEA/SH Risk Considerations

Construction-phase labor influx and mixed contractor workforces can elevate risks of Gender-Based Violence (GBV), Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH), alongside wider concerns (HIV/STIs, harassment of female workers, child labor). The ESMP sets out proportional mitigation, including Codes of Conduct, worker induction, a GBV-sensitive GRM with confidential referral pathways, community awareness, and contractor C-ESMP sub-plans (OHS, security, labor management). Detailed measures and responsibilities are presented in Chapter 6.

4.2.7 Awareness and Perception of ACReSAL Intervention

Respondents in both Gwagwalada and Zuba expressed strong acceptance of the planned ACReSAL intervention, noting that recurrent gully erosion and flooding have disrupted mobility, damaged assets, and constrained access to services. Communities view properly engineered drainage/channel stabilization and catchment management as urgent needs and expect tangible improvements to safety, access, and livelihoods if works proceed with sustained engagement and timely maintenance.

4.3 Stakeholder Landscape

The stakeholder landscape for the Gwagwalada/Zuba ESMP spans five functional groups with distinct but complementary interests as defined below:

- Group-1 comprises residents within and adjacent to the proposed corridors (including the 5 m setbacks) whose priorities are protection of assets and livelihoods, safe access, and drainage safety; they constitute the PAPs/PAHs and are central to risk identification and mitigation design.
- Group-2 includes the Community/Residents Associations that enable community-wide mobilization, welfare coordination, and two-way information flow between the project and households.
- Group-3 covers non-resident users, traders, farmers, and service providers, whose businesses depend on reliable access and drainage performance; their inputs inform construction staging and traffic/access planning.
- Group-4 brings together CBOs, FBOs, and NGOs active in the FCT, providing watershed stewardship, waste management advocacy, social support to vulnerable groups, and GBV/SEA-SH awareness and referral pathways that align with ESS4/ESS10.
- Group-5 consists of public authorities, Gwagwalada Area Council leadership, Zuba ward councilors, FCT and national legislators, and key FCTA agencies (STDD, AEPB, FEMA, AGIS, Water Board, Development Control, Resettlement & Compensation, and FCT-ACReSAL SPMU), responsible for permits, ROW/compensation administration, utility and data coordination, emergency readiness, and safeguards compliance. Together, these groups provide the governance, accountability, and community ownership framework necessary for effective ESMP implementation and long-term maintenance.

Table 4.10: List of Stakeholders and Their Responsibilities

GROUPS	IDENTIFIED STAKEHOLDER	AREA OF INTEREST IN SUBPROJECT
Group-1	Residentsof Gwagwalada and Zuba communities, particularly those living/operating within the proposed corridor and 5 m setback on either side	PAPs/PAHs – protection of assets/ livelihoods, safe access, drainage safety

Group-2	Offices of the Community/Residents Associations (Gwagwalada & Zuba)	Overall community development, welfare, mobilization, information flow
Group-3	Persons residing outside Gwagwalada/Zuba but with businesses/farms/trades within the subproject area	Individual livelihood continuity, market access, service connectivity
Group-4	Community-Based Organizations (CBOs)	Watershed stewardship, waste control, community monitoring
	Faith-Based Organizations (FBOs) in Gwagwalada/Zuba	Spiritual/social support, volunteer mobilization, vulnerable-group outreach
	Non-Governmental Organizations (NGOs) active in FCT	Environmental health, GBV/SEA-SH awareness/referrals, community advocacy
Group-5	Office of the Chairman – Gwagwalada Area Council (GAC)	Area-wide development coordination; permits, access, enforcement support
	Zuba Ward/Area Council Representatives (Councilors)	Ward-level liaison, grievance escalation, community sensitization
	FCT House of Representatives Member (Abuja South Federal Constituency)	Constituency development support; policy/budget advocacy
	Senator representing the FCT	High-level advocacy, inter-agency coordination
	FCTA Secretariats/Agencies: STDD, AEPB, FEM A, AGIS, FCT Water Board, Dept. of Development Control, Dept. of Resettlement & Compensation, FCT-ACReSAL SPMU	Technical oversight; right-of-way/compensation, drainage/waste management, emergency response, mapping/data, utility coordination, safeguards compliance

CHAPTER 5: POTENTIAL IMPACTS, MITIGATION MEASURES AND ANALYSIS OF ALTERNATIVES

5.1 Introduction

The impact assessment for the Gwagwalada and Zuba subproject first identified the relevant project activities and the environmental and social aspects they would affect. This process, which included issues raised by stakeholders during consultation, allowed us to pinpoint the key areas for focus during project implementation. This chapter now outlines the methods and techniques used to assess and analyze these potential social and environmental impacts. The methods used to determine the significant impacts are detailed in Tables 5.1 through 5.4.

5.2 Methodology for Impact Evaluation

The methodology for identifying and assessing environmental and social impacts was anchored in the World Bank Group EHS Guidelines and the ISO 14001:2015 Environmental Management Standard, following the steps detailed below. Predicting these potential impacts also incorporated several other factors: findings from public consultations, expert judgment, and the application of an unranked pair-wise comparison approach (Canter and Sadler, 1997).

- Step 1: Define all necessary project activities for developing and executing the project components.
- Step 2: Determine the potential environmental and social risks (hazards or impact sources) linked to each gully rehabilitation activity.
- Step 3: Assess the significance of the identified environmental and social impacts.

Following the initial steps, we identified the major activities across all project phases and their associated environmental and social aspects. To ensure a thorough evaluation, we employed several methods to weigh the likelihood of these impacts occurring. These methods included overlaying the rehabilitation plans onto maps of existing conditions to visually pinpoint potential impacts, and reviewing published guidance documents such as the World Bank Environmental Assessment Sourcebook for best practices in impact analysis for infrastructure projects.

5.2.1 Impact Consequence Criteria

To objectively screen for potential impacts and determine their likely significance, we first developed general impact criteria. These criteria covered both natural (physical and biotic) and socioeconomic components. We applied these criteria to each subproject activity to establish its effective level. **Table 5.1** shows the criteria used to determine the impact magnitude for each identified project activity.

Table 5.1: Criteria for Determining Impact Magnitude

RATING	DESCRIPTION OF RATING	ASSIGNED SCORE
Extent – the area over which the impact will be experienced		
Localized	Confined to specific project activity area or part thereof	1
Entire Watershed	The entire watershed	2
Regional	Beyond the watershed	3
Intensity – the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources		
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions and processes are severely altered	3
Duration – the timeframe over which the impact will be experienced and its reversibility		
Short-term	Up to 6 months	1
Medium-term	6 months to 1 year	2
Long-term	More than 1 year	3

The combined score of the three criteria (extent, intensity and duration) corresponds to the Impact Magnitude (Consequence) Rating shown in Table 5.2.

Table 5.2: Method used to determine Consequence Score

Combined Score (A+B+C)	Impact Magnitude Rating	Definition
3 – 4	No Consequence	**No Consequence:** Any impacts are not distinguishable from the baseline or within the natural level of variation. These impacts do not require mitigation and are not a concern of the decision-making process.

5	Low Consequence	Low Consequence: Detectable but Not Significant. Impacts with a "**Low**" consequence may produce noticeable changes to baseline conditions, beyond what would naturally occur, but are not expected to cause any hardship or degradation. However, these impacts warrant the attention of decision-makers, and shall be avoided or mitigated where practicable.
6	Moderate Consequence	Impacts with a "**Moderate**" consequence are likely to be noticeable and result in lasting changes to baseline conditions, which may cause hardship to or degradation of the receptor. Broader consequences for the ecosystem or community are not anticipated. These impacts are a priority for mitigation in order to avoid or reduce their significance
7 – 9	High Consequence	Impacts with a "**High**" consequence are likely to have damaging and lasting changes to the functioning of a receptor, and may have broader consequences (e.g. on ecosystem health or community well-being). These impacts are a priority for mitigation in order to avoid or reduce their significance.

5.2.2 Impact Probability Criteria

The likelihood of an impact occurring for each subproject activity is also developed and applied using the probability classifications presented in Table 5.3 below.

Table 5.3: Probability Classification

Probability – the likelihood of impact occurring		**Assigned Score**	**Rating**
Improbable	< 40% chance of occurring	1	Negligible
Possible	40% – 70% chance of occurring	2	Low
Probable	> 70% - 90% chance of occurring	3	Medium
Definite	> 90% chance of occurring	4	High

Impact significance is a function of its consequence and the probability of its occurrence. We applied this dual approach (consequence and probability) to determine the overall significance of all impacts associated with the Gwagwalada and Zuba subproject activities.

We used a modified Leopold impact assessment matrix to combine impact severity and the likelihood of occurrence. As shown in **Table 5.4**, this matrix ranks the potential impacts of each activity. Throughout the project lifecycle, we will implement appropriate practices and measures to mitigate adverse impacts. These mitigation plans, which conform to both national and international guidelines, are addressed alongside each potential impact to ensure easy alignment and application.

Table 5.4: Impact Significance Matrix

		Receptor Sensitivity (Probability)			
		Negligible	Low	Moderate	High
Impact Magnitude (Consequence)	Negligible	Not significant	Not significant	Not significant	Low
	Low	Not significant	Low	Low/Moderate	Moderate
	Moderate	Not significant	Low/Moderate	Moderate	Moderate/High
	High	Low	Moderate	Moderate/High	High

The overall impact level is determined by its position on the impact risk assessment matrix, which provides a qualitative evaluation of the risk of each impact. By using this risk-based screening (combining consequence and probability), the ESMP ensures that it identifies and focuses resources on the components most likely to be affected by the project. Impacts falling within the red boxes are assigned a "high" risk rating.

- Impacts designated as High Risk (red boxes) become the top priority for further evaluation and management action.
- Those in the Medium Risk (yellow category) are considered tolerable, but we must make efforts to reduce them to levels that are as low as reasonably practical (ALARP).
- Finally, Low Risk (green boxes) impacts have low significance and low priority; they are considered acceptable and do not require specific mitigation measures.

5.3 Analysis of Potential Impacts Associated with Gwagwalada and Zuba Subproject

Based on the ESMF, the environmental risk rating is moderate because the project proposes to support some civil works under ACReSAL Component A.2, while the social risk rating is substantia**l.** The substantial social risk rating is because the project involves vulnerable categories and other related social risks that include, the poor, women, community fragility, SEA/GBV and communal conflicts related to social norm campaigns.

As previously indicated under Chapter 1, the envisaged project activities will include:

- Civil Construction/Remediation Works:
  - cutting and filling for percentage recovery
  - compaction of soils
  - concrete casting
  - assembling of structures
  - Slope stabilization

- Digging of foundations of the lattice structures
- Vegetation clearing
- Deployment and movement of transport vehicles and power equipment
- Use of earth moving equipment such as excavators, compactors, bulldozers and pay loaders;

- Bio-Engineering Remedial Works:
  - Terracing;
  - Structured vegetation;
  - Specific trees planting with known root strength
  - Economic trees planting

Overall, the primary objective of this project is to halt and mitigate the environmental and social degradation resulting from recurrent flooding and soil erosion within the project area and its surrounding communities. The intervention is therefore expected to yield predominantly positive impacts, particularly in terms of environmental restoration, infrastructure protection, and community resilience.

Table 5.5 below presents a summary of the anticipated positive and negative impacts associated with the construction and rehabilitation activities along the Gwagwalada and Zuba flood and gully erosion corridors, covering the biophysical, socio-economic, and cultural environments.

Table 5.5: Environmental and Social Components and Associated Impact Indicators

Impact Aspects	Components	Impact Indicators
Biophysical	Atmospheric Elements	• Emissions of gases such as nitrogen oxides (NO_x), sulfur oxides (SO_x), hydrogen sulfide (H_2S), volatile organic compounds (VOCs), total suspended particulates (TSP), and carbon monoxide (CO) can deteriorate ambient air quality and contribute to atmospheric pollution at both local and global scales.
	Noise Levels	• Increase in ambient noise levels
	Aquatic Ecology	• Alterations in the baseline physico-chemical and biological properties of surface water; • Modifications to the physico-chemical properties of sediments; • Shifts in the community composition and abundance of aquatic biota, including microbes, plankton, macrobenthos, fishes, mammals, reptiles, amphibians, and bird species.
	Geology	• Changes in geology and geomorphology
	Soil	• Changes in physico-chemical and biological properties of soil
	Topography	• Changes in land terrain and topography

Impact Aspects	Components	Impact Indicators
	Vegetation	• Changes to vegetation population, health, species abundance and diversity, and impact on endangered and economic species
	Ecosystem	• Changes that affect the entire ecosystem, such as modifications to plant and animal communities, alterations in nutrient cycling, and the destruction of habitats.
	Surface Water	• Changes in physico-chemical and biological properties of surface water bodies.
Socioeconomic and Cultural	Land Use Pattern	• Changes in land use patterns such as agriculture, fishing, logging, hunting, etc.
	Local Population	• Immigration, emigration and in-migration of people
	Socioeconomic System	• Impacts on the local economy, including changes in employment opportunities, fluctuations in income metrics (differentials and per capita income), shifts in the inflation rate, and resulting inequality in benefits for the local population.
	Socio-cultural System	• Changes in social structure, organization and cultural heritage, practices and beliefs, natural resources, rights of access, changes in value system influenced by foreigners, etc.
	Basic Amenities and Infrastructure	• Access to goods and services such as housing, education, healthcare, water, fuel, electricity, sewage and waste disposal, consumer goods brought into the region, etc.
	Transportation System	• Changes in transport systems and associated effects such as noise, accident risk, changes in existing facilities, etc
	Environmental Justice	• Conflicts in choice making between development and protection, natural resources use, recreational use, historical and cultural resources, tourism, etc.
	Aesthetics	• Presence of unsightly facilities, structures, etc
Human Health	Construction Workers	• Risks to public health and safety, including accidents, injury, and fatality, exposure to nuisances (like dust and noise), fire hazards, and the potential spread of infectious diseases (such as STDs, including HIV).
	General Public / Workplace	• Risks that generally degrade human quality of life, including issues related to personal security and exposure to electromagnetic radiation.

This ESMP identifies the key areas of intervention that are likely to generate environmental and social risks associated with the proposed project activities. The framework for defining and regulating each intervention is guided by applicable laws, policies, plans, standards, and objectives, as well as limits of acceptable change, performance targets, and environmental quality benchmarks. These instruments collectively establish the regulatory and operational boundaries within which the project must be implemented to ensure compliance and minimize adverse impacts.

The potential environmental and social impacts on the affected communities were identified in line with the grouped and project-phased impact indicators outlined in the Environmental and Social Management Framework (ESMF) for ACReSAL, as well as those presented in Table 5.5. These impacts were further assessed through an evaluation of their significance ratings, using the analytical matrices provided in Tables 5.1 to 5.6 and detailed in the Impact Significance Matrix.

The assessment covers all three key project phases are pre-rehabilitation, rehabilitation, and operation is to ensure a comprehensive understanding of potential risks and their corresponding mitigation requirements.

Following the collection of primary environmental and socio-economic data on the subproject communities, a qualitative and quantitative analysis of the data was conducted to assess direct impacts on project population. Existing environmental conditions that affect human health and safety were evaluated to ascertain imminent risks that may be associated with the subproject.

Specifically, analytical data on the ambient air and surface water quality was used to assess potential health risk concerns to residents within the Gwagwalada and Zuba project corridors. The evaluation of the social environment requires assessment of the need for land for the subproject as proposed and the remedial alternatives by conducting the following:

- Analysis of watershed to determine drainage corridors and the consequential storm water flow path resulting from anthropogenic activities within the project areas;
- Development of conceptual remedial alternatives based on field surveys and the analysis of the watershed;
- Evaluation of the availability of land for proposed project or alternatives.

In assessing the social impacts, the measurable changes in human population, communities and social relationships resulting from the intervention project were identified. The social variables were evaluated under the following general headings:

- Population characteristics;
- Community and institutional structures;
- Political and social resources;
- Individual and family changes; and,
- Community resources.

The potential risks identified are organized considering the critical phases of the subproject from the pre-rehabilitation phase through the rehabilitation phase to the operation (post-rehabilitation) phase and summarized based on whether the subproject impact areas will result in positive or negative impacts. The potential impacts that arise from all the information/data sources identified were developed and presented in matrix (Table 5.6)

5.3.1 Potential Positive Impacts

A. Mobilization Phase

The primary positive impact during the **mobilization and construction phase** of the proposed gully erosion control works is a short-term economic "boom," primarily through **local job creation** and an increase in commercial activities.

Key positive impacts include:

- **Employment Opportunities**: The project directly creates numerous jobs in construction, project management, and related services, which are expected to be filled by local and national workers.
- **Economic Stimulation**: The influx of workers and project-related spending increases demand for local goods and services (e.g., food, housing, transport), stimulating the local economy.
- **Skill Development**: Local workers may receive on-the-job training in construction techniques, equipment operation, and erosion control methods, enhancing their future employment prospects.
- **Improved Local Infrastructure Access**: The process of bringing heavy machinery and materials to the site may involve upgrading access roads, which can benefit the community beyond the project's duration.
- **Community Participation and Integration**: Active community involvement in the initial stages can foster a sense of ownership and social integration, improving the project's long-term sustainability and success.

These immediate benefits help mitigate the socio-economic disruptions that gully erosion projects often address, such as the loss of farmlands and damage to existing infrastructure.

B. Construction Phase

Gully erosion control works during the construction phase offer significant positive impacts, primarily through **site stabilization**, **economic benefits**, and the **protection of infrastructure and livelihoods**.

Environmental and Physical Impacts

- **Halting Land Degradation:** The immediate implementation of control measures (e.g., check dams, diversion banks, concrete drainage channels) during construction helps to significantly reduce the rate of ongoing land degradation caused by the gully.

- **Protection of Surrounding Land:** Construction works prevent the gully from expanding into valuable agricultural land, residential areas, and natural habitats, thus preserving the existing topography and land use.
- **Improved Water Management:** The installation of designed hydraulic structures and drainage systems helps to control the flow and velocity of surface runoff, which, when properly designed, prevents future erosion and sedimentation of nearby water bodies.
- **Restoration of Soil Quality:** By stabilizing the area and allowing for potential future re-vegetation, the construction phase sets the groundwork for the eventual "healing"

and stabilization stages, which can lead to the return of fertile topsoil and improved soil functions over time.

Socio-Economic Impacts

- **Infrastructure Protection:** The most direct positive impact is the protection of existing and future infrastructure, such as roads, bridges, culverts, and communication routes that were previously threatened or destroyed by the gully erosion.
- **Enhanced Agricultural Production:** By safeguarding or reclaiming agricultural land, these projects can lead to improved agricultural production and food security for local communities.
- **Job Creation:** The construction phase itself generates employment opportunities for local populations, including skilled and unskilled labor for building structures, earthworks, and site management activities.
- **Community Empowerment and Awareness:** In many cases, these projects involve community participation and education on proper land use and sustainable practices, leading to increased awareness and a better ability to manage future erosion risks.
- **Economic Loss Prevention:** Halting the advancement of gullies prevents further significant economic losses related to property damage and the disruption of livelihoods.

Operational Phase Impacts

When properly designed, funded, and maintained, gully erosion construction works lead to several positive outcomes**:**

- **Land Stabilization:** The primary benefit is the stabilization of the gully area, preventing further headcut advancement and widening.
- **Restoration of Productivity**: Once stabilized, gullies can be rehabilitated into lush vegetation or cropland, restoring land for agriculture and other uses.
- **Infrastructure Protection**: Roads, bridges, buildings, and underground utilities in the vicinity are protected from damage or destruction.
- **Improved Water Quality**: The reduction in eroded sediment entering waterways leads to decreased turbidity and lower nutrient/pollutant loads, benefiting aquatic ecosystems.

- **Reduced Flood Risk**: Sediment deposition in streams and rivers can reduce their hydraulic capacity and increase flood frequency; effective control measures help maintain channel capacity**.**
- **Enhanced Access and Safety:** Stabilized areas no longer pose a hazard to people or vehicles, improving access across the land**.**

5. 3.2 Mobilization Phase and Construction Phase Negative Impacts

The negative impacts during the construction phase of the gully erosion control works are primarily short-term effects related to the physical disturbance of the site and the introduction of construction activities.

Key negative impacts include:

1. Environmental Impact

- **Air Pollution Impacts:** Air quality would be disturbed during the construction stage due to vehicular movement (emission of Carbon-monoxide), and the release of particulate matter PM2.5 from vehicular emission. Construction activities will generate dust and pollute the surrounding area during. The construction activities are anticipated to result in an increase in generation of short-term fugitive dust and combustion emissions. The primary sources of fugitive emissions will include construction activities especially stripping/clearing of vegetation, grading and excavation and increased traffic on unpaved roads. The amount of dust generated will depend on construction activities, soil type, and moisture content, and wind speed, frequency of precipitation, vehicle traffic, vehicle type, and roadway characteristics. Fugitive dust will be greater during drier periods in areas of fine textured soil. The sources of combustion emissions (e.g., SO2, NOx, CO, and particulates) will be mainly operations of diesel-powered construction equipment: excavator, wheel loader, trucks, motor grader and compactor.
- **Dust pollution:** Dust will be generated from demolition activities, and drainage alignment construction works due to excavation work, and movement of vehicles, stock piling of materials, dust from uncovered trucks bringing in construction materials/sand and general earth works at the worksite. Loading of cement and dry sand gravel to concrete mixer the addition of water to make concrete will generate dust which impacts

directly on workers' health. Dust and fumes will have major direct but short-term impacts during the project construction phase.

- **Gaseous Pollution:** Reduced air quality may be due to fuel-powered equipment including vehicles engines and construction equipment. The emission from the machinery used in earthwork activities will also degrade the air quality of the immediate project area affecting humans and the environment. Exhaust fumes will mainly come from construction plants, machinery and vehicles in operation.
- **Elevated Noise Level and Vibration Effect:** Increased construction traffic and the operation of heavy machinery generate temporary noise, which can affect the local population and wildlife. During construction, noise and vibrations are expected to be generated from such activities as the use of machinery/equipment including bulldozers, generators, light and heavy trucks delivering construction materials. This will contribute to increased levels of noise and vibration within the construction site and the surrounding area. Therefore, elevated noise levels within the site can affect project workers and the community residents especially the sensitive receptors within the project site and along the gully sections. The impact significance is expected to be moderate. This impact is negative but short-term and reversible by mitigation measures.
- **Water Pollution and Contamination Impact:** Construction equipment and materials can introduce pollutants (e.g., fuel, oil, cement, and other chemicals) into the local environment, potentially contaminating soil and water supplies. During the construction stage, different types of activities such as cutting, earthwork, and concrete work will lead to the accidental discharge of cement and other chemicals like epoxy and paints could result in deteriorating the surface water quality. In addition, surface water pollution may result from uncontrolled discharges, accidental spills of oil and lubricants from vehicle repairs and, discharges of eroded soils runoff, erosion, and sediment transport. Inadequacies in waste management practices during construction could cause littering during waste collection, transportation and disposal, which could cause clogging of drainage. The likelihood of groundwater contamination is **low**.
- **Water Diversion and Flooding Impacts:** Insufficient diversions/bypasses the diversion of flow around gully fingers under construction could cause a disturbance to construction activity such as water flow to houses if not properly managed and if this

is done during the rainy season it will lead to flooding as create a nuisance for the community and project workers.

- **Hydrology and Hydrogeology Impact:** During construction, stockpiling of excavated materials, equipment and machinery as well as creation of construction camps could obstruct natural drainage routes. This could lead to flooding in upstream areas, and drying up in downstream area. Construction of diversion route could alter the existing hydrological layout of the area, leading to significant changes. During posconstruction phase, the diversion of floodwaters from the existing gully coverage layout could create microclimatic modifications, leading to hydrological modifications.
- **Increased Topsoil Soil Erosion and Sedimentation Impacts:** Soil erosion is likely to occur during slope cuts and excavation works. Erosion is often caused by failing to keep water off road surfaces. Clearing of demolished debris for roads expansion, construction of culverts and site drains, detours for collecting construction materials from quarries/borrow areas will expose soils during rainy seasons and may result in incremental soil erosion and sedimentation of stream courses.
- Loss **of Biodiversity and Natural Habitat:** The construction footprint involves the clearing of existing vegetation and topsoil, destroying local habitats and leading to a loss of biodiversity (both plant and animal life). ESS6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources could be triggered through poor construction preparation practices for the gully erosion civil works activities. Accidental spills of fuels and oils for machinery and vehicles, which would normally be stored on site, could toxify vegetation. If herbivorous animal species feed on such vegetation, this could also poison them, or lead to bioaccumulation of toxins in wildlife species, with the possibility of bio-magnification up the food chain. There is a possibility for project workers to poach on wildlife species, especially burrowing rodents such as grass-cutters, ground squirrels, and larger mammals like duikers, during site preparation. Also, construction works would necessitate clearance of natural vegetation especially at burrow site for laterite sourcing.
- **Soil Degradation:** Construction activities, such as the movement of heavy machinery, lead to soil compaction and the mixing of topsoil and subsoil, which drastically alters the physical and chemical properties of the soil. This reduces soil quality, fertility, and its ability to retain water, making future rehabilitation efforts more difficult.

- **Materials Sourcing Impact:** The construction of roads drainages, retaining structures and WASH facilities in addition to other aspects of the interventions require local materials such as stones, gravel, sand and water for the construction activities and will be obtained from quarries, rivers and land. Since substantial quantities of these materials will be required for the construction activities, the availability and sustainability of such resources at the extraction sites will be negatively affected, as they are not renewable in the short term. In addition, the sites from which the materials will be extracted may be affected in several ways including landscape changes, risk of economic displacement of people (agricultural land), animals' outmigration and vegetation removal, which could lead to destruction of crops, injuries to humans and animals.
- **Potential for Failure:** Poor design, inadequate supervision, or low-quality construction of gully control measures (e.g., check dams, drop structures) can lead to the failure of these structures, resulting in even greater erosion and damage than before the project started.

These construction-phase impacts emphasize the need for careful planning, robust environmental management plans, and the timely implementation of supplementary biological or engineering measures (such as re-vegetation or proper outlet protection) to mitigate the potential for the works themselves to worsen the erosion problem.

A. **Social Impact Assessment**

The proposed gully erosion construction works, while a necessary long-term solution, can cause several negative social impacts during the construction phase due to community disruption and the physical nature of the work.

- **Infrastructure Damage:** Construction traffic and the flow of concentrated runoff can damage existing infrastructure, such as local roads, fences, and culverts, which may not be adequately designed to handle the temporary disruption caused by construction.
- **Disruption of Transportation and Access:** Construction activities and the presence of heavy machinery can block or damage existing roads, footpaths, and bridges, making it difficult for residents to commute, transport goods (like farm produce), or access essential services.

- **Physical Displacement and Relocation:** In some cases, construction may require the temporary or permanent relocation of homes and families situated near the gully site or the path of the new control structures, leading to social dislocation.
- **Loss of Livelihoods:** Communities may experience the temporary loss of access to farmlands, grazing fields, or trading areas located within the construction zone, impacting their primary sources of income.
- **Public Health and Safety Risks:** During the construction stage, there are possible impacts on the health, safety and hygienic conditions of both the workforce and the local community resulting potential safety-related impacts on the local communities shall be direct, such as being struck by moving vehicles within and outside the sub-project area, bumping onto a stationary equipment of falling into unprotected pits. The impact will continue for the duration of the work and can be mitigated by using speed traps, caution tapes and road signages. Essentially, the construction sites themselves pose physical hazards, with potential for accidents involving community members, especially children. The work can also generate noise and dust pollution, which may lead to poor health conditions.

- **Contamination of Water Sources:** Construction runoff and disturbed soil can lead to the sedimentation and contamination of local water supplies and drainage channels, forcing communities to find alternative, potentially distant, sources of clean water.
- **Psychological Trauma and Anxiety:** The physical changes to the landscape, the disruption of daily life, and the inherent dangers of a major construction project can cause stress, fear, and psychological trauma among residents, especially those who have already experienced losses due to gully erosion.
- **Loss of Access to Social and Cultural Sites:** Construction may inadvertently cut off access to important social, religious (e.g., churches, shrines), or ancestral sites (e.g., graveyards), affecting the community's cultural and spiritual lives.
- **Community Conflict:** Disagreements can arise among community members or between the community and the construction company/government regarding land acquisition, compensation, access routes, or perceived effectiveness of the control measures.

- **Labor Influx Management:** Migrant workers may be (skilled or semi-skilled) may be brought into the project site where the requirement of labour is large or the required skilled is absent in the project communities. However, preference should be given to offering these jobs to PAPs and other residents within the neighborhoods, such requirements should be included in the bid.

  - **Risk of social conflict**: Conflicts may arise between the local community and the migrant workers, which may be related to competition for limited local resources such as water accommodation, electricity, job opportunities e.tc. Tensions may also arise between different groups within the labor force, and pre-existing conflicts in the local community may be exacerbated.

  - **Increased risk of illicit behavior and crime**: The influx of migrant workers into the communities may increase the rate of crimes and/or a perception of insecurity by the local community. Possible illicit behaviors or crimes include theft, physical assaults, substance abuse, prostitution and human trafficking. Local law enforcement may not be sufficiently equipped to deal with the temporary increase in local population.

  - **Influx of additional population ("followers")**: Considering the anticipated construction timeframe of eighteen (18) months with possible extensions, different people may possibly migrate to the project area in addition to the labor force, thereby exacerbating the problems of labor influx. These can be close family members of workers, as well as traders, suppliers and other service providers, particularly in areas where the local capacity to provide goods and services is absent.

  - **Impacts on community dynamics**: Depending on the number of migrant workers and their engagement with the host community, the composition of the local community, and with it the community dynamics, may change significantly. Pre-existing social conflict may intensify because of such changes.

  - **Increased burden on and competition for shared resources and public services**: The presence of migrant workers (including their families) can generate additional demand on shared community resources, (such as water, toilets, public spaces etc.) it also has a toll on the provision of public services, such as electricity, medical services, transport, education and social services. This is particularly the case when the influx of migrant workers is not accommodated by additional or separate supply systems.

- **Increased risk of communicable diseases and burden on local health services**: The influx of migrant workers may lead to the outbreak of communicable diseases in the project area, including sexually transmitted diseases (STDs), or they may be exposed to diseases of which they have low resistance. Both scenarios will result in an additional burden on local health resources. In addition, there are also the tendency of workers with health concerns relating to substance abuse, mental issues or STDs not wishing to visit the existing medical facilities and instead undergo self-cure, thereby placing further endangering the lives of their hosts. Local health and rescue facilities may also be overwhelmed and/or ill-equipped to address the work-related accidents that can occur in large construction sites.
- **Child labor and school dropout:** Increased opportunities for the host community to sell goods and provide services to the project workers may lead to child labor producing and delivering these goods and the provision of the required services, which in turn can lead to enhanced school dropout.
- **Local inflation of prices**: A significant increase in demand for goods and services due to labor influx may lead to local price hikes and/or crowding out of community consumers.
- **Increased pressure on accommodation and hikes in rents**: Depending on project worker income and form of accommodation provided, there may be increased demand for accommodations, which again may lead to price hikes and crowding out of residents.

- **Gender Based Violence, Sexual Exploitation & Abuse/Sexual Harassment :** Construction workers are predominantly younger males and females. Those who are away from home on the construction job are typically separated from their family and act outside their normal sphere of social control. This can lead to inappropriate and unethical acts such as sexual harassment of women and girls, exploitative sexual relations, and illicit sexual relations with minors from the communities or colleagues. A large influx of male workforce may also lead to an increase in exploitative sexual relationships whereby women and girls are forced into sex for work. During construction, the vulnerable residents of the host communities, such as youth and women, may be subjected and exploitative tendencies due to social interaction between community members, casual workers who are coming from different places during construction phase, which may result in gender-based violence

(GBV), sexual exploitation and abuse (SEA) as well as attitude and behavioral changes among local people. All these are to be considered among the impacts of Gender Violation issues especially during compensation for the affected properties.

Interference with Business and Daily Activities during Demolition: Demolition of structures on the road reserves will lead to interference with informal business activities and basic earnings. Traders, pharmacists, informal markets, mobile money stands, and motorcycles parking sites will be affected.

Disastrous Impacts - Fire Outbreak: Risks to human safety related to fire and handling of construction material including fuel and other explosive substances. The scope of these impacts is limited; they are for the workers and depend on compliance with safety requirements normally expected.

Security Risk

Implementation of the Gwagwalada and Zuba subproject being along the busy high way will result in an influx of persons seeking employment to the project communities. Different types of persons, including criminals of sorts, may be expected to find their ways into the project communities within this time. Such movement of persons will increase potential for criminal activities within project communities. An increased pressure in the demand for police services and other security issues in the project area. Additionally, the cumulative unemployment levels in the communities resulting from the influx of employment seeking persons to the area will pose its own security risks for both the communities and the security institutions.

The Federal Capital Territory is bonded with the states that currently facing serious insecurity such as kidnapping and terrorism threats. The subprojects are consequently subject to these threats, against which appropriate security measures are to be identified and deployed. More specifically, there are reasonable concerns on the security risk and safety situation within the Capital City.

Kidnapping has become a common occurrence across many States of Nigeria and may occur as a result of political or socioeconomic concerns on the part of the perpetrators. The project faces a potential terrorism risk from both politically motivated attacks and destructive acts.
To counter this, a comprehensive mitigation strategy is in place. This strategy uses personnel, procedures, and technology to reduce the likelihood and impact of all identified risks, ensuring the overall threat rating remains acceptable.

The SPMU is required to convert the Security Management Plan (SMP) into a clear Implementation Plan for stakeholder guidance.

Table 5.7: Mitigation Measures for Assessed Security Risks

S/N	Risk	Assessed Risk Level	Mitigation Measures	Responsible Party
1	Breaches of security into the community sensitive receptors	HIGH	• Restriction of access to facilities/office buildings; • Code of conduct for all workers and security personnel; • Surveillance of persons on site • Presence of armed security guards on site; • Provision for controlled and monitored site evacuation; • Liaison with police, local authorities and other stakeholders.	SPMU-ESO; Community Leaders; Site Committee; Contractor
2	Kidnapping of citizens and project workers for ransom purposes	HIGH	• Restriction of access to site • Surveillance of persons on site • Presence of armed security guards on site • Citizen awareness on security • Security patrol vehicles • Community vigilante services • Liaison with police, local authorities and other stakeholders;	SPMU-ESO; Community Leaders; Site Committee; Contractor

Citizen Awareness on Security/Safety Measures

Project security will be enhanced through sustained community awareness programs that focus on safety. We will partner with the community vigilante group to bring security matters closer to the citizens and ensure they provide supplementary security presence at all project locations.

5. 3.3 Operation Phase Negative/Residual Impacts

Environmental Impact

The residual impacts of the proposed Gwagwalada and Zuba gully erosion construction works that could lead to negative effects remaining after the building and implementation of gully control measures could largely stem from substandard engineering, improper materials, and inadequate long-term site management. These issues can lead to a *failure of the control structures*, which in turn exacerbates the original erosion problem and causes further damage to the surrounding environment and infrastructure.

Primary Residual Impacts

- **Renewed or Worsened Erosion:** The most significant impact is the potential for the gully to reform or expand, often becoming more severe than before the construction began. Failure of control structures (like check dams or diversion banks) can lead to a sudden release of water and sediment, causing rapid and extensive land degradation downstream.
- **Infrastructure Damage:** Poorly executed construction can undermine existing or new infrastructure. Failed control measures can result in damage to roads, bridges, and underground utilities, leading to significant economic losses and social disruption.
- **Soil Degradation:** Even with construction, if the underlying soil properties are not adequately addressed, the soil's structure, fertility, and moisture retention capacity may remain compromised. This residual degradation makes the land less resilient to future environmental disturbances and less productive for agriculture.
- **Sedimentation and Water Pollution:** If construction works fail to completely stabilize the soil, ongoing sedimentation of waterways remains a problem. This pollution increases the turbidity (cloudiness) of streams, rivers, and dams, harms aquatic habitats and species, and increases water treatment costs.
- **Habitat and Biodiversity Loss:** Continued land degradation and water contamination from failed projects can result in permanent loss of natural vegetation and habitats for various plant and animal species, reducing the overall ecosystem resilience.

- **Economic and Social Strain:** Communities may face persistent socio-economic consequences, including ongoing loss of farmland, reduced food security, property devaluation, and the psychological stress of living in an area susceptible to an ongoing hazard. In some cases, failed projects can force the displacement of residents.
- **Ecosystem imbalance:** The introduction of engineered solutions or specific types of vegetation for biological control can disrupt the local ecosystem's natural balance, potentially favoring some species while displacing others and reducing the overall resilience of the environment to other disturbances.

1. **Aquatic habitat degradation and biodiversity loss:** Sedimentation and changes in water quality (e.g., increased nutrient loads from agricultural runoff trapped in altered waterways) can severely damage aquatic ecosystems, leading to a decline in fish populations and other species and a general loss of biodiversity in the affected water bodies.
2. **Aquatic habitat degradation and biodiversity loss:** Sedimentation and changes in water quality (e.g., increased nutrient loads from agricultural runoff trapped in altered waterways) can severely damage aquatic ecosystems, leading to a decline in fish populations and other species and a general loss of biodiversity in the affected water bodies.

Social Impact

While the primary goal of gully erosion construction works is to mitigate hazards, the subsequent *operation phase* (long-term management and existence of the control measures) can introduce negative social impacts, often stemming from the long-term changes to the environment and community access.

Key negative social impacts during the operation phase include:

3. **Restricted land use and access:** The implemented control measures (e.g., permanent structures, retaining walls, or established vegetation cover) can limit access to formerly used land or traditional routes. This can affect farming practices, grazing areas, and general movement within the community.
4. **Loss of agricultural productivity:** If the control measures (such as large physical structures or significant land re-contouring) permanently alter or remove farmland, it

can lead to a long-term decline in agricultural production and income for local farmers who rely on that land for their livelihood.

5. **Aesthetic and psychological impacts:** Large, permanent civil engineering works (like concrete channels or extensive wire netting weirs) can create a "frightful" or unnatural scenic environment that residents may find distressing or a constant reminder of past trauma.
6. **Disruption of community cohesion:** If the gully control measures isolate parts of a settlement or cut off communities from essential services (like water sources, churches, or markets), it can disrupt social networks and force migration of residents.
7. **Maintenance burden and conflict:** The responsibility for long-term maintenance of certain control measures (e.g., simple stone walls or vegetation) often falls on the local community. If communities lack the resources or organization, the measures may fail, leading to recurring erosion and potential intra-community conflict over maintenance and resource allocation.
8. **Perceived unsustainability of solutions:** If initial, simple control measures fail over time due to intense weather events, it can lead to a sense of frustration, distrust in authorities, and psychological trauma among residents who continue to face the threat of gully expansion.

Cumulative & Indirect Impacts

The cumulative impact of the project includes:

1. Cumulative Environmental Impacts
   - Altered Watershed Hydrology: Multiple gullies within the same catchment collectively modify surface water flows, increasing runoff velocity and volume, and reducing groundwater recharge. This alteration can exacerbate downstream flooding, particularly during peak rainfall periods.
   - Sedimentation and Soil Instability: Erosion from multiple gullies contributes to high sediment loads in rivers and streams, which can reduce soil fertility and impair agricultural productivity. Sediment deposition downstream may also threaten infrastructure, including roads, bridges, and drainage systems.

- Aquatic Habitat Degradation: Increased turbidity, sedimentation, and nutrient loading reduce water quality, leading to hypoxic conditions that stress aquatic species. Fish spawning areas may be smothered by sediments, reducing population resilience and biodiversity.

2. Indirect Social and Land-Use Impacts

- Migration Pressures: Degraded farmland and reduced water availability may force communities to relocate, increasing pressure on nearby lands and contributing to deforestation or overgrazing.
- Land-Use Changes: Expansion into marginal areas for agriculture or settlements can further destabilize soils, creating a feedback loop that intensifies erosion.
- Livelihood Disruption: Reduced agricultural productivity and access to fishing resources can diminish income, food security, and community well-being. Social cohesion may be affected if traditional routes, grazing areas, or communal lands are disrupted.

3. Cumulative Exposure to Pollutants and Health Risks

- Heavy Metals in Water and Soil: Lead (Pb), cadmium (Cd), and chromium (Cr) detected at concentrations above guideline levels pose significant ecological and human health risks.
- Ecological Risks: Chronic exposure to these metals can impair aquatic life, causing reduced growth, reproductive failure, and mortality in sensitive species, potentially leading to long-term ecosystem imbalance.
- Human Health Risks: Persistent exposure through consumption of contaminated fish, crops, or water can result in neurotoxicity (Pb), kidney and bone damage (Cd), and carcinogenic effects (Cr). Bioaccumulation magnifies these risks over time, particularly for vulnerable populations such as children and pregnant women.

4**. Mitigation and Management Considerations**

- Implement integrated watershed management, combining engineering measures, sediment control, and restoration of riparian vegetation.

- Conduct long-term monitoring of sediment loads, water quality, and heavy metal concentrations.
- Raise community awareness on safe practices, potential health risks, and alternative livelihoods.
- Plan land-use interventions to minimize migration pressures and prevent expansion into marginal or vulnerable areas.

5.3.4 Climate & Extreme Events

Climatic extremes such as the variability of climatic elements and other extreme events (increasing rainfall intensity, increased surface runoff, and soil instability) strongly influence gully erosion processes. These conditions require climate-resilient engineering solutions such as reinforced drainage and slope stabilization. Extreme events also heighten social risks, including property damage, displacement, health hazards, and livelihood losses, making community engagement, safety measures, and livelihood support essential for sustainable project outcomes.

The project can withstand these extreme events over the next 25–30 years since various climate-resilient, adaptive, and integrated design approach was adopted. First, erosion control structures designed using projected extreme rainfall and peak runoff values, rather than historical averages, ensuring channels, culverts, and drop structures can safely convey high flows without failure were taken into consideration. Durable materials such as reinforced concrete, stone pitching, and geotextiles to enhance structural strength and resistance to erosion, weathering, and prolonged moisture exposure were also used.

Second, engineering solutions was combined with nature-based measures to improve long-term stability. Consideration was made for continuous revegetation of gully slopes, use of deep-rooted grasses, and preservation of buffer vegetation help bind soils, reduce runoff velocity, and limit gully expansion even during extreme storms. Third, a robust operation and maintenance framework, involving routine inspection, desilting of channels, and prompt repair of minor damages before they escalate under extreme events.

Table 5.6 below summarizes the risks expected during the pre-construction, construction, and operations phases of the intervention.

Table 5.6: Identified Environmental and Social Impacts

Pre-construction			
Media/Activities	**Potential Impact**	**Probability of Impact and Impact**	**Significance**
Land use and Resettlement	Changes in land use (fishing, livestock rearing) resulting from land acquisition, resettlement, and compensation process		High
Construction			
Air Quality	Potential for fugitive emission or particulate matter (dust) from earthworks, stockpile materials, heavy vehicles during construction phase.	Prob: 4, Impact: 3 Risk: Medium	Substantial Low Moderate
	Potential for road traffic exhaust emission (NOx, PM etc.) including dust from vehicular movement during construction phase.	Prob: 3, Impact: 3 Risk: Medium	Moderate
Noise and vibration	Potential for increased noise generation from construction machinery, earth moving equipment as a result of construction activities	Prob: 4, Impact: 3 Risk: Medium	Substantial
	Vehicle movement both during construction, operation could cause increase noise		Moderate Low
	Potential for project activities to cause noise		Moderate
Soils/Erosion	Potential impact on soils physical, chemical and biological properties from clearing, excavation during construction.	Prob: 3, Impact: 3 Risk: Medium	Low

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	Soil erosion from vegetation removal, soil exposure, excavations during construction and road rehabilitation.		Low
	Potential for contamination from stockpile areas, wastes storage areas, fueling of vehicles		Moderate
Surface Water	Potential for water pollution from soil erosion during construction and extreme rainfall event	Prob: 3, Impact: 2 Risk: Medium	Substantial
	Construction (eg. Spillage of oil, fuel and chemicals) activities may discharge contaminants into the water body	Prob: 3, impact: 2 Risk: Medium	Low
	Potential for wastewater discharges into water body during construction	Prob: 3, Impact: 2 Risk: Medium	Moderate
Visual Aesthetics	Landscape impacts from site preparation and construction activities including vegetation removal and soil removal	Prob: 2, Impact: 2 Risk: Low	Low
	Reduced aesthetic quality impact resulting from presence of equipment, vehicles and machinery and poor waste management practices		Low
Wastes	Potential impact on the environment due to nonexistence of sustainable waste management practice and increase of generation of waste streams	Prob: 3, Impact: 3 Risk: Medium	Low
	Potential impact on environmental media (soil, water, air) and the community from waste transportation and disposal of spoils and contaminated materials.		Low
	Disposal of spoils in unsuitable areas such as hilly terrain could result in environmental impacts including erosion, water pollution, obstruction of		Low

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	drainage patterns, etc. spoils disposal will be particularly pertinent for the urban upgrading project and the landfill construction project.		
Vegetation	Potential impact on sensitive vegetation and increase in invasive species during construction and site clearing activities.	Prob: 2, Impact: 2 Risk: Low	Low
	Impact on sensitive vegetation – mangroves, trees during site clearing activities.		Negligible
Natural Habitat	Impact natural habitat during site clearing activities.	Prob: 2, Impact: 2 Risk: Low	Negligible
Flood and landslide	Floods/landslide over slopes in the form of overland flow	Prob: 4, Impact: 3 Risk: Medium	Substantial
GHG	Emissions from construction activities like fuel combustion, power generators, concrete batching plant, operational vehicles could cause adverse impacts on air quality affecting the health and welfare of people, crops and sensitive natural fauna and flora	Prob: 3, Impact: 3 Risk: Medium	Moderate Low
	Potential impact on endangered and threatened species around the hilltop areas due to habitat loss during construction		Negligible (no endangered and threatened species
Aquatic life	Potential impact on aquatic life (fish spawning ground), from oil spillage and discharge of wastewater or other contaminants during construction.	Prob: 2, Impact: 2 Risk: Medium	Low
Job creation, flood control	Potential positive impact of the Project includes creation of employment, flood and improved access to basic services.		Substantial

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Infrastructure service	Increase in individual and household wellbeing due to increased income from direct and indirect employment		Substantial
	Potential positive impact from improved access to healthcare facilities and health care	Prob: 3, Impact: 3 Risk: Medium	High
	Potential strain on existing infrastructure and waste services due to increased population and increased vehicle from contractor presence in the community		Low
Economics, Livelihood	Disruption of livelihood activities resulting from land acquisition for Project	Prob: 3, Impact: 3 Risk: Medium	High
	Temporary disruption of livelihood activities due to blockades, diversions, traffic etc., during construction		Moderate
	Potential economic loss due to damage to assets (e.g animals) from Project related activities		Moderate Low
Community health and safety	Risks of accident and injury during Project related activities	Prob: 3, Impact: 2 Risk: Medium	Moderate Low
	Potential increase in disease (malaria, communicable diseases, HIV) due to migration of workforce to the community		Moderate
	Potential mental issues caused by disruption of traditional support and community cohesion resulting from possible resettlement and compensation		Substantial
	Brutality/Accidental Discharge by security personnel	Prob: 4, Impact: 4 Risk: Medium	High

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Community and social cohesion	Potential conflict and tension between communities, local leaders and Project proponent due to unmet expectations around Project benefits and employment	Prob: 3, Impact: 3 Risk: Medium	High
Land use and Resettlement	Potential physical and economic displacement during land acquisition	Prob: 3, Impact: 3 Risk: Medium	High
	Potential increase in land disputes during resettlement and compensation		High
	Changes in land use (fishing, livestock rearing) resulting from land acquisition, resettlement, and compensation process		High
Labour and working condition	Potential injury or loss of life due to inadequate occupational health and safety standards.	Prob: 3, Impact: 3 Risk: Medium	Moderate
	Potential impact on wellbeing of workers due to discrimination, infringement on labour and employment rights (excessive working hours, forced labour)		Low
Labour influx	Risk to community health from HIV/AIDS/COVID-19 or other transmitted infections because of the presence of migrant construction labour.	Prob: 3, Impact: 3 Risk: Medium	Moderate
GBV/SEA/SH	Risk of gender-based violence from migrant labour, which often remains away from home on the site.		
	Unwanted aggressive advances, SEA/SH against women and children.	Prob: 3, Impact: 2 Risk: Medium	Substantial
Cultural heritage	Sites or items of heritage significance could be found during development work.	Prob: 2, Impact: 2 Risk: Low	Moderate
Traffic	The increased vehicular movement and speed may result in road safety issues like traffic accidents.	Prob: 3, Impact: 3 Risk: Medium	Substantial

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Post Construction phase			
Air Quality	Potential for fugitive emission or particulate matter (dust) from earthworks, stockpile materials, heavy vehicles during operation phase.	Prob: 2, Impact: 1 Risk: low	Low
Noise and vibration	Vehicle movement both during construction, operation could cause increase noise		Moderate low
Soil /Erosion	Potential impact on soils physical, chemical and biological properties from clearing, excavation during construction.	Prob: 2, Impact: 1 Risk: Medium	Low
	Soil erosion from vegetation removal, soil exposure, excavations during construction and road rehabilitation.		Moderate
Surface Water	Construction (eg. Spillage of oil, fuel and chemicals) activities may discharge contaminants into the water body	Prob: 3, impact: 2 Risk: Medium	Low
GHG	Emissions from construction activities like fuel combustion, power generators, concrete batching plant, operational vehicles could cause adverse impacts on air quality affecting the health and welfare of people, crops and sensitive natural fauna and flora	Prob: 3, Impact: 2 Risk: Medium	Moderate Low
Job creation and erosion control	Potential positive impact of the Project includes creation of employment, flood and improved access to basic services.		Substantial
Economics, Livelihood	Disruption of livelihood activities resulting from land acquisition for Project	Prob: 3, Impact: 3 Risk: Medium	High

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	Potential economic loss due to damage to assets (e.g animals) from Project related activities		Moderate
Community health and safety	Risks of accident and injury during Project related activities	Prob: 3, Impact: 2 Risk: Medium	Moderate Low
	Potential mental issues caused by disruption of traditional support and community cohesion resulting from possible resettlement and compensation		Moderate
	Brutality/Accidental Discharge by security personnel		
Community and social cohesion	Potential conflict and tension between communities, local leaders and Project proponent due to unmet expectations around Project benefits and employment	Prob: 3, Impact: 3 Risk: Medium	High
Land use and Resettlement	Potential physical and economic displacement during land acquisition	Prob: 3, Impact: 3 Risk: Medium	High
	Potential increase in land disputes during resettlement and compensation		High
	Changes in land use (fishing, livestock rearing) resulting from land acquisition, resettlement, and compensation process		High
Labour and working condition	Potential impact on wellbeing of workers due to discrimination, infringement on labour and employment rights (excessive working hours, forced labour)	Prob: 3, Impact: 3 Risk: Medium	Moderate
			Low

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5.4 Significant Environmental and Social Impacts

Based on the impact significance outcome of Table 5.6, the identified environmental and social impact categories that will suffer medium to high impact levels during the Pre-Construction, Table 5.7 provides a description of the project's construction and post-construction phases. The remaining environmental and social effect categories are regarded as unimportant since their impact levels will be minimal to nonexistent. Below is a description of the appropriate mitigation techniques for the risks and significant consequences linked to the Gwagwalada and Zuba subprojects.

Table 5.8: Mitigation Measures for Identified Environmental and Social Impacts

Pre-construction		
Media/Activities	**Potential Impact**	**Proposed Mitigation Measures**
Land use and Resettlement	Changes in land use (fishing, livestock rearing) resulting from land acquisition, resettlement, and compensation process	• Stakeholders Engagement Plan developed and implemented • Develop and implement Resettlement Action Plan (RAP), • Ensure commensurate compensation
Construction		

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Electric poles Stabilisation/Relocation	• Direct Infrastructure Failure and Power Outages • A collapsed pole creates an immediate, severe public safety hazard due to live power lines touching the ground or falling onto public areas, risking electrocution.	• Construct earthen berms or trenches on the stable ground *above* the gully head. These structures must safely intercept and redirect all surface water runoff away from the gully and towards a stable, armored outlet. • Move the pole entirely out of the gully corridor to a stable area. This is the only permanent solution that removes the structure from the hazard zone.
Air Quality	Potential for fugitive emission or particulate matter (dust) from earthworks, stockpile materials, heavy vehicles during construction /operation phase.	• Dust minimization measures shall be implemented including watering of the construction areas, including unpaved or alternative road surfaces. • Soil stockpiles and stores of friable material will be covered to reduce the potential for fugitive emissions of dust where possible. • Vehicles carrying friable materials will be enclosed or sheeted. • Loading, unloading and handling of dusty materials will only be carried out in designated areas. • Regular damping of unpaved roads or exposed soils/ground to control dust/particulate matter and keep it down.

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		Workers would be provided with dust protection PPE
Air Quality	Potential for road traffic exhaust emission (NOx, PM etc.) including dust from vehicular movement during construction phase.	• Ensure vehicles/machines are switched off when not in use. • Ensure only vehicles required to undertake works are operated on-site. • Ensure all construction vehicles, plant and machinery are well maintained and in full operating condition. • Effective preventative maintenance established to ensure all construction equipment and electricity generators are maintained in good working order and do not adversely impact air quality due to inadequate maintenance or damage. • Concrete batching, crushing and screening plants will be fitted with dust extraction and / or suppression systems where necessary.

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Noise and vibration	Potential for increased noise generation from construction machinery, earth moving equipment as a result of construction activities	• Install noise reduction devices such as silencers and mufflers as appropriate to mobile plant and equipment. • Limit work to daylight hours. Schedule noisy construction activities during specific times in the day especially near the sensitive receptors
	Vehicle movement during construction, operation cause increase noise	• Advance notice will be given to communities if short-term noisy construction activities are to take place, which could cause these levels to be exceeded.
	Potential for project activities to cause noise	• Near places of worship, construction producing nuisance level noise be minimised or rescheduled so as not to occur on locally recognised religious day. • Work areas will be organised and operated strive to restrict noise levels to not exceed World Bank thresholds at the nearest sensitive receptor during normal activities. • If existing noise levels exceed these threshold values, the Project will not cause more than a 3dB increase in measured ambient levels during normal activities
Soil/Erosion	Potential impact on soils physical, chemical and biological properties from clearing, excavation during construction.	• Vegetation along drainage lines and gullies will be protected where practicable to provide natural attenuation of flows.

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	Soil erosion from vegetation removal, soil exposure, excavations during construction and road rehabilitation.	• Where possible, drainage outlets will discharge into vegetated areas and not to exposed soil.
	Potential for contamination from stockpile areas, wastes storage areas, fueling of vehicles	• Slope stability measures will be incorporated such as benching and installation of erosion protection features such as silt barriers and sedimentation ponds. • Area to be cleared will be kept to the minimum necessary to prevent disturbance of soils outside the boundary
Surface Water	Potential for water pollution from soil erosion during construction and extreme rainfall event	• Refuelling, maintenance and wash-down of construction vehicles and equipment will only occur in designated areas and away from surface water bodies, and provided with secondary impermeable containment measures. • The construction contractor will be contractually required to take all reasonable precautions to prevent and clean up all spills / leaks, and take necessary measures to prevent materials from falling into the river or pollute soils or groundwater. • The Environmental and Social Management Plans including spills and waste management measures will be implemented. • For work undertaken close to surface water bodies measures will be taken to ensure that pollution of water resources does not occur

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	Potential for wastewater discharges into water body during construction	• Set-up temporary disposal mechanism within the construction area and properly dispose solid waste generated. Mobile toilet facilities should be provided and be properly maintained.
Visual Aesthetics	Landscape impacts from site preparation and construction activities including vegetation removal and soil removal	• Construction material to be stacked in designated area and cordoned off.
	Reduced aesthetic quality impact resulting from presence of equipment, vehicles and machinery and poor waste management practices	• Construction material to be stacked in designated area and cordoned off.
Wastes	Potential impact on the environment due to nonexistence of sustainable waste management practice and increase of generation of waste streams	• Waste bins will be provided at all construction sites for the disposal of the various types of wastes generated by the project. These bins will be clearly marked to facilitate segregation of waste, for collection, transportation and disposal. • Separation of domestic and hazardous waste at the source shall be strictly enforced. • Where possible, wastes will be re-used or recycled. This is a requirement for waste oils, other hydrocarbons and tires and other hazardous and non-hazardous wastes • Burning of waste will not be permitted • All personnel will be trained in the appropriate management of waste according to the WMP.

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	Potential impact on environmental media (soil, water, air) and the community from waste transportation and disposal of spoils and contaminated materials.	• Proper storage, transport and disposal of hazardous wastes (oily wastes, used batteries, fuel drums) in the designated areas by the national/municipal authorities in accordance with National Environmental Law.
	Disposal of spoils in unsuitable areas such as hilly terrain could result in environmental impacts including erosion, water pollution, obstruction of drainage patterns, etc. spoils disposal will be particularly pertinent for the urban upgrading project and the landfill construction project.	• In as far as practicable, spoils will be backfilled into the borrow pits as part of the rehabilitation of these borrow pits, which is a condition of the contractor contracts. • Side tipping of spoils in any hilly locations will be strictly prohibited. • Roads will be designed to achieve a balance between the amount of spoil produced from cuttings and that required for fill to minimise the need for disposal of surplus.
Vegetation	Potential impact on sensitive vegetation and increase in invasive species during construction and site clearing activities.	• Vegetation along drainage lines and gullies will be protected where practicable to provide natural attenuation of flows.
	Impact on sensitive vegetation – mangroves, trees during site clearing activities.	• Area to be cleared will be kept to the minimum necessary to prevent disturbance of soils outside the boundary
	Impact natural habitat during site clearing activities.	• Contractor to only use public non-productive land for laydown/equipment storage. • Ensure that stockpile is secured and stored in a safe place. • Vegetate stockpiles if storage required for long periods

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Flood and landslide	Floods/landslide over slopes in the form of overland flow	• Prefer given not to work during rainy seasons Provide alternative drainage for rainwater if earthworks fill established drainage lines. • Best construction practices to be employed • Flood/landslide emergency to be employed by contractors.
GHG	Emissions from construction activities like fuel combustion, power generators, concrete batching plant, operational vehicles could cause adverse impacts on air quality affecting the health and welfare of people, crops and sensitive natural fauna and flora	• Use of ozone depleting substances such as chlorofluorocarbons (CFCs), halons, carbon tetrachloride, trichloroethane and halogenated hydrobromofluorocarbons (HBFCs) will not be permitted.
Job creation, Erosion control	Potential positive impact of the Project includes creation of employment, Erosion control and improved access to basic services.	• No mitigation required
	Increase in individual and household wellbeing due to increased income from direct and indirect employment	• No mitigation required
Infrastructure service	Potential positive impact from improved access to healthcare facilities and health care	• Flag persons are to be provided where the plant cross/meet the community road. • The contractor's Community Liaison Officer collaborates with communities to identify sensitive areas and inform communities before movement.

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		• Request for road closure must be approved by the relevant authority
	Potential strain on existing infrastructure and waste services due to increased population and increased vehicle from contractor presence in the community	• Develop and implement Resettlement Action Plan (RAP), • Ensure commensurate compensation • Develop livelihood restoration plan
Community health and safety	Risks of accident and injury during Project related activities	• Adequate signage and warnings including "highly-flammable", "no smoking" • Ensure that construction workers and host community are • adequately informed, and aware
	Potential increase in disease (malaria, communicable diseases, HIV) due to migration of workforce to the community	• Adequate signage and warnings including "highly-flammable", "no smoking" • Ensure that construction workers and host community are • adequately informed, and aware
Community and social cohesion	Potential conflict and tension between communities, local leaders and Project proponent due to unmet expectations around Project benefits and employment	• Stakeholders Engagement Plan developed and implemented

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GBV/SEA/SH	Unwanted aggressive advances, SEA/SH against women and children.	• Clearly define the GBV requirements and expectations in the bid documents for a GBV action plan, Code of conduct for workers and adequate costing for implementing the GBV plan. • The contractor ESMP and should among others, set out the mechanism for receiving, reviewing and addressing GBV complaints in a confidential manner, workers SEA/SH code of conduct and the accountable framework, mapping of GBV response actors within the project areas and working with them to provide quality survivor cantered services including case management, referral services and linkage to others services not provided by them, etc. • The supervising consultants' team should include a GBV specialist to supervise implementation of the contractor GBV plan. • Contractual Clauses on mandatory and regular training for workers on required lawful conduct and legal consequences for failure to comply with laws on non-discrimination and GBV will be inserted in the Contractors and Consultants Contracts as well as those of PMU staff; • Contractual Clauses with a commitment to cooperate with law enforcement agencies investigating cases of GBV will be inserted into the Contract Documents of the Contractors, Subcontractors and Supervising Consultant;

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		• Workers of Project Consultants, Contractors and Subcontractors will be made to sign Code of Conduct with acceptable behaviour and sanction against GBV; • Sensitization workshops/training on GBV/SEA/SH shall be undertaken for all employees of the Contractor/Supervising Consultant and Sub-Contractors; • Contractors shall provide contact numbers of the nearest law enforcement Agency Office, the Grievance Committee Members and GBV/SEA Service Providers/FSU to workers and paste same at vantage points within the project zones/sites/communities; • Prohibition posters on sexual exploitation and harassment will be posted in and around the sites as well as in the project communities. • A helpline will be provided and disseminated in all the project communities and facilities by the ACC/EOC to deal with GBV/ SEA/H complaints

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Traffic	The increased vehicular movement and speed may result in road safety issues like traffic accidents.	• Community consultations and meetings on the ongoing works and related hazards will be held. • Active sites will be sealed off from the public using reflective tapes and cones; where necessary road diversions will be created. • Safety initiatives will be developed and implemented, including: – Ensuring that only qualified (licenced) drivers operate machinery; – Implementing speed limits and traffic control measures in appropriate locations; – Implementing safety signage; – Installing speed control devices such as governors on trucks • Movement of large construction machinery will be guided by a flagwoman/flagman.
	Post -construction	
Economics, Livelihood	Potential economic loss due to damage to assets (e.g animals) from Project related activities	• Stakeholders Engagement Plan developed and implemented • Develop and implement Resettlement Action Plan (RAP), • Ensure commensurate compensation • Develop livelihood restoration plan
Community health and safety	Potential mental issues caused by disruption of traditional support and community cohesion resulting from possible resettlement and compensation	• Adequate signage and warnings including "highly-flammable", "no smoking" • Ensure that construction workers and host community are • adequately informed, and aware

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5.5 Analysis of Alternatives

A robust alternatives analysis was conducted to weigh technical performance, climate resilience, life-cycle costs, social impacts, and institutional feasibility. Nigerian gully erosion literature highlights that intense rainfall, land-use change, poor drainage, and soil/slope instability drive gully formation, and that hybrid approaches combining engineered drainage with bioengineering and upstream controls deliver more durable outcomes than single-solution strategies. Local assessments in Gwagwalada further emphasize the role of community practices (waste disposal, informal drainage) and call for multi-pronged management techniques. Broad mitigation patterns and geotechnical diagnostics (including resistivity-based subsurface profiling) also support targeted structural works at critical failure points paired with vegetative stabilization.

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Alternative	Technical effectiveness	Climate resilience	Social impacts	Life-cycle O&M burden	Indicative cost	Key risks
A. No action/status quo	Very low: continued headcut advance and lateral	Very low: vulnerable to extreme rainfall	High negative: asset loss and safety risks	Low initially, very high consequence	Low upfront, high long-term damages	Progressive gully expansion and asset failure
B. Hard/grey-only engineering (lined channels, gabion drop structures, culverts)	High at critical segments; immediate stabilization	Moderate: robust conveyance but limited peak attenuation	Moderate: construction disruption; improved safety if well-designed	High: desilting, repairs, defect correction	High capex; recurring O&M	Downstream impacts if not coupled with flow attenuation
C. Nature-based solutions (NBS) only (vetiver, live staking, buffers, swales)	Moderate on gentle slopes and incipient gullies; limited at active deep gullies	Moderate–high: attenuates peaks and improves infiltration	High positive: co-benefits for amenity and livelihoods	Moderate: vegetation establishment and upkeep	Low–moderate capex	Insufficient at high-energy reaches; slower to deliver protection
D. Hybrid grey–green (engineered drainage + bioengineering + upstream detention)	High: addresses hydraulic conveyance and slope stability end-to-end	High: combines capacity, attenuation, redundancy	High positive: safer crossings, greener corridors	Moderate: balanced desilting and vegetation care	Moderate–high capex; better cost-effectiveness long-term	Coordination complexity; requires strong O&M systems
E. Upstream catchment management	Moderate–high: reduces	High: peak shaving,	Moderate positive: reduced	Moderate: inspection of	Moderate	May not fix existing

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focus (detention basins, pavement drainage retrofits, LID)	inflow energy and volumes	overflow pathways	downstream risks	basins and retrofits		deep gullies without downstream works
F. Managed retreat/relocation at highest-risk segments	Very high at specific hazard zones	High: removes exposure to extremes	High negative short-term; potential net positive if resettlement is fair	Low–moderate post-relocation; high transaction/coordination	High transaction costs	Social acceptance, land/tenure disputes

5.5.1 Alternative-Specific Analysis

A. No action/status quo

Verdict: Not viable. Severe ongoing erosion, safety hazards, and escalating damage costs. No resilience to intensifying rainfall.

B. Hard/grey-only engineering

Strengths: Rapid stabilization at active headcuts and high-energy reaches; clear standards and predictable performance.

Limitations: Peak flow displacement downstream; higher lifecycle O&M (desilting, repairs). Less adaptable to climate variability without parallel attenuation.

C. Nature-based solutions only

Strengths: Peak attenuation, infiltration, biodiversity, and local job creation via nurseries and maintenance.

Limitations: Insufficient for deep, active gullies; slower protective effect; needs pairing with structural measures at critical points.

D. Hybrid grey–green (recommended)

Strengths: Comprehensive risk control—capacity for conveyance, energy dissipation, slope stabilization, plus upstream attenuation and vegetative reinforcement.

Limitations: Requires coordinated O&M, community engagement, and multi-agency roles; moderate–high capex offset by better lifecycle outcomes.

E. Upstream catchment management focus

Strengths: Tackles root causes—flow concentration from paved areas and poor drainage; reduces inflow energy via detention and LID.

Limitations: Must be combined with downstream stabilization to address existing gully morphology.

F. Managed retreat/relocation

Strengths: Eliminates exposure at extreme-risk sites where engineering is infeasible or uneconomic.

Limitations: Social complexity, land/tenure issues; needs strong safeguards and fair compensation processes.

5.5.2 Preferred strategy and rationale

Preferred alternative: D. Hybrid grey–green, integrated with E. Upstream catchment management, and selective F. Managed retreat at segments where failure risk and costs exceed feasible engineering solutions.

Rationale: The literature and local context show that combining engineered conveyance (culverts, drop structures, channel linings) with bioengineering (vetiver, live stakes, buffers) and upstream detention/LID achieves superior control of erosive forces, reduces downstream impacts, and builds climate resilience. It balances rapid stabilization with long-term ecosystem services and more sustainable O&M, underpinned by community stewardship.

5.5.3 Implementation notes for the preferred strategy

- **Targeted structural works:** Stabilize headcuts and high-velocity reaches with gabion drop structures, Reno mattresses, energy dissipation, and resilient culverts.
- **Upstream attenuation and LID:** Detention basins, vegetated swales, curb inlets, pavement retrofits to spread and slow inflow; formalize maintenance access and debris screens.
- **Bioengineering program:** Vetiver hedgerows, native deep-rooting species on banks/toes, riparian buffers; community nurseries and maintenance crews.
- **O&M system:** Scheduled desilting, vegetation upkeep, storm-triggered inspections; asset registers and performance-based contracts.
- **Safeguards and social measures:** Co-design with affected communities, clear grievance redress, and managed retreat protocols for extreme-risk segments.

5.6 Project Sustainability Assessment

Gully erosion in the FCT is driven by intense rainfall, land-use change, poor drainage, and soil instability; it threatens homes, roads, utilities, and livelihoods, particularly where settlements encroach into drainage paths without adequate stormwater management. A sustainability assessment must ensure the control works are environmentally sound, socially inclusive, financially maintainable, climate-resilient, and institutionally embedded for long-term performance. Evidence from Nigerian gully contexts and local assessments in Gwagwalada informs design, mitigation, and community engagement priorities for durable impact.

Scope and objectives

1. **Project focus:** Comprehensive control of active gullies and prevention of new ones through engineered drainage, slope stabilization, nature-based solutions, and upstream/downstream hydrologic management across priority sites in Gwagwalada and Zuba. This includes protecting critical assets (roads, schools, utilities), restoring safe access, and improving stormwater governance at neighborhood scale.
2. **Assessment goal:** Evaluate long-run environmental integrity, climate resilience, social equity, economic viability, and institutional capacity across design, construction, and operations, with a 10–20 year horizon for performance and risk reduction.
3. **Geographies:** Active and incipient gullies mapped within Gwagwalada and Zuba catchments; selection guided by hazard severity, exposure of people/infrastructure, feasibility, and cost-effectiveness.

Assessment framework

Environmental sustainability

- **Hydrologic integrity:** Size and stage drainage to convey peak flows safely (primary/secondary channels, culverts, energy dissipation) while maintaining baseflow pathways; design must avoid offsite impacts through controlled outfalls and riparian buffers.

- **Soil and slope stability:** Use terracing, benching, and geotechnical measures (gabions, retaining structures) alongside bioengineering (vetiver, deep-rooting native species) to stabilize walls and toes of gullies and reduce erosive shear stresses.
- **Sediment control**: Install check dams, sediment traps, and stilling basins to intercept and settle transported materials; schedule routine desilting tied to rainfall seasons to prevent reactivation.
- **Water quality and ecosystems:** Protect downstream water bodies by filtering runoff through vegetated swales and wetlands; prioritize native species to enhance biodiversity and slope resilience.

Climate resilience

- **Future rainfall loads:** Apply updated intensity–duration–frequency (IDF) curves and safety factors to accommodate extreme events exacerbated by climate change; integrate overflow paths and controlled bypasses to prevent catastrophic overtopping.
- **Nature-based solutions:** Combine grey works with green infrastructure—bioswales, riparian buffers, live check dams—to lower peak flows and increase infiltration, improving performance under climate variability.
- **Asset protection:** Elevate and harden critical crossings; design resilient culverts with debris screens and access points for rapid clearing post-storms.

Social inclusion and equity

- **Community co-design:** Engage residents, traditional leaders, and vulnerable groups in site selection, access routes, and safety features; integrate local knowledge of flow paths and hotspots to refine designs.
- **Health and safety:** Include fencing or barriers at hazardous edges, lighting near crossings, and safe pedestrian detours during works; provide information on risks and emergency procedures through community channels.
- **Livelihood-sensitive planning:** Preserve or reconfigure market stalls and small businesses near gullies; create local green jobs for maintenance and native plant nurseries.

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Economic and financial sustainability

- **Lifecycle costing**: Estimate capital, routine O&M (desilting, vegetation management, minor repairs), periodic rehabilitation (gabion re-lining, culvert relining), and end-of-life replacements; schedule expenditures over 20 years with reserves for extreme-event recovery.
- **O&M financing:** Secure budget lines within FCTA/Area Council allocations, complemented by performance-based maintenance contracts; consider community micro-franchising for vegetation and litter control along drains.
- **Cost-effectiveness**: Use phased delivery from critical hotspots outward; apply value engineering (local materials, modular gabions, standardized culvert components) to reduce costs without compromising safety.

Institutional and technical sustainability

- **Roles and mandates:** Clarify asset ownership and O&M responsibilities among FCTA departments, Gwagwalada and Abuja Municipal Area Councils, utilities, and community committees; formalize handovers with as-built records and maintenance manuals.
- **Capacity building:** Train municipal engineers and local stewards on inspection, data logging, minor works, and emergency clearing; integrate hydrologic monitoring into routine operations.
- **Standards and QA/QC:** Adopt national and project-specific standards for drainage, slope stabilization, and occupational safety; enforce supervision and defect correction periods with measurable performance criteria.

Key risks and mitigation

- **Hydraulic underperformance and overtopping:** To be mitigated through robust hydrologic/hydraulic design with climate allowances, energy dissipation structures, and controlled overflow pathways; routine inspections after peak events.

- **Slope failure and toe erosion:** to be mitigated through combined structural measures (gabions, retaining toes) with bioengineering and staged stabilization to address progressive failure mechanisms.
- **Sediment and solid waste clogging drains:** To be mitigated by installing litter screens at culvert inlets, define desilting schedules, and implement community waste management campaigns and collection points near gully corridors.
- **Land acquisition and access disruptions:** To be managed through early consultations, negotiated micro-alignments, compensation per legal frameworks, and safe temporary access routes; active grievance redress channels.
- **O&M funding gaps and institutional drift:** To be managed through dedicated, protected budget lines; performance-based contracts; annual sustainability reviews and public dashboards to sustain accountability.

Engineering and nature-based solutions

- **Upstream controls:** Headwalls, inlet structures, vegetated swales, and detention basins to slow and spread inflow; pavement drainage retrofits to prevent sheet flow concentration into gully heads.
- **Channel stabilization:** Gabion drop structures, Reno mattress linings, and concrete aprons where velocities exceed permissible limits; integrate live staking and vetiver to reinforce banks and reduce maintenance costs over time.
- **Outfall management:** Stilling basins and erosion-resistant aprons at discharge points to protect downstream channels and properties; riparian vegetative buffers to improve infiltration and habitat.
- **Access and crossings:** Resilient culverts and footbridges with guardrails and debris screens; maintain maintenance access tracks for rapid response after storms.

Operation and Maintenance Plan

- Asset register: Unique IDs with materials, dimensions, inspection cycles, and critical thresholds.

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- Scheduled maintenance: Pre-rainy season clearing and post-event desilting; vegetation pruning linked to growth cycles and visibility/safety needs.
- Emergency response: Storm-triggered inspections with 24–72 hour clearing targets and stockpiles of gabion rock, sandbags, and fencing.
- Procurement: Performance-based maintenance contracts tied to indicators (functionality uptime, response times); include bonus/penalty mechanisms for measurable outcomes.

Governance, participation, and safeguards

- **Participatory governance**: Establish site committees for co-monitoring walks, reporting hazards, and coordinating cleanup; leverage local survey findings on causes/effects to tailor behavior change and maintenance priorities.
- **Grievance redress:** Accessible intake channels, clear timelines for resolution, and transparent disclosure of cases and outcomes; align with ESIA commitments and legal frameworks.
- **Safeguards**: Implement ESIA/ESMPs addressing biodiversity, noise, dust, chance finds, worker safety, and traffic management; monitor compliance throughout construction and operations.

CHAPTER 6: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

6.0 Introduction

This chapter discusses the Environmental and Social Management and Monitoring Plan (ESMMP) for the Gwagwalada and Zuba subproject. It is necessary to achieve the health, safety, and environmental regulatory compliance objectives of the project. Environmental and social management systems/procedures are developed to establish sound basis for mitigation, monitoring and management at the project level. The E&S requirements are integrated into existing procedures to ensure that project bottlenecks are not created. To this end, the Plan has focused on specific steps to be taken with respect to implementation of the mitigation measures and monitoring activities for the environmental and social impacts identified in Chapter 5.

The plan highlights the specific mitigation measures that would be taken and the entities responsible for carrying them out. This ESMP also contains a monitoring plan indicating the responsible parties, the frequency of monitoring, key indicators and the reporting format, and provides for necessary capacity building to facilitate the ESMP implementation. Cost estimates for implementation of the various mitigation measures, monitoring plan and capacity building are also given. The projected implementation budget will enable the ESMP to be an integral part of financing for the Construction and operational works in the project.

6.1 Impacts Mitigation/Enhancement Measures

Based on the impacts identified appropriate corresponding mitigation measures have been identified to prevent, minimize, mitigate or compensate for adverse environmental and/or social impacts. In addition, enhancement measures have been developed to improve project environmental and social performance. The roles and responsibilities of implementing these measures are clearly defined alongside the budget for the measures estimated. Also, the cost for environmental and social capacity building and gender mainstreaming have been included.

Mitigation Measures Hierarchy The measures proposed are specific, measurable, achievable and relevant to the proposed and time based (SMART). The measures also considered the environmental laws in Sierra Leone, and the World Bank E & S management framework requirements including the principles of sustainable development and best available technology. The principle of mitigation hierarchy outlined below was also considered:

- **Avoid: Avoiding investments that are very detrimental and adverse environmental and social impacts**
- **Reduce at Source**: Avoiding or reducing at source or minimizing the footprint of an activity is essentially designing 'the subproject so that a feature causing impact is designed out or altered (e.g. reducing road width/work area). This can also be termed minimization.
- **Abate on Site:** This involves considering measures to the basic design to abate the impact- pollution controls fall within this category based on site realities.
- **Abate at Receptor:** If an impact cannot be abated on-site then measures can be implemented off-site. An example of this is for the Supervision Consultant and Contractors OHS team to increase the level of supervision focusing on community health and safety during the period of civil work.
- **Repair or Remedy:** Some impacts involve unavoidable damage to a resource, e.g. proper damage or affected structures during construction and material sourcing. Repair essentially involves restoration and reinstatement type measures.

6.2 Environmental and Social Impact Mitigation Measures

6.2.1 Construction Phase Environmental and Social Impact/Risks Management Measures

The construction impact mitigation measures is designed to prevent, reduce, or offset negative effects (environmental, social, cultural) of the project to ensure the gully erosion control construction development works balances economic goals with protecting the project area ecosystems, community well-being, in line with regulatory compliance, as presented below:

A. Environmental Impact and Risks Mitigation Measures

Air Pollution Impacts Mitigation Measures

Essentially, the preventive measures under listed shall be adhered:

- The Contractor will be required to obtain approval (from The Construction Supervision Consultant) for the dust abatement plan/Pollution Prevention Plan.

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- Sprinkling should be practiced regularly at all active work sections along the roads and at borrow sites for the protection of workers. In addition, sections of earthen roads worksite heavily traversed by construction vehicles should also be regularly watered.
- Dust at workplaces within or close to human habitation should be critically minimized by periodic water sprinkling on working sections. The contractor should advise or notify local households about dust, noise, vibration and other dangers.
- All vehicles, machinery, equipment, and generators used during construction activities will be kept in good working conditions to minimize exhaust emissions & limit the idling time of construction vehicles to 2 minutes to minimize local air pollution.
- Enforce the maximum speed limit to 10km/h for vehicles to reduce dust emissions.
- Conduct ambient air quality monitoring as per Environmental Management Plan (EMP).

Exhaust Emissions

- All vehicles, machinery, equipment, and generators used during construction activities will be kept in good working conditions to minimize exhaust emissions & limit the idling time of construction vehicles to 2 minutes to minimize local air pollution.
- Enforce the maximum speed limit to 20km/h for vehicles to reduce dust emissions.
- Conduct ambient air quality monitoring as per Environmental Management Plan (EMP).

Noise Pollution and Vibration Mitigation

Work activities with the greatest potential to generate noise shall be conducted during the day to ensure the least disturbance to the sensitive receptors around the construction area. The schedule of such work shall be agreed to between the contractor and the local communities with proper consultation. Horns should not be used unless it is necessary to warn other road users or animals of the vehicles and equipment approach. The mitigations shall be to limit working hours to between 6 am and 6 pm, six days a week. Noise monitoring will be conducted every month as recommended in ESMP.

Despite this, the affected communities are at liberty to carry out on-demand noise monitoring in case of any complaint or request. The noise level of machines to be used during the construction will be controlled and measured will be taken to limit the levels in line with regulatory standard,

it is expected that workers shall be provided earmuffs, where necessary. Also, noise from construction equipment should be minimized by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and using portable street barriers to minimize sound impact to surrounding sensitive receptors.

All machinery and equipment used during construction shall comply with national and international noise emission standards, and regular inspections shall be carried out to ensure compliance. Personal protective equipment (PPE) such as earmuffs or earplugs will be provided to workers exposed to high noise levels. Additionally, vehicle silencers shall be maintained in good condition, jackhammers shall be fitted with noise-reducing mufflers, and temporary noise barriers or portable acoustic screens shall be installed around noisy equipment to minimize sound propagation to nearby sensitive receptors.

Mitigation of Water Related Impacts

Water related challenge within the project area calls for serious caution to avoid aggravation of the current dire situation through reckless impact on the surface water within the communities. It is expected that the water channels would be diverted properly, and a protection mechanism should be provided, or construction will be undertaken during the dry season.

Contractors engaged in the project shall make arrangement for water by sinking boreholes that could be transferred to the communities at project completion or truck water from other sources out of the community and should not in any way rely on existing community resources and should not extract from sources currently used by the community.

Should a campsite be needed, contractors must provide convenience facilities at each campsite which include latrines, lined washing areas, septic tanks, and soaking pits for toilet waste. Key mitigation measures to be observed are as under listed:

- There should be proper septic tanks and soaking pits for sewage treatment and disposal, sewage/sanitation at work camps and proper wastewater collection facilities.
- Wastewater effluent from contractors will be passed through an oil skimmer and to gravel/sand beds to remove oil/grease contaminants before discharging it into the water body.

- The Septic tank and soak pit shall be covered properly to avoid any obnoxious smell in the surrounding areas. The soak pit will be built in absorbent soil and located 300m away from a water source.
- Soak pits will be designed to accommodate wastewater generated during the total operation. It should be designed and constructed to avoid runoff cannot seepage. At the time of restoration, septic tanks will be dismantled in place and backfilled with at least a 1m soil cover keeping in view the landscape of the surrounding natural surface.
- To overcome the drinking water contamination issue, at the construction camp/s, the contractor shall make external arrangement for the supply of drinking water from sources outside of the communities
- The contractor shall prepare and implement a spoils management plan under the supervision of PMU and the Supervising Engineer
- The E & S team of PMU shall carry out regular monitoring of water quality and the contractors shall submit weekly water quality test results where applicable.
- Wastewater from laundry, kitchen washings and showers will be disposed of in separate soak pits.
- Soak pits will be built in absorbent soil and located 250 m away from a surface water source or groundwater well.
- Water consumption will be monitored during the construction stage and records will be maintained to avoid any waste and to ensure resource efficiency management.
- Diesel, oil, and lubricants should be properly stored following petroleum product storage guidelines. The storage area shall be bound with concrete barrier and restriction/no-smoking signage.
- It has been further proposed that before the start of the construction, the contractor will establish updated baseline environmental monitoring of air, water & noise including the soil analysis (trace metals such as Cd, Zn, Cu, Cr, Pb and Ni as per WHO standards) for comparison during the construction phase.
- Permissible limits/standards according to the World Health Organization.

- Avoid stockpiling of earth fill especially during the wet season unless covered by tarpaulins or plastic sheets
- Dispose of any waste generated by construction activities in designated dumpsites.;
- Conduct surface quality inspection according to the Environmental Management Plan (EMP).
- Community liaison will be maintained and the established GRM will address complaints related to waste disposal.
- The contractor shall ensure wastes are sorted before disposal in reference to type of wastes and categories of wastes the project will generate or handle (biodegradable / organic wastes; packaging materials; non-biodegradable (metallic, plastic), construction wastes, and hazardous wastes i.e. fuels, oils, lubricants, vehicle / machinery fluids and excavated materials);

Water Course Diversion Impacts Mitigation

The Contractors should provide an adequate-sized diversion so that there shall be no disturbance to the water flows of the canal /water course. Schedules for construction activities alongside the water body should be prepared with the consultation of the local community. The Grievance Mechanism and active GRC needs should be operational all the time. Adequate planning should be ensured to avoid construction delays that could lead to flooding due to improper diversion activities.

Local Hydrology Interferences Mitigation

- Good design features shall be adopted to ensure that the changes of the hydrological regimes are minimized to ensure minimal impacts.
- The design will provide controlled and effective storm water dispersion by installation of adequate and appropriate drainage structures.
- The discharges points shall be well designed to avoid accelerated erosion downstream and beach erosion
- Design will be done as not to drain all logging water from streams by considering the spillway/embankment to the drainage for the maximum flow control.

Soil Erosion Mitigation

Excavation of earth fill should be limited to an appropriate depth of 20cm. Priority will be given to getting the earth fill material from the licensed contractors with avoidance of agricultural land, private land will not be taken until a prior written agreement (with local tradition) and documentation of relevant details of compensation (on prevailing market rates) are signed between the owner/s and relevant authorities. Furthermore, the top 15cm of topsoil will be stripped and stored and then replaced with borrowed material. Where deep ditching is carried out, the top half-meter layer will be stripped and stockpiled. The ditch will be filled initially with debris/scrap material from old construction and leveled with stockpiled topsoil later. Where ditches and borrow pits cannot be fully rehabilitated, landowners will be compensated as provided in agreements between the landowner/s and contractor.

Vegetation with a fast-growing tress/shrubs/grasses crop and a native seed mix immediately shall be planted after fill placement to prevent scour and encourage stabilization according to the design. The uses of stone pitching or riprap where appropriate should adopted based on design consideration, especially around culverts and retaining structure. Provision for riprap in discharge zones from drainage structures has been made in the design to reduce erosion; Side slopes will be adjusted to a gradient necessary to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion.

The contractors shall:

- Appropriately drain water from excavations and transfer it to the sediment retention pond for sedimentation before discharging to the environment
- Break the runoff velocity using ditches, series of rock check dams or other arrangements
- Maintain the natural hydrological flow direction unless diverted for protecting buildings, or other properties
- Cover stockpiled materials with fabric
- Select and implement sediment control devices such as: i) site fencing; ii) straw bales; iii) sediment basins or traps; iv) storm inlet traps; vi) rock check dams and vii) interception berms/swales

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Waste Management Measures

Proper management of waste is also important because of the risk that improper waste handling and disposal poses to human health and environmental degradation. Careless and indiscriminate open dumping of waste can create unsightly and unsanitary conditions within the project area. Impact includes improper disposal of hazardous wastes (oily wastes, used batteries, fuel drums) in the designated areas leading to contamination of land, surface water and seepage into groundwater. The total quantity of domestic waste generated will vary depending on the type and scale of work activities.

- Grit chambers should be provided for sediment straining and screening chamber for solid waste prevention. Screening and grit chambers should be designed to slow down the flow of stormwater so that pollutants and solids such as sand and small stones will settle out and prevent blockage.
- The contractors shall ensure proper handling and treatment procedures of hazardous wastes e.g., sludge and other waste with faecal matter from latrines and septic tanks
- Only inert materials or readily decomposable materials shall be disposed of by burial.
- Open burning oils shall be prohibited.
- Frequent cleaning of the drainage channels and strainers to prevent drainage blockage.;
- The contractor shall develop and implement an efficient waste collection and disposal system based on the principles of reduction, re-use and recycling of materials, at the camp and construction sites.;
- Solid waste produced especially from the camp sites as well as at the construction sites will be collected by municipal garbage truck or registered vendor and disposed of at government approved dumpsite.
- Other waste like uprooted trees will be given to the local communities for firewood.
- Waste disposal bins shall be placed at strategic locations at the work sites and campsites, warning notices shall be posted also.
- “DOs & Don’ts” etc. posted at strategic points, through the campsite and construction sites.

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- Hazardous waste like used batteries will be recycled or collected and disposed of according to regulatory guidelines.

6.3 Biodiversity Impacts Mitigation

During the baseline survey of the sub-project area, no endemic or rare species were observed in the primary impact zone as well as the secondary impact zone. All species recorded during the field survey have a wide range of distribution. However, should the establishment of campsites be required, the campsite is expected to occupy small areas and should be in existing clearings within the communities, the impacts are reversible and localized by adopting mitigation measures.

The contractor shall:

- Sensitize workers and enable them to properly handle concrete spillages or waste cement
- Prevent sediment and solid waste introduction to the sea as to protect breeding sites for the fish and other marine organisms into shoreline and under mangroves
- Topsoil shall be stockpiled and used for reinstating flora along the road and drainage. It is assumed that displaced fauna will return once the work is over or seek another habitat locally.
- Spilled cement or concrete should be collected and disposed of away from natural water ways or storm water drainage
- Sensitize workers and enable them to properly handle concrete spillages or waste cement
- The designs should ensure that all trees which are not in the corridor of impact remain intact even if they are located within the route of work if safety is guaranteed.
- Efforts should be made to offset a few trees along the project alignment route of the subprojects that will be removed.

Materials Sourcing Management Measures

The contractor shall ensure that new extraction sites:

- Are not located in the vicinity of settlement areas, cultural sites, water resources or any other valued ecosystem component, or on high or steep ground or in areas of high scenic value and shall not be located less than 1 km from such areas.
- Are not located adjacent to stream channels wherever possible to avoid siltation of river channels.
- Are not located in forest reserves. However, where there are no other alternatives, permission shall be obtained from the appropriate authorities, and an environmental impact study shall be conducted.
- It will be easily rehabilitated. Areas with minimal vegetation cover such as flat and bare ground, or areas covered with grass only or covered with shrubs less than 1.5 m in height, are preferred.
- Shall have clearly demarcated and marked boundaries to minimize vegetation clearing.
- Vegetation clearing is restricted to the area required for safe operation.

B. Social Impact Management Measures

Land Expropriation, Loss of Property and Resettlement Mitigation Measures

During consultations with the communities and government officials, it was very clear that compensation must be made prior to implementation of the project. Failure to implement the compensation plan can result in social friction with local communities that can cause delays in construction schedules. The following measures shall be undertaken:

- Compensation for affected assets will be carried out with reference to the ACReSAL Resettlement Policy Framework (RPF)
- Compensation shall be done according to WB ESS5 requirement and related Nigeria laws governing resettlement before commencement of the construction activities
- A Resettlement Plan shall be prepared and implemented. Resettlement will be avoided and where impossible it should be minimized at design stage and during implementation
- Compensation at full replacement rate or replace affected structure with improved conditions before demolition

- Consultations with community and religious leaders shall be done to arrange for the procedures to relocate the religious and affected public properties.
- The compensation shall be paid in advance (before commencement of construction) before demolition of the existing structures

Labor Influx Management

a) Risk of social conflict:

- Provision of information regarding migrant workers
- Code of Conduct in local language(s)
- Provision of cultural sensitization training for migrant workers regarding engagement with the local community.
- Contractors should try to recruit more community residents where applicable (unskilled labour)

b) Increased risk of illicit behavior and crime:

- Paying salaries into workers‟ bank accounts rather than in cash
- Sourcing of local workforce
- Creation of supervised leisure areas in workers' camp
- Cooperation with local law enforcement
- Introduction of sanctions (e.g., dismissal) for workers involved in criminal activities
- Provision of substance abuse prevention and management programs
- Conduct routine drug test for workers

c) Influx of additional population ("followers"):

- Contractor to hire workers through recruitment offices and avoid hiring "at the gate" to discourage spontaneous influx of job seekers.

d) Impacts on community dynamics:

- Provision of services in the workers‟ camp to reduce the need for workers to use local community facilities

- Provision of entertainment and events for migrant labours within camp to reduce
- incentives for mixing with local community

e) Increased burden on public service provision:

- Where required, workers' camps should include wastewater disposal and septic systems
- Identification of authorized water supply sources and prohibition of use from other community water sources
- Separate service providers for community and workers‟ camp/construction site
- Contractors should provide generators for electricity supply to the works yards

f) Increased risk of communicable diseases (including STDs and HIV/AIDS):

- Since construction works will normally attract many job seekers and services, the contractor shall enforce a code of conduct in the works yard to encourage respect for the local community and to always maintain cleanliness of the yards.
- The contractor shall deploy locally available labour to reduce risks of spreading communicable diseases (especially STDs) which normally result from labour influx.
- A safety, health and environmental induction course shall be conducted for all workers, putting more emphasis on HIV/AIDS,
- Provide Voluntary Counselling and Testing (VCT) centers for HIV/AIDs at workplace
- Enforce HIV/AIDS law and regulations and support Campaign for communicable diseases
- All measures to prevent infections and other communicable diseases like HIV/AIDS etc.
- Migrate workers should be vaccinated against common and locally prevalent diseases
- Implementation of HIV/AIDS education programs
- Information campaign on STDs among the workers and local community
- Education about the transmission of diseases
- Provision of condoms

g) Child labor and school dropout:

- Ensuring that children and minors are not employed directly or indirectly and do allow trade or provide services on the project sites.

h) Local inflation of prices:

- Appropriate mix of locally and non-locally procured goods to allow local project benefits while reducing the risk of crowding out of and price hikes for local consumers

i) Increased pressure on accommodation and rents:

- When accommodation supply is limited, establishment of workers‟ camp facilities with sufficient capacity for workers including sub-contractors and associated support staff

j) Increase in traffic and related accidents:

- The contractors shall prepare a traffic management plan to be approved by the PMU
- Building additional/separate roads to project and workers‟ campsites
- Organization of commute from camp to project to reduce traffic
- Road safety training and defensive driving training for staff
- Sanctions for reckless driving

Traffic/Access Obstruction-Related Mitigations

The construction contractor will be required to:

- Plan all works to minimize traffic disturbance/blockades; on all the roads under construction and adjacent connected / linked roads and streets, work planning is crucial to minimize the inconvenience to the public due to the construction works
- Prepare and implement a Traffic Management Plan with the involvement of state actors
- Locate entry and exit points in areas where there is low potential for traffic congestion
- Keep the site free from all unnecessary obstructions
- Coordinate with Traffic/Local Police for temporary road diversions and provision of traffic aid if transportation activities cannot be avoided during peak hours
- Proper road signage and traffic aids should be provided at the site. Use all necessary safety precautions including signboards, temporary signals, skilled traffic guides, traffic

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diversions, electric lights, demarcation of construction work lanes/worksites/excavation areas, construction equipment/plant/machinery, separate active/live traffic lane from the active construction work sites,

- Pro-Actively update the signage well in advance based on planned construction activity.
- Notify socially sensitive receptors through direct engagement and by providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.
- Increase workforce in the areas with predominantly institutions, places of worship, business establishment, hospitals, and schools; consult businesses and institutions regarding operating hours and factoring this into work schedules.

Outreach to nearby communities informing them of road closures and construction schedules. Conduct an awareness program on the nature of work, likely disturbances and risks and construction work, mitigation measures in place, entry restrictions, and dos and don'ts and to the communities.

Mitigation Measures for Traffic Accident

- Ensure site entry controlled by installing hard barriers around work areas whether active or not. Visitors' access shall be properly controlled with total restriction on children
- Ensure timely public notification on planned construction works
- Seeking cooperation of local religions leaders and educational facilities (schoolteachers) for road safety campaigns, especially when/if a school and other receptors is near work adjacent areas
- Ensure provision of proper safety and diversion signage, particularly at socially sensitive receptors areas
- Ensure setting up speed limits in close consultation with the traffic police at road intersections; and
- Alternate pedestrian and vehicular passages shall be provided for crossing near the settlement whenever construction works impact directly community access,

- Open trenches and deep excavated area shall be protected with hard barrier hoarding fence/barricade to avoid any accident.

Public Infrastructure Damage/Disruption Mitigation

The relocation works for utilities along the subproject footprint alignment corridor will be carried out in consultation with the utility companies while damaged culverts giving way for road and drainage construction will be replaced as applicable. There must be good coordination between the Project construction team and the utility companies in order to reduce project delays, conflicts, safety risks and traffic congestion on the work sites.

The measures to minimize risks from utilities relocation or damage include:

- Notify the public before commencement of the works activities
- Discuss and co-ordinate closely with utilities companies about pre and post construction works.
- Avoidance strategies such as sidestepping settled areas, sensitive/important natural or social /cultural or economic features to avoid /minimizing extensive resettlement
- Appoint a competent person to supervise construction works at or near to transmission line to avoid electricity related accidents.
- Add structures to design (e.g. walking slabs, culverts) meant to facilitate access and crossing over linear infrastructures such as drainage channels/crossings.
- Perform utilities detection and piloting prior to the actual relocation or trenching work.
- Any abandoned water or sewer pipe after relocation works shall be properly sealed off to prevent soil settlement or sink holes which pose danger to the public.
- All safety requirements must be complied with, including safety requirements with regards to electrocution, fire hazards and working in confined space.
- There should be an Emergency Response Team (ERT) team and must always be on standby
- All damaged or removed infrastructures will be repaired or restored to their original or improved condition.

- Liaison with the community will be maintained and site-based GRM will be established to address any related complaint.

Management of Security Concerns

The contractor shall ensure:

- The works yard should be fenced for the safety and security purpose of the staff and the immediate surroundings
- Grant safety and security to workers by providing day and night security guards and adequate lighting within and around the works yards
- Establishing effective community engagement and grievance redress mechanism to handle grievances

Management of Business Disruption

Contractor shall:

- Provide access to residences and businesses along the roads being rehabilitated
- Provide alternative temporary spaces for informal businesses (mobile credit selling stands, motorcycles parking sites) as much as practicable
- Engage with formal businesses owners in dialogue on potential periods of disruption
- Conduct the construction works in phases to allow some businesses to continue
- Provide temporal access bridges to the businesses during construction works
- Provide appropriate information to potentially affected local communities prior to the commencement of works to allay fears, complaints or potential risks due to lack of information or awareness about the project activities.

Fire Risk Management

The contractor shall:

- Put in place and implement a fire prevention and fighting plan

- Provide an adequate number of fire extinguishers at the workshops, fuel and bitumen storage areas, workers' camps, asphalt plants and all campsites, duly serviced and located at easily accessible points.
- Designate an area within the worksite as a fire evacuation/assembly area.
- Have some staff adequately trained in firefighting operations.
- Provision of safety signage such as "No smoking" at workshops, fuel and bitumen storage areas, workers' camps, asphalt plants and all work sites where fire hazards are likely to occur.
- Ensure the availability of a health centre/ hospital and transport emergency vehicles (ambulance)

Workers Safety Management

a) **Risk from operations**: The Contractor is required to comply with all the precautions as required for the safety of the workmen as per the International Labour Organization (ILO) Convention No. 62 as far as applicable to the contract. The contractor will supply all necessary safety appliances such as safety goggles, helmets, masks, etc., to the workmen. The contractor must comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress.

b) **Risk from electrical equipment**: Adequate precautions will be taken to prevent danger from electrical equipment. No material at any of the sites will be so stacked or placed to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public. All machines to be used in the construction will conform to the relevant standards and codes, be free from patent defect, in good working order and will be regularly inspected and properly maintained as per standard provisions and to the satisfaction of the Engineer – in charge (CSC).

c) **Risk at hazardous activity**: All workers employed on mixing asphaltic material, cement, concrete etc., will be provided with protective footwear and protective goggles. Workers who are engaged in welding works would be provided with welder's protective eye-shields. The use of any herbicide or other toxic chemical will be strictly in accordance with the manufacturer's instructions. The Engineer – in charge (CSC) will be notified at least 6 working

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days' ahead of the proposed use of any herbicide or toxic chemical. A register of all herbicides and other toxic chemicals delivered to the site will be kept and maintained up to date by the Contractor. The register will include the trade name, physical properties and characteristics, chemical ingredients, health and safety hazard information, safe handling and storage procedures, emergency and first aid procedures for the product.

d) **Risk of lead pollution**: No person below the age of 18 will be employed to undertake painting works with products containing lead in any form. No paint containing lead or lead products will be used except in the form of paste or ready-made paint. Face masks will be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint is dry rubbed and scraped.

e) **Malarial risk**: The Contractor will, at his own expense, conform to all anti-malarial instructions given to him by the Engineer; including filling up any borrow pits which may have been dug by him. Gravid, blood-laden mosquitoes cannot fly very far, so they generally bite within a kilometre or so of their breeding place. Thus, borrow pits and any other water bodies created during the construction process should be situated far away from the human settlements. Pits dug up closer than these will be adequately drained to prevent water logging. Similarly compensatory measures for filling up part of the water bodies situated within the project corridors will be directed towards deepening of the water bodies concerned. This way the capacity of the water body remains the same, while the water surface available for breeding mosquitoes is reduced. This will have an additional advantage in decreased evaporation losses.

f) **First aid**: At every workplace, a readily available first aid unit including an adequate supply of sterilized dressing material and appliances will be provided as per the Factory Rules. Workplaces remote and far away from regular hospitals will have indoor heath units with one bed for every 250 workers. Suitable transport will be provided to take injured or ill person(s) to the nearest hospital. At every workplace an ambulance room containing the prescribed equipment and nursing staff will be provided.

g) **Potable water**: In every workplace, at suitable and easily accessible places, a sufficient supply of cold potable water will be provided and maintained.

h) Where water must be drawn from an existing well, which is within such proximity of any latrine, drain or any other source of pollution, the well will be properly chlorinated before water

is drawn from it for drinking water. All such wells will be entirely closed in and provided with a trap door, which will be dustproof, and waterproof fitted with a submersible pump. The trap door will be kept locked and opened only for cleaning or inspection, which will be done at least once a month.

i) **Sanitation Facilities**: These shall be provided within the precincts of every workplace, latrines and urinals in an accessible place, and the accommodation separately for each of these, as per standard requirements. Except in workplaces provided with water-flushed latrines connected with a waterborne sewage system, all latrines will be provided with dry-earth system (receptacles) which will be cleaned at least four times daily and at least twice during working hours and kept in strict sanitary condition. Receptacles will be tiled inside and outside. separate latrines and urinals should be provided for women, screened from those for men and marked in the vernacular language shall be provided. There will be an adequate supply of water, close to latrines and urinals.

GBV/SEA/SH Mitigation Strategy

As part of the mitigation strategy, training/orientation sessions will be conducted to sensitize the PMU and the Contractor's staff/workers on the importance of addressing GBV/SEA/SH risks at the project level. The contractor will be required to have a written contract with their workers materially consistent with the objective of ESS2, following the procedures as specified in the World Bank's Procurement Guidelines. The workers shall be required to sign a Code of Conduct (CoC) prepared by the Contractors and reviewed and approved by PMU. Further measures should be undertaken as under listed:

- The Community Based Organizations (CBO) recruited by the PMU and other Institutions should support and provide training on gender issues and ensure mainstream GBV into all humanitarian response and maintain the updated comprehensive data needed to inform advocacy, planning, implementation and M&E of interventions.
- National and international Gender policy and guidelines on GBV shall be implemented, used and considered during project employment.
- Increase awareness and enhance systems for the prevention of GBV including SEA through mitigating risk factors and strengthening community protection strategies.

- The contractors should have and implement their policies related to Gender Based Violence against Women and Children throughout the project implementation in addition to the ACReSAL GBV Action Plan
- The cost of undertaking: i) support and provide training on gender issues; ii) ensure mainstreaming of GBV issues; and iii) maintain the updated comprehensive data needed to inform advocacy, planning, implementation and M&E of interventions will be part of the contractors' budget.
- Increase access to a comprehensive and well-coordinated GBV response services including livelihood support for survivors.

In addition, the contractor will integrate measures for prevention and handling Gender Based Violence (GBV) and Sexual Exploitation and Abuse (SEA) in the contractor's environmental and social management plan (C-ESMP). Every Gender Based Violence (GBV)-related incident should be reported and appropriate actions taken. The contractor should develop an induction program, including a Code of Conduct, for all workers directly related to this project. A copy of the Code of Conduct should be presented to all workers and signed by each addressing various issues such as:

- respect for residents and customs
- zero tolerance to violence (whether physical, verbal or otherwise)
- zero tolerance of bribery or corruption
- zero tolerance of illegal activities by construction personnel including:
  - Prostitution
  - Illegal sale or purchase of alcohol
  - Sale, purchase or consumption of drugs
  - Gambling or fighting
- Description of disciplinary measures for infringement of the Code and company rules.

6.4 Impacts on Health, Safety, and Environment (HSE) of Community and Construction Workers

During the construction phase of the proposed sub-project, there is potential for adverse impacts on the health, safety, and hygiene of both construction workers and the surrounding community.

The local communities may be directly affected by increased movement of construction vehicles and equipment, which raises the risk of accidents and injuries both within and around the project area. Indirect impacts may arise from a decline in ambient air quality due to dust generation from excavation, material handling, and haulage activities, as well as emissions from construction machinery and transport vehicles.

These impacts are expected to persist throughout the construction period but can be effectively mitigated through the application of appropriate HSE management measures, including regular dust suppression using water bowsers, strict traffic and equipment control, and adherence to occupational health and safety protocols.

6.5 Health and Safety Mitigation Measures

To ensure the protection of both workers and the surrounding community, robust Health, Safety, and Environmental (HSE) measures shall be implemented throughout the construction phase of the sub-project.

Dust suppression will be achieved through the regular use of water bowsers on active construction and haulage routes. All construction plants, vehicles, and equipment shall be regularly maintained and serviced to meet the Standard Environmental Quality and Safety (SEQS) requirements and minimize emissions. Water for dust control shall be sourced responsibly from approved water bodies or boreholes to avoid disruption to community supplies.

The following actions shall guide effective management of occupational health and safety within the sub-project area:

Occupational Health and Safety Planning:

- The contractor shall prepare and implement a site-specific Labour Management Plan (LMP) and an Occupational Health and Safety (OHS) Plan in accordance with ESS2 – Labor and Working Conditions.
- The OHS Plan shall describe all construction activities, associated hazards and risks, and control measures to minimize or eliminate those risks.

- Control measures may include the use of Personal Protective Equipment (PPEs), work restrictions, and specific safety protocols for high-risk operations.

Worker Training and Capacity Building:

(1) The OHS Plan shall include a worker training matrix, specifying the required safety training for each job role.

(2) Specialized training shall be provided for tasks involving work near water bodies, at heights, or with heavy machinery, ensuring workers are fully aware of hazards and safe work practices.

Use of Personal Protective Equipment (PPEs):

- The contractor shall ensure the mandatory use of appropriate PPEs (e.g., helmets, gloves, reflective vests, safety boots, ear protection, and harnesses) for all labor categories and activities undertaken on-site.
- Regular inspection and replacement of PPEs shall be enforced to maintain safety compliance.

6.6 Project Activities Public Impacts

Impacts on the Public from Project Activities

Project construction activities may pose both direct and indirect impacts on the surrounding public. Direct impacts include the risk of accidents or injuries resulting from the movement of heavy vehicles and construction equipment within and around the sub-project area. Indirect impacts may arise from a decline in ambient air quality, primarily due to dust emissions generated during excavation, material haulage, and other construction-related operations, as well as exhaust emissions from plants, machinery, and vehicles.

These impacts are expected to persist for the duration of the construction phase but are temporary and manageable through appropriate mitigation measures.

Potential Mitigation Measures

To minimize potential public health and safety risks during project implementation, the following mitigation measures shall be adopted:

- **Controlled Site Access:** Establish and maintain secure site boundaries using hard barriers or fencing around all work areas, whether active or inactive. Access to the site shall be strictly controlled, with complete restriction of entry to children and unauthorized visitors.
- **Public Notification:** Provide timely and adequate notice to the public regarding planned construction activities, expected disruptions, and duration of works.
- **Community and Institutional Engagement:** Collaborate with local religious leaders, schools, and community organizations to promote road safety awareness, especially in areas where schools or other sensitive receptors are located near construction zones.
- **Safety Signage**: Install clear and visible safety and diversion signs at strategic points, particularly near schools, markets, and other socially sensitive areas.
- **Speed Control**: Establish and enforce speed limits in consultation with the traffic police, particularly at intersections and near populated areas.
- **Access Management:** Provide alternative pedestrian and vehicular access routes for residents and road users where construction activities obstruct existing pathways.
- **Excavation Safety:** Secure all open trenches, pits, and deep excavations with robust barriers, hoarding, or fencing to prevent accidental falls and injuries.

6.7 Project Activities Public Impacts

Displacements and Resettlement

The proposed project may result in the displacement of households and business premises located along the gully Right of Way (RoW). Involuntary resettlement may also be required in densely populated sections to facilitate project implementation. A Resettlement Action Plan (RAP) will be prepared to address all issues related to land acquisition, displacement, and livelihood restoration. Displacement could additionally occur in areas prone to flooding or where project activities alter natural runoff paths, potentially redirecting water through residential or commercial properties. Appropriate consideration will be given to all potential displacement and resettlement impacts, with mitigation measures clearly outlined in the respective RAPs. The RAP shall be fully implemented prior to the commencement of construction activities.

6.8 Project Activities Public Utility Impacts

Relocation / Damage to Physical Infrastructure/

The construction works can potentially damage existing infrastructure such as roads, culverts, and utility lines. Some of this infrastructure may need to be relocated to allow the proposed works to be carried out.

Public Infrastructure Damage Mitigation

The relocation works for utilities along the gully alignment corridor will be carried out in consultation with the utility companies while damaged culverts giving way for gully expansion will be replaced as applicable. There must be good coordination between the Project construction team and the utility companies in order to reduce project delays, conflicts, safety risks and traffic congestion on the work sites.

The measures to minimize risks from utilities relocation or damage include:

- Notify the public before commencement of the works.
- Discuss and co-ordinate closely with utilities companies about pre and post construction works.
- Appoint competent person to supervise any construction works at or near to transmission line to avoid electricity related accidents.
- Perform utilities detection and piloting prior to the actual relocation or trenching work.
- Any abandoned water or sewer pipe after relocation works shall be properly sealed-off to prevent soil settlement or sink holes which pose danger to the public.
- All safety requirements must be complied with, including safety requirements with regards to electrocution, fire hazards and working in confined space.
- Emergency Response Team (ERT) team must be on standby at all times
- All damaged or removed infrastructures will be repaired or restored to their original or improved condition.
- Liaison with the community will be maintained and site-based GRM will be established to address any related complaint.

6.9. Cultural Heritage Impact

Cultural Heritage

There may be several sacred sites along the route of the gully rehabilitation works (e.g. water sources, cemeteries, sacred trees etc.) which are cultural heritage sites. The sites or items of heritage significance could be found in the course of development work. This will be probed further during detailed field investigation.

Chance Find Strategy

Sites or items of heritage significance could be found in the course of development works. A "chance finds" procedure will be prepared by the contractor to cover the actions to be taken upon the discovery of a heritage site or item for its investigation and assessment for redesigning and realignment of a project to avoid significant adverse impacts to local community culture. No historic archaeological sites are located within the proposed project area.

In case of new chance finds, The Contractor is required to immediately, without delay, halt works and inform the PMU and to undertake measures to ensure the findings are not destroyed or damaged and to protect the area and position in which they are discovered. Contractors will be trained on how to deal with historical archaeological and sacred sites in a responsible manner. It must be ensured that further finding of "any chance find" is not disturbed until an assessment by competent professionals is made and actions taken consistent with the requirements of ESS8 – Cultural Heritage. ESS8 recognizes the importance of cultural heritage as a valuable source of scientific and historical information, as an economic and social asset for development, and as an integral part of people's cultural identity. This standard sets out measures to protect cultural heritage throughout the lifecycle of the project, which includes:

- In the case of a chance find, the contractor will secure the site and report immediately to SPMU. Works may not recommence until the Engineer approves.
- SPMU will intimate relevant Archaeological Department.
- Meanwhile, the contractor will cease their operations and due caution will be ensured for archaeological remains.
- Archaeology department shall inspect, identify, advice on management, and recover remains.

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- Site visits by the Archaeological Department will be facilitated and further works could only be carried out on such sites after obtaining clearance from the Archaeological Department

6.10 Labor Influx Impacts

Impacts of Labour Employed from Outside

Some social impacts could arise due to labour influx. There shall also be a risk to community health from HIV/AIDS or other transmitted infections as a result of the presence of migrant construction labour. There could be the risk of gender-based violence from migrant labour, which often remains away from home on the site. This may lead to inappropriate behaviour including sexual harassment of women, girls and boys in the local community.

Mitigation Labour Influx

A large-scale labour influx is not expected due to the availability of local unskilled labour supply in the subproject area and the scale of works anticipated under the subproject. Except for a limited number of managers, supervisors and skilled workers, the majority of workers may be sourced locally or from nearby areas within Gwagwalada and Zuba district. The priority for local labour (dependent on skill, and experience capacity) is expected to minimize the risk of labour influx. As part of the mitigation process, the contractors shall locate/ construct camps for their staff at least 500 meters away from communities to avoid social conflict as well as to avoid the possible adverse impacts of the construction camps on the surrounding communities. Fencing will be provided around the campsite and the Contractor will provide security. The camp layout plan and workers' code of conduct will be prepared by the contractor and will be submitted for review and approval by the SPMU and Supervising Engineer.

While the contractor shall also include proposals for awareness of HIV/AIDS and the spread of sexually transmitted diseases in the Contractor’s Environmental & Social Management Plan (CESMP) and the training plan. The contractor will raise awareness among workers regarding (Gender Based Violence - GBV) and also sensitize workers about sexual harassment, child abuse, and human trafficking for reducing the GBV risk.

6.11. Gender Base Violence (GBV), Sexual Exploitation & Abuse (SEA)/Sexual Harassment (SH)

Impacts related to GBV/SEA/SH

Large-scale influx of transient male workers outside of their social spheres may result in forming close social relationships with local community residents. This can lead to unacceptable and/or illegal behaviour, ranging from unwanted aggressive advances, SEA/SH against women and children.

GBV/SEA/SH Mitigation Strategy

As part of the mitigation strategy, training/orientation sessions will be conducted to sensitize the PMU and the Contractor's staff/workers on the importance of addressing GBV/SEA/SH risks at the project level. The contractor will be required to have a written contract with their workers materially consistent with the objective of ESS2, following the procedures as specified in the World Bank's Procurement Guidelines. The workers shall be required to sign a Code of Conduct (CoC) prepared by the Contractors and reviewed and approved by PMU.

6.12 Child Labor Impacts

Impacts Related to Child Labour

The risk of child labor is minimal but present; contractors may occasionally employ individuals under 18. These children are exceptionally susceptible to exploitation, unfair treatment, and violence. They are often discouraged from raising complaints because they fear losing the job, which they view as a needed source of income.

Mitigations Related to Child Labour

Shall other labor-related issues of such arise during the project, the PMU will promptly develop and implement preventative procedures. This will include regular awareness sessions in the communities to prohibit and sensitize workers and residents on the negative impacts of both child and forced labour.

6.13. Project Activities Public Impacts

Road Safety Risks and Mitigations

The higher volume and speed of vehicles will create a road safety hazard, resulting in a permanent, moderately negative risk of traffic accidents.

To reduce this risk, the contractor shall put the following measures in place:

i. Strictly manage speed by enforcing limits and penalizing violators.
ii. Install clear traffic signs for speed limits, turns, and speed breakers, including informative signs near socially sensitive locations.
iii. Display warning messages in the local language at key points to educate drivers about accident risks from speeding.
iv. Enhance nighttime visibility by reflectorizing all medians and sharp bends.
v. Implement traffic calming measures near sensitive areas, such as adding zebra crossings, speed restrictions, rumble strips, raised walkways, and extra signage and marking.

Harmonize with the impact presented above and mitigation measures presented in chapter 6 before deleting

Environmental Mitigation Measures

The table presents key environmental mitigation measures addressing vegetation loss, fauna displacement, and fisheries and aquatic habitat impacts to ensure ecological protection and sustainable livelihoods during project implementation.

Impact Area	Potential Impact	Mitigation Measures	Responsible Party	Monitoring Indicators
Tree Planting / Vegetation Loss	Removal of trees and vegetation during construction leading to habitat loss and reduced slope stability	Implement compensatory tree planting using native species. Re-vegetate gully slopes and buffer zones after construction• Restrict vegetation clearing to project footprint only	Project Contractor / Environmental Officer	Number of trees planted vs. removed• Survival rate of planted trees• Vegetation cover recovery
Fauna Displacement	Temporary displacement of small mammals, reptiles, and birds due to noise and land disturbance	• Schedule construction to avoid peak breeding seasons where possible• Preserve nearby refuge areas and buffer zones• Gradual clearing to allow fauna escape	Contractor / Environmental Specialist	• Reduced wildlife mortality incidents• Presence of fauna in surrounding areas post-construction
Fisheries and Aquatic Habitat	Sedimentation and runoff affecting streams, ponds, and aquatic ecosystems	• Install sediment traps and silt fences to reduce sediment flow• Maintain natural water flow patterns• Prohibit	Contractor / Supervising Agency	• Water turbidity levels• Condition of downstream water bodies

		disposal of construction waste into water bodies		
Fish Spawning Grounds	Disturbance or destruction of fish breeding areas	• Identify and protect spawning zones during construction• Avoid in-stream works during breeding seasons• Restore disturbed streambeds after works	Environmental Officer / Local Authorities	• Presence of fish fry and eggs• Recovery of spawning habitats
Water Quality	Pollution from construction materials and runoff	• Regular water quality testing (pH, turbidity)• Controlled use and storage of fuels and chemicals• Emergency spill response plan	Contractor / Environmental Officer	• Compliance with water quality standards
Local Fishing Livelihoods	Reduced fish availability affecting local livelihoods	• Engage fishing communities during project planning• Provide temporary livelihood support where impacts occur• Promote alternative income activities during construction	Project Proponent / Social Safeguard Team	• Number of affected fishers supported• Community satisfaction levels

Operational Phase Measures

In the operational phase of the project, several risks undermine long-term sustainability were identified if not adequately managed. The following are some the risks identified:

1. **Maintenance failure**. Drainage structures such as concrete-lined channels, drop structures, and culverts are subject to weathering, sediment deposition, and occasional vandalism. For instance, if a culvert becomes partially blocked by sand, debris, or construction waste, the flow capacity decreases, causing localized flooding during heavy rainfall. Over time, neglected minor damages like cracks in channel linings can expand, leading to structural collapse and increased erosion.
2. **Blocked drains** represent another operational challenge. In communities like Zuba, where residents sometimes dispose of refuse into open drains, sediments and solid waste can accumulate, reducing flow and redirecting water to unprotected gullies. This often results in erosion recurrence, with previously stabilized gullies reactivating and threatening nearby homes, roads, and farmlands. For example, in Gwagwalada, rapid stormwater flows during

the rainy season have previously caused small gullies to widen because drains were clogged and maintenance was irregular.

3. **Community safety** is also a critical operational risk. Even stabilized gullies can pose hazards if access is uncontrolled or warning signs are absent. Children playing near gully edges or informal pathways crossing drainage channels may face accident risks, particularly during heavy rains. Moreover, stagnant water in partially blocked drains can become breeding grounds for mosquitoes, increasing vector-borne disease risks.

To address these operational risks, the projects incorporate long-term safeguards guided by sustainability principles was considered which include:-

1. A comprehensive maintenance schedule should be institutionalized, specifying periodic inspection, desilting, vegetation management, and structural repairs.
2. Community-based monitoring, through drainage committees or citizen reporting, allows residents to act as first-line monitors, identifying blocked drains, erosion signs, or structural weaknesses early. For example, a local committee could report a partially silted drop structure after a storm, prompting immediate clearing before a gully reactivates and,
3. Securing dedicated funding for upkeep, either from government allocations or community contributions, ensures resources are available for timely maintenance and repairs.

6.14 Institutional Responsibilities and Organogram

The structure and reporting arrangements for the implementation of the ESMP are integrated into the overall project monitoring and evaluation program for the Gwagwalada and Zuba gully rehabilitation project. The key actors as well as the roles and responsibilities of the various institutions in the ESMP implementation are as shown in Table 6.1. The matrix includes listing of all entities (public and private) responsible for designing and implementing the various aspects of the plan. The need for additional capacity building for the involved institutions and actors, including long-term consultation and training program for the implementing agency, are also built into the structure.

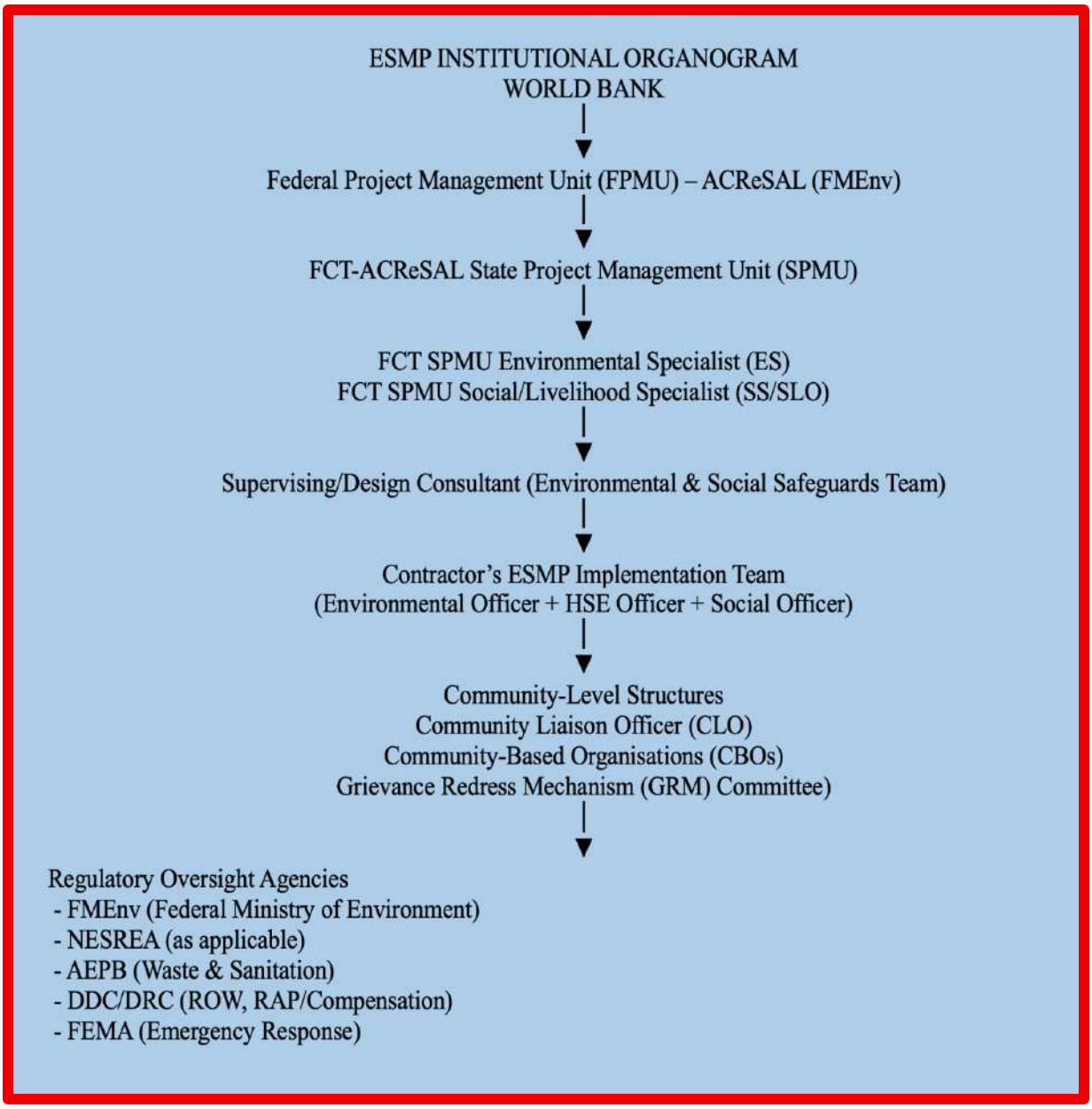


Fig 6.1: ESMP Institutional Organogram.

Table 6.1: Institutional Responsibilities

Project Phase	Potential Impact	Mitigation Measures	Responsible Party	Monitoring Frequency
Pre-Construction	Land clearing and vegetation loss	Minimize clearing footprint; preserve buffer zones; plan compensatory tree planting	Contractor, SPMU, Focal NGO, Local Community	Monthly
	Fauna disturbance	Schedule works to avoid breeding seasons; identify wildlife refuge areas	Environmental Officer, Contractor, SPMU	Monthly
	Community awareness gaps	Conduct stakeholder engagement, sensitization campaigns, mobilize local communities	CDOs, Local Government, Focal NGO	Monthly
	Land acquisition & resettlement issues	Ensure compliance with land acquisition and compensation policies	AGIS, SPMU	As needed
Construction	Soil erosion and gully expansion	Construct drop structures, energy dissipators; stabilize slopes with vegetation	Contractor, SPMU, AEPB	Weekly
	Blocked drains / sedimentation	Install silt traps; monitor drainage channels; ensure proper waste disposal	Contractor, Community Drainage Committees, SPMU	Weekly
	Water quality degradation	Control sediment runoff; prevent chemical spills; maintain flow in water bodies	Contractor, SPMU, Focal NGO	Weekly
	Fisheries & aquatic habitat impacts	Protect spawning grounds; avoid in-stream work during breeding; maintain water quality; support local fishers	Contractor, SPMU, Local Community, Focal NGO	Bi-weekly
	Community safety hazards	Safety buffers, warning signage, enforce restricted access around gullies	Site Committee, Local Government, CDOs, SPMU	Weekly
Post-Construction / Operational Phase	Erosion recurrence	Routine inspection of structures; revegetation and slope maintenance	SPMU, Contractor, Community Committees	Quarterly
	Maintenance failures / blocked drains	Implement regular maintenance schedules; clear drainage channels; monitor sediment accumulation	SPMU, Community Committees, Local Government	Monthly

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	Long-term water quality and fisheries	Monitor water quality, restore disturbed aquatic habitats, support fishery livelihoods	SPMU, Focal NGO, Local Community	Quarterly
	Community safety	Maintain signage, safety awareness, restrict access to rehabilitated gullies	SPMU, Local Government, Community Committees	Quarterly
	Operational funding gaps	Allocate funds for upkeep, ensure sustainability of monitoring programs	SPMU, Local Government	Annual review

A summary of the impact mitigations and monitoring plan for the pre-Construction, Construction, and post-Construction phases of the project with the associated monitoring frequencies, responsible parties and projected costs are presented in Table 6.2.

Table 6.2 E&S Impact Mitigation and Monitoring Plan for Gwagwalada and Zuba Project

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
SOCIAL								
PRE-CONSTRUCTION PHASE								
Preparation of staging and construction areas.	Disruption of activities and inconveniences to persons (temporary); Potential social conflicts and grievances	Create awareness among the communities, and sensitize the people to all project activities	Contractor	To be included as part of awareness and sensitization costs of Contractor Budget	Level of awareness and understanding of community members; No of community members that attend trainings; No of women gainfully employed by project; No of other businesses induced by project	Weekly Continuous Quarterly Continuous Quarterly;	SPMU-Safeguard officers; SME.; Community Leaders; Site Committee	N3,000,000.00

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
					Questionnaires, direct observations and interviews.	Six months intervals		
Mobilization of workers to site	Labor influx into the subproject communities. Increase in potential spread of STIs/STDs, HIV/AIDs Potential increase in GBV/SEA Pregnancies from inappropriate sexual relations between site workers and minors Potential presence of sex	Encourage use of local labor in the project All workers must sign Code of Conducts and be trained on the implications Workers shall be discouraged away from social sensitivities with community members Sensitization of workers on Code of Conduct, Prevention of STIs/ STDs/ GBV/ SEA risks by health workers, Women Affairs, relevant NGOs Report inappropriate practices through the GRM, and forward	Contractor	To be included as part of the project overall Budget	Number of workers from within and outside the communities Evidence of signed Code of Conducts; Report on training and sensitization; Zero incidence of report of misconduct No. of sensitization workshops held for workers on cultural issues	Monthly At start of employment Monthly Weekly Quarterly Weekly Weekly	SPMU-Safeguard officers; SME.; Community Leaders; Site Committee	N3,500,000.00

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
	workers in the local communities Competition for resources like water, health facilities, electricity in the project locations	reports to appropriate GBV referral services. Implement effective GRM accessible to community members. Workers Code of Conduct shall be translated in local language and included in cultural sensitization training for workers Sanctions for workers involved in criminal behaviors and substance abuse.			No. of reported GBV cases No. of grievances recorded			
	SEA/SH risk due to labor influx	Code of Conduct signing and training on its content to all workers Have GRM in place and people sensitized on its use The Project already has a GBV referral directory, so ensure people are	Contractor	To be included as part of the project overall Budget	No. of GBV/SEA awareness workshops held; Level of GBV/SEA awareness of workers & others;	Monthly Monthly Weekly	SPMU-Safeguard officers; SME.; Community Leaders; Site Committee	N2,500,000.00

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
		made aware of it to referral survivors to SEA/SH risks			No. of reported GBV cases No. of peer educators' training	Monthly		
CONSTRUCTION PHASE								
All civil and rehabilitation works	Potential Child Labor and Forced Labor Grievances resulting from unfair treatment of workers	Monitor compliance with the project Labor Management Plan Code of Conduct on prohibition of use of children as labor and associated sanctions No hiring of children for menial activities no matter the situation No one shall be forced to work Ensure GM is in place at the site and also for workers	Contractor	To be included in the overall project Budget	Presence of child labor Cases of public complaints	Weekly Weekly	SPMU-Safeguard officers; SME.; Community Leaders; Site Committee	N4,200,000.00/

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
	Poor terms and conditions of employment	Provide clean water always Provide training to workers on OHS Provide conducive work environment Implement Workers GRM and ensure all workers are informed of the process	Contractor	To be included in the overall project Budget	Cases of complaints from workers based on welfare conditions	Weekly	SPMU-Safeguard officers; SME.; Community Leaders; Site Committee	N2, 500,000.00/
	Insecurity at sensitive receptor sites	Contractor to appoint security personnel operating 24/7 a week Body-search workers to avoid getting weapons on site and to ensure nothing is stolen Ensure that only authorized personnel get into site Security alarms shall be installed in appropriate areas of the site	Contractor	To be included in the overall project Budget	Cases of insecurity complaints	Weekly	SPMU-Safeguard officers; SME.; Community Leaders; Site Committee	N3,000,000.00/

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
	Possible social conflicts between workers and community members	Implement GRM throughout civil and rehabilitation works Community members shall be given priority during workforce selection Prohibit all construction workers from socializing with children or certain category of residents Identify construction workers by wearing uniforms and name tags	Contractor	To be included as part of the project overall Budget	Cases of reported social conflicts	Weekly	SPMU-Safeguard officers; SME.; Community Leaders; Site Committee	N3,500,000.00/
Presence of foreign workers on site	Kidnapping of workers Equipment may be vandalized or stolen.	Use of local labor shall be encouraged at all times Implement security plans and liaise with police/security agencies where required. Community leaders to sensitize their youths to	Contractor	To be included in the overall project Budget	Cases of insecurity complaints	Daily	SPMU-Safeguard officers; SME.; Community Leaders; Site Committee	N2,800,000.00/

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
		desist from nefarious activities						
Project sustainability operations and inclusivity	Disabled and internally displaced persons may not benefit from the project	Facilities design shall take into consideration disability-friendly solutions Interventions shall consider areas in proximity to IDPs so displaced persons can also benefit from the program	Contractor	Part of State Awareness Budget	Numbers of benefiting disabled or IDP persons	As Necessary	SPMU-Safeguard officers; SME.; Community Leaders; Site Committee	
POST CONSTRUCTION (OPERATIONS)								
Continued sustainability operations	Increased number of women/girls exposed to harassment, SEA/SH Exposure of minors to sexual immoralities,	Project shall leverage on the use of monitoring groups (formal and informal) to monitor conduct of the workers within the localities Strengthen guidance and counselling functions and report abuse	Contractor	State Education Budget/ State Health/ Women Affairs programs	Minimal incident reports Functional guidance and counselling Number of awareness campaigns	Monthly	SPMU-Safeguard officers; SME.; Community Leaders; Site Committee	N4,000,000.00

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
	substance and alcohol abuse, etc	Sensitization and awareness programs on sex education Access to functional sickbays/clinics provided for workers						
		Sustainability plans shall be developed by Abuja SPMU and reviewed by the FPMU and the World Bank. Abuja state needs to make deliberate efforts to increase awareness budgets and develop a sustainability plan for the subprojects						
ENVIRONMENTAL								
PRE-CONSTRUCTION								
Excavation of materials from within the project corridors	Noise and air pollution.	Mark out areas for clearance & where possible use manual method of vegetation clearing; Use of PPE protection	Contractor	To be included in the overall project Budget	Areas of stressed vegetation; Size of cleared vegetation areas	Monthly Monthly Weekly	SPMU-Safeguard officers; SME.; Community Leaders;	3,000,000.00/

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Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
		Use of properly maintained vehicles and equipment. Use of water tanker for purposes of water dousing to control dust emission in large areas. Use of nose masks by all workers on site works.			No. of public complaints; Level of particulates in air Level of other air pollutants Vegetation surfaces free of dusts Ambient air monitoring using standard methods	As Necessary As Necessary Weekly Daily	Site Committee	
Disposal of debris and excavated materials	Increase in waste burden for the community management Increase in inappropriate acts of burning wastes	Implement waste management plan Contractor shall reuse and recycle materials Liaise with the state MDA on waste management	Contractor	To be included in the overall project Budget	No. of public complaints; Level of particulates Level of air pollutants	Daily Continuous as necessary Continuous as necessary Two month	SPMU-Safeguard officers; SME.; Community Leaders; Site Committee	3,000,000.00

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
					Vegetation surfaces free of dusts Ambient air monitoring using standard methods	intervals or as required Two month intervals or as required		
Traffic and transportation of solid waste materials	Water contamination, accidental spillages and water sedimentation	Erection of speed control signals and ramps mounted around the project areas Implement emergency response plan for spillages Cover hauling trucks carrying soil and other aggregates;	Contractor	To be included in the overall project Budget	Cases of non-compliance Cases of complaints or disruption of facility Cases of complaints from residents or PAPs	Weekly Weekly Weekly	SPMU-Safeguard officers; SME.; Community Leaders; Site Committee	2,000,000.00
	Dust emission, traffic congestion, accidents and incidents along the vehicular routes	Enforce speed limit and train drivers regularly Avoid extraction and excavation during extreme dry season	Contractor	To be included in the overall project Budget	Cases of non-compliance Cases of complaints or disruption of facility	Weekly Weekly Weekly	SPMU-Safeguard officers; SMEnv.; Community Leaders;	

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
		Cover stockpiles and install pollution control devices Use of PPE			Cases of complaints from students or PAPs		Site Committee	
Excavation of materials from within gully corridors	Associated effects on ecosystem; Occupation health and safety (OHS) risks	Implement OHS management plan	Contractor	To be included in the overall project Budget	Cases of non-compliance	Weekly	SPMU-Safeguard officers; SMEnv.; Community Leaders; Site Committee	
CONSTRUCTION								
Disposal of debris and demolished materials	Increase in waste burden for the community management Increase in acts of burning wastes	Implement Waste Management Plan Reuse and recycle materials Liaise with the state MDA on waste management	Contractor	To be included in the overall project Budget	No. of public complaints; Level of particulates Level of air pollutants Vegetation surfaces free of dusts	Daily Continuous as necessary Continuous as necessary Two month intervals	SPMU-Safeguard officers; SMEnv.; Community Leaders; Site Committee	3,600,000.00

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
					Ambient air quality	or as required		
All installations and rehabilitation works	Overuse of water and conflicts arising from water usage	Contractor shall make provision for all civil works Harness rainwater harvesting Promptly detect, repair water pipe and tank leak Sensitize staff to conserve water; Install water conserving taps that turn-off automatically when water is not being used	Contractor	To be included in the overall project Budget	Evidence of conflict with community members	Weekly	SPMU-Safeguard officers; AEPB.; Community Leaders; Site Committee	3,500,000.00
	Poor hygiene and sanitation due to sewage		Contractor	To be included in the overall project Budget	Cases of accidents/incidents	Weekly	SPMU-Safeguard officers; AEPB; Community Leaders; Site Committee	

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Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
	Waste Management (solid and liquid wastes) Generation of debris of various forms such wastes, bricks, stones, cements Increased pressure on local waste dump facilities Indiscriminate and unauthorized disposal and littering of solid wastes.	Waste bins to be provided for the disposal of waste generated; Waste will be segregated into three at source - organic (food residues), recyclables (woods, metals) and non-recyclables (plastic and glass wastes); Organic waste to be composted near the site office to enrich the soil, while plastics and glass are taken to the district dump-sites; Topsoil removed from the right of way for maintenance work to be spread on the land to avoid disrupting drainage network; and Toilets and urinals to be sited at least 100m from any stream or drainage	Contractor	To be included in the overall project Budget	Cases of accidents/incidents	Weekly	SPMU-Safeguard officers; AEPB.; Community Leaders; Site Committee	

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
		channel and decommissioned at the end of project.						
	Noise and Vibration Exposure	Stationary equipment shall be sited at safe distances from sensitive areas to minimize noise impacts Continuous equipment noise exposure for no more than 3 hours a day. Workers will be provided with ear plugs. Continuous equipment vibration exposure for no more than 3 hours a day. Sanctions (ranging from a warning to dismissal) for workers who do not observe use of appropriate PPEs	Contractor	To be included in the overall project Budget	No of complaints from community members; Absence of structural failures; Absence of debris accumulation; No of debris removals & repairs made; Sensor measurements around workplace	Daily Daily Daily Daily Daily	SPMU-Safeguard officers; AEPB.; Community Leaders; Site Committee	
	Efficient Resource Utilization	Contractor to make provision for water	Contractor	To be included in the		Weekly	SPMU-Safeguard officers;	

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
	Competition for resources like water Possible conflicts between residents and workers	availability during the rehabilitation works.		overall project Budget			SME.; Community Leaders; NGOs/CBOs	
	Occupational & Public Health and Safety/exposure of workers at active worksite Exposure to water borne diseases due to poorly maintained toilet facilities Potential exposure to alcohol and drugs as a	Health, safety and environmental training and awareness will be extended to project community members and local stakeholders; Posting of speed limits of 25km/hr at approaches to construction sites; Safety meetings held twice a week and documented accordingly; Inductions and awareness program held for all employees on	Contractor	To be included in the overall project Budget	No. of sanitary facilities provided at start of project; Adherence to stipulated speed limit Record of incidents; Use of PPEs by workers; Records of appropriate workers' training;	At start of project; Twice weekly; Weekly; Daily; Monthly;	SPMU-Safeguard officers; SMEnv.; Community Leaders; NGOs/CBOs	4,200,000.00

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
	result of social mix with project workers	occupational health and safety practices; Caution signs and flagmen at strategic locations to provide warning and guidance especially for children crossing Construction activities to be carried out during holidays preferably, or otherwise site managers and HSE officer to ensure children stay off equipment areas, staging areas and construction sites.			Record of reinstatement plan for burrow pits; Record of health and safety meetings Record of first aid exercises Hazards assessment	At beginning of project Weekly; Monthly At start of project		
	HIV/AIDS and STIs Management		Contractor	To be included in the overall project Budget	No. of HIV/AIDS workshops held; Level of awareness of workers & others;	Quarterly Continuous Bi-monthly	SPMU-Safeguard officers; SME.; Community Leaders; NGOs/CBOs	4,000,000.00

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
					Records of peer educators' training; Records of condoms distributed	Monthly		
Traffic and Transportation	Increased traffic movements Potential vehicular accidents.	Implement drivers' training in conjunction with Road Safety/ State Traffic Management Agencies A temporary structure to be constructed on one lane to allow for traffic flow while work is on-going on the other lane; Actual working areas to be secured with barricades; Adequate road warning signs to be posted at vantage points to warn and direct traffic; Traffic and transport associated with project	Contractor	To be included in the overall project Budget	Effective traffic flow with vehicular & worker safety; Appropriate positioning of road signs, reflectors, speed ramps, control limits, traffic wardens; Records of accidents and near misses	Daily; Daily; Daily.	SPMU-Safeguard officers; SME.; Community Leaders; NGOs/CBOs	5,500,000.00

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
		will adhere to existing roads or follow specified routes as established. All measures shall be effectively monitored by Contractor to ensure their implementation.						
POST CONSTRUCTION PHASE (OPERATIONS)								
Sanitation and Waste Management Generation of solid and liquid wastes,	Implement waste Management plan (solid and liquid wastes) Increased pressure on local waste dump facilities Indiscriminate and unauthorized disposal and littering of solid wastes. Increase in solid waste and	Communities shall continue to implement waste management plan during the operation phase Provision of potable water, toilets and wash water to the workers Waste recycling to be encouraged Contractors to partner with associations that provide recycling functions. Stockpiles of sand, clay and other materials shall be properly covered	Contractor	To be included in the overall project Budget	Waste segregation and littering; Emptying of bins at waste dump sites; Waste composting; Indiscriminate defecation; Toilets closure Presence of rodents or rats	Daily; Weekly; Weekly; Daily; At end of project Weekly	SPMU-Safeguard officers; SME.; Community Leaders; NGOs/CBOs	4,000,000.00

Project Activity	Potential Negative E&S Impact	Proposed Mitigation Measures	Responsible to Implement	Mitigation Cost (N)	Monitoring Indicator	Monitoring Frequency	Responsible to Monitor	Monitoring Cost (N)/Site
	sanitation waste during operation phase could lead to diseases and pollution	Use of ECO toilets, latrines which are easier to manage. Intervention designs shall take into consideration erosion prone areas to avoid future disasters.						

Based on Table 6.2, a summary of the proposed E&S mitigation monitoring costs through the pre-Construction, Construction and post-Construction phases of the project are presented in Table 6.3.

Table 6.3: Summary of Mitigation Monitoring Cost by Project Phase

Project Impact Area	Associated Monitoring Costs (₦)			TOTAL/Site
	Pre-Construction	Construction	Post Construction	
Gwagwalada and Zuba Gully Erosion Intervention Subproject				
Social Impacts	9,000,000.00	16,000,000.00	4,000,000.00	29,000,000.00
Environmental Impacts	8,000,000.00	20,800,000.00	4,000,000.00	32,800,000.00
TOTAL	**17,000,000.00**	**36,800,000.00**	**8,000,000.00**	**61,800,000.00**

A total sum of Sixty-One Million Eight Hundred Thousand naira (N61,800,000) only is required as the cost for mitigation monitoring per site across the project phase

6.15 Capacity of FCT SPMU to Implement the ESMP

6.15.1 Capacity and Training Needs

To achieve effective ESMP implementation, there is need to strengthen relevant competencies on environmental and social management at primarily the LGA and community levels including contractors. This will stimulate the required collaboration among the key actors. Experience has shown that strengthening capacity involves more than improving technical skills, developing new systems or establishing quality assurance and improving standards. While these are important, strengthening capacity is, however, essentially about changing behavior towards achieving desired goals.

The capacity building shall include equipping individuals with understanding, skills and access to information and training that enables them to perform effectively. Personnel of the erosion control intervention project need to understand the purpose of the ESMP and their expected roles during its implementation. The target groups for the training will include:

- SPMU Environmental & Social (E&S) Safeguard Officers and Project Engineers (PE);
- Contractor's personnel;
- Construction workers and site personnel; and,
- Select members from the project communities (Gwagwalada and Zuba).

The SPMU Environmental & Social (E&S) Safeguard Officers and contractors will require capacity building in the implementation of the project's environmental and social safeguards and general project planning and management interfaced with E&S components. Capacity requirements are also necessary in the areas of E&S monitoring and reporting, adherence to the required E&S principles, standards and commitments. The construction workers and select members of the project communities will undergo training on public awareness creation/educational techniques (on environmental, social and health issues) and first aid procedures.

Below is the minimum coverage required for the contractor's environmental and social awareness training program proposed for the workforce before commencement of construction works:

Key Coverage Aspects

- World Bank (ESF – ESS) environmental and social awareness

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- Key environmental and social issues associated with the project and subprojects ESMP and findings
- Subproject monitoring and reporting
- Occupational Health and Safety management
- Safety issues associated with Construction.
- Grievance Redress Mechanism implementation
- Gender-Based Violence (GBV)/SEA/SH)
- Child Labor
- Communicable Disease Management and Monitoring
- Water conservation and optimal resource use,
- Awareness regarding open defecation and better WASH practices for relevant community
- Identifications, conservation and precautionary measures of wildlife

6.15.2 Capacity Building Cost

The capacity building plan for the ESMP with the associated cost implications is shown in Table 6.3 below. To enhance the respective roles and collaboration of the relevant stakeholders, the broad areas for capacity building and effective ESMP implementation are identified and shown in Table 6.3.

Table 6.3: Summary of Institutional Capacity and Training Needs with Costs

Programme /Description	Participants	Form of Training	Duration	Training Agency	Estimated Cost In (₦) and Project Phase/Site
Understanding the Environment: • Concepts, Regulations & Statutory Requirements; • Environmental Management; • Flood and Erosion Prevention & Control; • Stakeholder & Community Participation	Officials of AEPB, SEPA, FCDA, SMLS, SPMU, Contractor, Community Leaders, Focal NGO, CBOs & Other Relevant Groups	Workshop	2 Days	External Agency for capacity building or Environmental & Social Specialist	4,500,000.00 (Pre-Construction Phase)
Scope of Gwagwalada and Zuba Gully Intervention Subproject: • Environmental & Social Impacts;	Contractor, SPMU Safeguard Officers and Project Engineers, SMENV, SEPA & relevant MDAs,	Workshop	2 Days	External Agency for capacity building or Environmental & Social Specialist	3,800,000.00 (Pre-Construction Phase)

Programme /Description	Participants	Form of Training	Duration	Training Agency	Estimated Cost In (₦) and Project Phase/Site
• Engineering Design and Associated ESMP; • Coordination with Other MDAs and the Community	Community Leaders, CDOs, & NGOs				
Project Implementation: • Civil Works with Bio-remediation in the project; • Roles and Responsibilities of Key Actors; • Environmental Monitoring	SPMU Project Engineers and Safeguard Officers, Contractors, SMEnv, SEPA	Lecture and Site Visit	2 Days	External Agency for capacity building or Environmental & Social Specialist	4,500,000.00 (Construction Phase)
Monitoring and Evaluation and GRM: • ESMP Monitoring and Reporting Strategy; • Stakeholder and Community Participation	Contractor, SPMU Safeguard Officers, Engineers, SMEnv, SEPA & relevant MDAs, Community Leaders, CDOs, & Focal NGO	Workshop	2 Days	Environmental & Social Specialists; External Agency engaged for capacity building	3,500,000.00 (Construction Phase)
Watershed Protection and Management: • Alternative income generation programme for stakeholders and skills requirements; • Promotion of Agricultural Methods and Technologies for Improving Farm Production and Erosion Prevention;	Watershed Committee, Community Leaders, LGA Staff, Support Professionals	Workshop	2 Days	World Bank/External Agency Engaged for Capacity Building/ Environmental & Social Specialists	4,000,000.00 (Post-Construction Phase)
TOTALS					**₦20,300,000.00**

As part of the project's preparation for ESMP implementation, the capacity building and training expenses listed in Table 6.3 must be covered by the project's total construction budget. Before the contractor is mobilized to the site, the trainings must be completed. As a result, all training must

be finished before mobilization or at the latest two weeks following the contractor's site mobilization.

6.16 ESMP Management Costs

Table 6.4 Management cost

Institutional Category	Roles & Responsibilities	Associated Management Costs (₦)		
		Pre-Construction	Construction	Post Construction
AEPB	• Overall oversight, assessment and monitoring of specific and general project implementation ;		3,000,000.00	4,000,000.00
SPMU (Safeguard Officers, Project. Engineer)	• Oversight of all specific activities associated with the ESMP implementation	7,000,000.00	15,500,000.00	5,000,000.00
SPMU	• Project assessment and monitoring of this ESMP implementation and the construction activities.	2,500,000.00	5,000,000.00	3,000,000.00
World Bank	• Overall assessment and monitoring of specific and general project implementation;	N/A	N/A	N/A
Contractor (Site Engineers/ Supervisors)	• Provide oversight function during decommissioning to ensure adherence to good practice and the ESMP	N/A	N/A	N/A
Site Committee	• Monitor and ensure compliance with ESMP, BEME and implementation quality	2,000,000.00	3,500,000.00	3, 200,000.00
Local government	• Provide support in monitoring project execution within their domains to ensure compliance with this ESMP and other relevant requirements	N/A	N/A	N/A
Local Community	• Support and promote environmental awareness	2,000,000.00	3,400,000.00	3,000,000.00
CDOs/CBOs	• Ensure community participation by mobilizing, sensitizing community members;	N/A	N/A	N/A
General Public	• Identify issues that could derail the project	N/A	N/A	N/A

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Institutional Category	Roles & Responsibilities	Associated Management Costs (₦)		
		Pre-Construction	Construction	Post Construction
	• Support project impacts and mitigation measures as well as awareness campaigns			
TOTALs		**₦13,500,000.00**	**₦33,400,000.00**	**₦15,200,000.00**

6.17 Budget to Implement ESMP

An indicative budget of N144,200,000.00 (One Hundred and Forty-Four Million, Two Hundred Thousand Naira) is allocated for the comprehensive implementation of the ESMP per site.

This projected budget covers the following essential elements of the implementation process:

- Routine E & S duties of the SPMU;
- Capacity Building for the SPMU and other stakeholders;
- Engagement of Environmental and Social Specialists
- Environmental and Social Due Diligence investigations and/or Audits;
- Monitoring and evaluation activities of the SPMU and other regulatory Agencies.

6.17.1 Public/Stakeholder Consultation Plan

A key element of sustaining stakeholders' support in the project is to sustain the consultations and communication process that has already been effectively established in the course of the preparation of this ESMP. Stakeholders' engagement needs to be enhanced and managed through a well-defined strategy. Table 6.4 provides a summary of the stakeholder consultation activities to be considered in the engagement plan. Public sensitization and consultation will continue throughout the project execution.

The Contractor shall be required to prepare and submit for approval of SPMU and FPMU, comprehensive Stakeholder Engagement Plans. The Plans will provide the Contractor's specific engagement plan to ensure that all segments of the community and other stakeholders are fully and effectively involved in the project decision process.

Table 6.5: Summary of Stakeholder Consultation Plan

Activity	Stakeholders / Community	Timeline
Pre-Construction / Prior to Project Commencement		
Project briefings, site tours, personal meetings, community sessions, consultation meetings	FCDA, Local Government, Site committee, Residents of affected areas/ Community and interest groups	As required, subject to project updates and feedback from the community
Development/dissemination of feedback and complaints mechanism and communications procedures	FCDA, Local Government, Site committee, Residents of affected areas/ Community and interest groups	As required, subject to any updates on the project
Briefings, Site Tours and Community Sessions for flood control and intervention works	Government authorities, Local communities, Key/ relevant stakeholders	Prior to Work Plan approval
Construction and Operations		
Responding to issues and inquiries as per feedback and complaints mechanism	All stakeholders	Ongoing / as required
Monthly/Quarterly reporting on status of project	All stakeholders	Monthly/quarterly/as required.
Briefings, site tours and community sessions for flood control and intervention works closure plan	Government authorities, Local communities, Key/ relevant stakeholders	Prior to project completion
Prior to Project Closeout/Post-Construction		
Project briefings, site tours, personal meetings, community sessions, consultation meetings with stakeholders	All stakeholders, FCDA , Local Govt, Site committee, Affected residents/ Community/ interest groups	As required, subject to approvals and feedback from the community

6.18 ESMP Monitoring and Evaluation

The objectives of the monitoring and evaluation program are:

- To ensure that the measures suggested herein are carried out accordingly during project implementation;
- To evaluate the efficiency of the proposed mitigation and enhancement measures;

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- To investigate the adequacy of the ESMP as well as suggest improvements to it;
- To generate data that could be incorporated in future ESMPs;
- To evaluate what additional enforcement is required for the effective project implementation.

For effective implementation of the ESMP, a monitoring program has been designed. The monitoring plan indicates the operational links between the impacts identified, indicators to be measured, the methods to be used, frequency of measurements and definition of thresholds indicating the need for corrective actions. The necessary costs and the responsibilities for all aspects of the monitoring arrangements are also identified.

6.18.1 Monitoring and Reporting

Project performance monitoring has the overall objective of achieving the desired outcomes through reporting of measurable events or parameters or aspects that can be monitored and verified. The following monitoring and reporting sequence is proposed for the ESMP implementation for the Gwagwalada and Zuba intervention subprojects.

- The respective Contractors shall submit to SPMU a monthly monitoring report and the ESMP accomplishments during the project implementations,
- The SPMU shall prepare monthly ESMP monitoring and accomplishment reports to be submitted to FPMU and the WB.

This reporting cycle shall be repeated as the feedback mechanism scheme to all key players consisting of the affected stakeholders, Contractors, CBOs/CDOs, SPMU, etc.

6.18.2 Post Construction Monitoring

In the post-Construction phase of the project, the respective Contractors shall be required to maintain continuous monitoring of the intervention beyond the project completion. This will ensure that the Gwagwalada and Zuba gully rehabilitation/healing process and the associated livelihood programmes are sustained beyond the project closeout. Since the Contractors will have a big role in sustaining the post Construction (operations) phase of the project, necessary capacity building trainings will be required to provide its officers/leaders the needed capabilities for formulating necessary policies, systems and procedures. The SPMU and the AEPB will be required

to ensure that the Contractors and other monitoring Agencies, including the NGOs/CBOs are institutionally strengthened.

6.19Community Engagement and Community-Based Monitoring

The project integrates community engagement and community-based monitoring as core strategies for strengthening participation and ensuring the long-term sustainability of gully erosion control interventions in Gwagwalada and Zuba, FCT, Abuja. Given that, local communities are the most directly affected by erosion and flooding impacts, their involvement in project monitoring enhances ownership, accountability, and early detection of risks.

A key approach is the establishment of community drainage and erosion monitoring committees, comprising residents, traditional leaders, women, youths, and local government representatives. These committees are trained to routinely observe drainage channels, culverts, and gully control structures, especially during and after heavy rainfall events. Their responsibilities include identifying blockages caused by sediment or waste, reporting structural cracks or undercutting, and discouraging activities such as refuse dumping that exacerbate erosion. This localized monitoring system ensures rapid response to minor issues before they develop into major structural failures.

The project also adopts participatory monitoring and audit mechanisms, where community members are actively involved in assessing project performance and environmental and social impacts. Through periodic participatory audits, residents provide feedback on the functionality of erosion control structures, the effectiveness of drainage systems, and the adequacy of social safeguards such as safety buffers and access routes. These audits promote transparency, strengthen trust between project implementers and beneficiaries, and help align interventions with local needs and priorities.

Capacity-building is another critical component of community engagement. Training sessions and awareness program equip community members with basic technical knowledge on erosion processes, climate risks, and simple maintenance practices. This empowers residents to act as first-line monitors**,** complementing formal inspections by engineers and government agencies.

Overall, integrating community engagement and monitoring roles transforms beneficiaries into active project partners. By strengthening drainage committees, institutionalizing participatory

audits, and building local capacity, the project enhances resilience, ensures continuous oversight, and promotes sustainable management of gully erosion control infrastructure in the face of climate and extreme events.

Some of these adopted include:

1. **Community-Based Monitoring (CBM):** Trained local residents regularly observe and report changes in gully conditions, drainage performance, and vegetation stability, especially after heavy rainfall events.

2. **Participatory Mapping and Early Warning Systems:** Communities help map erosion hotspots and act as first responders by reporting blockages or structural damage through simple communication channels.

3. **Environmental and Social Watch Groups:** Community groups monitor compliance with environmental safeguards, buffer zones, and social impacts, helping prevent harmful activities such as encroachment or waste dumping.

6.20 Grievance Mechanism and Procedures

It is for the benefit of the AEPA/FCDA, ACRESAL, Communities and the PAPs to devise a mechanism through which complaints and disagreements arising from the implementation of the Gwagwalada and Zuba gully intervention subprojects can be resolved. A Grievance Mechanism (GM) is necessary to prevent and address community issues, reduce exposure to risks and also provide the platform for the optimization of environmental and social benefits of the project. The grievance procedures consist of the steps that ensure proper documentation of all grievances, a discussion mechanism for hearing and resolving the grievances, and provisions for appeals in the event of dissatisfaction by any affected persons.

The issues considered include: the project's benefit(s) to the stakeholders; potential changes to the routine activities of the stakeholders that might occur due to the project; and the project activities that might cause damage or conflict for the stakeholders. Any issues that may lead to grievances will be addressed through documented grievance mechanism that takes into consideration the cultural and traditional rights of people avoiding as much as possible potential for legal redress

mechanism. The specific objective of the mechanism is to facilitate the process and ensure effective and timely grievance resolution thereby reducing the risk of escalation of conflicts and avoiding unnecessary delays. The grievances and remedial actions shall be carefully documented to enhance accountability and reduce liability.

The traditional community land dispute resolution structure currently constitutes the nucleus of traditional resolution of disputes among community members on matters of land. It is therefore wise and advisable that this structure be necessarily retained in the event of any grievance or dispute relating to the ESMP implementation. Inputs from the leadership may also be limited to providing recommendations as to how a specific dispute is to be addressed. Aside from the traditional structure, Figure 6-1 provides a secondary mechanism for grievance resolution using the Grievance Committee (GC). The proposed GM will also help to achieve the following:

- To serve as the open channel for effective communication, together with the identification of emerging environmental and social concerns due to the project;
- To prevent and mitigate any adverse environmental and social impacts as a result of any phase of the project;
- Promote harmonious relationships and respect among stakeholders; and,
- Ensure community acceptance of the project.

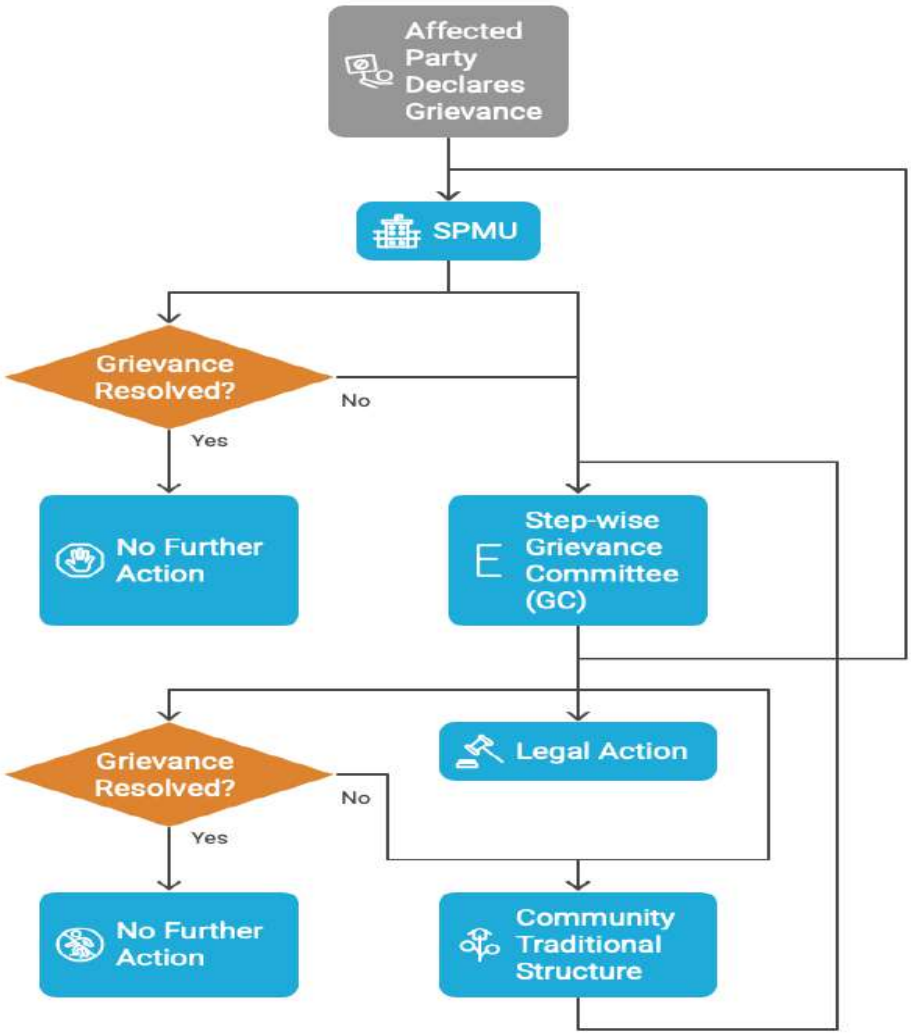


Figure 6-1: Grievance Procedure.

6.20.1 Formation of Grievance Committee (GC)

The objective of the GC is to respond to the complaints relating to the project in a timely and transparent manner and to provide a mechanism to mediate conflict and cut down on lengthy litigation, which often delays projects. It will also provide people who might have objections or concerns about their assistance a public forum to raise their objections and through conflict resolution, address these issues adequately. The committee will provide ample opportunity to complaints informally, in addition to the existing formal administrative and legal procedures.

The major grievances that might require mitigation include:

- PAPs not listed;
- Use of local workforce;
- GBV/SEA Issues
- Losses not identified correctly;
- Inadequate assistance;
- Dispute about ownership;
- Delay in disbursement of assistance and improper distribution of assistance.

The ACRESAL SPMU shall establish necessary levels of Grievance Committees (GRC) overseen by ACRESAL for Gwagwalada and Zuba project to address complaints from this ESMP implementation. Each GRC shall provide specific necessary support and resolution of the potential PAP related grievances in accordance with provisions of this ESMP. The Committees will be coordinated as provided for at each level with the compositions of each GRC level comprising of the following:

FIRST LEVEL: COMMUNITY GRIEVANCE COMMITTEE (COM-GRC)

The first stage of the GRC in the grievance process shall be the community-based GRC (Community GRC) which shall be coordinated by the Focal NGO (FNGO) and shall be made up of the following:

- 1 Representative from each of the Community Associations
- 1 Representative from the traditional ruler of the Community
- 1 Representative of the Local Government Area
- 1 Representative of Ministry of Lands, Survey and Physical Planning.
- 1 Representative of the Project Affected Persons (PAPs)
- Environmental Safeguards Officer (ESO) in SPMU as the Secretary
- 1 Representative from the Focal NGO as coordinator

This committee shall be the place of first recourse for anyone who has a grievance matter related to the site. The timeline for addressing/resolving the issues raised by a complainant by this GRC shall be at most 15 days from the last day allowable for grievance and complaints submission following the end of ESMP disclosure.

SECOND LEVEL: PMU GRIEVANCE COMMITTEE (PMU-GRC)

Where the Com-GRC is unable to resolve the matter, the Complainant may seek redress from the Project Management Unit – Grievance Committee (PMU-GC). This Committee shall be coordinated by the Project Coordinator of the SPMU and made up of the following:

- 1 Representative from the Ministry of Environment
- 1 Representative from the Ministry of Lands and Survey
- 1 Representatives of the Project Affected Persons (PAPs)
- 1 Representative from the Focal NGO
- Environmental Safeguards Officer in SPMU as the Secretary
- Project Accountant in the SPMU
- Project Coordinator of the SPMU as the Coordinator

This committee shall be the second place of recourse for anyone who has a grievance matter related to the site. The timeline for addressing/resolution of the issues raised by a complainant by this PMU-GRC shall be at most 15 days from the last day allowable for grievance and complaints submission following the inability of the Com-GRC to resolve the matter.

THIRD LEVEL: ACRESAL STEERING/TECHNICAL COMMITTEE (STATE-GRC)

Where the SPMU-GC is unable to resolve the matter at this level, the Complainant may seek redress from the ACRESAL Steering and Technical Committee GC (FCT-GC). This Committee will be coordinated by the Chairman of the Steering Committee, who is the Director General of Abuja Environmental Protection Board. The composition of this Committee shall be as follows:

- The Federal Environmental Safeguards Specialist
- Representative of the Umbrella NGO
- Environmental Safeguards Officers from 2 neighboring ACRESAL states who have experience in handling grievance matters
- Project Coordinator of the SPMU as the Secretary

The timeline for addressing/resolving issues raised by a complainant by this FCT-GC shall be at most 15 days from the last day allowable for grievance and complaints submission following the inability of the PMU- GC to resolve the matter.

FOURTH LEVEL: THE COURTS

Where the Complainant is not satisfied with the decisions of the FCT-GC, he/she may seek redress in the law Courts. All grievances will first of all be addressed at the First Level. It will only move on to Second Level if the first level agreement was not accepted by the party involved and then to third and forth under similar situations. If negotiated settlement of grievances cannot be achieved through the normal procedural steps outlined in the grievance mechanism, the complainant has the right to approach the courts. The GM procedure will be included in the community engagement plan to ensure that all PAPs know and understand the process and are able to access it whenever they feel the need. The effectiveness of the GM will be one of the crucial monitoring indicators.

6.20.2 Training of the Grievance Committee

The various Grievance Committees shall be provided with training to enable them adequately perform their responsibilities. The training shall be organized by the SPMU who shall provide logistics such as writing materials, per diem, transportation, training venue and time.

The details of the training including time and date shall be adequately communicated to all members for their attendance. At the end of the training, members of the intervention community shall be adequately sensitized on the procedure for submission of complaints and grievances.

6.21 ESMP Implementation Schedule

The implementation and management of the ESMP schedule is designed to facilitate any necessary resettlement issues associated with the RAP. The ESMP activities also need to be implemented within an agreed timeframe and budget. Appropriate timing shall be adhered to in order to avoid project delays especially if the situation arises where site clearing is to begin before the resettlement end date.

Execution of the ESMP activities is recommended in accordance with the schedule shown in Table 6.5. The period of the first week will be used to develop and set up all structures necessary to support all aspects of the programs.

Table 6.6: Proposed ESMP Implementation Schedule

DESCRIPTION OF ACTIVITY	DURATION IN WEEKS											
	1	2	3	4	5	6	7	8	9	10	11	12
Disclosure of ESMP Report												
Formation of Project Grievance Committees (GRCs)												
Review and Approval of Contractors Implementation Plan												
Hold Stakeholders' Meetings and Consultations												
Execute Capacity Building Programs												
Implementation of Mitigation Measures												
Supervision of ESMP Implementation												
Monitoring & Reporting on ESMP Implementation												
Conduct ESMP Implementation Audit												
Program Administration												

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CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The Gwagwalada and Zuba gully erosion project is not just necessary; it is a critically needed intervention poised to deliver substantial and long-term benefits to the communities in the Federal Capital Territory. This environmental and social management plan (ESMP) confirms that the project's overall positive socio-economic impacts, both locally and regionally, will significantly outweigh its few manageable, temporary adverse effects.

This subproject directly addresses the devastating perennial floods and soil erosion that have plagued Gwagwalada and Zuba. By improving the drainage landscape, the intervention will enhance the safety and comfort of residents, protect lives and property, and end the emotional trauma associated with these seasonal disasters. Furthermore, it aligns perfectly with the FCT's broader development and socio-economic goals by:

Facilitating the redevelopment of agriculturally degraded lands.

- Restoring unimpeded use of agricultural lands.
- Improving the overall environmental and health situation of the area.

The analysis shows that any potential adverse environmental, social, or health effects can be safely mitigated through the implementable and monitorable measures outlined in the ESMP.

Managing Adverse Impacts

While the project promises major benefits, its main adverse impacts are:

- Temporary in nature and will occur during the construction phase.
- Social issues related to the temporary displacement and relocation of people, as well as the permanent acquisition of setback land for the new drainage channels and access roads.

To address these, the FCTA has committed to compensating all Project Affected Persons (PAPs) for impacts such as temporary disturbance, loss of economic trees and crops, and loss of land. With the recommended mitigation measures in place, the residual impacts will be managed to acceptable levels.

Public consultations revealed widespread and strong support for the project, with residents desperately seeking relief and an improved quality of life. The clear consensus is that the project is, in essence, a mitigation measure against the perennial threats of floods and erosion.

To ensure this critical project's success and guarantee its longevity, stringent monitoring and enforcement of the ESMP are non-negotiable. The Sub-project Management and Planning Unit (SMPU) and the Supervising Engineer, in partnership with the Federal Project Management Unit (FPMU) and the World Bank, must collaboratively and diligently monitor the implementation. The community's key concern, which must be addressed, is the need for an effective, long-term maintenance programme to ensure the sustained functionality and structural integrity of the Gwagwalada and Zuba drainage system.

In conclusion, the Gwagwalada and Zuba Project is a vital and urgently needed solution to a long-standing environmental hazard. Its implementation will result in a profound and positive transformation for the affected communities.

7.2 Recommendations

The absence of a formal solid waste management system in Gwagwalada and Zuba is evident in the pervasive litter throughout both communities. Residents resort to makeshift containers like plastic bags and baskets for disposal, but with no collection service, this waste is left to decay. This attracts scavengers, which scatter the debris, while wind and rain ultimately wash the majority of it into local waterways. The result is a cycle of environmental degradation and water contamination that fosters the spread of disease.

There is widespread public support for implementing an effective waste collection and disposal system. Many schemes have been instigated in the past but have failed due to a lack of resources, including infrastructure. The most made comment, during the public consultation process, was that a community awareness programme will be key to the success of the waste collection and disposal system. It is therefore imperative that waste collection and disposal systems that works on a regular basis is required so that the current problem of waste accumulation in water courses can be eliminated. It is therefore strongly recommended that the volumes of waste that currently collect in stormwater drains shall not be allowed to continue as they inhibit the effective flow through water courses thereby reducing the overall capacity of the drainage systems.

Specific recommendations received from stakeholders, project-affected-persons (PAPs) and project affected households (PAHs) which include the involvement of community associations, the FMEnv and FCT-ACReSAL during the preparation of this ESMP include:

- Community associations shall be involved during the pre-construction and construction stages of the intervention, to mediate in resolving grievances or concerns in a manner that is consistent with the GM setting of the FCT ACReSAL.
- The community leaders are to be continuously updated by the FCT ACReSAL on all aspects of the intervention project in the area that concerns or relates to them.
- The State Focal NGOs shall be adequately briefed and/or given orientation on the grievance procedure, including whom to contact in the FCT ACReSAL.
- Dust suppression shall be ensured by contractors before and during work, and the use of caution signs, tapes, and traffic guide/marshals must be adhered to.
- Stalls shall be prepared for food hawkers and vendors, and mobile toilets strategically placed especially during the construction phase with care to avoid GBV/SEA/SH issues.
- Security and safety shall be prioritized through contractors' collaboration with community associations, traditional rulers, and security agencies in line with the FCT ACReSAL Security Management Plan.
- Personnel Protective Equipment (PPE) such safety helmets, hand gloves, safety boots etc shall be adequately provided, and a fund set aside for compensation in the case of accidents on the job, for victims to access easily.
- Development Resettlement Action Plan shall be immediately initiated for PAPs and PAHs living along the gully site to prevent any damage to lives and properties.
- Sourcing both skilled and unskilled opportunities irrespective of gender shall be considered by the Contractor among local youths for economic empowerment except when not available.
- local sourcing of goods and services in the community shall be encouraged provided such meets the required standard to improve economic activities in the area.
- There would be a significant increase in traffic density into and out of the community during the construction stage, proper traffic planning and management shall be implemented to reduce road traffic accidents. Thus, the use of suitable traffic warning signs

and speed control measures shall be enforced. Project drivers shall be conversant with defensive and safe driving to avoid accidents.

- A competent Health and Safety officer shall be on hand, to ensure the safety of the workers, project's sub-contractors and visitors to the site. The manager shall keep and maintain a record of injuries, near-misses, and maintenance of a First Aid Box on site,
- The project site shall be well condoned off with conspicuous caution tape to warn non-project workers and prevent intruders. This is necessary to reduce work site accidents and related hazards.

In conclusion, the proposed erosion gully reclamation works are strongly recommended. They offer substantial socioeconomic and environmental benefits, with minimal and manageable risks. The project can be executed in a sustainable, socially responsible, and inclusive manner.

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ANNEX 1: TERMS OF REFERENCE

1. Project Overview

The **Agro-Climatic Resilience in Semi-Arid Landscapes (ACReSAL)** project is a multi-sectoral initiative aimed at desertification control, landscape restoration, and community resilience in Northern Nigeria.

- **Objective:** Increase sustainable landscape management and strengthen Nigeria's climate-resilient framework.
- **Site Focus: * Gwagwalada:** A 2km+ gully threatening the Aguma's palace and local infrastructure, emptying into the Gurara River.

- **Zuba:** A mountain-fed gully causing severe land devastation and loss of life during rainy seasons.

- **Proposed Interventions:** A mix of **civil works** (concrete drains, gabions, culverts) and **bio-engineering** (planting Vetiver and Bahamas grass).

2. Objective of the Consultancy

The consultant will develop a site-specific **ESMP** to identify, avoid, and mitigate environmental and social risks triggered by the proposed construction. The plan must align with **World Bank Environmental and Social Standards (ESS)** and Nigerian EIA laws.

3. Scope of Work & Key Tasks

The consultant is required to:

- **Baseline Assessments:** Document biophysical (soil, water, climate) and socioeconomic conditions.
- **Impact Analysis:** Identify risks to natural habitats, community health, and safety, including Gender-Based Violence (GBV) and Sexual Exploitation and Abuse (SEA).
- **Mitigation & Monitoring:** Propose cost-effective measures to reduce impacts and establish a monitoring framework with clear indicators.
- **Stakeholder Engagement:** Conduct and document consultations with affected communities and vulnerable groups.
- **Institutional Framework:** Define roles for agencies responsible for implementation and propose technical assistance where capacity gaps exist.

4. Deliverables & Timeline

The total duration of the assignment is **12 weeks**.

Phase	Deliverable	Timeline
I	Inception Report	Week 1
II	Draft ESMP Report	Week 4

Phase	Deliverable	Timeline
III	Draft Final ESMP (incorporating feedback)	Week 8
IV	Final Approved ESMP & Database	Week 12

5. Consultant Qualifications

- **Education:** Advanced degree in Civil/Environmental Engineering, Environmental Sciences, or Social Sciences.
- **Experience:** Minimum **8 years** total experience; at least **4 years** specifically in land degradation or infrastructure projects.
- **Skills:** Proven competency in World Bank Environmental and Social Framework (ESF) and preparing operational action plans for urban/semi-arid regions.

6. Payment Schedule

- **30%:** On submission of Inception Report.
- **40%:** On submission of Draft Report.
- **20%:** On submission of Draft Final Report & Presentation.
- **10%:** On acceptance and disclosure of the Final Report.

7. Institutional Arrangements

The consultant will report to the **FCT Project Management Unit (SPMU)** and interface with relevant stakeholders, including the FCT Environmental Protection Board, RUWASSA, and Nigeria Meteorological Agency (NIMET).

Note: All data and reports generated during this assignment remain the property of FCT ACReSAL.

ANNEX 2: DEMOBILIZATION/ABANDONMENT

This section offers specific guidance for preventing and controlling community health and safety impacts throughout the project's development and after its completion. These provisions are largely based on the World Bank's General EHS Guidelines.

Noise and Vibration

Decommissioning activities will generate noise and vibration from earth-moving and excavation equipment, and the transport of materials, equipment, and personnel. Noise reduction and control strategies should be implemented in areas near communities. These strategies include:

- Planning activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance;
- Using noise control devices, such as temporary noise barriers and deflectors for impact and blasting activities, and exhaust muffling devices for combustion engines; and,
- Avoiding or minimizing project transportation through community areas.

Soil Erosion

Soil erosion may be caused by exposure of soil surfaces to rain and wind during site clearing, earth moving, and excavation activities. The mobilization and transport of soil particles may, in turn, result in sedimentation of surface drainage networks, which may result in impacts to the quality of natural water systems and ultimately the biological systems that use these waters. Recommended soil erosion and water system management approaches include reducing or preventing erosion by:

- Scheduling to avoid heavy rainfall periods (i.e., during the dry season) to the extent practical
- Contouring and minimizing length and steepness of slopes
- Mulching to stabilize exposed areas
- Re-vegetating areas promptly
- Designing channels and ditches for post-construction flows;
- Lining steep channel and slopes (e.g. use jute matting).

Air Quality

Decommissioning activities may generate emission of fugitive dust caused by a combination of on-site excavation and movement of earth materials, contact of construction machinery with bare soil, and exposure of bare soil and soil piles to wind. A secondary source of emissions may include exhaust from diesel engines of earth moving equipment, as well as from open burning of solid waste on-site. Techniques to consider for the reduction and control of air emissions from construction and decommissioning sites include:

- Minimizing dust from material handling sources, such as conveyors and bins, by using covers and/or control equipment (water suppression, bag house, or cyclone);
- Minimizing dust from open area sources, including storage piles, by using control measures such as installing enclosures and covers, and increasing the moisture content;
- Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements;
- Selectively removing potential hazardous air pollutants, such as asbestos, from existing infrastructure prior to demolition;
- Managing emissions from mobile sources;
- Avoiding open burning of solids.

Solid Waste

Non-hazardous solid waste generated at construction and decommissioning sites includes excess fill materials from grading and excavation activities, scrap wood and metals, and small concrete spills. Other non-hazardous solid wastes include office, kitchen, and dormitory wastes when these types of operations are part of construction project activities. Hazardous solid waste includes contaminated soils, which could potentially be encountered on-site due to previous land use activities, or small amounts of machinery maintenance materials, such as oily rags, used oil filters, and used oil, as well as spill cleanup materials from oil and fuel spills. Techniques for preventing and controlling nonhazardous and hazardous construction site solid waste include those already discussed in Section 1.6 of the EHS guidelines.

Hazardous Materials

Decommissioning activities may pose the potential for release of petroleum-based products, such as lubricants, hydraulic fluids, or fuels during their storage, transfer, or use in equipment. These materials may also be encountered during decommissioning activities in building components or industrial process equipment. Techniques for prevention, minimization, and control of these impacts include:

- Providing adequate secondary containment for fuel storage tanks and for the temporary storage of other fluids such as lubricating oils and hydraulic fluids;
- Using impervious surfaces for refueling areas and other fluid transfer areas;
- Training workers on the correct transfer and handling of fuels and chemicals and the response to spills;
- Providing portable spill containment and cleanup equipment on site and training in the equipment deployment;
- Assessing the contents of hazardous materials and petroleum-based products in building systems (e.g. PCB containing electrical equipment, asbestos-containing building materials) and process equipment and removing them prior to initiation of decommissioning activities.

Wastewater Discharges

Decommissioning activities may include the generation of sanitary wastewater discharges in varying quantities depending on the number of workers involved. Adequate portable or permanent sanitation facilities serving all workers should be provided at all construction sites. Sanitary wastewater in construction and other sites should be managed as prescribed in Section 1.3 of the EHS guidelines.

Contaminated Land

Land contamination may be encountered in sites under construction or demobilization due to known or unknown historical releases of hazardous materials or oil, or due to the presence of abandoned infrastructure formerly used to store or handle these materials, including underground storage tanks. Actions necessary to manage the risk from contaminated land will depend on factors

such as the level and location of contamination, the type and risks of the contaminated media, and the intended land use. However, a basic management strategy should include:

- Managing contaminated media with the objective of protecting the safety and health of occupants of the site, the surrounding community, and the environment post construction or post decommissioning;
- Understanding the historical use of the land with regard to the potential presence of hazardous materials or oil prior to initiation of construction or decommissioning activities;
- Preparing plans and procedures to respond to the discovery of contaminated media to minimize or reduce the risk to health, safety, and the environment consistent with the approach for Contaminated Land in Section 1.6
- Preparation of a management plan to manage obsolete, abandoned, hazardous materials or oil consistent with the approach to hazardous waste management described in Section 1.6 of the EHS guidelines.

Slips and Falls

Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are also among the most frequent cause of lost time accidents at construction and decommissioning sites. Recommended methods for the prevention of slips and falls from, or on, the same elevation include:

- Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths;
- Cleaning up excessive waste debris and liquid spills regularly;
- Locating electrical cords and ropes in common areas and marked corridors;
- Use of slip retardant footwear.

Struck by Objects

Construction and demolition activities may pose significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities. Techniques for the prevention and control of these hazards include:

- Using a designated and restricted waste drop or discharge zones, and/or a chute for safe movement of wastes from upper to lower levels;
- Conducting sawing, cutting, grinding, sanding, chipping or chiseling with proper guards and anchoring as applicable;
- Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap;
- Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails and toe boards to prevent materials from being dislodged;
- Evacuating work areas during blasting operations, and using blast mats or other means of deflection to minimize fly rock or ejection of demolition debris if work is conducted in proximity to people or structures;
- Wearing appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes

Moving Machinery

Vehicle traffic and use of lifting equipment in the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise. Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving. Techniques for the prevention and control of these impacts include:

- Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic;
- Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle;
- Ensuring moving equipment is outfitted with audible back-up alarms;
- Using inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.

Dust

- Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements;
- PPE, such as dusk masks, should be used where dust levels are excessive

Other Site Hazards

Construction and decommissioning sites may pose a risk of exposure to dust, chemicals, hazardous or flammable materials, and wastes in a combination of liquid, solid, or gaseous forms, which should be prevented through the implementation of project specific plans and other applicable management practices, including:

- Use of specially trained personnel to identify and remove waste materials from tanks, vessels, processing equipment or contaminated land as a first step in decommissioning activities to allow for safe excavation, construction, dismantling or demolition;
- Use of specially trained personnel to identify and selectively remove potentially hazardous materials in building elements prior to dismantling or demolition including, for example, insulation or structural elements containing asbestos and Polychlorinated Biphenyls (PCBs), electrical components containing mercury;
- Use of waste-specific PPE based on the results of an occupational health and safety assessment, including respirators, clothing/protective suits, gloves and eye protection.

General Site Hazards

Projects should implement risk management strategies to protect the community from physical, chemical, or other hazards associated with sites under construction and decommissioning. Risks may arise from inadvertent or intentional trespassing, including potential contact with hazardous materials, contaminated soils and other environmental media, buildings that are vacant or under construction, or excavations and structures which may pose falling and entrapment hazards. Risk management strategies may include:

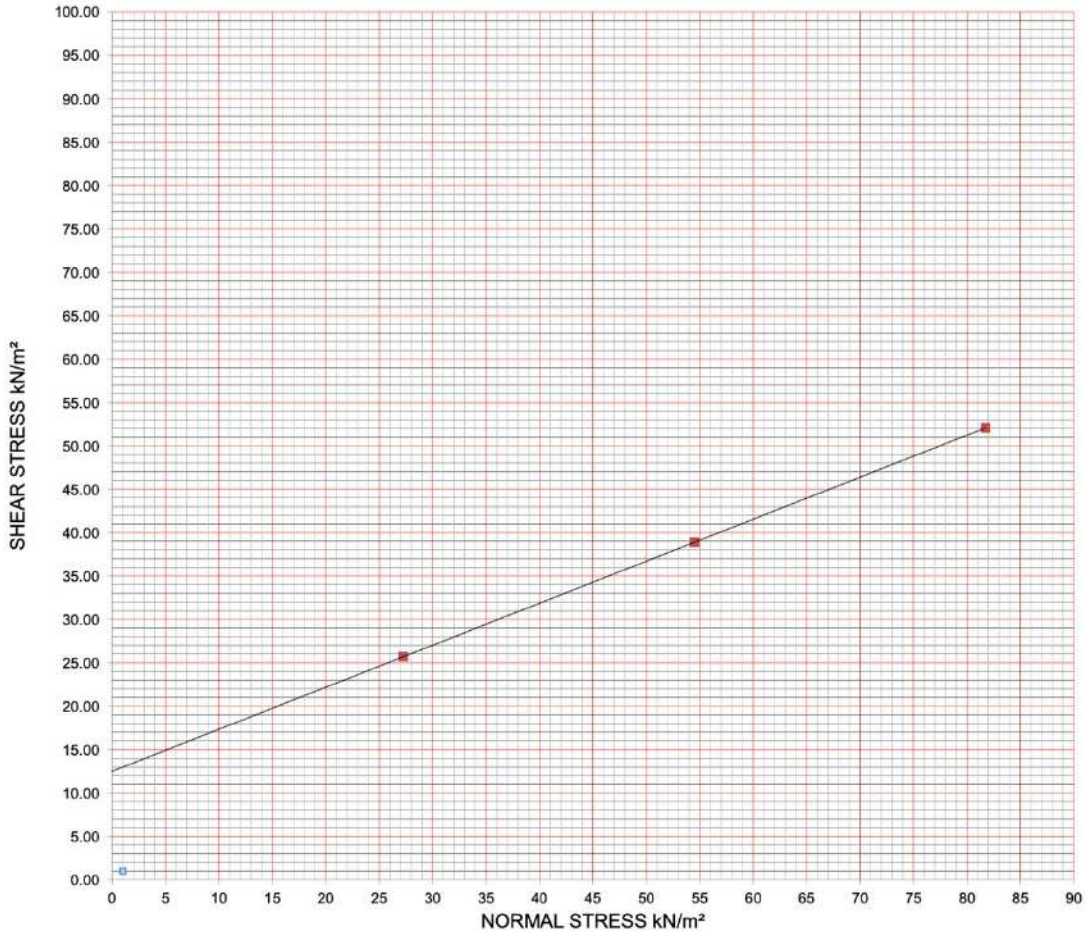
- Restricting access to the site, through a combination of institutional and administrative controls, with a focus on high-risk structures or areas depending on site-specific situations, including fencing, signage, and communication of risks to the local community;

- Removing hazardous conditions on construction sites that cannot be controlled effectively with site access restrictions, such as covering openings to small confined spaces, ensuring means of escape for larger openings such as trenches or excavations, or locked storage of hazardous materials

Traffic Safety

Construction activities may result in a significant increase in movement of heavy vehicles for the transport of construction materials and equipment, increasing the risk of traffic-related accidents and injuries to workers and local communities. The incidence of road accidents involving project vehicles during construction should be minimized through a combination of education and awareness-raising, and the adoption of procedures prescribed for Traffic Safety.

APPENDIX E
SHEAR BOX TEST GRAPH



Field Description of Sample	Specimen Identification	Proving Ring (def)	Normal Stress (kN/m²)	Shear Stress (kN/m²)	Wt. Of Cutter + Sample (g)	Bulk Density (kN/m)	Ø°	C (kN/m)
	BH 2	37	27.25	25.69	1364	19.19	**26**	13
	@	56	54.5	38.89	1383			
	2.1	75	81.75	52.08	1402			



Plate A: Residential structures in immediate proximity to the gully edge, indicating setback encroachment and foundation risk (Gwagwalada corridor).



Plate B: Residential structures in immediate proximity to the gully edge, indicating setback encroachment and foundation risk (Zuba corridor).



Plate C: Soil Sample Collection at the gully edge of Gwagwalada site

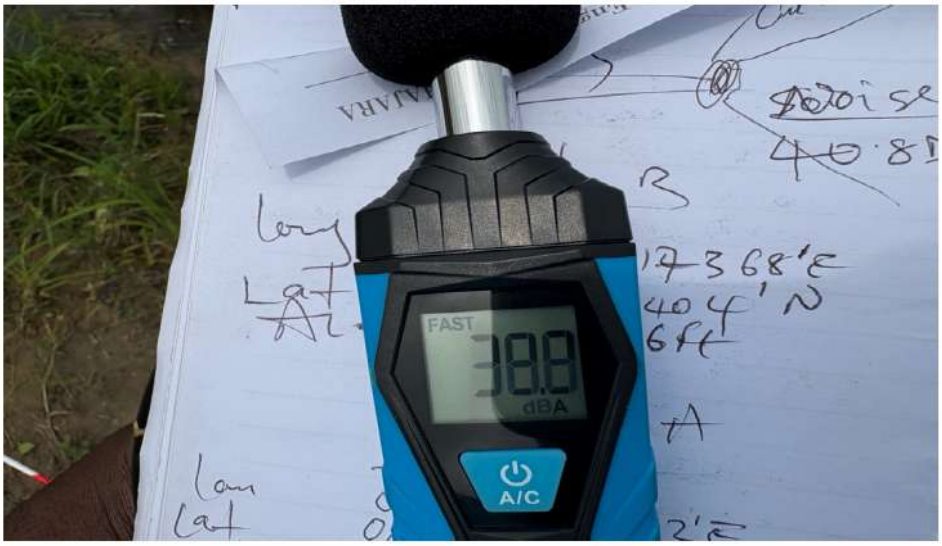


Plate D: Noise Level Meter use in measuring noise level at Zuba gully site
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Plate E: Community Engagements at the Palace of Community Head in Zuba

ANNEX 3: QUESTIONNAIRE

LAYUSA INTEGRATED SERVICES LIMITED

Services
Air, Soil & Water Quality Analysis | Civil Engineering Services
Borehole Drilling & Testing | Training | Supply & General Contracts

Date 23 / 09 / 2025

Questionnaire for Environmental and Social Management Plan (ESMP)
Gwagwalada Gully Erosion Control Project

Section A: General Information

1. Name of Respondent (optional): _____

2. Gender: ☐ Male ☐ Female

3. Age: ☐ <18 ☐ 18–30 ☐ 31–50 ☐ 51+

4. Educational Level: ☐ None ☐ Primary ☐ Secondary ☐ Tertiary

5. Occupation: _____

6. Community/Area of Residence: _____

Section B: Environmental Conditions

7. Are there active gully erosion sites near your community? ☐ Yes ☐ No

8. If yes, how far is the gully from your home/farmland? ☐ <500m ☐ 500m–1km ☐ >1km

9. What environmental challenges are most severe in your area? (tick all that apply)
☐ Gully erosion ☐ Flooding ☐ Poor drainage ☐ Waste disposal ☐ Others: _____

10. Have you noticed changes in soil quality, water sources, or vegetation due to erosion? ☐ Yes ☐ No ☐ Not sure

11. How often do floods or stormwater affect your area? ☐ Rarely ☐ Sometimes ☐ Frequently

Section C: Social Impacts

12. Has erosion/flooding affected:

- Your farmland? ☐ Yes ☐ No
- Your house? ☐ Yes ☐ No
- Road access/transportation? ☐ Yes ☐ No
- School/market/community facilities? ☐ Yes ☐ No

1



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08160157056, 08072001023
layusaintegrated.servicesltd@gmail.com
www.layusa.com

Date 16 / 09 / 2025

Questionnaire for Environmental and Social Management Plan (ESMP)
Zuba Gully Erosion Control Project

Section A: General Information

1. Name of Respondent (optional): _____

2. Gender: ☐ Male ☐ Female

3. Age: ☐ <18 ☐ 18–30 ☐ 31–50 ☐ 51+

4. Educational Level: ☐ None ☐ Primary ☐ Secondary ☐ Tertiary

5. Occupation: _____

6. Community/Area of Residence: _____

Section B: Environmental Conditions

7. Are there active gully erosion sites near your community? ☐ Yes ☐ No

8. If yes, how far is the gully from your home/farmland? ☐ <500m ☐ 500m–1km ☐ >1km

9. What environmental challenges are most severe in your area? (tick all that apply)
☐ Gully erosion ☐ Flooding ☐ Poor drainage ☐ Waste disposal ☐ Others: _____

10. Have you noticed changes in soil quality, water sources, or vegetation due to erosion? ☐ Yes ☐ No ☐ Not sure

11. How often do floods or stormwater affect your area? ☐ Rarely ☐ Sometimes ☐ Frequently

Section C: Social Impacts

12. Has erosion/flooding affected:

- Your farmland? ☐ Yes ☐ No
- Your house? ☐ Yes ☐ No
- Road access/transportation? ☐ Yes ☐ No
- School/market/community facilities? ☐ Yes ☐ No



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ANNEX 4: General Environmental and Social Management Conditions for Construction Contracts

The document below presents a general overview of general environmental and social management conditions for typical construction/civil works contracts handled by the PCU under the purview of the World Bank.

A1.1 General

1. In addition to these general conditions, the Contractor shall comply with any specific Environmental Management Plan (EMP) or Environmental and Social Management Plan (ESMP) for the works he is responsible for. The Contractor shall inform himself about such an EMP, and prepare his work strategy and plan to fully take into account relevant provisions of that EMP. If the Contractor fails to implement the approved EMP after written instruction by the Supervising Engineer (SE) to fulfil his obligation within the requested time, the Owner reserves the right to arrange through the SE for execution of the missing action by a third party on account of the Contractor.

2. Notwithstanding the Contractor's obligation under the above clause, the Contractor shall implement all measures necessary to avoid undesirable adverse environmental and social impacts wherever possible, restore work sites to acceptable standards, and abide by any environmental performance requirements specified in an EMP. In general these measures shall include but not be limited to:

(a) Minimize the effect of dust on the surrounding environment resulting from earth mixing sites, asphalt mixing sites, dispersing coal ashes, vibrating equipment, temporary access roads, etc. to ensure safety, health and the protection of workers and communities living in the vicinity dust producing activities.

(b) Ensure that noise levels emanating from machinery, vehicles and noisy construction activities (e.g. excavation, blasting) are kept at a minimum for the safety, health and protection of workers within the vicinity of high noise levels and nearby communities.

(c) Ensure that existing water flow regimes in rivers, streams and other natural or irrigation channels is maintained and/or re-established where they are disrupted due to works being carried out.

(d) Prevent bitumen, oils, lubricants and waste water used or produced during the execution of works from entering into rivers, streams, irrigation channels and other natural water bodies/reservoirs, and also ensure that stagnant water in uncovered borrow pits is treated in the best way to avoid creating possible breeding grounds for mosquitoes.

(e) Prevent and minimize the impacts of quarrying, earth borrowing, piling and building of temporary construction camps and access roads on the biophysical environment including protected areas and arable lands; local communities and their settlements. In as much as possible restore/rehabilitate all sites to acceptable standards.

(f) Upon discovery of ancient heritage, relics or anything that might or believed to be of archaeological or historical importance during the execution of works, immediately report such findings to the SE so that the appropriate authorities may be expeditiously contacted for fulfillment of the measures aimed at protecting such historical or archaeological resources.

(g) Discourage construction workers from engaging in the exploitation of natural resources such as hunting, fishing, collection of forest products or any other activity that might have a negative impact on the social and economic welfare of the local communities.

(h) Implement soil erosion control measures in order to avoid surface run off and prevents siltation, etc.(i) Ensure that garbage, sanitation and drinking water facilities are provided in construction workers camps.

(i) Ensure that, in as much as possible, local materials are used to avoid importation of foreign material and long distance transportation.

(j) Ensure public safety, and meet traffic safety requirements for the operation of work to avoid accidents.

3. The Contractor shall indicate the period within which he/she shall maintain status on site after completion of civil works to ensure that significant adverse impacts arising from such works have been appropriately addressed.

4. The Contractor shall adhere to the proposed activity implementation schedule and the monitoring plan / strategy to ensure effective feedback of monitoring information to project management so that impact management can be implemented properly, and if necessary, adapt to changing and unforeseen conditions.

5. Besides the regular inspection of the sites by the SE for adherence to the contract conditions and specifications, the Owner may appoint an Inspector to oversee the compliance with these environmental conditions and any proposed mitigation measures. State environmental authorities may carry out similar inspection duties. In all cases, as directed by the SE, the Contractor shall comply with directives from such inspectors to implement measures required to ensure the adequacy rehabilitation measures carried out on the bio-physical environment and compensation for socio-economic disruption resulting from implementation of any works.

A1.2 Worksite/Campsite Waste Management

6. All vessels (drums, containers, bags, etc.) containing oil/fuel/surfacing materials and other hazardous chemicals shall be bunded in order to contain spillage. All waste containers, litter and any other waste generated during the construction shall be collected and disposed off at designated disposal sites in line with applicable government waste management regulations.

7. All drainage and effluent from storage areas, workshops and camp sites shall be captured and treated before being discharged into the drainage system in line with applicable government water pollution control regulations.

8. Used oil from maintenance shall be collected and disposed off appropriately at designated sites or be re-used or sold for re-use locally.

9. Entry of runoff to the site shall be restricted by constructing diversion channels or holding structures such as banks, drains, dams, etc. to reduce the potential of soil erosion and water pollution.

10. Construction waste shall not be left in stockpiles along the road, but removed and reused or disposed of on a daily basis.

11. If disposal sites for clean spoil are necessary, they shall be located in areas, approved by the SE, of low land use value and where they will not result in material being easily washed into

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drainage channels. Whenever possible, spoil materials should be placed in low-lying areas and should be compacted and planted with species indigenous to the locality.

A1.3 Material Excavation and Deposit

12. The Contractor shall obtain appropriate licenses/permits from relevant authorities to operate quarries or borrow areas.

13. The location of quarries and borrow areas shall be subject to approval by relevant local and national authorities, including traditional authorities if the land on which the quarry or borrow areas fall in traditional land.

14. New extraction sites:

a) Shall not be located in the vicinity of settlement areas, cultural sites, wetlands or any other valued ecosystem component, or on on high or steep ground or in areas of high scenic value, and shall not be located less than 1km from such areas.

b) Shall not be located adjacent to stream channels wherever possible to avoid siltation of river channels. Where they are located near water sources, borrow pits and perimeter drains shall surround quarry sites.

c) Shall not be located in archaeological areas. Excavations in the vicinity of such areas shall proceed with great care and shall be done in the presence of government authorities having a mandate for their protection.

d) Shall not be located in forest reserves. However, where there are no other alternatives, permission shall be obtained from the appropriate authorities and an environmental impact study shall be conducted.

e) Shall be easily rehabilitated. Areas with minimal vegetation cover such as flat and bare ground, or areas covered with grass only or covered with shrubs less than 1.5m in height, are preferred.

f) Shall have clearly demarcated and marked boundaries to minimize vegetation clearing.

15. Vegetation clearing shall be restricted to the area required for safe operation of construction work. Vegetation clearing shall not be done more than two months in advance of operations.

16. Stockpile areas shall be located in areas where trees can act as buffers to prevent dust pollution. Perimeter drains shall be built around stockpile areas. Sediment and other pollutant traps shall be located at drainage exits from workings.

17. The Contractor shall deposit any excess material in accordance with the principles of the general conditions, and any applicable EMP, in areas approved by local authorities and/or the SE.

18. Areas for depositing hazardous materials such as contaminated liquid and solid materials shall be approved by the SE and appropriate local and/or national authorities before the commencement of work. Use of existing, approved sites shall be preferred over the establishment of new sites.

A1.4 Rehabilitation and Soil Erosion Prevention

19. To the extent practicable, the Contractor shall rehabilitate the site progressively so that the rate of rehabilitation is similar to the rate of construction.

20. Always remove and retain topsoil for subsequent rehabilitation. Soils shall not be stripped when they are wet as this can lead to soil compaction and loss of structure.

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21. Topsoil shall not be stored in large heaps. Low mounds of no more than 1 to 2m high are recommended.

22. Re-vegetate stockpiles to protect the soil from erosion, discourage weeds and maintain an active population of beneficial soil microbes.

23. Locate stockpiles where they will not be disturbed by future construction activities.

24. To the extent practicable, reinstate natural drainage patterns where they have been altered or impaired.

25. Remove toxic materials and dispose of them in designated sites. Backfill excavated areas with soils or overburden that is free of foreign material that could pollute groundwater and soil.

26. Identify potentially toxic overburden and screen with suitable material to prevent mobilization of toxins.

27. Ensure reshaped land is formed so as to be inherently stable, adequately drained and suitable for the desired long-term land use, and allow natural regeneration of vegetation.

28. Minimize the long-term visual impact by creating landforms that are compatible with the adjacent landscape.

29. Minimize erosion by wind and water both during and after the process of reinstatement.

30. Compacted surfaces shall be deep ripped to relieve compaction unless subsurface conditions dictate otherwise.

31. Revegetate with plant species that will control erosion, provide vegetative diversity and, through succession, contribute to a resilient ecosystem. The choice of plant species for rehabilitation shall be done in consultation with local research institutions, forest department and the local people.

A1.5 Water Resources Management

32. The Contractor shall at all costs avoid conflicting with water demands of local communities.

33. Abstraction of both surface and underground water shall only be done with the consultation of the local community and after obtaining a permit from the relevant Water Authority.

34. Abstraction of water from wetlands shall be avoided. Where necessary, authority has to be obtained from relevant authorities.

35. Temporary damming of streams and rivers shall be done in such a way avoids disrupting water supplies to communities down stream, and maintains the ecological balance of the river system.

36. No construction water containing spoils or site effluent, especially cement and oil, shall be allowed to flow into natural water drainage courses.

37. Wash water from washing out of equipment shall not be discharged into water courses or road drains.

38. Site spoils and temporary stockpiles shall be located away from the drainage system, and surface run off shall be directed away from stockpiles to prevent erosion.

A1.6 Traffic Management

39. Location of access roads/detours shall be done in consultation with the local community especially in important or sensitive environments. Access roads shall not traverse wetland areas.

40. Upon the completion of civil works, all access roads shall be ripped and rehabilitated.

41. Access roads shall be sprinkled with water at least five times a day in settled areas, and three times in unsettled areas, to suppress dust emissions.

A1.7 Disposal of Unusable Elements

45. Unusable materials and construction elements such as electro-mechanical equipment, pipes, accessories and demolished structures will be disposed of in a manner approved by the SE. The Contractor has to agree with the SE, which elements are to be surrendered to the Client's premises, which will be recycled or reused, and which will be disposed of at approved landfill sites.

46. As far as possible, abandoned pipelines shall remain in place. Where for any reason no alternative alignment for the new pipeline is possible, the old pipes shall be safely removed and stored at a safe place to be agreed upon with the SE and the local authorities concerned.

47. AC-pipes as well as broken parts thereof have to be treated as hazardous material and disposed of as specified above.

48. Unsuitable and demolished elements shall be dismantled to a size fitting on ordinary trucks for transport.

A1.8 Health and Safety

49. In advance of the construction work, the Contractor shall mount an awareness and hygiene campaign. Workers and local residents shall be sensitized on health risks particularly of AIDS.

50. Adequate road signs to warn pedestrians and motorists of construction activities, diversions, etc. shall be provided at appropriate points.

51. Construction vehicles shall not exceed maximum speed limit of 40km per hour.

A1.9 Repair of Private Property

52. Should the Contractor, deliberately or accidentally, damage private property, he shall repair the property to the owner's satisfaction and at his own cost. For each repair, the Contractor shall obtain from the owner a certificate that the damage has been made good satisfactorily in order to indemnify the Client from subsequent claims.

53. In cases where compensation for inconveniences, damage of crops etc. are claimed by the owner, the Client has to be informed by the Contractor through the SE. This compensation is in general settled under the responsibility of the Client before signing the Contract. In unforeseeable cases, the respective administrative entities of the Client will take care of compensation.

A1.10 Contractor's Environment, Health and Safety Management Plan (EHS-MP)

54. Within 6 weeks of signing the Contract, the Contractor shall prepare an EHS-MP to ensure the adequate management of the health, safety, environmental and social aspects of the works, including implementation of the requirements of these general conditions and any specific requirements of an EMP for the works. The Contractor's EHS-MP will serve two main purposes:

- For the Contractor, for internal purposes, to ensure that all measures are in place for adequate EHS management, and as an operational manual for his staff.
- For the Client, supported where necessary by a SE, to ensure that the Contractor is fully prepared for the adequate management of the EHS aspects of the project, and as a basis for monitoring of the Contractor's EHS performance.

55. The Contractor's EHS-MP shall provide at least:

- a description of procedures and methods for complying with these general environmental management conditions, and any specific conditions specified in an EMP;
- a description of specific mitigation measures that will be implemented in order to minimize adverse impacts;
- a description of all planned monitoring activities (e.g. sediment discharges from borrow areas) and the reporting thereof; and
- the internal organizational, management and reporting mechanisms put in place for such.

56. The Contractor's EHS-MP will be reviewed and approved by the Client before start of the works. This review should demonstrate if the Contractor's EHS-MP covers all of the identified impacts, and has defined appropriate measures to counteract any potential impacts.

A1.11 EHS Reporting

57. The Contractor shall prepare bi-weekly progress reports to the SE on compliance with these general conditions, the project EMP if any, and his own EHS-MP. An example format for a Contractor EHS report is portrayed below. It is expected that the Contractor's reports will include information on:

- EHS management actions/measures taken, including approvals sought from local or national authorities;
- Problems encountered in relation to EHS aspects (incidents, including delays, cost consequences, etc. as a result thereof);
- Lack of compliance with contract requirements on the part of the Contractor;
- Changes of assumptions, conditions, measures, designs and actual works in relation to EHS aspects; and
- Observations, concerns raised and/or decisions taken with regard to EHS management during site meetings

58. It is advisable that reporting of significant EHS incidents be done "as soon as practicable". Such incident reporting shall therefore be done individually. Also, it is advisable that the Contractor keep his own records on health, safety and welfare of persons, and damage to property. It is advisable to include such records, as well as copies of incident reports, as appendixes to the bi-weekly reports. A sample format for an incident notification is shown below. Details of EHS performance will be reported to the Client through the SE's reports to the Client.

A1.12 Training of Contractor's Personnel

59. The Contractor shall provide sufficient training to his own personnel to ensure that they are all aware of the relevant aspects of these general conditions, any project EMP, and his own EHS-MP, and are able to fulfil their expected roles and functions. Specific training should be provided to those workers that have particular responsibilities associated with the implementation of the EHS-MP. General topics should be:

- EHS in general (working procedures);
- emergency procedures; and
- social and cultural aspects (awareness raising on social issues).

A1.13 Cost of Compliance

60. It is expected that compliance with these conditions is already part of standard good workmanship and state of art as generally required under this Contract. The item "Compliance with Environmental Management Conditions" in the Bill of Quantities covers this cost. No other payments will be made to the Contractor for compliance with any request to avoid and/or mitigate an avoidable EHS impact.

EHS Report Format

Contract: **Period of reporting:**

EHS management actions/measures:

Summarize EHS management actions/measures taken during period of reporting, including planning and management activities (e.g. risk and impact assessments), EHS training, specific design and work measures taken, etc.

EHS incidents:

Report on any problems encountered in relation to EHS aspects, including its consequences (delays, costs) and corrective measures taken. Include relevant incident reports.

EHS compliance:

Report on compliance with Contract EHS conditions, including any cases of non-compliance.

Changes:

Report on any changes of assumptions, conditions, measures, designs and actual works in relation to EHS aspects.

Concerns and observations:

Report on any observations, concerns raised and/or decisions taken with regard to EHS management during site meetings and visits.

Signature (Name, Title Date):

Contractor Representative

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4. Example Format: EHS Incident Notification

EHS Incident Notification

Provide within 24 hrs to the Supervising Engineer

Originators Reference No:.....

Date of Incident:..... Time:.....

Location of incident:.....

Name of Person(s) involved:.....

Employing Company:.....

Type of Incident:.....

Description of Incident:

Where, when, what, how, who, operation in progress at the time (only factual)

Immediate Action:

Immediate remedial action and actions taken to prevent reoccurrence or escalation

Signature (Name, Title, Date):.....

Contractor Representative

ANNEX 5: Project Occupational Health and Safety (OHS) Plan

1.0 INTRODUCTION

Every project poses its HSE risks. This plan was necessitated to meet up with OHS standards and to achieve the objectives set for the proposed project. The project team shall undertake to ensure high performance standards and conformity with contract requirements by managing the works in a systematic and thorough manner.

2.0 PROJECT DESCRIPTION

The project will involve the construction of Livestock water facility.

2.1 Purpose

The purpose of this document is to describe the Project Occupational Health and Safety (OHS) plan for the proposed renovation and construction and the specific management controls, risk control systems and workplace precautions required to ensure compliance with Occupational Health and Safety Laws and Standards.

2.2 HSE Objectives

The Objectives for this plan are to:

- Adopt a positive Health & Safety Culture.
- Adopt the principles of prevention to avoid risk.
- Complete the project without incident (Zero fatalities, Zero Lost Time Injury (LTI) or occupational illness).

2.3 Scope of Work

The Project Occupational Health and Safety (OHS) plan covers the scope of works defined in the contract. This includes Preconstruction, Construction and Operation & Maintenance

2.4 Policy Statement

In addition to the existing HSE policy, other policies shall be developed which includes:

- Substance Abuse Policy – Prohibiting the consumption or possession of narcotics, drugs, alcohol and other banned substances
- Emergency Response Policy – Stating commitment to ensure adequate resources and arrangement are in place in the case an emergency.
- Community Affairs Policy – Stating commitment to foster healthy relationships with communities through observance of the highest standard of conduct.

3.0 KEY RESPONSIBILITIES

Involvement of all in implementing, maintaining and continually improving OHS processes is the key to successful completion and achievement of quality objectives set by the management. All project personnel shall therefore be required to be familiar with the content of this OHS plan and shall participate in implementing, maintaining and improving the management system.

It is the responsibility of the project manager and all key personnel to ensure that the requirements for quality are fulfilled for works under their responsibility.

All staff are to be inducted into the requirements set out in this plan in general and into their function and responsibilities in particular.

3.1 Project Manager Responsibilities

4. Set good example in HSE issues.

- Ensure the availability of resources essential to establish, implement, maintain and improve the OHS Management System.
- Define, document and communicate roles, allocate responsibilities and accountabilities, delegating authorities, to facilitate effective OHS management.
- Ensure that all of the activities undertaken in the Project conform to Nigerian legislation, client requirements or international standards when applicable.
- Review objectives achievements throughout the year.

3.2 Project Supervisors Responsibilities

- Enforcing all phases of the established HSE plan.
- Set good example in HSE issues.
- Preparing Job Hazard Analysis when required.
- Ensuring the safety of all workers associated with the site.
- Conducting HSE inspections.
- Ensuring workers are competent for their allocated tasks.
- Attending and participating in HSE meetings.
- Participating in accident investigations.

3.3 HSE Manager/Supervisor Responsibilities

- Prepare relevant OHS documentation and procedures.
- Monitor the efficient implementation of OHS requirements.
- Participate and organize the OHS risk assessments.
- Advise management of compliance and of conditions requiring attention.
- Conduct regular HSE inspections.
- Make thorough analysis of statistical data and inspections; delineates problem areas; and makes recommendation for solutions.
- Take part in the review of all OHS incidents and assist in investigating incident.
- Monitor the efficient implementation of the Project's OHS requirements.
- Organize the Project's OHS risk assessment exercises.
- Check on the use of all types of personal protective equipment specifies the use of appropriate PPE for the various work activities. Evaluates their effectiveness and suggests improvements where indicated.

3.4 HSE Advisor Responsibilities

- Check on the use of all types of personal protective equipment specifies the use of appropriate PPE for the various work activities. Evaluates their effectiveness and suggests improvements.
- Conduct independent inspections to observe conformance with established OHS Plan and determines the effectiveness of individual elements of the plan (pre-task briefing, weekly toolbox talk, etc)
- Establish contact with Subcontractors with the objective of maintaining good relations and coordination of accident prevention activities and compliance with the established OHS plan.
- Correct unsafe acts and unsafe conditions.
- Deliver HSE induction/orientation course to all workers, including subcontractors.
- Deliver HSE awareness course and toolbox talk.
- Advise workers on OHS matters.

3.5 All workers Responsibilities

- Take all reasonable and practical steps to care for their own health and safety and avoid affecting the health and safety of co-workers and the general public.
- Follow all instructions and use the equipment properly
- Not interfere with any safety arrangements.
- Report any circumstances which may not comply with the project's OHS management system.

4.0 Competency

All personnel required to operate or work with any equipment or machine must be competent, be tested for each equipment that he/she shall be operating. All personnel who as part of their profession require licensing or certification must obtain the necessary certification before he/she shall be allowed to work on the site.

5.0 Fitness

All personnel working on site shall be required to be certified medically fit to do so by an approved medical facility or Medical Doctor (pre-employment medical examination)

6.0 HSE Training

6.1 Induction/Orientation

Every new or rehired employee and Subcontractors workers must undergo mandatory OHS orientation / induction. The purpose of the Induction is to educate workers and make them aware of the major potential hazards he or she shall come into contact with while working on the site; also, it is one more opportunity to stress the importance of HSE being the first priority in the operations.

The content of the HSE orientation / induction shall cover the following subjects:

- Site safety rules.
- Personnel protective equipment requirements (PPE).
- Environmental sensitivity and protection.
- Preparation and planning of the job (Daily Pre-task talk).
- Emergency plan and muster points.

6.2 Project Specific HSE Training

In addition to the HSE orientation /induction, there shall be specific site HSE trainings which shall cover the following topics:

- Manual handling.
- Electrical Safety
- Emergency Prevention, Preparedness and Response
- Work at height training
- First Aid training (for site First Aiders)
- Lifting and Rigging
- Safe Driving techniques (for drivers)

7.0 Hazard identification & HSE risk assessment

7.1 Project HSE Risk Assessment

The project HSE risk assessment shall be developed and recorded. The Project's HSE risk assessment shall be conducted by a team consisting of HSE Manager/ Supervisor and technical managers/supervisors. It must be approved by the Project manager.

7.2 Fire Risk Assessment

A fire risk assessment shall be developed and recorded. A fire safety plan shall be in place in the site.

7.3 Job Hazard Analysis

Job hazard analysis is required when the hazards and risks associated with a specific task is to be identified so as to implement control measures. The HSE department together with the technical managers/supervisors shall develop a job hazard analysis when applicable.

8.0 EMERGENCY PREPAREDNESS AND RESPONSE

Anticipated incident in the construction site could be classified as:

- Medical Emergencies/First Aid
- Fatality
- Fire
- Electrocution
- Chemical/Fuel Spill

- Security Breach

The emergency response procedure for managing anticipated incidents during the construction works is highlighted below:

8.1 Medical Emergencies/First Aid

SPIU shall have an established protocol with **Emergency Medical Services** as well as a Medical Doctor, which will include 24-hour access to assist with patient care in serious medical emergencies as presented in Section 8.0in addition to Site Nurses that are available at to provide First Aid services in the event of an Emergency. A medical emergency can arise because of a number of factors, which include:

- A person suffering a medical condition.
- A person involved in an isolated incident.
- Group of personnel receiving injuries due to a natural event.
- Group of personnel receiving injuries due to a man-made event (structural collapse, hazardous material exposure etc.)

Serious Injury

Upon the occurrence of a serious injury, the first person on the scene must immediately assess the scene and ensure there is no danger to themselves or others. Once the scene is safe, they should raise alarm, call for help and then administer first aid if qualified. Expected actions upon becoming aware of a medical emergency:

- Raise alarm and notify the site manager who will activate Medical Evacuation (MEDIVAC) process if emergency services are required.
- If safe to do so, remain at the scene until assistance arrives.
- Do not move the injured person unless there is a life-threatening situation.
- Keep the injured person warm.
- Reassure the injured person.
- Give first aid to the extent of your level of knowledge and/or training.

DRSABCD First Aid measure should be activated to save a Non-Breathing Casualty:

- **DANGER** – Check for any danger to self and others before doing anything.
- **RESPONSE** – Check for response from casualty.
- **SEND** – Send for Help.
- **AIRWAY** – Check, clear and open airway.
- **BREATHING** – look, listen and feel for normal breathing.
- **CPR** – commence compressions, 30 compressions to two breaths, 100 compressions/min.
- **DEFIBRILLATE** – apply automatic external defibrillator if available.
- **Continue CPR** until qualified personnel arrive or signs of life return.

Non-Serious Injury

Upon occurrence of non-serious injury, the first person on the scene must immediately assess the scene and ensure there is no danger to themselves or others. Once the scene is safe, first aid should be applied if qualified and contact the onsite First Aider. The Retainership Clinic (MECURE) must be contacted on the injury and the condition of the patient to determine the victim's stability.

8.2 Fatality

A fatality on site from an accident or disease is a tragedy. One of the most important things SPIUshall do is to prevent this from happening by conducting **Health Fitness Test** for all workers and to ensure safe operation at site. If a fatality does occur, SPIU will ensure that sensitive support is provided to co-workers, victim's family and friends.

Each circumstance will be different and the following shall apply as a guideline:

a. The first individual at the scene shall immediately raise alarm and remain at the scene until the Emergency Response Team (ERT) comprising the Project Manager, Site Manager, First Aider, HSE Officer and MEDIVAC team arrives.

b. The individual shall not put himself or herself at risk, but secure the scene as much as possible.

c. The Emergency Response Coordinator (Site Manager) will proceed to the scene.

d. Once a fatality has been confirmed by the MEDIVAC team, the Incident Commander (Project Manager) will issue a directive to all workers to restrain premature external communication.

e. The Incident Commander shall contact Medivac team from the Retainership Clinic, Maroko Police Station, Client and other relevant authorities.

f. If there is no further threat to the health and safety of other personnel, the area shall be cordoned off to maintain the integrity of the site for further investigation and the scene shall not be disturbed without the approval of the authorities.

g. Once the scene has been secured, it is the responsibility of the Project Manager to determine if an "All Clear "can be signalled and if work can resume.

h. Upon arrival of the authorities, SPIU Senior Management will work cooperatively to ensure that the next of kin of the victim is notified.

i. Arrangements will be made to transfer the body to the appropriate location if authorized to do so by Coroner.

j. A proper briefing communicating the circumstances of the tragedy with reassurance of safety measures on site shall be communicated by the Project Manager.

k. Grief counsellors will be brought to site to assist individuals.

8.3 Fire

Fires can occur in any location within the site, but a fire with serious consequences would be one involving the building project, fuel and chemical storage areas or tanks at the site. Evacuation procedures, emergency exit routes and muster points for the site, shall be posted throughout the

site. Fire drills shall be conducted quarterly or based on site realities at the discretion of the Site Manager.

a. In the event of a fire, individual on scene should raise the alarm and follow emergency procedures in to extinguish the fire provided there is no risk to themselves or others.
b. The nearest fire pull station should be activated to alert all those in the area to proceed to the designated Muster point.
c. Accounting for all personnel needs to be organized quickly so that any individual who may be at risk can be identified quickly and rescue efforts put forth.
d. Upon hearing the alarm, all individuals must immediately evacuate the building or work location through the closest safe exit; shouting “fire” and checking on each rooms within the building as they exit each floor, (no one should wait for a response to the knocking).
e. Individuals will not be permitted to return to the building or work location until an “All Clear” has been issued.
f. The Fire Service Rescue team who shall be call on by the Project Manager will attend the scene, depending on the degree of the fire.
g. All woks or movement on the site will stop to ensure safe and efficient management of the emergency.
h. A sweep must be conducted on all rooms and entire site by the security team to ensure complete evacuation.
i. The Site Manager shall take a head count at the Muster Station. First aid will be conducted at Mecure if required.
j. If the fire is uncontrollable and further assistance may be required, the Incident Commander may request support from the Lekki Fire Station or other agencies to avoid the spread of fire.
k. The Project Manager will initiate planning for site evacuation.

Fire Equipment

a. Fire fighting equipment shall be located in every work vehicle and in the site office(s).
b. Fire fighting equipment shall be easily accessible at all times.
c. Fire fighting equipment locations, trained fire personnel, and contact numbers shall be displayed on site notice boards.
d. Fire fighting equipment shall be tested and tagged by a competent person every six months.
e. Used fire extinguishers shall be promptly removed from service and replaced immediately with a full replacement.
f. All personnel shall b trained in the use of fire equipment.

8.4 Electrocution

In the event of an electrocution case, the first person at the scene must establish a safe area prior taking any step.

a. If the victim is still in contact with the electrical current, do not touch the person and immediately turn off the electrical power source; then raise alarm.
b. If you cannot disconnect the power source, try to separate the victim from the power source with a nonconductive object, such as a wood-handled broom.
c. Have someone call for emergency medical assistance immediately.
d. Site is to be secured to prevent injury to other persons.
e. Assess condition and stabilise person.
f. Assess worker and give necessary first aid treatment, apply basic life support if required:
g. Site Manager to ensure evacuation of victim to a medical facility.
h. Site Manager should obtain and record relevant information relating to the electric shock incident, and send it with the injured person to the medical facility.
i. Site Manager to contact the medical facility and advise them of the incident with details of incident.
j. Where the person is released from the medical facility for return to work, the Site Manager shall arrange transportation.
k. Upon arrival back at the workplace, the Project Manager will review the results of the medical assessment; then, the Site Manager shall commence an investigation.

8.5 Chemical/Fuel Spill

This plan shall be used in conjunction with the site's Spill Response Procedure in the event of a spill. Spill response drills shall be conducted quarterly or based on site realities at the discretion of the Site Manager. SPIU shall implement the following action plan in the event of a spill:

a. The Store Supervisor, Store Keeper, HSE Officer, Mechanical technicians who trained in spill response management or any first person at the scene of the spill shall identify the Spill or release.
b. The safety of workers and of others and environment shall be assessed.
c. The spill shall be stopped if safely possible.
d. Contain spill to limit entering water bodies and surrounding areas through drainage channel.
e. Quantify spill (under or over guideline/threshold levels).
f. Notify Site Manager and emergency response crew and authorities (in event of major spill).
g. Clean up spill using spill kit.
h. Record spill incident and conduct investigation Spill report form.
i. Conduct investigation in line with Section 12 (Accident / Incident Reporting & Investigation) of the project HSE Plan.

Transferring, storing, and managing spill related wastes:

Used sorbent materials are to be placed in plastic bags for future disposal. Following clean up, any tools or equipment used must be properly washed and decontaminated, or replaced if this is not possible.

Spilled substances and materials used for containment must be placed into empty waste oil containers and sealed for proper disposal at an approved disposal facility.

Restoring affected areas:

Criteria that may be considered include natural biodegradation of oil, replacement of soil and revegetation.

8.6 Security Breach

Security drills shall be conducted quarterly or based on site realities at the discretion of the Site Manager to assess the attitude and alertness of the workers.

Civil Disturbance

a. All workers are to keep clear of the disturbance and do not say or do anything that may encourage irrational behaviour.
b. The site shall be locked down to prevent unauthorised entry.
c. All workers are to follow closely the instructions of Security Supervisor and Site Manager.
d. The Site Management team shall make effort to engage those responsible for the civil unrest.
e. The police shall be called for intervention if the site management team could not convince those responsible for the civil unrest.
f. The site shall be evacuated under the guidance of the police or based on best discretionary approach decided by the site management; led by the project manager.

Attack or Armed Threat

a. All workers should keep clear of the intruder and do not say or do anything that may encourage irrational behaviour.
b. The police shall be contacted as highlighted in Section 8.0.
c. As many as possible details shall be noted and present to the police.
d. The instruction of the police through the Project Manager shall be followed closely by all workers.
e. The site shall only be evacuated under the guidance of the police or based on best discretionary approach decided by the site management; led by the project manager.

EVACUATION PROCEDURE

a. On hearing an evacuation alarm, or on instruction of emergency control personnel, immediately cease all activity.
b. Assist any person in immediate danger, but only if safe to do so.
c. If practical, and only if safe to do so, secure any activity or process that may become hazardous or suffer damage if left unattended as a consequence of evacuation.

d. Act in accordance with directions given by emergency control personnel and evacuate the site immediately.

e. Move calmly to the muster assembly area and do not leave the evacuation assembly area until the all clear has been given.

f. Follow the instructions of relevant emergency services personnel.

9.0 HSE IMPLEMENTATION AND PERFORMANCE MONITORING

9.1 HSE Meetings

HSE management meetings shall be held once a month. The meeting is to help identify safety problems, develop solutions, review incident reports, provide training and evaluate the effectiveness of our safety program. Some of the meetings shall be:

- Project/Site Management HSE Meeting for management and supervision (Monthly).
- Tool box talk meetings for all workforce (Weekly).
- Pre-task briefing for all workforces (Daily).
- Special situation meeting (As required).

9.2 HSE Reporting

All incidents and illnesses must be reported to site supervisor after which investigation shall commence and recorded so that appropriate corrective actions shall be implemented to prevent any re-occurrence and report findings shall be forwarded to management for review. Reporting requirements shall include notification of incident, investigation report, and monthly report. Notification of Incident form shall be developed which shall be filled and submitted to HSE department for investigation.

9.3 HSE Inspection and Audits

For continual improvement of HSE management system, HSE inspection and audit shall be conducted. An inspection checklist shall be developed. This is to ensure that the HSE management system is being adhered to. The inspection shall be conducted by the HSE department together with site management.

9.4 Corrective and Preventive Actions and Non Conformities

During the cause of inspections, concerns raised shall be addressed and closed out. It is expected that in a period of two weeks, a close out inspection shall take place to verify that the corrective actions have been closed.

10.0 Project HSE Rules

The project HSE rules shall be developed and supervision shall develop specific rules and procedures when necessary.

The following site rules shall be implemented at all times. The Site Manager shall draw these rules to the attention of their own workmen or staff. All sub-contractors must ensure that these rules are drawn to the attention of their workmen and staff.

The Principal Contractor may implement additional site rules during the contract programme. Any such additional rules shall be notified to all personnel engaged on the project prior to their implementation. The HSE rules shall include but not limited to:

- Personal Protective Equipment must be worn at all times.
- All instructions issued by the Site Manager regarding the storage, handling or cleaning of materials, plant and equipment must be followed.
- All vehicles must be parked in the designated areas.
- Any workman suffering from a medical condition that might affect his work and/or that could require specific medical treatment must inform the supervisor before commencing work.
- All site tools shall either be battery operated or 110 volts.
- No one shall be permitted on site if it is believed that they are under the influence of alcohol or drugs.
- Vehicles must not reverse without a banksman in attendance.
- All visitors to site must undergo a site-specific induction and operative Identity badges must be worn at all times.
- All excavations must be secured.
- Smoking and eating shall only be permitted in the designated area. This area shall be identified during induction.
- No hot works operations are permitted without a hot work permit in place.
- There shall be no radios or other music playing devices on site.
- Good housekeeping practices to be adopted**.**
- Compliance with all Ethical Power Permit to Work systems
- The site keyed access procedure must be strictly adhered to.
- All Contractors must comply with Site Health & Safety Guidelines / Site Safety Method Statement
- No untrained worker shall be permitted to operate heavy machineries.

11.0 SAFE WORK PRACTICES

Implementing safe work practices is one of the keys to achieving our HSE objectives and some of these safe work practices include:

11.1 Personal Protective Equipment (PPE)

The basic PPE required for the project shall be Safety Glasses, Safety Boots, Hand Gloves, Hard Hat and Coverall. Any other PPE shall be used as applicable. Management is responsible for the provision of PPE and usage shall be enforced at all time.

PPE shall be provided in circumstances where exposure to hazards cannot be avoided by other means or to supplement existing control measures identified by a risk assessment. An assessment shall be made to ensure that the PPE is suitable for purpose and is appropriate to the risk involved.

Information, instruction & training shall be given to all workers on safe use, maintenance and storage of PPE.

Workers shall, in accordance with instructions given, make full use of all PPE provided and maintain it in a serviceable condition and report its loss or defect immediately to the maintenance department where it shall be replaced.

PPE shall be replaced when it is no longer serviceable and returned on a new for old basis. Workers shall sign to state that they have received PPE when issued.

12.0 WELFARE FACILITIES

The provision of welfare facilities on the site shall be communicated to all operatives at site induction.

A cleaning regime shall be implemented and maintained for the duration of the construction phase to ensure the site welfare facilities remain in a clean and tidy condition.

If mains drinking water becomes unavailable during the construction phase bottled water shall be brought to site for all operatives for the necessary period.

13.0 SIGNAGE

Adequate provision for warning and directional signs shall be made.

14.0 PROJECT HSE PROCEDURES

OHS procedures shall be developed. Project activities shall generally be controlled in accordance with OHS Procedures. These procedures shall include:

1. Lifting and Rigging Procedure
2. HSE Reporting Procedure
3. Working at Height Procedure.
4. Emergency Procedure.

ANNEX 6: Company Code of Conduct Preventing Gender Based Violence and Violence Against Children

The company/contractor is committed to creating and maintaining an environment in which gender based violence (GBV) and violence against children (VAC) have no place, and where they will not be tolerated by any employee, associate, or representative of the company/contractor. Therefore, in order to ensure that all those engaged in the project are aware of this commitment, and in order to prevent, be aware of, and respond to any allegations of GBV and VAC, the company/contractor commits to the following core principles and minimum standards of behavior that will apply to all company/contractor workers, associates, and representatives including sub-contractors, without exception:

- The company/contractor —and therefore all workers, associates, and representatives—commit to treating women, children (persons under the age of 18), and men with respect regardless of race, color, language, religion, political or other opinion, national, ethnic or social origin, property, disability, birth or other status. Acts of GBV and VAC are in violation of this commitment.
- Demeaning, threatening, harassing, abusive, culturally inappropriate, or sexually provocative language and behavior are prohibited among all company/contractor workers, associates, and its representatives.
- Acts of GBV or VAC constitute gross misconduct and are therefore grounds for sanctions, which may include penalties and/or termination of employment. All forms of GBV and VAC, including grooming are unacceptable, regardless of whether they take place on the work site, the work site surroundings, at worker's camps or at worker's homes.
- In addition to company/contractor sanctions, legal prosecution of those who commit acts of GBV or VAC will be pursued if appropriate.
- Sexual contact or activity with children under 18—including through digital media—is prohibited. Mistaken belief regarding the age of a child is not a defense. Consent from the child is also not a defense or excuse.
- Sexual favors—for instance, making promises or favorable treatment dependent on sexual acts—or other forms of humiliating, degrading or exploitative behavior are prohibited.
- Unless there is full consent[1] by all parties involved in the sexual act, sexual interactions between the company/contractor workers (at any level) and members of the communities surrounding the work place are prohibited. This includes relationships involving the withholding/promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex—such sexual activity is considered "non-consensual" within the scope of this Code.
- All workers, including volunteers and sub-contractors are highly encouraged to report suspected or actual acts of GBV and/or VAC by a fellow worker, whether in the same company or not. Reports must be made in accordance with GBV and VAC Allegation Procedures.
- Managers are required to report suspected or actual acts of GBV and/or VAC as they have a responsibility to uphold company commitments and hold their direct reports responsible.

To ensure that the above principles are implemented effectively the company/contractor commits to ensuring that:

[1] **Consent** is defined as the informed choice underlying an individual's free and voluntary intention, acceptance or agreement to do something. No consent can be found when such acceptance or agreement is obtained through the use of threats, force or other forms of coercion, abduction, fraud, deception, or misrepresentation. In accordance with the United Nations Convention on the Rights of the Child, the World Bank considers that consent cannot be given by children under the age of 18, even in the event that national legislation of the country into which the Code of Conduct is introduced has a lower age. Mistaken belief regarding the age of the child and consent from the child is not a defense.

- All managers sign the 'Manager's Code of Conduct' detailing their responsibilities for implementing the company/contractor commitments and enforcing the responsibilities in the 'Individual Code of Conduct'.
- All workers sign the project's 'Individual Code of Conduct' confirming their agreement not to engage in activities resulting in GBV or VAC.
- Displaying the company/contractor and Individual Codes of Conduct prominently and in clear view at workers' camps, offices, and in in public areas of the work space. Examples of areas include waiting, rest and lobby areas of sites, canteen areas, health clinics.
- Ensure that posted and distributed copies of the company/contractor and Individual Codes of Conduct are translated into the appropriate language of use in the work site areas as well as for any international staff in their native language.
- An appropriate person is nominated as the company/contractor 'Focal Point' for addressing GBV and VAC issues, including representing the company/contractor on the GBV and VAC Compliance Team (GCCT) which is comprised of representatives from the client, contractor(s), the supervision consultant, and local service provider(s).
- Ensuring that an effective Action Plan is developed in consultation with the GCCT which includes as a minimum:
  a. **GBV and VAC Allegation Procedure** to report GBV and VAC issues through the project Grievance Redress Mechanism (GRM);
  b. **Accountability Measures** to protect confidentiality of all involved; and,
  c. **Response Protocol** applicable to GBV and VAC survivors and perpetrators.

1. That the company effectively implements the Action Plan, providing feedback to the GCCT for improvements and updates as appropriate.
2. All workers attend an induction training course prior to commencing work on site to ensure they are familiar with the company/contractor commitments and the project's GBV and VAC Codes of Conduct.
3. All workers attend a mandatory training course once a month for the duration of the contract starting from the first induction training prior to commencement of work to reinforce the understanding of the project's GBV and VAC Code of Conduct.

I do hereby acknowledge that I have read the foregoing company/contractor *Code of Conduct, and on behalf of the* company/contractor *agree to comply with the standards contained therein. I understand my role and responsibilities to prevent and respond to GBV and VAC. I understand that any action inconsistent with this* company/contractor *Code of Conduct or failure to take action mandated by this* company/contractor *Code of Conduct may result in disciplinary action.*

Company name: _____

Signature: _____

Printed Name: _____

Title: _____

Date: _____

ANNEX 7: Manager's Code of Conduct on Preventing Gender Based Violence and Violence against Children

Managers at all levels have particular responsibilities to uphold the company/contractor commitment to preventing and addressing GBV and VAC. This means that managers have an acute responsibility to create and maintain an environment that prevents GBV and VAC. Managers need to support and promote the implementation of the Company Code of Conduct. To that end, managers must adhere to this Manager's Code of Conduct and also sign the Individual Code of Conduct. This commits them to supporting and developing systems that facilitate the implementation of the Action Plan and maintain a GBV-free and VAC-free environment at the workplace and in the local community. These responsibilities include but are not limited to:

Implementation

- To ensure maximum effectiveness of the company/contractor and Individual Codes of Conduct:
  a. Prominently displaying the company/contractor and Individual Codes of Conduct in clear view at workers' camps, offices, and in in public areas of the work space. Examples of areas include waiting, rest and lobby areas of sites, canteen areas, health clinics.
  b. Ensuring all posted and distributed copies of the company and Individual Codes of Conduct are translated into the appropriate language of use in the work site areas as well as for any international staff in their native language.
- Verbally and in writing explain the company and Individual Codes of Conduct to all staff.
- Ensure that:
  a. All direct reports sign the 'Individual Code of Conduct', including acknowledgment that they have read and agree with the Code of Conduct.
  b. Staff lists and signed copies of the Individual Code of Conduct are provided to the GCCT and the client.
  c. Participate in training and ensure that staffs also participate as outlined below.
  d. Staffs are familiar with the Grievance Redress Mechanism (GRM) and that they can use it to anonymously report concerns of GBV or VAC incidents.
  e. Staffs are encouraged to report suspected or actual GBV or VAC through the GRM by raising awareness about GBV and VAC issues, emphasizing the staff's responsibility to

the company/contractor and the country hosting their employment, and emphasizing the respect for confidentiality.

- In compliance with applicable laws and to the best of your abilities, prevent perpetrators of sexual exploitation and abuse from being hired, re-hired or deployed. Use background and criminal reference checks for all workers.
- Ensure that when engaging in partnership, sub-contractor or similar agreements, these agreements:
  - Incorporate the GBV and VAC Codes of Conduct as an attachment.
  - Include the appropriate language requiring such contracting entities and individuals, and their workers and volunteers, to comply with the Individual Codes of Conduct.
  - expressly state that the failure of those entities or individuals, as appropriate, to take preventive measures against GBV and VAC, to investigate allegations thereof, or to take corrective actions when GBV or VAC has occurred, shall constitute grounds for sanctions and penalties in accordance with the Individual Codes of Conduct.
- Provide support and resources to the GCCT to create and disseminate internal sensitization initiatives through the awareness-raising strategy under the Action Plan.
- Ensure that any GBV or VAC issue warranting police action is reported to the client and the World Bank immediately.

Training

- All managers are required to attend an induction manager training course prior to commencing work on site to ensure that they are familiar with their roles and responsibilities in upholding the GBV and VAC Codes of Conduct. This training will be separate from the induction training course required of all workers and will provide managers with the necessary understanding and technical support needed to begin to develop the Action Plan for addressing GBV and VAC issues.
- Ensure that time is provided during work hours and that staff attend the mandatory project facilitated induction training on GBV and VAC required of all workers prior to commencing work on site.
- Ensure that staff attend the monthly mandatory refresher training course required of all workers to combat increased risk of GBV and VAC during civil works.
- Managers are required to attend and assist with the project facilitated monthly training courses for all workers. Managers will be required to introduce the trainings and announce the self-evaluations.
- Collect satisfaction surveys to evaluate training experiences and provide advice on improving the effectiveness of training.

Response

l. Managers will be required to provide input to the GBV and VAC Allegation Procedures and Response Protocol developed by the GCCT as part of the final cleared Action Plan.

m. Once adopted by the company/contractor, managers will uphold the Accountability Measures set forth in the Action Plan to maintain the confidentiality of all workers who report or (allegedly) perpetrate incidences of GBV and VAC (unless a breach of confidentiality is required to protect persons or property from serious harm or where required by law).

n. If a manager develops concerns or suspicions regarding any form of GBV or VAC by one of his/her direct reports, or by an employee working for another contractor on the same work site, s/he is required to report the case using the GRM.

o. Once a sanction has been determined, the relevant manager(s) is/are expected to be personally responsible for ensuring that the measure is effectively enforced, within a maximum timeframe of 14-days from the date on which the decision to sanction was made.

p. Managers failing to report or comply with such provision can in turn be subject to disciplinary measures, to be determined and enacted by the company's CEO, Managing Director or equivalent highest-ranking manager. Those measures may include:

a. Informal warning.

b. Formal warning.

c. Additional Training.

d. Loss of up to one week's salary.

e. Suspension of employment (without payment of salary), for a minimum period of 1 month up to a maximum of 6 months.

f. Termination of employment.

q. Ultimately, failure to effectively respond to GBV and VAC cases on the work site by the company/contractor managers or CEO may provide grounds for legal actions by authorities.

I do hereby acknowledge that I have read the foregoing Manager's Code of Conduct, do agree to comply with the standards contained therein and understand my roles and responsibilities to prevent and respond to GBV and VAC. I understand that any action inconsistent with this Manager's Code of Conduct or failure to take action mandated by this Manager's Code of Conduct may result in disciplinary action.

Signature: _____

Printed Name: _____

Title: _____

Date: _____

ANNEX 8: Individual Code of Conduct Preventing Gender Based Violence and Violence against Children

I, _____, acknowledge that preventing gender based violence (GBV) and violence against children (VAC) is important. The company/contractor considers that GBV or VAC activities constitute acts of gross misconduct and are therefore grounds for sanctions, penalties or potential termination of employment. All forms of GBV or VAC are unacceptable, be it on the work site, the work site surroundings, or at worker's camps. Prosecution of those who commit GBV or VAC may be pursued if appropriate.

I agree that while working on the project I will:

- Consent to police background check.
- Treat women, children (persons under the age of 18), and men with respect regardless of race, color, language, religion, political or other opinion, national, ethnic or social origin, property, disability, birth or other status.
- Not use language or behavior towards women, children or men that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate.
- Not participate in sexual contact or activity with children—including grooming, or contact through digital media. Mistaken belief regarding the age of a child is not a defence. Consent from the child is also not a defence or excuse.
- Not engage in sexual favors—for instance, making promises or favorable treatment dependent on sexual acts—or other forms of humiliating, degrading or exploitative behavior.
- Unless there is the full consent[2] by all parties involved, I will not have sexual interactions with members of the surrounding communities. This includes relationships involving the withholding or promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex—such sexual activity is considered "non-consensual" within the scope of this Code.
- Attend and actively partake in training courses related to HIV/AIDS, GBV and VAC as requested by my employer.
- Consider reporting through the GRM or to my manager any suspected or actual GBV or VAC by a fellow worker, whether employed by my company or not, or any breaches of this Code of Conduct.

With regard to children under the age of 18:

[2] **Consent** is defined as the informed choice underlying an individual's free and voluntary intention, acceptance or agreement to do something. No consent can be found when such acceptance or agreement is obtained through the use of threats, force or other forms of coercion, abduction, fraud, deception, or misrepresentation. In accordance with the United Nations Convention on the Rights of the Child, the World Bank considers that consent cannot be given by children under the age of 18, even in the event that national legislation of the country into which the Code of Conduct is introduced has a lower age. Mistaken belief regarding the age of the child and consent from the child is not a defense.

- Wherever possible, ensure that another adult is present when working in the proximity of children.
- Not invite unaccompanied children unrelated to my family into my home, unless they are at immediate risk of injury or in physical danger.
- Not sleep close to unsupervised children unless absolutely necessary, in which case I must obtain my supervisor's permission, and ensure that another adult is present if possible.
- Use any computers, mobile phones, or video and digital cameras appropriately, and never to exploit or harass children or to access child pornography through any medium (see also "Use of children's images for work related purposes" below).
- Refrain from physical punishment or discipline of children.
- Refrain from hiring children for domestic or other labor which is inappropriate given their age or developmental stage, which interferes with their time available for education and recreational activities, or which places them at significant risk of injury.
- Comply with all relevant local legislation, including labor laws in relation to child labor.

Use of children's images for work related purposes

When photographing or filming a child for work related purposes, I must:

- Before photographing or filming a child, assess and endeavor to comply with local traditions or restrictions for reproducing personal images.
- Before photographing or filming a child, obtain informed consent from the child and a parent or guardian of the child. As part of this I must explain how the photograph or film will be used.
- Ensure photographs, films, videos and DVDs present children in a dignified and respectful manner and not in a vulnerable or submissive manner. Children should be adequately clothed and not in poses that could be seen as sexually suggestive.
- Ensure images are honest representations of the context and the facts.
- Ensure file labels do not reveal identifying information about a child when sending images electronically.

Sanctions

I understand that if I breach this Individual Code of Conduct, my employer will take disciplinary action which could include:

- Informal warning.
- Formal warning.
- Additional Training.
- Loss of up to one week's salary.
- Suspension of employment (without payment of salary), for a minimum period of 1 month up to a maximum of 6 months.

- Termination of employment.
- Report to the police if warranted.

I understand that it is my responsibility to avoid actions or behaviors that could be construed as GBV or VAC or breach this Individual Code of Conduct. I do hereby acknowledge that I have read the foregoing Individual Code of Conduct, do agree to comply with the standards contained therein and understand my roles and responsibilities to prevent and respond to GBV and VAC. I understand that any action inconsistent with this Individual Code of Conduct or failure to take action mandated by this Individual Code of Conduct may result in disciplinary action and may affect my ongoing employment.

Signature: _____

Printed Name: _____

Title: _____

Date: _____

ANNEX 9: Waste Management Plan

1.0 INTRODUCTION

The following Waste Management Plan (WMP) presents a framework outlining the general requirements essential for effective management of waste generated onsite during the construction of the project construction . The WMP outlines measures required to manage and mitigate the impact of waste generation and resource consumption during the construction works of the hospital building. The plan includes details on the following:

- The types waste generated during construction activities;
- Procedures to collect and dispose of waste;
- Measures that will be implemented to minimize waste generation associated with the development; and program for monitoring the effectiveness of these measures.

This Plan also considers other aspects to waste management such as waste reduction, segregation of waste, disposal of waste.

2.0 ROLES AND RESPONSIBILITIES

The relevant roles and responsibilities to this plan are as outlined:

Project Manager

- Coordinate the implementation of this Construction Waste Management Plan.
- Coordinate site team to ensure site inspections and audits are conducted.
- Ensure environmental inspections are undertaken and records are kept.
- Coordinate the implementation of corrective and preventative action and incident response.
- Activate resources to ensure technical advice regarding environmental obligations, measures and protection is available.

Site Manager

- Ensure adequate waste management infrastructure, equipment (bins and trucks) and services are provided as required.
- Ensure that any incidents or observations that may occur during waste storage and/or handling events are properly managed.
- Implement approved waste management and minimization strategies as highlighted in this plan.
- Ensure that this plan is implemented and conduct Monthly Audit in coordination with the HSE Officer.
- Shall maintain the record of audits and trainings conducted.

HSE Officer

- Ensure that appointed waste transport vendor completes waste certificates prior to transporting.
- Ensure all waste bins are correctly labelled and stored in the appropriate designated area.
- Verify that all personnel, including contractors have received the appropriate training in waste management practices and keep records of training as per Section 5 of this plan.
- Ensure Waste Inspections are being carried out on a weekly basis and Waste Inventories are being maintained.

All Personnel

- Implement the requirements of this Waste Management Plan in all aspects of the construction works.
- Ensure that the site is kept tidy, free from litter and that waste is put in the correct bins.
- Ensure that all incidents and observations relevant to waste are reported to Project Manager.

3.0 AWARENESS AND TRAINING

The Project will implement an awareness and training program that will be delivered to all construction workers. This training will include, but not be limited to:

- The application of the waste management hierarchy;
- Common waste streams produced in the construction site. ;

- Dangerous materials segregation and hazard classification codes;
- Efficient waste segregation;
- Spill Response; and
- Community impacts of poor waste management.

4.0 WASTE MANAGEMENT REQUIREMENTS

4.1 Waste Elimination and Minimization

The Project shall meet or exceed the requirements of this plan by implementing and maintaining a waste minimization strategy, as a minimum standard. The waste minimization strategy shall eliminate, minimize and manage waste during the construction activities through the following:

- Identification of waste streams and quantities;
- Implementation of management strategies for each waste stream;
- Defined roles and responsibilities;
- Training and awareness;
- Monitoring of waste streams and management activities;
- Encouraging sustainable waste management practices in the supply chain;
- Minimizing wastes from excess materials including but not limited to using surplus materials prior to re-ordering and reducing packaging waste;

4.2 Types of Waste, Classification and Handling Method

Construction site waste can be categorized as general (non-hazardous) or regulated (hazardous) waste. Regulated wastes are hazardous waste such as waste containing asbestos, oil or chemicals substances. All other waste streams are considered general waste, unless contaminated with a regulated waste.

In the event that an unknown material is discovered (e.g. liquid in a drum), it will be the responsibility of the site HSE Officer to identify the waste in coordination with the Site Manager and Store Supervisor. The person accountable in the event that the waste is not identified correctly and disposed of in the appropriate manner is the Site Manager.

Table 1 presents the waste types, classification and proposed handling methods to be implemented during the construction works.

Table 4.0.1: Types of Wastes, Classification and Handling Method

Waste Type	Classification	Handling Method
Aluminum cans	General	Recycling
Batteries (cadmium andnickel/cadmium (NiCad), leadacid, lithium and other)	Regulated	Recycling

Paper	General	Recycling
Cardboard	General	Recycling
Printer cartridges	Regulated	Recycling
Plastics – bottles, drums and othercontainers	General (drums, depends on contaminant)	Recycle
General municipal waste	General	Treatment/Landfill
Organic waste	General	Recycle
Concrete	General	Recycle
Spent chemicals, Solvent, Paint	Regulated	Recycle
Oily waste	Regulated	Recycle
Scrap Metal (steel, aluminium, brass, copper, lead, other nonferrous metal, stainless steel and zinc)	General	Recycle
Used Filters – Oily filters	Regulated	Recycle
Septic/Effluent	Regulated	Regulated Site
Contaminated Soil	Not a waste	Treated*
High density polyethylene (HDPE) waste	General	Recycle
Rubber	Regulated	Recycle
Tyres	Regulated	Recycle
Textiles and rags	General (unless contaminated with a regulated waste)	Reuse/ Recycle
Other solid regulated waste	Regulated	Regulated Landfill
Concrete –solid form left over	General	Recycled
Spent spill Clean Up	Regulated	Regulated Landfill

Note: General – Non Hazardous Wasted, Regulated – Hazardous Waste

5.0 WASTE STORAGE REQUIREMENTS

5.1 General Waste

The following must be considered as minimum requirement for general waste storage areas:

1. General waste bins and containers (e.g. food scrap bins, recyclable bins, recyclable paper bins)
   are to be placed in easily accessible locations around the worksite. Recyclable waste shall be stored separately from general waste; ensuring maximized segregation potential has been met to minimize waste sent to landfill.
2. Liquid and solid wastes shall be segregated to allow for maximized recycling, bins will be colour
   coded for the waste stream, where practicable.
3. Where a waste material or product does not have a specific bin, the bin used must be compatible
   with the waste and must then be labelled.
4. Spare bins shall be made available to accommodate for unforseeable events.
5. Waste bins shall be maintained in good condition to prevent leaks or spills. Defective containers hall not be used for waste storage or transport.
6. Containers used for waste storage (such as waste oil drums) shall not be opened, handled, transported or stored in a manner that may rupture the container, cause it to leak or subject it to overpressure.
7. The waste storage area shall be of an adequate capacity to handle the volume of waste stored
   there without a risk to the environment.
8. The waste storage area shall be located in an easily accessible area to provide vehicle access to
   materials and waste storage areas for the collection and transport of wastes.
9. Waste storage areas shall have adequate firefighting equipment suitable for the type of waste
   stored at site.
10. The location of the waste storage area shall also consider the proximity to neighbors and environmentally sensitive areas to minimize impacts on people and the surrounding environment (e.g. impacts due to dust, windblown rubbish, pests, odour, visual amenity, noise and light).
11. Suitably sized spill kits and spill containment systems relevant to the activities within the site shall be available in the vicinity of the waste storage areas. Maintenance of spill kits shall be kept
    up to date, ensuring that no equipment is missing from the kit. Spills shall not be cleaned by hosing
    or activities resulting in the further spread of the contaminant to land or water.
12. All waste storage bins shall have secure lids and if required, clasps.

Official Use Only

13. All waste containers shall be appropriately identified and clearly labelled.
14. All lids and if applicable clasps shall be maintained on waste storage bins to ensure that the
    waste does not cause an odour nuisance.
15. Lids on general waste bins containing food scraps shall be suitable to prevent access by birds.
16. Maximum retention times for wastes that may produce odours shall not exceed 7 days.
17. Waste shall not be burned.

5.2 Regulated (Hazardous) Waste

Regulated wastes shall be stored in the designated waste storage area. The area shall be clearly marked and records of the waste streams stored at site shall be held by the Site Manager. An assessment of the regulated waste storage area shall be undertaken by the HSE Officer on a regular basis to ensure that incompatible wastes are segregated.

To assist in the collection and transfer of regulated wastes, designated regulated waste bins, drums and skips shall be used where applicable. The following measures shall be implemented:

1. There will be dedicated regulated waste storage areas, to prevent the mixing of regulated wastes with other stored material.
2. An inventory will be kept and maintained of all regulated waste stored.
3. Loading and unloading procedures shall be undertaken in a manner that ensures wastes will not spill or containers break.
4. Containers storing regulated wastes shall be securely closed where practical.
5. Waste storage areas shall be clearly signed designating what wastes are to be deposited at storage location and any specific directions/hazards.
6. All containers shall be labelled at all times for clear interpretation of the contents.
7. There will be adequate containment measures to prevent off-site migration of spills.
8. Sufficient and appropriate clean-up equipment (spill kit) shall be provided together with appropriate instructions and training.
9. Spills shall not be cleaned by hosing or activities resulting in the further spread of the contaminant to land or water through the drainage channel.
10. No liquid wastes, wash down waters or storm water waste contaminated with hazardous waste will be disposed of via the storm water drainage system.
11. As soon as practicable, all regulated waste shall be removed to an approved waste disposal facility or recycling facility.
12. Waste shall not be burned or allowed to burn.

6.0 WASTE LABELLING

All wastes shall be labelled in accordance with examples provided in line with the following guidelines:

- Ensure that there are no other labels on the waste container except a label that refers to the current contents of the specific storage vessel or container.
- Containers shall be labelled as soon as the waste is added.
- Labels shall not be placed on a waste storage vessel or container prior to the addition of the waste as any spills may destroy such labels.
- Labels shall be of a reasonable size and clarity so that the waste material is easily identified.
- Labels shall be placed on the side of the containers; however in the event a label cannot be placed on the side it shall be placed on the top of the container.
- Label shall be positioned such that it can be easily read.
- Do not cover the manufacturer‘s product label (should the original drum be used) with waste labels.

7.0 WASTE DISPOSAL

All waste generated on site shall be disposed of in accordance with the S.I.15 National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations 1999. Waste management options shall be done in accordance with the waste hierarchy. All other disposal options shall be considered first before sending waste to landfill and all opportunities to reduce waste volumes generated shall be explored.

10.1 Surplus Materials Identification, Classification and Declaration

- **Identification**

The Site Manager in coordination with Store Supervisor shall identify materials that are surplus on an ongoing basis during the construction works to avoid unnecessary purchase that may lead to waste generation.

- **Classification**

Surplus Materials shall be classified by the Project as:

a. **Obsolete:** Where a design change has rendered materials no longer required for incorporation into the construction works.

b. **Damaged:** Where rectification of the damaged Material is not cost effective.

c. **Scrap and waste materials:** Scrap are waste Materials that have no intended Project use which include but are not limited to:

- Off cuts of pipe;
- Off cuts of cable;
- General recyclable waste (copper, steel, aluminium, timber, concrete);
- Consumables; and
- Excess tools and consumable Materials used in the construction phase.

8.0 WASTE TRANSPORT AND DISPOSAL

Waste shall be segregated accordingly until collection and off site processing or disposal occurs. All waste volumes shall be transported by a LAWMA licensed contractor and must be recorded on the Site Waste Report Register.

The following procedure shall be followed when waste collection occurs:

- The waste collector must complete a Waste Consignment note by ensuring that:

a. The register has been filled out correctly.

b. The type of waste is identified in detail.

c. The area where the waste is to be collected from is identified.

d. Amount of waste to be transported is identified.

e. Site contact for the collection of the waste is noted.

f. Handling requirements of waste have been identified from the MSDS where applicable or another relevant reference.

g. A contact for the waste destination has been identified and notified, where required.

- During the loading of waste, spill kits and firefighting equipment must be made available as applicable.
- If at any time during the load out and transporting event, it is considered unsafe to proceed or there is an increased potential that a waste material may be released to the environment, the activity shall cease, the Site Manager must be informed of the event and an assessment of the situation must be undertaken.
- All reasonable and practical measures shall be taken to ensure that wastes are adequately secured prior to the waste being transported.
- The appointed waste vendor shall ensure that vehicles and equipment used for the transfer and transportation of wastes are not overloaded or loaded in a manner which could lead to a loss of containment during transportation. This shall be stated as a contract requirement.
- The handling and management of wastes during transport shall be closely monitored to ensure there is no risk of a release to the environment.

9.0 INSPECTION CHECKLIST AND INVENTORY MANAGEMENT

Weekly visual inspections shall be performed. Evidence of inspection shall be retained and provided as may be required. The inspection checklist and inventory to be applied shall include but not be limited to:

- Labeling
- Bin condition
- House keeping
- Waste Segregation
- Availability of Spill kits
- Materials and Waste Inventory

ANNEX 10: Traffic Management Plan (TMP)

1.0 INTRODUCTION

This Construction Traffic Management Plan (CTMP) has been prepared for the construction of project facilities, to ensure application of good environmental practice, according to World Bank Performance Standard which mandates the need for compliance monitoring and reporting of environmental and social impact mitigation of the development projects which are categorized as causing environmental and social impacts, through institutionalizing a set of procedures and organizational structures.

During the construction phase of the Project, construction/building materials, Infrastructure, including support structures and machinery will be transported to and from the site using road transport. The purpose of the Traffic Management Plan (TMP) is to minimize the potential traffic related incidents on the project site, as well as impact of project related traffic on other road users and people living along transport routes.

The objectives of the CTMP are to:

- Provide a framework description and plan of the traffic and transport management elements involved with the construction project;
- Ensure the health and safety of workers, the public and those who may be impacted by the work;
- Ensure that road users are not inconvenienced and that site operations are kept at a satisfactory level of performance;
- Serve as key management and mitigation measures implementation framework.

2.0 ROLES AND RESPONSIBILITIES

Project Manager

- Provide adequate resources for the implementation of this management plan.

Interface for construction traffic matters between government authorities, private industry, subcontractors, community groups and the wider community.

Site Manager

- Ensure implementation of this management plan.
- Report information relating to construction traffic management to the site management.
- Coordinate reviews of this management plan.
- Provide oversight for Inspections in the project.

Banksman

- Clearly direct vehicles and mobile plant at all times ensuring they are kept separate.

- Minimise the amount of reversing where possible and be aware of the dangers caused when reversing cannot be avoided.
- Use practical techniques and agreed system of signalling and hand signals to assist drivers and operatives in all manoeuvres.
- Be visible to drivers at all times whilst directing vehicles and plant.
- Stand in a safe position, from which to guide all vehicles without being on the line of fire.
- Keep traffic areas free of pedestrians.
- Be fully compliant with PPE requirements of the site to ease sighting by drivers and operators.
- Report any near miss incidents involving vehicle movements with the site.

Driver

- Adhere to posted speed limits and road signs.
- Use of the horn only as a warning device.
- Ensure all vehicles to be wholly contained on site before being required to stop
- Ensure all loads are to be covered when coming to or leaving the site.
- Ensure all vehicles are to loaded and unloaded within site
- Allow enough room between vehicles.
- Respect and be watchful for pedestrians and other drivers on the dedicated transport routes,
- Follow instructions given by Police, Road and Traffic Authority (RTA), other authorities and Banksman.

All personnel (Workers, subcontractors & third-party suppliers) Comply with all requirements of this management plan.

3.0 SITE OPERATIONS

3.1 **Reversing of Vehicles**

Considering the space constraint within the work area, one-way road and turning circles systems cannot be implemented, hence reversing of vehicles cannot be avoided. The following measures shall be implemented to avoid incidents associated with vehicle reversing: using mirrors and reversing warning alarms; ensuring a signal person (banksman) wearing high visibility clothing assists the driver who cannot see clearly behind their vehicle – the driver should always be able to see the signaler; ensuring workers and other people are familiar with reversing areas and these areas are clearly marked, and ensuring plant operators are aware of workers who may be in the

vicinity of the swing radius, articulation points and overhead load movement of their vehicle Signs, warning devices and visibility

3.2 Signage **and Pedestrian Control**

Signs shall be used to alert workers and pedestrians to potential hazards from vehicles entering and exiting the construction workplace. Pedestrian exclusion zones shall be clearly marked and barricaded. Pedestrian access shall be through the gatehouse to ensure controlled access to the worksite.

Traffic routes shall be clearly signed to indicate restricted parking, visitor parking, headroom, speed limits, vehicle movement, key site areas and other route hazards within the site and local routes while drivers will be advised to follow signs and traffic rules on the highway. Standard road signs shall be used where possible and speed limits shall be implemented and enforced.

3.3 Deliveries **and Collections**

Deliveries and collections would in general be restricted to between 09:30am and 4:30pm; this is to ensure that during peak times construction traffic will be restricted from causing obstructions to the highway. Vehicle speed limit shall not exceed 30 kmph within the adjoining construction site traffic.

3.4 Vehicle **Wheel Washing**

Due to the existing state of the site, there is no expected impact of site mud/detritus originating from the construction site on the public highway. In consideration of this, wheel washing shall not be carried out.

3.5 **Vehicle Coordination**

The site manager in conjunction with security supervisor and storekeeper shall have overall responsibility for the management of Construction deliveries and will advise what times supplies are expected to arrive on site. Specific “NO DELIVERY” times are expected to be adhered to strictly. In order to prevent a build up of traffic on the public highway staggering of delivery times will be implemented.

1. The Site Manager shall have overall responsibility and will be the person supervising and monitoring vehicle movements to/from the site.
2. During busy delivery, periods when a large number of construction traffic could be expected the delivery suppliers will be asked to contact the Site Manager 20 – 30minutes prior to the agreed delivery time to ascertain the set down area is clear.

4.0 TRAFFIC IMPACT AND TRANSPORT MANAGEMENT MITIGATION

4.1 **Hours of Work and Noise**

In order to minimize the impact of noise generated by the operational activities at the worksite, all work including building/demolition and excavation work, and activities in the vicinity of the site generating noise (e.g. loading and unloading of goods, transferring of tools etc.) shall only be carried out between the hours of 7.30am and 5.30pm on Mondays to Fridays. While on Saturdays, works shall be carried out between 7.30am and 3.30pm, with daily safety inspections conducted by 7.00am. No work shall be carried out on Sundays or public holidays.

4.2 **Parking of Vehicle and Storing of Materials on Public Road**

It is not envisaged to store any equipment or Materials on the public road. All equipment and materials will be stored within the site boundary.

4.3 **Protection of Pedestrians**

Signage, fencing, overhead protection, safety barriers and line marking details, as required, will be provided and maintained on-site at all times. Signage to identify the Construction site shall be erected at the main entrance of the site to ensure vulnerable pedestrians are made aware of the site traffic using this entrance/exit.

Signage details, the control of pedestrians near the site, and the control of trucks to and from the site will be the responsibility of the Banksman.

4.4 **Public Highway License**

The use of the public highway for Construction activity or storage of materials is not intended in the project, therefore application for licenses is not required.

4.5 **Traffic Diversions**

Traffic diversion will not be required during the construction period as haulages is expected to align with regular traffic.

4.6 **Spoil Removal**

Spoil removal will be carried out throughout the construction period. At no time, will skips or temporary structures be required to be stored on the adjoining roads. All methods of spoil removal will be carried out within the site boundary and waste removed by vehicle as per the above traffic routes.

4.7 **Risk Identification**

Table 1 present the Project Traffic Management Risk Register.

Table **1**: Project Traffic Management Risk Register

Hazard	**Risk**	**Risk Ranking**	**Control Measures - to be implemented by site manager and site team**
Contact Injuries	Site vehicles and pedestrians not properly segregated	H	Signs to be set up to clearly indicate safe routes. Banksman to attend. If children are playing next to the site - any loading or unloading must stop until they are moved to a safe distance away.
	Hit by site vehicles	H	All operatives to wear high-visibility jackets if they work near where vehicles are operating. Signs to be set up directing traffic and pedestrians. If vehicle has to reverse, use a banksman.
Deliveries	Vehicles block highway or other pedestrian routes	H	Agree delivery schedule with suppliers - make sure that vehicles can load and unload safely.
Driving Vehicles	Drivers not competent	M	Make sure that all drivers are competent and able to drive their vehicles - get certificates and keep a copy for reference.
Speeding	Speeding causing accidents	M	Skip loader to be restricted to 5 km/h – zero tolerance to speeding.
Vehicle malfunction	Excessive noise, possible contact injury	M	All vehicles to be maintained in accordance with manufactures requirements – skip loader to be regularly inspected.
Handling materials	Operative injury	M	Detailed handling assessments required for any loads over 25kg that must be lifted by hand.
Noise	Nuisance to others nearby	M	May need to consider installation of acoustic sheets when loading into skip loader if noise levels too high.
Dust	Nuisance to others	M	Skips to be covered to prevent spillage.

	nearby		
Waste	Spillage into public roads and pathways	M	Site team to keep road and paths clean at all times.
Emergency vehicles	Unable to access required area	M	No fire escapes to be blocked. Site access to be kept clear at all times.
Emergency response	Unable to contact contractors	M	Contact phone numbers to be displayed on site hoarding.
First aid injuries	Operative minor injury	M	Site manager and HSE Officer to be trained first aider.
Oil/Fuel	Spillage	M	Site manager to keep spill kit available.
Pollution to controlled waters	Harm to environment	M	Site manager to ensure local drains are protected against potential spillage of concrete or other detritus materials.
Damage to local roads	During offload of machine	M	Temporary protection blocks or mats to be placed during machine operations.

Note: H – High, M – Medium

5.0 MEASUREMENT, EVALUATION AND IMPROVEMENT

5.1 **Monitoring**

The HSE Officer and Security Supervisor under the guidance of the Site Manager shall be responsible for ensuring this (CTMP) is monitored and updated based on changes within the construction area and worksite area. Any divergence from the plan shall be amended and the plan re-issued to the Project Team.

Table 2: Monitoring Programme

Parameter	Monitoring Required	Frequency	Criteria/Performance Measure/Trigger	Response
Onsite Truck routes	Spot Monitoring	Weekly	Onsite blockages or disturbance.	Follow up with driver. Review of procedures.
Traffic Flow	Congestion	As Required	Complaints Detection	Respond according to result.
Driver Management	Spot Monitoring	Ongoing on a case by case basis.	Complaints Detection	Review of procedures and operations. Follow up with driver.

5.2 Incidents

Traffic incidents to be reported shall include:

1. HSE Hazards;
2. Near misses;
3. Injury, illness or disease;
4. Environmental incidents;
5. Equipment damage or loss;
6. Community complaints, issues or concerns;
7. Impact to corporate image or reputation; and
8. Non-compliance issues.
9. The following information shall be collated as part of incident reporting:
10. Time, date, location and name of person who identified the incident;
11. Description of the incident and investigation;
12. How and why the incident occurred;
13. What were the actual and potential impacts;
14. Corrective actions to reduce recurrence and risk.

5.3 Domestic and Commercial Waste Collections

It shall be the responsibility of the Site Manager to ensure the times of Construction deliveries do not interfere with any domestic and commercial waste collections services. Times shall be sought from the local authority and suppliers advised to avoid large deliveries within these periods, where practical.

5.4 Complaints Management

Traffic related complaints shall be managed in line with the project Grievance Management Plan.

The Project Manager shall deal with any complaints from the local who shall be informed of any complaints. All complaints received shall be recorded and lodged in the complaint register. Information recorded shall include the following:

1. date and time the complaint was logged;
2. personal details provided by the complainant;
3. nature of the complaint;
4. action taken regarding the complaint, or if no action was taken, the reason why; and
5. follow-up contact with the complainant.

5.5 Performance Measurement

The implementation of this CTMP will be guided by the performance measures in Table 3.

Table 3: Performance Measures

Objective	**Performance Indicator**	**Target**
Minimize traffic impacts during construction of surface infrastructure and new access road	Number of traffic complaints received regarding the construction activities	Zero
	Mitigation measures implemented	All mitigation measures in place
Traffic impacts not to exceed Environmental Assessment (EA) predictions	Comparison to EA prediction	Negligible traffic impact
Utilize safest route when entering and exiting major highway from local roads	Number of traffic incidents related to Integral Underground construction activities	Zero
	Number of traffic complaints received regarding the construction activities	Zero

Official Use Only

6.0 TRAINING AND AWARENESS

6.1 Training, Awareness and Competency

All project personnel, subcontractors and visitors will be inducted and/or trained to a level appropriate to the level of risk their works are likely to entail, prior to commencing on site. The specific elements of training that relate to an individual understanding and applying their environmental, health and safety responsibilities may include:

1. Environmental, health and Safety policies and the requirements of the Project Environmental and Social Management Plans and associated documents including HSE Plan, specific roles and responsibilities;
2. Significant environmental impacts which may be caused by their activities;
3. Incident management and notification; and
4. Potential consequences of non-conformance.

6.2 Inductions

6.2.1 Project Inductions

All project personnel and subcontractors will be inducted into the key requirements of this CTMP and associated management documents as part of the Project Induction.

The Project Induction has been developed to induct personnel into the broad aspects of the project including safety, environment, community and the Project overview. The induction will reinforce that it is the responsibility of all personnel to adhere to the safety and traffic requirements of the Project. The Induction will include but not be limited to the following:

1. Overview of the requirements of this CTMP.
2. PPE requirements.
3. Project contact details.
4. Incident management and notification.
5. Hours of work.
6. Safety policy.
7. Key traffic safety issues relating moving trucks and crane.
8. Designated Parking Areas
9. Speed Limits
10. Community Interface Protocol

6.2.2 Visitor Inductions

All visitors will undergo a visitor's induction and their host will be responsible for the actions and conduct of their visitors and will ensure that all requirements of the site are obeyed. All visitors will be accompanied around the site by project personnel at all times.

ANNEX 11: Grievance Uptake Channels Information Sheet

In spite of all the care planned for implementing this project, it is possible that some people may be affected, and will wish to complain. In such a case, a Grievance Redress Mechanism (GRM) will be provided. See Chapter 5. The GRM complaints form that will be provided for those who may wish to formally write in their grievances is provided below, while Figure 1 (also below) provides contact details for all grievances.

<table>
<tr><th colspan="2">GRIEVANCE FORM</th></tr>
<tr><td colspan="2">Information About the Person Submitting the Grievance</td></tr>
<tr><td colspan="2">We would like you to provide your name, address and email if possible, so we can keep you informed about future developments with the Project. However, if you wish to remain anonymous this is not a problem - please just enter ANONYMOUS in the box below– your grievance will still be considered by the LUTH.</td></tr>
<tr><td>Name:</td><td rowspan="4">Internal use only: how was the grievance lodged:
□ In person
□ By Phone
□ At reading room
□ By Mail
□ By email
□ Other (please describe)
……</td></tr>
<tr><td>Date lodged:</td></tr>
<tr><td>Recorded by:
□ Person submitting grievance □ Other (please specify who)
…….</td></tr>
<tr><td>Address:</td></tr>
<tr><td>Email address:</td><td>Do you wish to be kept informed of Project developments? □ Yes □ No</td></tr>
<tr><td>Neighbourhood/Locality:</td><td rowspan="2">Internal use only: Confirm that the Grievance has been acknowledged and a copy of this form provided to the complainant?
□ Yes. Date: ……</td></tr>
<tr><td>Signature of Complainant confirming receipt of completed
Grievance Form copy:</td></tr>
<tr><td colspan="2">Information About Grievance</td></tr>
<tr><td colspan="2">Describe the Grievance:</td></tr>
<tr><td colspan="2">Internal Use Only: Recording and Response</td></tr>
<tr><td>Grievance Reference Number:</td><td>Date logged in Grievance Log</td></tr>
</table>

Name of staff member recording the grievance:	**Copies provided to:** □ Responsible party's office, (Original) □ Person lodging grievance/ Complainant (Copy 1) □ (Copy 2)
Action required (to be updated as needed as the grievance is progressed):	
Deadline for reporting back to Complainant on progress (to be updated as necessary): Date: ……	
***Internal Use Only*: Status of Grievance**	
Date:	Status of Grievance (add further rows as needed):
Grievance Closed:	Date: / Signed off:

APPENEX 12: DESIGNED DRAWING

Design Floods and Actual Sections Capacity

Gully #	stations	Name of the Gully	Designed Channel Slope (m/m)	Length of channel (KM)	Design Discharge 25 Q (m3/s)	Capacity 50Q (m3/s)	Manning's n	Depth of Water hw (m)	Design Width (m)	Design Clear Depth (m)	Velocity (m/s)	TYPE OF CANAL
1	0+000-0+300	MG	1.5%	0.30	36.07	39.88	0.012	0.91	5.50	2.0	3.28	Rectangular Rc.concrete
2	0+300-0+700	MG	2.0%	0.40	36.31	40.15	0.012	0.78	6.00	2.0	3.36	Rectangular Rc.concrete
3	0+700-1+000	MG	2.2%	0.30	42.16	46.61	0.012	0.79	6.50	2.0	3.60	Rectangular Rc.concrete
4	1+100-1+150	MG	2.5%	0.05	42.41	46.90	0.012	0.72	7.00	2.0	3.37	Rectangular Rc.concrete
5	1+150-1+390	MG	2.0%	0.24	44.69	49.41	0.012	0.76	7.50	2.0	3.31	Rectangular Rc.concrete
6	1+390-1+450	MG	2.5%	0.06	45.94	50.49	0.012	0.68	8.00	2.0	3.19	Rectangular Rc.concrete
7	1+450-1+500	MG	2.0%	0.05	46.56	50.57	0.012	0.71	8.50	2.0	3.04	Rectangular Rc.concrete
8	1+500-1+800	MG	2.5%	0.30	48.04	57.95	0.012	0.69	9.00	2.0	2.97	Rectangular Rc.concrete
9	1+800-2+200	MG	2.0%	0.40	54.41	60.16	0.012	0.70	10.00	2.0	3.02	Rectangular Rc.concrete
10	2+200-2+375	MG	2.2%	0.18	54.98	60.50	0.012	0.61	12.00	2.0	2.55	Rectangular Rc.concrete
11	2+375-2+810	MG	2.8%	0.44	56.30	62.25	0.012	0.52	14/19	2.0	2.23	Cable Concrete Channel
12	0+000-0+300	FG-1	2.0%	0.30	17.78	19.66	0.012	0.66	4.00	2.0	2.47	Rectangular Rc.concrete
13	0+300-0+465	FG-1	2.5%	0.17	18.12	20.04	0.012	0.62	4.00	2.0	2.52	Rectangular Rc.concrete
14	0+000-0+174	FG-2	2.0%	0.17	11.14	12.32	0.012	0.61	3.00	2.0	2.06	Rectangular Rc.concrete
15	0+000-0+300	FG-3	1.8%	0.30	16.12	17.82	0.012	0.81	3.00	2.0	2.99	Rectangular Rc.concrete
16	0+300-0+400	FG-3	2.5%	0.10	18.74	20.72	0.012	0.64	4.00	2.0	2.60	Rectangular Rc.concrete