ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) REPORT

Replacement of the Main Water Transmission Line Project

" Transmission Pipeline from McCauley Hill, Johnsonville through Paynesville to Congo Town)

Project Ref: (P-L-R-EAC-002-REMAWATL-MR)

Prepared for: LIBERIA WATER and SEWER CORPORATION (LWSC)/Co-Financed by: OPEC Fund & AfDB Bank Group

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Submitted to: Environmental Protection Agency (EPA) of Liberia
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EXECUTIVE SUMMARY

lNTRODUCTION & BACKGROUND

The Government of Liberia, through the Liberia Water and Sewer Corporation (LWSC), has secured financing from the African Development Bank Group and the OPEC Fund to replace the main water transmission line serving Monrovia and surrounding communities. The Replacement of the Main Water Transmission Line Project will construct 15.2km of Ductile Iron (DI) pipes from McCauley Hill, Johnsonville, to Congo Town, opposite White Flower, outside Monrovia, thereby replacing the aging 36-inch pipeline that transmits treated water from the White Plains Water Treatment Plant to Monrovia and its environment. The project will complement the 10km segment of the corridor already completed under the Liberia Urban Water Supply Project with funding from the World Bank. The project comprises two (2) main components: 1) Infrastructure Development and 2) Institutional Strengthening and Capacity Building. Component 1 is focused on a) construction of 15.2km of 48-inch DI transmission line; b) Procurement & Installation of 10,000 smart prepaid meters; c) procurement & installation of two high-lift pumps at Airfield Gantry; d) Procurement of engineering and consulting services. Component 2: Institutional Support & Project Management; a) Project Management & Coordination; b) Institutional Strengthening & Capacity Building

The project responds to urgent infrastructure needs, aiming to improve access to safe water, enhance service reliability, and strengthen institutional efficiency. This ESIA has been prepared to ensure compliance with the Environmental Protection Agency of Liberia requirements and international safeguard requirements, particularly those of the African Development Bank (AfDB).

PROJECT DESCRIPTION

The Replacement of the Main Water Transmission Line Project is located within the Greater Monrovia area covering a total distance of approximately 15.2 km. It begins at McCauley Hill in Johnsonville and continues through several key population centers, including Johnsonville Roundabout, Pipeline Community, Red Light Community, Police Academy Junction, Duport Road Junction, GSA Road Junction, ELWA Junction, and Boulevard Junction. The route concludes in Congo Town, one of the central districts of Greater Monrovia. Geographically, the project route alignment runs through densely populated and economically active areas from McCauley Hill (UTM 317443/702871) to Congo Town (UTM 309761/692861). The project is expected to deliver improved water supply reliability, reduced losses, and enhanced operational efficiency.

MAIN PROJECT ACTIVITIES

The main activities of the Replacement of the Main Water Transmission Line Project include a). Replacement of the aging 36-inch main transmission line carrying treated water from White Plains Water Treatment Plant to Monrovia with a 48-inch DI across a 15.2km corridor; b). Installation of key pipeline elements, including valves, chambers, and access points; c) Upgrading of the booster station; d). Design, Review & Monitoring of project implementation; e). Project Management & Coordination; f). Procurement and installation of Prepaid Meters (10,000 smart meters to ensure accurate billing and consumption tracking; g). Institutional Strengthening and capacity building of LWSC/PIU staff, etc.

This Environmental and Social Impact Assessment (ESIA) is conducted in line with the African Development Bank's Integrated Safeguard Systems (ISSs) and the Environmental Protection Agency of Liberia ESIA Procedural Guideline. In keeping with these requirements, the Forest & Environment Research Institute, Inc. (FERI), an EPA's Certified Private ESIA Evaluation Firm, was recruited and hired to update the existing Environmental and Social Impact Assessment Report and obtain the EPA's Permit for the Replacement of the Main Water Transmission Line Project

The construction and installation phase covers excavation, pipe laying, jointing, backfilling, ancillary works, and testing and commissioning of the 15.2 km, 48-inch ductile iron pipeline. In the operation phase, LWSC integrates the new pipeline into the Monrovia Water Distribution Network, installs smart meters, and undertakes monitoring, maintenance, and capacity enhancement to ensure a reliable water supply and financial sustainability. Finally, the decommissioning phase restores the corridor to its original state by removing temporary facilities, demobilizing equipment, rehabilitating access roads, and conducting a thorough site cleanup in compliance with environmental and safety standards

Key project activities associated with the construction and installation, that have potential to pose environmental and social risks and impacts, include excavation, trenching, pipe installation, utility coordination, and restoration of affected structures. These risks and impacts are temporary disturbances, such as dust, noise, traffic congestion, and short-term service disruptions, which are anticipated but will be mitigated through environmental and social management plans, traffic and pedestrian safety measures, waste management, and emergency preparedness.

ANALYSIS OF ALTERNATIVES

The Environmental and Social Impact Assessment (ESIA) evaluated and examined five (5) alternative options for addressing the deteriorated 36-inch transmission line that currently supplies water to Monrovia and its surrounding communities. This section examines key alternatives: a) The No Action Alternative; b) The Improvement Alternative; c) the Route Alignment Alternative; d) The Technological Alternative, and e) The Replacement Alternative. These options were assessed in terms of environmental and social implications, technical feasibility, financial considerations, and long-term sustainability.

The No-Action Alternative would avoid temporary construction impacts such as dust, noise, and traffic disruption, but it would leave Monrovia with a deteriorating pipeline that cannot meet growing demand, leading to water shortages, contamination risks, and financial losses for the Liberia Water and Sewer Corporation. The Improvement Alternative, which focuses on repairs, would reduce upfront costs and disturbances, but since the pipeline has exceeded its design life, repairs would only provide temporary relief and fail to address capacity limitations, making it unsustainable. The Route Alignment Alternative could reduce disturbances in certain areas, but it would require land acquisition, resettlement, and new studies, increase costs and delays while disturb new environments, so it is not preferred.

Technological alternatives were also considered: glass-reinforced plastic pipes were rejected due to fragility and limited local expertise, partial rehabilitation was rejected because the pipeline is too old, and cast-iron pipes were rejected for being costly, heavy, and corrosion-prone. The

preferred technological option is ductile iron pipes with hydraulic modelling, which are durable, corrosion-resistant, and suitable for long-term performance.

The Replacement Alternative, identified as the preferred option, involves installing a 48-inch ductile iron pipeline along the existing corridor. Although construction would cause temporary impacts such as dust, noise, and traffic disruption, these are manageable with safeguards. In the long term, this option would reduce leakage, improve water reliability and public health, strengthen resilience against growth and climate variability, and support socio-economic development through improved service delivery and smart metering. With financing secured from OFID, AfDB, and the Government of Liberia, the Replacement Alternative is the most technically sound, environmentally manageable, socially beneficial, and financially viable solution.

MAJOR ENVIRONMENTAL AND SOCIAL STAKES/ CHALLENGES

The project corridor is characterized by mixed land use, with residential settlements, informal markets, small businesses, public institutions, and transportation infrastructure concentrated along the route. In its current state, the corridor exhibits a combination of built-up land cover, roadside commercial activities, and informal structures, and unregulated waste disposal areas are common features, reflecting rapid urban expansion and limited land-use planning. The drainage systems are often inadequate, contributing to localized flooding during the rainy season and further stressing the physical environment.

The baseline environmental conditions reveal several valued environmental and social components (VECs) that may be affected by project activities. These include surface and groundwater resources, air quality, soil stability, existing public utilities, community health and safety, and the livelihoods of residents and businesses operating along the Right-of-Way. Socially, the corridor supports a high density of economic activities, pedestrian movement, and public transportation, making it a critical socio-economic artery within Greater Monrovia.

Without the project, existing challenges such as deteriorating water infrastructure, high levels of non-revenue water, and increasing pressure on urban services are expected to persist or worsen. Environmental pressures, including waste accumulation, erosion, and declining water quality, are likely to intensify as urbanization continues. Similarly, social vulnerabilities related to inadequate access to safe water, congestion, and public health risks would remain unaddressed. This baseline understanding provides the foundation for assessing potential project impacts and identifying appropriate mitigation measures.

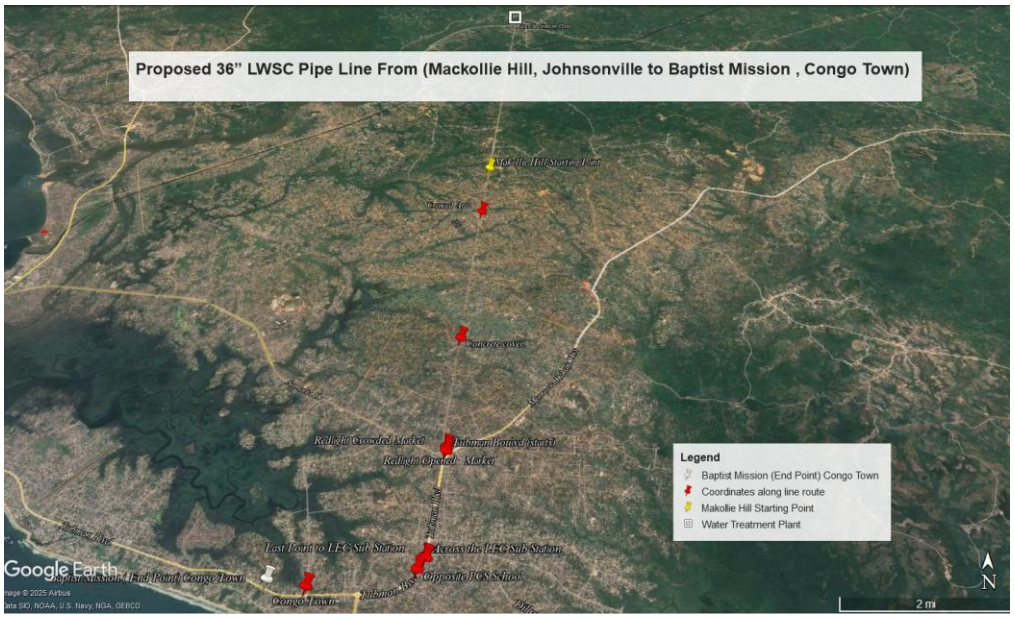

Figure 1: REMAWATL Project Corridor Map

INSTITUTIONAL AND LEGAL FRAMEWORK

This section consists of a list of relevant institutional frameworks and their role and responsibilities.

NATIONAL INSTITUTIONAL FRAMEWORKS

LIBERIA WATER AND SEWER CORPORATION (LWSC)

LWSC is the primary implementing agency for the project. As the national utility responsible for urban water supply and sewerage services, LWSC oversees the planning, design, procurement, and execution of the Replacement of the Main Water Transmission Line Project. The corporation ensures that the project aligns with national water sector strategies and improves the reliability and efficiency of water distribution within Greater Monrovia. LWSC also coordinates stakeholder engagement, supervises contractors, and ensures compliance with environmental and social safeguards throughout the project lifecycle.

PROJECT IMPLEMENTATION UNIT

The Project Implementation Unit (PIU) is domiciled in LWSC and serves as the primary body responsible for executing the project, ensuring that all activities comply with AfDB policies, national regulations, and donor requirements. PIU staff will operate under the supervision of the PIU Coordinator and the Managing Director of the Liberia Water and Sewer Corporation (LWSC), who will oversee daily tasks, including management, planning, monitoring, reporting, and coordination with stakeholders. The PIU will manage all project procurements and their implementation in strict adherence to safeguard laws, policies, and guidelines. To this end, designated specialists will contribute to the preparation of procurement processes from the outset, ensuring compliance, and will subsequently monitor and enforce safeguard measures during field implementation.

Together, the PIU and LWSC bear responsibility for ensuring that project activities are gender-responsive, environmentally sound, and socially sustainable. This includes embedding the

principles of green procurement across all project operations, thereby advancing sustainability, equity, and accountability throughout implementation

MINISTRY OF FINANCE AND DEVELOPMENT PLANNING (MFDP)

The MFDP plays a central role in mobilizing, managing, and allocating financial resources for the project. As the government's lead institution for development financing, MFDP facilitates loan and grant agreements with development partners such as the African Development Bank. It ensures that the project is integrated into national development priorities and that financial flows, procurement processes, and reporting obligations meet international standards. MFDP also monitors project performance to ensure value for money and fiscal accountability.

ENVIRONMENTAL PROTECTION AGENCY OF LIBERIA (EPA)

The EPA is the national regulatory authority responsible for environmental governance and enforcement. For this project, the EPA reviews and approves the Environmental and Social Impact Assessment (ESIA) and issues the Environmental Permit required for the Replacement of the Main Water Transmission Line Project. The Agency ensures that the project complies with national environmental laws, pollution control standards, and international best practices. It also monitors implementation of the Environmental and Social Management Plan (ESMP), focusing on issues such as waste management, air quality, noise control, and protection of wetlands and drainage systems along the project corridor.

MINISTRY OF PUBLIC WORKS (MPW)

The MPW is responsible for regulating and supervising infrastructure development across Liberia. Given that the project involves excavation, trenching, and installation of pipelines along major urban roads, MPW provides technical oversight and issues the necessary construction and right-of-way permits. The ministry ensures that the works conform to national engineering standards and that road safety, traffic management, and public infrastructure are adequately protected during construction. MPW also collaborates with LWSC to coordinate utility relocation and minimize disruptions to transportation networks.

MINISTRY OF LABOUR (MOL)

The Ministry of Labour ensures that all labour-related aspects of the project comply with national labour laws and international labor standards. This includes oversight of employment practices, worker contracts, occupational health and safety requirements, and the prevention of child or forced labor. The MoL may conduct inspections at construction sites to verify compliance with safety protocols, fair wages, and proper working conditions. Its involvement is essential for safeguarding the welfare of workers and promoting a safe and equitable work environment throughout the project.

LEGAL AND INSTITUTIONAL FRAMEWORK

The Environmental Protection Agency Act of 2000 was enacted in 2000 and established the legal mandate for the establishment of the Environmental Protection Agency of Liberia. It gives the EPA the authority to develop guidelines, regulations, and standards for the sustainable use and protection of all resources in Liberia.

The Environmental Protection and Management Law 2002/03 mandates that all projects and activities specified under Annex I (section 6) of this law conduct a mandatory Environmental and Social Impact Assessment (ESIA/EIA) before commencement. It establishes environmental quality standards, pollution control, and licensing, among others. The EPML provides a legal framework for the sustainable development, management, and protection of the environment by the EPA in partnership with regulated MACs and in close & responsive relationship with the people of Liberia, to provide high-quality information and advice on the state of the environment. The EPML gives the EPA the power to take care of the environment and punish people who pollute, violate the regulations, or contaminate the environment

The Environmental and Social Impact Assessment (ESIA) process is governed and administered by the Environmental and Social Impact Assessment Procedural Guideline 2017, updated in 2022. It is the legal instrument and reliance for the preparation of all environmental studies and research required for an environmental permit. Other national legal instruments considered during the preparation of the ESIA include: the National Water, Sanitation & Hygiene Commission Act 2020, National Occupational Health and Safety Guideline 2023, National Environmental & Occupational Health Policy 2013, Decent Work Act 2015, Liberia Water Sector Strategy 2025-2029, etc.

The African Development Bank's Integrated Safeguards System (ISS) apply to the Replacement of the Main Water Transmission Line Project. The Bank's ISS includes 10 different Operational Safeguards (Oss) which are: 1) OS1 – Environmental and Social Assessment; 2) OS– 2 Labor and Working Conditions; 3). OS3 – Resource Efficiency and Pollution Prevention and Management; 4). OS4 – Community Health, Safety, and Security; 5) OS6 – Habitat and Biodiversity Conservation & Sustainable Management of Living and Natural Resources; 6). OS7 – Gender and Vulnerable Groups; 7) OS8 – Cultural Heritage; 8); (OS9 – Financial Intermediaries; OS10 – Stakeholder Engagement.

Listed below are key Regulations related to the Project. These are presented in more detail in Chapter 2

National Legislative Framework

- Environmental Protection & Management Law (EPML) 2003
- Environmental Impact Assessment Procedural Guidelines (2021)
- National Water, Sanitation & Hygiene Commission Act Of (2020)
- National Occupational Health And Safety (OHS) Guidelines (2023)
- National Environmental & Occupational Health Policy (2013)
- Decent Work Act (2015)
- National Water, Sanitation And Hygiene (WASH) Policy (2013)
- National Fire Service Act
- Liberia Water Sector Strategy (2025-2029)

International Laws, Policies, And Guidelines

- Paris Agreement (2015)
- Convention On Biological Diversity (CBD)
- Ramsar Convention on Wetlands
- Basel Convention on Hazardous Waste
- Ilo Conventions on Labor Standards

IDENTIFIED POTENTIAL IMPACTS, AND MITIGATION MEASURES

The ESIA identifies both negative and positive risks and impacts:

POSITIVE IMPACTS

POSITIVE / BENEFICIAL IMPACTS

Positive / Beneficial Impacts (Cross-cutting Benefits): These outweigh risks if mitigation is applied.

- Employment Creation (Pre-construction & Construction) → ~200–300 local jobs created; household income boosted.
- Skills Development (Pre-construction & Construction) → ~100–150 workers trained in OHS and technical pipelaying.
- Community Awareness & Engagement (Construction) → Transparency and trust strengthened.
- Short-term Economic Activity (Construction) → Local procurement stimulates small businesses.
- Improved Access to Safe Water (Operation) → ~100,000–250,000 household's benefit; reduced waterborne illness.
- Long-term Supply Reliability & Climate Resilience (Operation) → Stable water supply for ~100,000+ residents.
- Increased LWSC Revenue & Efficiency (Operation) → 15–20% revenue improvement; financial sustainability strengthened.
- Improved Educational Performance (Operation) → Better student health and learning outcomes for ~90,000 students.

NEGATIVE IMPACTS

MAJOR RISKS / IMPACTS (High Significance Risks / Impacts)

High Significance Risks / Impacts (10–12 score) These are serious risks requiring strong mitigation and continuous monitoring.

- **Governance Weaknesses & Donor Dependency (Pre-construction)**
  - Impact: Project delays, reputational damage, reduced accountability.
- **GBV/SEA/SH & Discrimination (Pre-construction)**
  - Impact: Social tensions, community conflict, reputational harm.
- **Improper Waste Disposal (Construction)**
  - Spoil volume: ~15,000–20,000 m³; packaging/pipe offcuts ~5–10 tons.
  - Impact: Unsanitary conditions, flooding, environmental degradation, grievances.
- **Water Contamination (Construction)**
  - Shallow wells: ~50–70 at risk; contamination probability 10–20%.
  - Impact: Gastrointestinal illness incidence could rise by 5–10%; household health risks.
- **Wetland Disturbance (Construction)**
  - Area affected: ~2–3 ha; turbidity increase >50 NTU.
  - Impact: Flooding, vector-borne diseases, ecological degradation.
- **Disease Transmission in Worker Camps (Construction)**
  - Impact: HIV/AIDS/STD incidence could rise 5–10%; reduced workforce productivity.
- **Contractor Non-Compliance (Construction)**
  - Impact: Delays in safeguards, donor scrutiny, and reputational harm.
- **Extreme Weather Events (Construction)**

- Impact: Work stoppages, trench damage, increased costs, delays.
- **Poor Maintenance (Operation)**
- Impact: Long-term service disruptions, reduced reliability, financial instability for LWSC.
- **Tariff Disputes (Operation)**
- Impact: Financial disputes, reduced trust, non-payment, revenue loss.

MODERATE RISK / IMPACTS (Medium Significance Risks / Impacts)

Medium Significance Risks / Impacts (7–9 score): Noticeable but manageable risks requiring standard safeguards and monitoring.

- **Uneven Job Distribution (Pre-construction)** → Social tensions, reduced morale.
- **Occupational Health & Safety Hazards (Construction)**
- Incident frequency: 2–3 lost-time injuries per 100 workers.
- Impact: Worker injuries/fatalities, reputational damage, reduced productivity.
- **Community Health & Safety Risks (Construction)**
- Open trenches: ~10–15 km exposed.
- Impact: 5–10 community accidents projected; trust erosion if fencing/lighting inadequate.
- **Traffic Congestion & Mobility Disruption (Construction)**
- Congestion: peak-hour delays +20–30%.
- Accident risks: projected rise of 10–15%.
- Emergency response delays: 5–10 minutes.
- **Noise Pollution (Construction)**
- Machinery noise: 85–95 dB; WHO threshold exceeded.
- Sensitive receptors: ~5–10 schools/clinics affected.
- **Dust & Air Quality Deterioration (Construction)**
- PM10/PM2.5 exceedances: +50–100 µg/m³.
- Visibility reduction: 30–40%.
- Health risks: ~2,000–3,000 roadside traders, students, residents affected.
- **Utility Disruption (Construction)** → 500–1,000 households/businesses affected per outage.
- **Cumulative Impacts (Construction)** → Traffic delays compounded by 20–25%; drainage capacity reduced by 15–20%.
- **Fuel & Chemical Handling (Construction)**
- Storage: ~10,000–15,000 liters.
- Spill risk: 2–3 minor, 1 major possible.
- Impact: Soil/water contamination, fire/explosion hazard.

  Delays in Commissioning (Operation) → Service disruptions, grievances

MITIGATION MEASURES:

The mitigation measures to offset the potential environmental and social risks and impacts associated with the project are presented in the matrix below.

Table 1: Mitigation Measures

Negative Risks (Potential Problems)	Mitigation Measures
Pre-Construction Phase	
- Contextual governance risks (weak institutions, donor dependency)	- Strengthen institutional capacity through training and clear roles/responsibilities. - Establish transparent governance and reporting mechanisms.
- Labor-related risks (GBV/SEA/SH) Discrimination	-Enforce Codes of Conduct for workers (zero tolerance for GBV/SEA/SH) -Gender-sensitive recruitment policies and equal opportunities

	-Awareness campaigns and training on GBV/SEA/SH
- Risks of Uneven job distribution	- Implement transparent recruitment criteria - Public disclosure of hiring processes - local hiring quotas to ensure inclusion - Community oversight committees - Implementation of Stakeholders Engagement Plan - Implementation of grievance redress mechanisms for fair job allocation
Construction Phase	
- Risks of Traffic congestion and mobility disruption	- Prepare and implement traffic management plans (signage, detours, coordination with police). - Schedule works during off-peak hours.
- Risks of Noise pollution	- Limit night civil works. - Use noise barriers and mufflers. - Monitor decibel levels near schools/clinics.
- Risks of Dust and air quality deterioration	- Regular water spraying on haul roads. - Cover trucks transporting materials. - Enforce dust suppression protocols.
- Risks of Improper waste disposal	- Develop and implement Waste management Plan - Designate approved disposal sites. - Implement waste segregation and recycling. - Monitor contractors' compliance.
- Risks of Occupational health and safety accidents	- Provide PPE and enforce usage. - Train workers on OHS protocols. - Supervise trenching and lifting operations. - Emergency response plans in place.
- Risks of Community health and safety accidents	- Fence and light open trenches. - Conduct community awareness campaigns. - Restrict access to hazardous zones.
- Risks of Water contamination	- Prevent runoff into wells with barriers. - Monitor water quality during civil work. - Provide alternative water sources if needed.
- Risks of Soil Disturbance & Erosion	-Adopt controlled excavation practices - Use of silt traps and erosion control measures - Ensure seasonal scheduling to avoid peak rainfall - Continuous monitoring of soil stability
- Risks of Utility disruption	- Coordinate with utility providers before excavation. - Map and mark existing utilities. - Prepare contingency service restoration plans.
- Risks of Damage to public structures	- Document baseline conditions. - Restore damaged assets promptly. - Engage local authorities in monitoring.
- Risks of Wetland/Drainage disturbance	- Avoid sensitive areas where possible. - Install drainage controls. - Monitor turbidity and mosquito breeding.
- Risks of Cumulative impacts	- Coordinate with municipal authorities on overlapping work. - Phase activities to minimize congestion.
- Risks of Spread of HIV/AIDS & STD	- Provide adequate sanitation, health checks, and awareness programs. - Enforce camp hygiene standards. - Partner with local health facilities.
- Risks of Poor Fuel & Chemical handling (Spills, leaks, fire hazards)	- Store fuel/chemicals in secure, bunded areas. - Train staff in-spill response. - Fire extinguishers and emergency drills on site.

- Risks of Inadequate Security & Theft of Materials	- Establish secure storage yards with fencing and controlled access. - Deploy night security patrols and surveillance (CCTV where feasible) - Maintain inventory tracking systems and regular audits. - Use tamper-proof locks and restricted access protocols - Engage local community watch groups to strengthen oversight and trust.
-Contractor Non-compliance (failure to implement project specifications and E&S Measures)	- Include strict safeguard clauses in contracts with clear penalties for violations. - Ensure the contractor submits an Advance Payment Guarantee and an E&S Performance Guarantee prior to contracting -Conduct regular compliance audits and inspections. - Require contractors to submit monthly E&S performance reports - Establish independent monitoring and third-party verification. - Provide training and capacity building for contractors on E&S standards. - Enforce corrective action plans promptly when non-compliance is detected.
Extreme Weather Events (heavy rainfall, flooding, climate variability)	-Adopt weather-responsive scheduling (avoid peak rainy season for critical works) - Install emergency drainage systems and diversion channels. - Provide protective covering for materials and equipment. - Develop contingency/emergency response plans for flooding and storm events. - Integrate climate-resilient design features (e.g., elevated structures, reinforced trenches). - Monitor weather forecasts and establish early warning systems for site staff.
Operation Phase	
- Risks of Delays in commissioning	- Conduct phased testing and commissioning. - Maintain contingency plans for service continuity.
- Risks of Tariff disputes	- Engage communities in tariff consultations. - Implement transparent billing systems. - Provide subsidies for vulnerable groups.
- Risks of Poor maintenance due to lack of training/resources	- Train LWSC staff in preventive maintenance. - Establish dedicated O&M budgets. - Implement routine inspections and leak detection programs.
-Risks of Temporary School Disruptions	-Schedule construction work during holidays, weekends, or after school hours - Notify school administrations, teachers, and parents well ahead of planned works. - Provide alternative water supply (e.g., tanks, standpipes) to ensure uninterrupted access. - Install fencing, signage, & restricted access zones around active work areas. - Work closed with the Ministry of Education and school management to align with academic calendars. - Establish feedback channels with schools to quickly address grievances or unforeseen issues.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

The Environmental and Social Management Plan (ESMP) provides a framework for implementing mitigation, monitoring, and capacity-building measures across all phases of the project. It outlines responsibilities, timelines, and reporting requirements to ensure compliance with the EPA of Liberia regulatory requirements and AfDB ISS. A detailed ESMP has been developed as part of the full ESIA report.

The Stakeholder Engagement Plan and Grievance Redress Mechanism are developed as stand-alone instruments. They establish a structured and transparent framework for engaging stakeholders throughout the project lifecycle and to establish recognizable channels for filing project-related grievances, as well as procedures for resolving them. Additionally, capacity building and training are incorporated into the ESIA and costed.

INDICATIVE COST ESTIMATES FOR IMPLEMENTING THE ESMP

The indicative cost of implementing the ESMP is valued at **Thirty-Two Million One Hundred Fifty-Five Thousand Two-Hundred Liberian Dollars Only (L$32,155,200)** equivalent to **One Hundred Seventy-Eight Thousand, Six Hundred Forty United States Dollars (US$178,640)**. The breakdown is shown in the table below.

Table 2: Indicative Cost for Implementing the ESMP

Measures	Description	Cost (LRD)	Cost (USD)
Mitigation	Preconstruction Phase	2,880,000	16,000
	Construction Phase	6,120,000	34,000
	Operation Phase	2,412,000	13,400
	Subtotal Mitigation	**11,412,000**	**63,400**
Monitoring	Preconstruction Phase	2,430,000	13,500
	Construction Phase	5,220,000	29,000
	Operation Phase	1,260,000	7,000
	Subtotal Monitoring	**8,910,000**	**49,500**
Capacity Building	Training of relevant stakeholders & staff	8,910,000	49,500
	Subtotal: Capacity Building	**8,910,000**	**49,500**
	Sum of Subtotals	**29,232,000**	**162,400**
Contingency (10%)		2,923,200	16,240
	Grand Total	**32,155,200**	**178,640**

- *Currency: Liberian Dollars (LRD); Exchange Rate: US$1 = L$180*

STAKEHOLDER CONSULTATION & ENGAGEMENT

Two stakeholder consultations and engagement meetings were conducted during the preparation of the ESIA report along the corridor. The first was conducted at the Johnsonville Commissioner's Office on November 17, 2025 and involved participants/ stakeholders from Directly affected communities (McCauley Hill, Whein Town, Pipeline, Red Light, Duport Road, Congo Town, etc.), secondary groups (Bike Riders Association, Petty Traders Union, Liberia Marketing Association), and tertiary stakeholders (LWSC, EPA, MPW, Paynesville City Corporation, Johnsonville Township, Congo Town Township, District No. 2 Representative). The following are key outcomes.

- **Risks and Impacts Presented**

The consultation session focused on Stakeholder Engagement Strategies and the Grievance Redress Mechanism (GRM). Participants were presented with key issues to ensure clarity, transparency, and accountability in project implementation.

Key Discussion Points:

- Stakeholder Categories and Roles: Participants reviewed the different categories of stakeholders—primary, secondary, and tertiary—and their respective roles in the project. This distinction helps clarify responsibilities and ensures inclusive participation.

- Legal and Safeguard Requirements: The session emphasized compliance with national laws and donor safeguard policies, particularly regarding stakeholder consultation and information disclosure.
- Project Activities Requiring Consultation and Engagement: Several project-related risks were identified as requiring active stakeholder involvement, including:
  - Traffic and mobility disruption (restricted access, pedestrian safety, movement constraints).
  - Community health and safety (open trenches, heavy-duty vehicle movement, night works).
  - Occupational health and safety (worker safety, incidents, slips, trips, and falls).
  - Dust, noise, and air quality deterioration (impacts on roadside traders, schools, and residents).
  - Waste generation and disposal (unsustainable management of spoil, asphalt debris, packaging, and pipe offcuts).
  - Water contamination risks (shallow wells, runoff, spills).
  - Labor-related risks (GBV, SEA, SH, disease transmission).
  - Damage to public structures along the corridor.
  - Cumulative impacts from overlapping urban works.
- Grievance Redress Mechanism (GRM): The GRM was presented as a key tool to mitigate project-related complaints fairly and promptly.
- Grievance Platforms: Available platforms include written submissions, verbal reports, hotlines, and anonymous filing options, ensuring accessibility for all community members, workers, businesses, institutions, and vulnerable groups.
- Complaint Filing Methods: Procedures were explained to guarantee that grievances can be filed easily and equitably, regardless of literacy, access, or social status.
- Importance of the GRM: The GRM was highlighted as essential for building trust, preventing conflicts, and strengthening accountability between the project and its stakeholders.
- Roles of Grievance Representatives**:** Representatives of the grievance platform are responsible for receiving, documenting, and following up on complaints to ensure timely resolution.
- Confidentiality Principle: The principle of confidentiality was emphasized, ensuring that sensitive grievances—particularly those involving vulnerable groups—are handled discreetly and respectfully.

The second consultation and engagement meeting was held at the Paynesville City Corporation Hall on November 20, 2025. Stakeholders engaged include: Pipeline Community, Red Light Community, Police Academy Community, Duport Road, Paynesville Joe Bar, ELWA Junction Community, Paynesville Community, Congo Town, etc.; Secondary Stakeholder: Indirectly affected groups (Bike Riders Association, Petty Traders Union, Liberia Marketing Association, Business Community representatives); Tertiary Stakeholders: Institutional Stakeholders (Liberia Water and Sewer Corporation, Environmental Protection Agency of Liberia, Ministry of Public Works, Paynesville City Corporation, Johnsonville Township, Township of Congo Town, Office of the Representation of the District No. 2, Montserrado County, etc.).

Risks and Impacts Presented During Second Consultation:

- Stakeholders gained clarity on primary, secondary, and tertiary roles.
- Engagement is recognized as a legal and compliance requirement.
- Risks requiring consultation and mitigation were acknowledged.

- GRM presented as a fair and accessible mechanism (written, verbal, hotline, anonymous filing).
- Confidentiality emphasized for sensitive grievances.
- Stakeholders expressed support for the project and optimism about its positive impacts.

The ESIA concludes that while the project presents significant environmental and social risks, these can be effectively mitigated through the ESMP. The project is expected to deliver substantial positive impacts, including improved access to safe water, enhanced institutional efficiency, employment creation, and long-term supply reliability. Stakeholder consultations confirmed broad community support, provided that mitigation measures and grievance mechanisms are implemented transparently and inclusively.

SUMMARY OF STAKEHOLDERS' CONSULTATION

- Participants gained clarity on the distinction between primary, secondary, and tertiary stakeholders, and their respective roles in project implementation.
- Stakeholders noted that consultative meetings and engagement is a legal and compliance requirement.
- Stakeholders acknowledged several risks requiring consultation and also proposed mitigation measures
- The GRM was presented as a key to address complaints fairly and promptly. Stakeholders were informed about the available grievance platforms (written, verbal, hotlines, anonymous filing) and filing methods accessible to all groups, including vulnerable populations
- The GRM was highlighted as essential for building trust, preventing conflicts, and strengthening accountability. Confidentiality principles were emphasized to ensure sensitive grievances are handled discreetly.
- Stakeholders expressed acceptability of the project and hope that the project's positive impacts could be translated immediately.

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LIST OF ABBREVIATIONS

AFDB	AFRICAN DEVELOPMENT BANK
CESMP	CONTRACTOR ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN
CGC	COMMUNITY GRIEVANCE COMMITTEE
E&S	ENVIRONMENTAL AND SOCIAL
EIA	ENVIRONMENTAL IMPACT ASSESSMENT
EIA	ENVIRONMENTAL IMPACT ASSESSMENT
EPA	ENVIRONMENTAL PROTECTION AGENCY
EPML	ENVIRONMENTAL PROTECTION AND MANAGEMENT LAW
ESIA	ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT
ESMP	ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN
FERI	FOREST AND ENVIRONMENT RESEARCH INSTITUTE
GBV/SEA	GENDER BASED VIOLENCE/SEXUAL EXPLOITATION AND ABUSE
GRC	GRIEVANCE REDRESS COMMITTEE
GRM	GRIEVANCE REDRESS MECHANISM
HHS	HYGIENE, HEALTH, AND SAFETY
IEC	INFORMATION EDUCATION AND COMMUNICATION
ISSs	INTEGRATED SAFEGUARD SYSTEMS
LWSC	LIBERIA WATER AND SEWER CORPORATION
MICAT	MINISTRY OF INFORMATION, CULTURAL AFFAIRS AND TOURISM
MOL	MINISTRY OF LABOR
MPW	MINISTRY OF PUBLIC WORK
MSIPs	MANAGEMENT STRATEGIES AND IMPLEMENTATION PLANS
OHS	OCCUPATIONAL HEALTH AND SAFETY
OHS	OCCUPATIONAL HEALTH SAFETY
OPEC	ORGANIZATION OF PETROLEUM EXPORTING COUNTRIES
Oss	OPERATIONAL SAFEGUARDS
PAPs	PROJECT AFFECTED PERSONS/PARTIES
PCC	PYNSVILLE CITY COOPERATION
PDO	PROJECT DEVELOPMENT OBJECTIVE
PIU	PROJECT IMPLEMENTATION UNIT
PPE	PERSONAL PROTECTIVE EQUIPMENT
QA/QC	QUALITY ASSURANCE/QUALITY CONTROL
RAP	RESETTLEMENT ACTION PLAN
SEP	STAKEHOLDER ENGAGEMENT PLAN
STD	SEXUALLY TRANSMITTED DISEASE
VECs	VALUED ENVIRONMENTAL AND SOCIAL COMPONENTS

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

The Government of Liberia has received financing in the form of a credit and a grant from the African Development Bank and the OPEC Fund for International Development toward the cost of financing the Replacement of the Main Water Transmission Line Project. The Project Development Objective (PDO) is to increase access to clean and safe pipe-borne water supply services in the project area in Monrovia and improve the operational efficiency of Liberia Water and Sewer Corporation (LWSC). The project involves replacing 15.2 km of the 25 km stretch aging 36-inch pipeline that conveys treated water from the White Plains Water Treatment Plant to Monrovia and its environs. The Liberia Urban Water Supply Project is currently implementing the 10 km segment of the corridor under a different Project. This project comprises two (2) main components: (1) Infrastructure Development and (2) Institutional Strengthening and Capacity Building. Component 1 comprises the following activities: a) Construction of 15.2 km of 48-inch water transmission lines, (b) Procurement and installation of 10,000 prepared water meters; (d)Procurement and installation of two high lift pumps at the Airfield Gantry, and (e) Procurement of engineering consulting services.

Component 2 seeks to strengthen LWSC's overall institutional capacity so that the Project Implementation Team can plan, monitor, and deliver the project more effectively. Key activities under this component include: technical assistance in engineering, procurement, and contract management, which enhances support for environmental and social safeguards to ensure full compliance with national and international standards. The project activities will involve a series of coordinated construction and installation tasks. These include site clearing; procurement and delivery and laying of 48" ductile iron pipes, materials, and appurtenances, construction of chambers and air valves; include excavation of tranches, excavation, backfilling; technical testing; disinfection; and management of defect liability. The ductile iron pipes will be installed within the designated Right-of-Way in accordance with the project design.

The Replacement of the Main Water Transmission Line Project begins at McCauley Hill in Johnsonville (0km), passes through several urban and peri-urban communities, and concludes in Congo Town, opposite the May Flower Plaza, at approximately 15.2km. The Project's environmental and social risks are considered moderate, with potential impacts that are generally limited in scope, reversible, and manageable through appropriate mitigation measures. These potential risks and impacts include environmental impacts (soil quality, air quality, noise quality, water quality, waste generation & disposal), socio-economic impacts (improved water quality, job opportunities, improved skills and technical knowledge transfer, occupational health and safety related impacts, disruption of traffic, accident and incident risk, and commercial and petty trader's activities. These environmental and socio-economic impacts must be identified, analyzed, and mitigated appropriately.

Other forms of risks include: community health and safety risks, deterioration of natural resources (drinking water sources), Labor and working conditions challenges, occupational health and safety

hazards, and the possibility of community grievances, etc. Despite these risks, the project is expected to generate several significant positive impacts, such as; Improved reliability and efficiency of water supply to urban and peri-urban communities; Reduced water losses due to leakage and the existing aging infrastructure; Enhanced public health outcomes through better access to safe drinking water; Strengthened resilience of the water distribution system; Short-term employment opportunities during construction; Long-term socio-economic benefits from a more stable and efficient water service etc.

To address these risks and impacts the Project has prepared this Environmental and Social Impact Assessment (ESIA) in line with the African Development Bank's Integrated Safeguard Systems (ISSs) and the Environmental Protection Agency of Liberia ESIA Procedural Guideline. In keeping with these requirements, The Forest & Environment Research Institute, Inc. (FERI), an EPA's Certified Private ESIA Evaluation Firm was recruited and hired to update the existing Environmental and Social Impact Assessment Report and obtain the EPA's Permit for the Replacement of the Main Water Transmission Line Project. that conveys treated water from the White Plains Water Treatment Plant to Congo Town. The report is being updated to reflect the current baseline environmental and social parameters and conditions of the Project corridor.

1.2 PROJECT DEVELOPMENT OBJECTIVES

The Project Development objective is to increase access to clean and safe piped water supply services and improve the operational efficiency of the Liberia Water and Sewer Corporation (LWSC).

1.3 SCOPE OF THE ESIA

The scope of work will cover the Replacement of the Main Water Transmission Line Project area, and commences from the end of the 10 km currently under funding from the World Bank towards the 25 km endpoint. The project is designed to be implemented along the existing Right-of-Way (RoW) and comprises a field-based update of the existing ESIA, stakeholder consultation and engagement, with a water transmission line commencing from White Plains Water Treatment Plant to Congo Town, Tubman Boulevard, approximately a 25km stretch of the Government of Liberia Right-of-Way (RoW). The work comprises a field-based update of the existing ESIA to reflect the current environmental and social reality of the corridor, and preparation of a costed ESMP and other relevant safeguard instruments to mitigate risks associated with the project.

1.4 APPROACH AND METHODOLOGY

The Environmental and Social Impact Assessment (ESIA) for the Replacement of the Main Water Transmission Pipeline Project was prepared for the Liberia Water and Sewer Corporation (LWSC) in line with the Liberian Environmental and Social Impact Assessment Procedural Guidelines and the AfDB's ISS. Primary data were collected using both quantitative and qualitative methods, including focus group interviews, consultations with community representatives, and the gathering of baseline information on the physical, biological, and socio-economic environment. A Participatory Rural Appraisal (PRA) approach was applied to engage project-affected communities, allowing them to express their interests, concerns, and perspectives through public consultations. Key Informant Interviews (KII) were conducted with local authorities such as

Township Commissioners and community leaders, focusing on issues related to population, employment, education, healthcare, electricity, safe drinking water, and environmental and social conditions.

Field inspections and surveys were carried out by experts from the Forest & Environment Research Institute (FERI), who assessed baseline conditions along the project corridor. These surveys examined the physical environment, including topography, geology, air, noise, and water quality, as well as soil, rainfall, and land use. They also assessed the biological environment, covering vegetation, fauna, flora, and wildlife, and the socio-economic environment, including employment, education, healthcare, infrastructure, roads, water supply, energy, livelihoods, transportation, religion, and the economy. Secondary data were reviewed from existing literature and reports on the project area, drawing on sources such as the Liberia Institute of Statistics and Geo-Information System (LISGIS), Conservation International (CI), Fauna & Flora International (FFI), and the Society for the Conservation of Nature Liberia (SCNL).

Finally, all field and secondary data were compiled, reviewed, and analyzed in accordance with the Environmental and Social Impact Assessment Procedural Guideline of 2021 to ensure compliance and consistency.

CHAPTER 2: LEGAL & INSTITUTIONAL FRAMEWORKS

2.1 INSTITUTIONAL FRAMEWORKS

2.1.1 LIBERIA WATER AND SEWER CORPORATION

The Liberia Water and Sewer Corporation (LWSC) was created by an Act to amend the Public Utilities Law in 1973. The Corporation is empowered to construct, install, establish, operate, manage, and supply safe drinking water to all parts of Liberia, as well as to perform all sewerage services, and to maintain such water and sewerage facilities.

The Liberia Water and Sewer Corporation (LWSC) is tasked with managing, developing, constructing, installing, operating, and supplying water and sewage services throughout Liberia. It establishes and maintains facilities, offices, and agencies nationwide, and may exercise its corporate powers both within Liberia and abroad when necessary. LWSC sets fair and reasonable rates, fees, and charges for water and sewage services. It manufactures, imports, buys, sells, and installs equipment and materials related to water and sewage operations. The corporation acquires, protects, and utilizes patents, licenses, trademarks, and concessions, and works to improve technologies relevant to its services. It also acquires, builds, operates, and disposes of lands, buildings, reservoirs, water towers, machinery, and other infrastructure essential to its mandate. Finally, LWSC enters into, performs, and modifies contracts, leases, and agreements with government agencies, private entities, and other organizations to support its service delivery and corporate objectives. LWSC is the implementing agency on this project and is responsible for daily implementation and monitoring of the Project. To achieve this, LWSC has established a Project Implementation Unit (PIU).

2.1.2 ENVIRONMENTAL PROTECTION AGENCY OF LIBERIA (EPA)

The Environmental Protection Agency of Liberia EPA is an autonomous entity established by the enactment of the Agency Act of 2002 by the National Legislature as the statutory regulatory institution for environmental management and governance in Liberia. The primary function of the Environmental Protection Agency of Liberia is to regulate, coordinate, monitor, supervise, and protect the environment and the resources across the territorial demarcation of Liberia in a closed and collaborative effort with relevant ministries, agencies, and commissions, and in partnership with the people of Liberia. The EPA is also responsible for preparing the State of the Environment Report (SoER) every five (5) years that highlights Liberia's environmental issues, threats, opportunities, assessments on biodiversity, ecosystem, vegetation, Land Use and Planning, sustainable and unsustainable development strategic Plan, and natural resource planning.

The Environmental Protection Agency of Liberia is the statutory institution clothed with the mandate and authority for the technical and administrative management of the EIA/ESIA process in Liberia. Thus, the Agency has the oversight function for the issuance of an Environmental Permit for all projects and developments that have the propensity to create adverse environmental, socio-economic, and cultural impacts. The EIA process is implemented through the ESIA Procedural Guideline 2021 (updated).

2.1.3 MINISTRY OF FINANCE DEVELOPMENT & PLANNING (MFDP)

The Ministry of Finance Development and Planning is the entity of the government of the Republic of Liberia established under the Ministry of Finance Development & Planning Act to execute the mandates and functions, which include but are not limited to, the following;

- The Ministry shall formulate, institutionalize, and administer economic, development, fiscal, and tax policies for the promotion of sound and efficient management of the financial resources of the government;
- The Ministry shall have the power to administer this Chapter and all of the provisions contained herein as well as perform such other powers and functions as may be provided by law;

2.1.4 MINISTRY OF PUBLIC WORKS (MPW)

The MPW is responsible for regulating and supervising infrastructure development across Liberia. Given that the project involves excavation, trenching, and installation of pipelines along major urban roads, MPW provides technical oversight and issues the necessary construction and right-of-way permits. The ministry ensures that the works conform to national engineering standards and that road safety, traffic management, and public infrastructure are adequately protected during construction. MPW also collaborates with LWSC to coordinate utility relocation and minimize disruptions to transportation networks.

2.1.5 MINISTRY OF LABOUR (MOL)

The Ministry of Labour ensures that all labour-related aspects of the project comply with national labour laws and international labor standards. This includes oversight of employment practices, worker contracts, occupational health and safety requirements, and the prevention of child or forced labor. The MoL may conduct inspections at construction sites to verify compliance with safety protocols, fair wages, and proper working conditions. Its involvement is essential for safeguarding the welfare of workers and promoting a safe and equitable work environment throughout the project.

2.2 NATIONAL LEGISLATIVE FRAMEWORK

2.2.1 ENVIRONMENTAL PROTECTION & MANAGEMENT LAW (EPML) 2003

The Environmental Protection and Management Law of Liberia (EPML) 2002/03 calls for all projects and activities specified under Annex I (section 6) of this Law to conduct a mandatory Environmental and Social Impact Assessment (EIA/ESIA) prior to commencement. The EPML arranges the rules, regulations and procedures for the conduct of EIA. It establishes environmental quality standards, pollution control, and licensing, among others. The EPML provides a legal framework for the sustainable development, management, and protection of the environment by the EPA in partnership with regulated Ministries, Agencies, and Commissions (MACs) and in close & responsive relationship with the people of Liberia, to provide high-quality information and advice on the state of the environment. The EPML gives the EPA the power to take care of the environment and punish people who pollute, violate the regulations, or contaminate the environment.

2.2.2 ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURAL GUIDELINES (2021)

The Environmental Protection and Management Law (2003) mandate the EPAL to develop administrative procedures for the preparation of EIA to ensure effective environmental governance. In 2006, the EPAL developed the EIA Procedural Guidelines to guide the procedures and steps involved in conducting an environmental impact assessment. The ESIA Procedural Guideline 2021 (updated) is the legal instrument and reliance for the preparation and administration of the EIA process in Liberia**.**

2.2.3 NATIONAL WATER, SANITATION & HYGIENE COMMISSION ACT OF (2020)

This Act establishes the National Water, Sanitation & Hygiene Commission of Liberia (NWSHC), defines its functions and powers, and provides for its administration and organization. The Commission shall promote and regulate the development and management of water, sanitation, and hygiene services and serves as the principal government entity on water, sanitation, and hygiene (WASH) throughout the Republic of Liberia. It shall specifically, among other things) develop, promote and encourage a national agenda on the improvement of water, sanitation and hygiene services for the health, growth and development of the people of Liberia; b) oversee implementation of this Act and the Water Supply Sanitation Policy; c) build the capacity of local communities on sanitation and hygiene as a priority for sustainable livelihood; responsible for issuance of Water Supply Sanitation (WSS) service and development licenses to all stakeholders, in the interest of promoting private public partnership; d) engage prospect

2.2.4 NATIONAL OCCUPATIONAL HEALTH AND SAFETY (OHS) GUIDELINES (2023)

These guidelines, developed under the National Public Health Institute of Liberia (NPHIL), provide standards for workplace safety and health. They outline employer obligations to protect workers from injuries, illnesses, and hazardous exposures, and integrate occupational health into Liberia's Essential Package for Health Services.

2.2.5 NATIONAL ENVIRONMENTAL & OCCUPATIONAL HEALTH POLICY (2013)

Issued by the Ministry of Health & Social Welfare, this policy establishes frameworks for environmental health, occupational safety, and public health protection. It emphasizes safe water supply, sanitation, waste management, and pollution control, while also addressing workplace hazards and community health risks

2.2.6 DECENT WORK ACT (2015)

This is Liberia's primary labor law, which sets standards for employment, workers' rights, workplace safety, and fair wages. It incorporates occupational health and safety provisions and aligns with International Labour Organization (ILO) conventions.

2.2.7 NATIONAL WATER, SANITATION AND HYGIENE (WASH) POLICY (2013)

This policy provides a framework for improving access to safe water supply and sanitation services. It emphasizes institutional strengthening, community participation, and environmental safeguards in water resource management.

2.2.8 NATIONAL FIRE SERVICE ACT

This act establishes the Liberia National Fire Service and outlines responsibilities for fire prevention, safety standards, and emergency response. It is relevant to occupational safety and public health in urban and industrial settings.

2.2.9 LIBERIA WATER SECTOR STRATEGY (2025-2029)

The Liberia Water Sector Strategy provides a national framework for improving access to safe water and sanitation, strengthening institutions, and ensuring sustainable management of water resources. The Liberia Water and Sewer Corporation (LWSC) launched a $156 million five-year strategic plan to transform water and sanitation services. The plan focuses on boosting operational efficiency, expanding access to clean water, and improving sanitation across Liberia. It aligns with the Government's Arrested Agenda for Inclusive Development (AAID) and sets concrete targets for see delivery. It is highly relevant to the Replacement of the Main Water Transmission Line Project because the project directly supports the strategy's goals of expanding urban water supply, improving service delivery, and building resilience in Liberia's water infrastructure.

2.3 INTERNATIONAL LAWS, POLICIES, AND GUIDELINES

2.3.1 AFDB'S INTEGRATED SAFEGUARDS SYSTEMS (ISSs)

The African Development Bank's Integrated Safeguards Systems (ISS) including its Operational Safeguards (OS) apply to the Replacement of the Main Water Transmission Line Project as such the Project is expected to meets the requirements of each OS as applicable. These safeguards ensure that the project is designed and implemented in a manner that protects people, the environment, and the long-term sustainability of the investment.

Table 3: Brief Description of AfDB ISS & Relevance to the Project

Name	Description	Relevance to Project
OS1: Assessment and Management of Environmental & Social Risks and Impacts	Requires a comprehensive ESIA to identify, evaluate, and mitigate environmental and social risks.	Critical for pipeline replacement due to vegetation clearance, soil erosion, water contamination, noise, and community disruption. All these pose E&S risks and impacts which this OS seeks to manage
OS2: Labor and Working Conditions	Ensures fair treatment, safe working environments, and compliance with labor standards.	Relevant during construction with large workforce; requires OHS training, fair wages, and grievance mechanisms.
OS3: Resource Efficiency and Pollution Prevention and Management	Promotes efficient use of resources, pollution control, and climate resilience.	Relevant for pipe installation, excavation, waste disposal, dust suppression, and noise control.
OS4: Community Health, Safety, and Security	Protects local populations from risks such as accidents, traffic, fire hazards, and emergencies.	Highly relevant along the pipeline corridor where communities are exposed to construction impacts.
OS5: Land Acquisition, Restrictions on Access to Land and Land Use, and Involuntary Resettlement	Sets standards for fair compensation, livelihood restoration, and minimizing displacement.	Relevant for temporary land use, access roads, and utility relocation.

OS6: Habitat and Biodiversity Conservation and Sustainable Management of Living Natural Resources	Ensures avoidance or minimization of impacts on biodiversity and ecosystems.	Relevant where vegetation clearance and habitat disturbance occur along the corridor.
OS7: Vulnerable Groups	Protects women, children, elderly, disabled, and marginalized communities from disproportionate impacts.	Relevant for ensuring inclusive consultations and preventing adverse impacts on vulnerable populations.
OS8: Cultural Heritage	Safeguards tangible and intangible cultural heritage, including sites and traditions.	Relevant if pipeline route intersects cultural or historical sites.
OS9: Financial Intermediaries	Ensures intermediaries apply ISS standards to sub-projects financed through AfDB.	Not directly relevant, as project is implemented by LWSC, not via financial intermediaries.
OS10: Stakeholder Engagement and Information Disclosure	Requires meaningful engagement, timely disclosure, and grievance mechanisms.	Highly relevant for community consultations, transparency, and trust-building throughout project phases.

2.3.2 PARIS AGREEMENT (2015)

Liberia, as a signatory, has committed to climate resilience and sustainable infrastructure development. For this project, compliance means ensuring that the new transmission line is designed to withstand climate variability (e.g., heavy rainfall, flooding) and contributes to reducing greenhouse gas emissions through efficient water delivery systems. The project aligns with Liberia's Nationally Determined Contributions (NDCs) by promoting sustainable water infrastructure that supports adaptation and resilience.

2.3.3 CONVENTION ON BIOLOGICAL DIVERSITY (CBD)

The CBD obligates Liberia to conserve biodiversity and sustainably use natural resources. Pipeline trenching and construction activities may affect wetlands, vegetation, and species habitats. The ESMP therefore requires measures such as buffer zones, replanting, and biodiversity monitoring to ensure that construction does not lead to irreversible ecological damage. This ensures the project supports conservation while delivering infrastructure.

2.3.4 RAMSAR CONVENTION ON WETLANDS

Liberia is a party to the Ramsar Convention, which requires the protection of wetlands of international importance. Since sections of the transmission corridor may intersect wetland areas, the project must avoid sensitive zones, minimize disturbance, and implement restoration measures where impacts occur. This ensures compliance with Ramsar obligations and safeguards ecosystem services provided by wetlands, such as water filtration and flood control.

2.3.5 BASEL CONVENTION ON HAZARDOUS WASTE

The Basel Convention governs the safe handling, transport, and disposal of hazardous waste. For this project, it applies to chemicals used in pipe disinfection (e.g., chlorine) and construction activities that may generate hazardous residues. The ESMP mandates secure storage, spill kits, and

proper disposal procedures to prevent contamination of soil and water resources, ensuring compliance with international standards for hazardous waste management.

2.3.6 ILO CONVENTIONS ON LABOR STANDARDS

Liberia has ratified key ILO conventions that protect workers' rights. During construction, these obligations require fair contracts, safe working conditions, and grievance mechanisms to address labor disputes. The project's ESMP integrates occupational health and safety (OHS) training, PPE enforcement, and grievance redress systems, ensuring that labor practices meet international standards and safeguard workers.

2.3.7 AFRICAN CHARTER ON HUMAN AND PEOPLES' RIGHTS

The Charter recognizes the right to safe water and a healthy environment as fundamental human rights. By replacing the deteriorated transmission line, the project directly supports these rights by improving access to clean water, reducing disease risks, and enhancing community well-being. It also reinforces Liberia's obligation to protect citizens from environmental harm caused by failing infrastructure.

2.3.8 SUSTAINABLE DEVELOPMENT GOALS (SDGS)

The project contributes to multiple SDGs:

- SDG 6 (Clean Water and Sanitation): Expands access to safe, reliable water supply.
- SDG 3 (Good Health and Well-Being): Reduces waterborne diseases and improves public health.
- SDG 11 (Sustainable Cities and Communities): Strengthens urban infrastructure and resilience. Additionally, the project indirectly supports SDG 8 (Decent Work and Economic Growth) through job creation and SDG 13 (Climate Action) by building climate-resilient infrastructure.

2.4 KEY DIFFERENCES BETWEEN BORROWER AND DONOR FRAMEWORK

The Borrower's framework provides a legal foundation for environmental and social safeguard but is narrower in scope, less rigorous in monitoring, and limited in institutional capacity. The AfDB's Operational Safeguards (OSs) demand a broader, more integrated approach, covering cumulative impacts, resettlement, gender, climate resilience, and continuous stakeholder engagement. These differences mean the project must expand its ESMP/ESIA scope, strengthen stakeholder engagement, formalize grievance mechanisms, and invest in capacity building to ensure compliance with AfDB standards. See the table below for more details.

Table 4: Key Differences between the Borrower and Donor Frameworks

Aspect	Borrower Framework (Liberia / LWSC)	Donor Framework (AfDB OSs)	Potential Effect on Project Implementation
Legal Basis	Governed by the Environmental Protection and Management Law (2003) and EPA guidelines; ESIA/ESMP required for major projects.	AfDB Operational Safeguards (OS1–OS5) require comprehensive environmental and social assessments aligned with international best practice.	Liberia's framework is less detailed on cumulative impacts and climate resilience; AfDB requires broader scope, meaning additional studies and documentation.
Scope of Assessment	Focuses mainly on direct environmental impacts (erosion, waste, pollution) and basic social issues.	Requires assessment of direct, indirect, cumulative, and transboundary impacts,	Borrower assessments may need expansion to meet AfDB's holistic requirements.

		including climate change and gender.	
Social Safeguards	Addresses labor, health, and safety; grievance mechanisms are emerging but not fully institutionalized.	Strong emphasis on involuntary resettlement (OS5), labor rights (OS2), gender equality, and community health and safety (OS4).	Gaps in Liberia's framework on resettlement and gender inclusion may require additional safeguard instruments.
Stakeholder Engagement	Public consultations required but often limited in scope and documentation.	Requires continuous, inclusive, and documented stakeholder engagement, with special attention to vulnerable groups.	Borrower must strengthen consultation processes and record-keeping to align with AfDB standards.
Monitoring & Reporting	EPA requires periodic monitoring but capacity is limited; LWSC has weak internal monitoring systems.	AfDB requires robust monitoring frameworks, independent audits, and regular reporting to the Bank.	Borrower must enhance monitoring capacity and reporting mechanisms to meet donor expectations.
Institutional Capacity	EPA and LWSC have limited resources, technical staff, and enforcement capacity.	AfDB requires institutional strengthening and capacity building as part of project design.	Capacity gaps may delay compliance unless training and resources are provided.
International Obligations	Liberia is party to treaties (CBD, Ramsar, Basel, ILO, Paris Agreement) but enforcement is inconsistent.	AfDB requires full compliance with international conventions and integration into project safeguards.	Borrower must demonstrate practical compliance, not just ratification, which may require additional measures.

2.5 ADDRESSING GAPS IN HOST FRAMEWORKS

Deficiencies in the host framework can be addressed through a combination of administrative, legislative, regulatory, and institutional strengthening measures. Administratively, procedures can be streamlined to reduce delays, improve coordination among agencies, and establish clear accountability structures. Monitoring and evaluation systems should be enhanced to track compliance and performance, while continuous training can build staff capacity to implement safeguards effectively. Legislatively, outdated laws should be revised to align with international best practices, and new legal instruments can be introduced to address gaps such as environmental impact assessments, grievance redress mechanisms, and community consultation requirements. Stronger enforcement provisions, including penalties for non-compliance and incentives for proactive compliance, will ensure adherence, while codifying community rights to participation and access to information will strengthen inclusivity.

On the regulatory side, clear standards and guidelines should be developed for each sector, supported by independent oversight bodies with the authority to enforce compliance. Transparency mechanisms, such as mandatory disclosure of risks and monitoring reports, will build trust, and adaptive regulations should be periodically updated to reflect evolving challenges. Finally, institutional strengthening and capacity building are essential. This includes training and awareness programs for institutional and project management staff and stakeholders, adequate resource allocation for institutions, and formalized frameworks for stakeholder engagement. Knowledge-sharing platforms can promote best practices, while independent grievance mechanisms will provide communities with accessible avenues for raising concerns. Consequently, these measures create a holistic approach that ensures the host framework evolves into a resilient, transparent, and accountable system capable of meeting both national priorities and international donor requirements.

CHAPTER 3: ANALYSIS OF ALTERNATIVES

The analysis of alternatives is a critical component of the ESIA is it evaluates different options for addressing the deteriorated 36-inch transmission line that currently supplies water to Monrovia and its surrounding communities. This section examines five key alternatives: a) The No Action Alternative; b) The Improvement Alternative; c) the Route Alignment Alternative; d) The Technological Alternative; and e) The Replacement Alternative. Each option is assessed in terms of environmental and social implications, technical feasibility, financial considerations, and long-term sustainability.

3.1 NO ACTION/ DO-NOTHING ALTERNATIVE

Under the No-Action Alternative, the Government of Liberia and the Liberia Water and Sewer Corporation (LWSC) would not proceed with the Replacement of the Main Water Transmission Line. The system would continue to operate in its current deteriorated state, despite its inability to meet the growing water demand of Monrovia's expanding population. This alternative would avoid the temporary construction-related impacts such as dust, noise, traffic disruption, and disturbances to petty traders and roadside businesses. It would also eliminate the need for excavation, waste generation, and temporary community safety risks.

However, the long-term consequences of this option would be overwhelmingly negative. The existing pipeline is aged, structurally compromised, and prone to frequent leakages and bursts, resulting in significant water losses and reduced pressure across the network. Continued deterioration would exacerbate water shortages, undermine public health, and increase the risk of contamination of drinking water sources. Communities would continue to face unreliable water supply, forcing many households to rely on unsafe alternative sources. The LWSC would also continue to suffer financial losses due to high levels of non-revenue water. In addition, the system's inability to meet current and future demand would undermine the resilience of the water supply infrastructure. For these reasons, the No-Action Alternative is not viable and would result in long-term environmental, social, and economic harm.

3.2 IMPROVEMENT ALTERNATIVE (NOT REPLACEMENT)

The Improvement Alternative involves repairing or partially rehabilitating the existing 36-inch transmission line rather than replacing it entirely with a new 48-inch pipeline. This option would reduce the scale of construction activities and minimize short-term disturbances to communities along the corridor. It would also require a few resources and potentially lower upfront costs to a full replacement.

Despite these advantages, rehabilitation would only provide temporary relief. The existing pipeline has exceeded its design life and is structurally compromised. Repairs would not address the fundamental limitations of the system, including insufficient capacity to meet Monrovia's growing water demand. The line would remain vulnerable to future bursts, leakages, and contamination risks. Rehabilitation would also be inconsistent with the Government's broader water sector strategy, which includes the World Bank-financed replacement of 10 kilometers of the same transmission line. From a financial perspective, investing in short-term repairs would not justify

the long-term operational inefficiencies and recurring maintenance costs. Therefore, while the Improvement Alternative offers some short-term benefits, it is not recommended as a sustainable solution.

3.3 ROUTE ALIGNMENT ALTERNATIVE

The Route Alignment Alternative considers the possibility of relocating the transmission line to a different corridor to avoid densely populated areas, sensitive wetlands, or areas with high commercial activity. A new alignment could potentially reduce disturbances to roadside businesses, minimize traffic impacts, or avoid environmentally sensitive zones.

However, changing the alignment would introduce significant challenges. A new route would require the acquisition of land, which could bring in involuntary resettlement and compensation obligations under AfDB's Operational Safeguard 5 (OS5). It could also disturb previously unaffected wetlands, drainage channels, or green spaces, thereby increasing environmental impacts. From a technical standpoint, the existing alignment already follows a well-established utility corridor that has been partially upgraded under the World Bank's ongoing 10-kilometer replacement project. Deviating from this alignment would require new geotechnical studies, new rights-of-way, and additional engineering design, all of which would increase project costs and delay implementation. For these reasons, the Route Alignment Alternative is not preferred, as it is less efficient, more costly, and potentially more disruptive than the proposed alignment.

3.4 TECHNOLOGICAL ALTERNATIVE

The evaluation of technological alternatives is a critical component of the project's decision-making process, as it ensures that the selected design, materials, and construction methods provide the most reliable, cost-effective, and environmentally sustainable solution for replacing the aging water transmission line. Given the deteriorated condition of the existing 36-inch pipeline and the urgent need to improve water supply reliability in Monrovia and its surrounding communities, several technological options were assessed to determine their suitability for long-term operation under local conditions. These alternatives are examined in terms of durability, hydraulic performance, ease of installation, maintenance requirements, compatibility with Liberia's soil and traffic conditions, and alignment with international standards for pressure pipelines. The analysis also considered the availability of local expertise, long-term operational costs, and the ability of each technology to support the system's future capacity needs. The table below presents the key technological alternatives considered for the project, along with the rationale for selecting or rejecting each option.

Table 5: Technological Alternative & Rationale

Technological Alternative	Description	Reasons for Rejection / Selection
Option 1: Replace the pipeline with Glass Reinforced Plastic (GRP)	Installation of a new transmission line using GRP pipes, which are lightweight and corrosion-resistant.	Rejected because GRP is susceptible to damage under heavy traffic loads, especially in Monrovia's congested urban corridors. It also has limited local availability, low repair capacity, and requires specialized skills not widely present in Liberia.

Option 2: Maintain the existing pipeline with partial rehabilitation	Conduct spot repairs, replace damaged sections, and reinforce weak points of the existing 36-inch steel line.	Rejected because the existing pipeline is aged beyond repair, has high leakage rates, and cannot meet current or future water demand. Rehabilitation would be temporary and economically inefficient.
Option 3: Use cast iron pipes with traditional trenching	Replace the line with cast iron pipes installed through conventional open-cut trenching.	Rejected because cast iron is expensive, heavy, corrosion-prone, and incompatible with modern hydraulic requirements. It also increases transport and installation costs and has a shorter lifespan in Liberia's soil conditions.
Option 4: Use Ductile Iron (DI) pipes with hydraulic modelling (Preferred Option)	Install a 48-inch ductile iron pipeline designed using international hydraulic modelling standards to optimize pressure, flow, and long-term performance.	Selected because DI pipes are durable, corrosion-resistant, and suitable for high-pressure transmission systems. They conform to international design standards, have long service life, and are readily maintainable in Liberia. Hydraulic modelling ensures optimal system performance, reduced leakage, and improved resilience.

3.5 REPLACEMENT ALTERNATIVE (PREFERRED OPTION)

The Replacement Alternative involves the Replacement of the Main Water Transmission Line with a 48-inch Ductile Iron (DI) along the established utility corridor from McCauley Hill in Johnsonville to Congo Town, covering approximately 15.2 km. This option represents a comprehensive, long-term solution to the systemic challenges facing Monrovia's water supply system. It directly addresses the structural failures, high leakage rates, and insufficient capacity of the current pipeline, which has long exceeded its design life and can no longer meet the water demands of the rapidly growing urban and peri-urban population.

Under this alternative, the project would replace the aging infrastructure with a larger diameter, more durable pipeline constructed from modern materials such as ductile iron or High-Density Polyethylene (HDPE). These materials offer improved resistance to corrosion, reduced risk of breakage, and a significantly longer operational lifespan. The 48-inch diameter is specifically selected to increase transmission capacity, improve water pressure, and align with the Government of Liberia Water Sector Strategy.

From an environmental and social perspective, the Replacement Alternative generates temporary construction-related impacts such as dust emissions, noise, traffic disruption, waste generation, and short-term disturbances to the roadside, businesses, and petty traders. These impacts, however, are moderate in magnitude, localized, reversible, and readily manageable through appropriate mitigation measures outlined in the ESMP. Community health and safety risks, occupational hazards, and waste management concerns can be effectively controlled through established safeguards, including fencing of trenches, traffic management plans, OHS protocols, and proper soil disposal.

The long-term benefits of the Replacement of Alternative significantly outweigh the short-term inconveniences. The new pipeline will drastically reduce water losses caused by leakage and bursts, improve the reliability and efficiency of water supply, and enhance public health outcomes

by ensuring consistent access to safe drinking water. It will also strengthen the resilience of the water distribution system, enabling it to withstand population growth, climate variability, and operational stresses. Additionally, the project will create short-term employment opportunities during construction and contribute to long-term socio-economic development through improved service delivery and enhanced revenue collection supported by the installation of 10,000 smart prepaid meters.

Financially, the Replacement Alternative is fully supported by a structured funding arrangement involving the OPEC Fund for International Development (OFID), the African Development Bank (AfDB), and the Government of Liberia (GoL). OFID's US$20 million loan, AfDB's US$2.2 million grant, and the Government of Liberia's US$2.8 million contribution for smart metering collectively ensure that the project is adequately financed and aligned with national priorities.

In summary, the Replacement Alternative is the most technically sound, environmentally manageable, socially beneficial, and financially viable option. It provides a durable, long-term solution to Monrovia's water supply challenges and aligns with the national development goals and international best practices. For these reasons, it is identified as the preferred alternative for implementation.

3.6 DESIGN MEASURES

The Replacement Alternative, which involves the construction and installation of a 48-inch Ductile Iron (DI) water transmission line along the established utility corridor from McCauley Hill in Johnsonville to Congo Town. This design was selected as the preferred option because it provides a comprehensive, durable, and long-term solution to Monrovia's systemic water supply challenges. The design is firmly grounded in the application of the mitigation hierarchy.

First, the project design seeks to avoid major environmental and social risks and impacts by utilizing the existing utility corridor, thereby preventing land acquisition, avoiding potential displacement, and reducing interference with sensitive ecological areas. The choice of HDPE materials further avoids risks of premature failure, corrosion, and excessive leakage that have characterized the aging infrastructure.

Secondly, where impacts cannot be fully avoided, the design incorporates measures such as re-alignments, to minimize them. Construction-related disturbances such as dust emissions, noise, traffic disruption, and waste generation are reduced through the adoption of modern construction techniques, traffic management plans, occupational health and safety (OHS) protocols, and proper soil disposal practices. These measures ensure that temporary inconveniences remain localized, reversible, and manageable.

Thirdly, the project provides for the restoration of affected areas once construction is completed. Roadside disturbances, business interruptions, and petty trading disruptions will be address through site rehabilitation, reinstatement of access routes, etc.

Finally, the project design includes provisions and installation of 10,000 smart prepaid meters, which will enhance revenue collection and improve service delivery, thereby ensuring that communities benefit equitably from the project.

By applying the mitigation hierarchy, the Replacement Alternative not only addresses immediate structural deficiencies and leakage challenges but also strengthens the resilience of Monrovia's

water distribution system against future population growth, climate variability, and operational stresses.

In summary, the Replacement Alternative represents the most sustainable design measure, as it avoids unnecessary impacts, minimizes unavoidable disturbances, and restores affected areas thereby aligning with national development goals and international best practices.

CHAPTER 4 : PROJECT DESCRIPTION

4.1 PROPOSED PROJECT

The Replacement of the Main Water Transmission Line (P-LR-EAC-002-REMAWATL-MR) is a flagship water infrastructure initiative under the Government's AAID program. The project involves constructing a 15.2-kilometer, 48-inch transmission line, which continues the earlier 25.2-kilometer replacement of the aging 36-inch line from the White Plains Water Treatment Plant to Monrovia. The total estimated cost of the project is US$25 million, structured across three financing components. The first component, which focuses on infrastructure development, is jointly financed by the OPEC Fund for International Development (OFID) and the African Development Bank (AfDB). OFID has committed US$20 million, while AfDB has contributed US$2.23 million, and the Government of Liberia has contributed US$2.8 million, bringing the total project cost to US$25 million.

4.1.1 PROJECT COMPONENT

The components of the project include:

Component 1: Infrastructure Development-US$22,230,000.00

i)Sub-component 1.1: Replacement of 15.2 km Transmission Line: This sub-component will deliver a modern 15.2 km, 48-inch-diameter transmission pipeline to replace the aging and failing line between the White Plains Water Treatment Plant and Monrovia. By upgrading this critical stretch, we aim to increase the volume of water flowing into the city, reduce frequent leaks that disrupt service, and ensure communities receive water more reliably and efficiently.

ii). Sub-component 1.2: Installation of Data logger at Strategic Intersections: This sub-component will focus on installing and maintaining real-time monitoring services at key locations, particularly the Johnsonville intersection, the Paynesville—Somalia Drive branch line, and the ELWA-RIA Highway intersections. This will allow for continuous monitoring of pressure, flow, and system performance to enable early fault detection and operational optimization.

iii). Sub-component 1.3: Appurtenances and Civil Works: This sub-component involves the installation of key pipeline elements, including valves, chambers, and access points. This will support efficient operation and safeguard the integrity of the transmission system. The civil works will cover trench excavation, construction, and installation of the required chambers, and the full restoration of any roadways or landscapes affected during implementation. To ensure adherence to technical standards and best practices, we will engage qualified consulting firms to conduct detailed design reviews and provide construction supervision, ensuring quality assurance throughout the project.

iv). Sub-component 1.4: Upgrading of the Booster Station (US$240,000): This will include the supply and installation of two high-lift pumps at the Fish Market Booster Station. This will enhance pressure management and energy efficiency in the distribution network, particularly for Central Monrovia.

v). Sub-component 1.5: Supervision and Monitoring Consulting Services (US$850,000): This component will require the recruitment of a qualified consulting firm for design review and

construction supervision. This will ensure technical compliance, quality assurance, and adherence to environmental and social safeguards.

vi). Sub-component 1.6: Procurement of Spare Parts for WTP (US$100,000): This focuses on the procurement & delivery of critical spare parts for high-lift pumps at the WTP to meet the upgrades demand on the transmission mains, support long-term maintenance and operational reliability of the Water Treatment Plant.

vii). Sub-component 1.7: Procurement & Installation of Prepaid Meters (US$2.800,000.00): To help reduce non-revenue water and improve LWSC's collection efficiency, the project will purchase and install 10,000 prepaid smart meters in selected service areas. These smart meters will enable customers to better monitor and manage their water use while ensuring accurate billing and consumption tracking. The meters will be linked to a centralized billing and monitoring system, providing LWSC with real-time data to detect leaks more quickly, reduce losses, and strengthen overall revenue collection.

Component 2: Institutional Support & Project Management (US$1.546.576.00)-

i) Sub-component 2.1: Project Implementation Unit personnel Salaries (US$770,000.00): This allocation covers salaries for the Project Implementation Unit (PIU) personnel over three years. This investment ensures sustained technical, administrative, and fiduciary oversight throughout the project lifecycle.

ii) Sub-component 2.2: Coordination, Project Management & Operations (US$616,976.00): This component covers the essential operational and management costs required to ensure effective project implementation. Key areas are;

- *Vehicles & Logistics:* Purchase of two Hilux pickups, vehicle registration and insurance, maintenance, and fuel supply.
- *Human Resources:* Salaries for PIU staff over three years.
- *Administrative Support:* Stationery, office supplies and consumables, communication, internet subscription, and utility bills.
- *Governance & Oversight*: Internal and external audits, internal audit reviews, steering committee meetings, and legal services.
- *Technical & Safeguards*: Equipment repair and maintenance, safeguard materials, environmental consultancy, stakeholder consultation, and engagement.
- *Facilities & IT*: PIU building maintenance, IT equipment for meetings, computer software and licenses, genset maintenance.
- *Miscellaneous:* Entertainment and accommodation, bank charges

iii) Sub-component 2.3: Institutional Strengthening & Capacity Building (US$159,600.00): This sub-component aims to enhance the institutional capacity of the Liberia Water and Sewer Corporation (LWSC) through targeted investment in skills development and operational systems. The funding will support LWSC to;

- Conduct research and development initiatives;
- Develop skills & training in project proposals;
- Strengthen project management, implementation, monitoring, and evaluation capabilities.

Additionally, it will enable the Project Management Team to effectively plan, monitor, and manage the operations of the water treatment plant, ensuring improved service delivery and long-term sustainability.

iv) Sub-component 2.4: Contingency Allocations (US$1.223,424.00): Contingency allocations have been charged to the respective co-financiers to account for inflation adjustments and unforeseen implementation costs. Specifically, the OPEC Fund for International Development (OFID) has committed US$650,000, while the African Development Bank (AfDB) has allocated US$573,424.00. These activities collectively bring the total estimated project cost to US$25,000,000.00, reflecting the full scope of investment required for infrastructure, institutional strengthening, operational management, and contingency provisions.

4.1.2 PROJECT ACTIVITIES

The project activities will be implemented in six structured phases.

Phase 1: Planning and Appraisal - This phase establishes the project's foundation by defining its scope, objectives, institutional arrangements, expected outcomes, and budget. It includes preparing cost estimates, identifying funding sources, and confirming financing with OFID, AfDB, and the Government of Liberia. Feasibility studies are conducted to assess technical, economic, and environmental alternatives such as no-action, rehabilitation, route alignment, or replacement. Hydraulic modelling and engineering design are carried out to international standards, and the final design of the 15.2 km, 48-inch ductile iron pipeline is completed. Approvals are secured from LWSC, the Environmental Protection Agency, and funding partners. Project timelines and milestones are established to guide implementation.

Phase 2: Recruitment and Contracting: Once appraisal and approvals are complete, the focus shifts to securing expertise and contractors. Tender documents, technical specifications, and evaluation criteria are prepared. Bids are advertised and proposals invited in line with AfDB procurement standards. Technical and financial proposals are reviewed, bidders are shortlisted, and contractors are selected based on capacity, experience, and cost-effectiveness. Contracts are finalized with clear timelines, payment schedules, performance guarantees, and safeguard compliance. Notices to proceed are issued, and contractors are prepared for mobilization. Communities and stakeholders are notified about contractor selection, project start dates, impacts, and mitigation measures to ensure transparency.

Phase 3: Mobilization and Site Preparatory Work: This phase ensures readiness for construction through logistics planning, equipment deployment, and staff onboarding. Necessary permits are secured and stakeholders engaged. Vegetation is cleared, surveys are conducted, pipeline routes are marked, and access roads are established. Environmental safeguards and safety protocols are implemented. Ductile iron pipes, fittings, and valves are imported and transported to designated storage yards. Stakeholder consultations are held with communities and local authorities. Project staff are oriented on occupational health and safety, environmental safeguards, and community relations.

Phase 4: Site Preparation: This phase involves clearing vegetation, debris, and obstacles along the pipeline corridor. Site camps, storage areas, workshops, and sanitation facilities are established. Conflicting utilities such as electric cables and drainage structures are relocated where feasible. Traffic safety measures, including signage, barriers, and detours, are installed. Dust suppression, noise control, and waste management systems are implemented. Trench lines are surveyed, marked, and fenced to prevent accidents and unauthorized access.

Phase 5: Construction and Installation: This phase delivers the physical pipeline infrastructure. Trenches are excavated along the 15.2 km corridor from McCauley Hill to Congo Town. Ductile iron pipes are laid using hydraulic modelling standards to optimize flow and pressure. Pipe joints, valves, and fittings are installed to ensure leak-proof connections. Trenches are backfilled and compacted to restore ground stability, and excess soil is disposed of at designated sites. Ancillary works such as chambers, valve boxes, and network connections are constructed. Hydrostatic pressure testing, leakage detection, and disinfection are conducted before integration into the water supply system. Community engagement continues throughout construction.

Phase 6: Operation: This phase is managed by LWSC to ensure sustainability and service delivery. The new 48-inch pipeline is integrated into the Monrovia Water Distribution Network, replacing the old 36-inch line. Ten thousand prepaid smart meters are installed to improve revenue collection and reduce losses. Routine inspections, leak detection, and preventive maintenance are carried out. Transmission capacity is enhanced to meet current and future demand, water pressure is improved, and losses are reduced. Access to safe drinking water is expanded, sanitation outcomes are improved, and LWSC's financial sustainability is strengthened to support urban growth and climate resilience.

Phase 7: Decommissioning: Upon completion, the corridor is restored to its original state. Temporary facilities and installations are removed, equipment is demobilized, and surplus materials are cleared. Access roads and facilities used during construction are rehabilitated. A thorough site cleanup is conducted, and all ancillary structures are removed. The area is reinstated in compliance with environmental and safety standards, leaving it in a well-maintained condition.

4.2 GEOGRAPHIC CONTEXT

The project is located within the Greater Monrovia area, extending between UTM coordinates 0317443/0702871 and 309761/0692861. The alignment covers a total distance of approximately 15.2 kilometers and passes through a highly urbanized and economically active corridor. The route begins at McCauley Hill in Johnsonville and continues through several key population centers, including Johnsonville Roundabout, Pipeline Community, Red Light Community, Police Academy Junction, Duport Road Junction, GSA Road Junction, ELWA Junction, and Boulevard Junction. It concludes in Congo Town, one of the central districts of Greater Monrovia. This alignment ensures that the project directly serves densely populated communities and strategically connects major residential and commercial hubs.

Table 6: Coordinates of Project Corridor/ Location

Point	Name of Location	UTM Coordinates	
Start	McCauley Hill, Johnsonville	317443	702871
End	Congo Town, Opposite White Flower	309761	692861

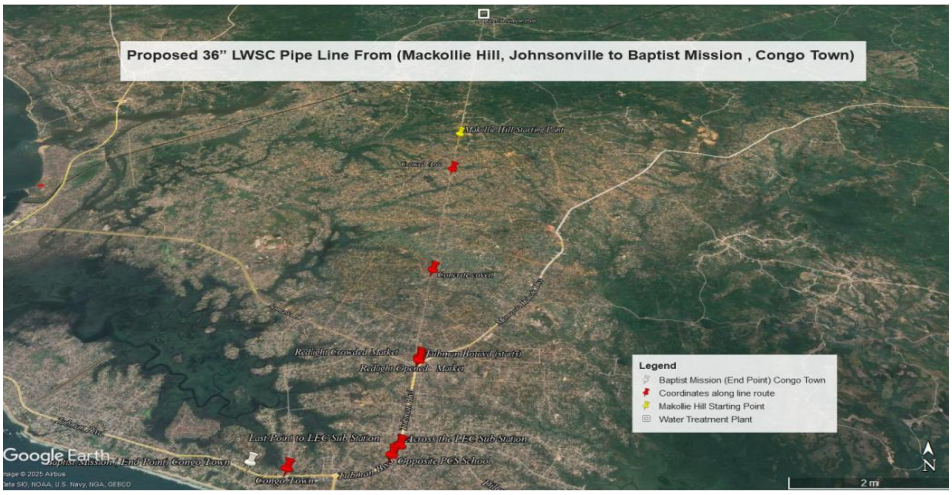

Figure 2: Map of Project Corridor

4.3 ENVIRONMENTAL CONTEXT

The transmission line passes through urbanized corridors, which reduces the likelihood of significant impacts on natural habitats. However, construction activities may generate temporary environmental disturbances such as dust emissions, noise pollution, and traffic congestion. There may also be short-term disruptions to water services during the installation phase. To mitigate these impacts, the project will incorporate environmental safeguards, resilient engineering designs, and community engagement strategies. These measures will ensure that ecological risks are minimized and that the project contributes positively to sustainable urban development. Key management strategies and implementation plan to address potential environmental and social risks include the implementation of the environmental and social mitigation and management plans, preparation and implementation of site-specific traffic management plan, pedestrian management plan, waste management plan, environmental and social management plan, emergency preparedness and response plan etc.

4.4 SOCIAL CONTEXT

The project is expected to benefit approximately 1.3 million individuals directly and indirectly. It will reduce the burden of water fetching, particularly for women and children, and enhance hygiene and sanitation standards across schools and communities. By providing reliable, affordable, and safe access to water, the project will lower the incidence of waterborne diseases, improve school attendance, and reduce exposure to gender-based violence (GBV). In addition, the project will generate employment opportunities during both construction and operation phases, while also strengthening technical capacities within Liberia's water sector. Temporary social risks, such as the disruption of roadside vendors, trades and traffic disruptions, will be managed through coordinated planning and stakeholder consultations to ensure that vulnerable groups are protected. This approach prevents loss of income to petty traders and ultimately avoid compensations payments in line with the mitigation hierarchy.

4.5 TEMPORAL CONTEXT

The project is designed as a multi-year undertaking, with phased implementation to minimize service interruptions. Construction is expected to commence in the upcoming fiscal year, with completion targeted within thirty-six months. The phased approach will allow for a continuous water supply to communities

while sections of the transmission line are being replaced. This timeline ensures that the project is delivered efficiently while balancing the need for uninterrupted service delivery.

CHAPTER 5: BASELINE DATA

5.1 RELEVANCE TO PROJECT DECISIONS

The Baseline data for the project corridor encompasses physical, biological, socio-economic, health, safety, and institutional parameters, all of which directly inform the project design and mitigation. Importantly, the alternatives analysis itself forms part of the baseline decision-making framework because they establish the context, rationale, and trade-offs that influence location, design, operation, and mitigation measures. Additionally, they ensure that decision makers understand why the chosen alignment, design, or technology was selected, and how it compares to other feasible options. This ensures that project decisions are transparent, evidence-based, and aligned with both national priorities and donor safeguard requirements. Details of the baseline are provided below;

5.1.2 DATA AVAILABILITY, GAPS AND UNCERTAINTIES

The baseline assessment of the project corridor has drawn upon existing national datasets, sectoral reports, and field surveys to characterize environmental and social (E&S) conditions. While these sources provide valuable insights, the extent and quality of available data vary considerably across parameters. Hydrological and geological data are relatively robust due to prior infrastructure and feasibility studies; however, biological and socio-cultural datasets remain fragmented and outdated.

5.1.3 CHALLENGES IN FIELD DATA COLLECTION

The field surveys encountered several practical challenges that further constrained data quality. These include the following;

- Reduced vegetation cover in urban and peri-urban sections of the corridor made it difficult to identify and document bird species and other fauna.
- Human activity and habitat loss along the corridor, particularly in densely populated and commercial zones, have displaced wildlife, making populations harder to observe and record.
- Security and access constraints in certain settlements limited the ability to conduct household surveys and community consultations at the desired depth.

5.1.4 IMPLICATIONS FOR E&S RIKS CHARACTERIZATION

The data gaps and field challenges have important implications for the characterization of anticipated risks and impacts. They include;

- Biodiversity impacts may be underestimated due to incomplete bird and habitat records, requiring adaptive monitoring during construction.
- Social impacts such as livelihood disruption, gender-related vulnerabilities, and health risks may not be fully captured without disaggregated community-level data.
- Uncertainty in predictions necessitates a precautionary approach, which flexible mitigation measures and ongoing stakeholder engagement to validate assumptions.

5.2 PHYSICAL ENVIRONMENT DESCRIPTION

5.2.1 SITE SETTING

The Replacement of the Main Water Transmission Line Project is located within the Greater Monrovia area, extending between UTM coordinates 0317443/0702871 and 309761/0692861. The project covers a total distance of approximately 15.2 km; the alignment passes through a highly urbanized and economically active corridor. It begins at McCauley Hill in Johnsonville and continues through several key population centers, including Johnsonville Roundabout, Pipeline Community, Red Light Community, Police Academy Junction, Duport Road Junction, GSA Road Junction, ELWA Junction, and Boulevard Junction. The route concludes in Congo Town, one of the central districts of Greater Monrovia. The baseline conditions along this alignment reflect a complex mix of residential settlements, commercial activities, public infrastructure, drainage systems, and utility installations. Understanding these baseline conditions is essential for assessing the potential environmental and social impacts of the project

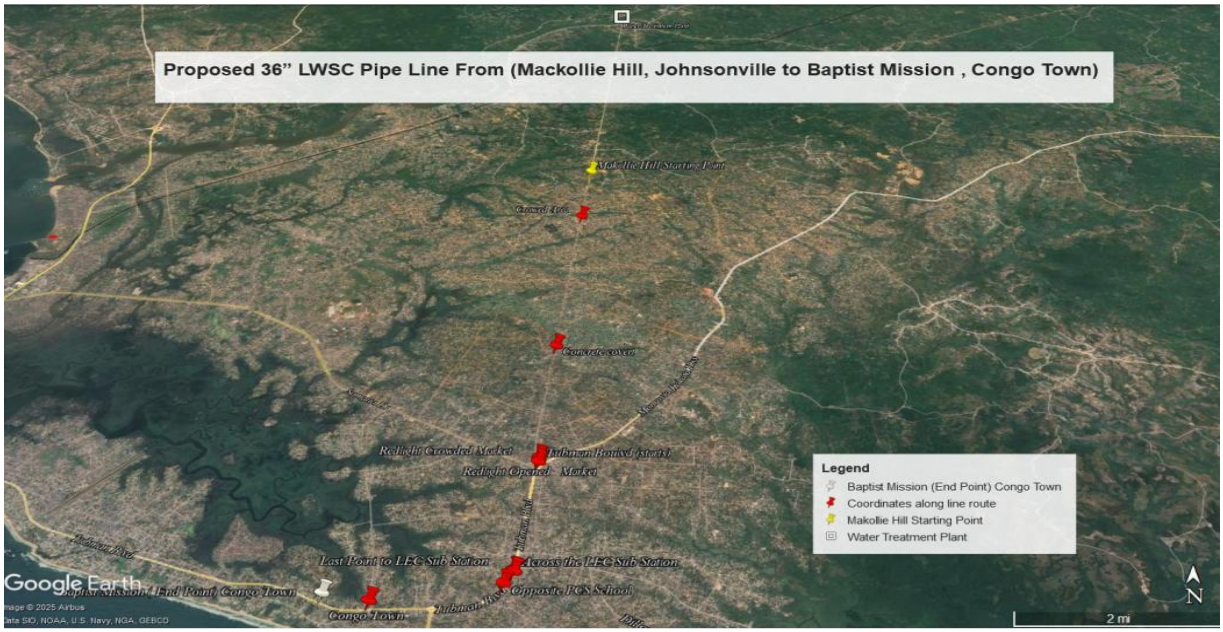

Figure 3: Project Location Map

5.2.2 TOPOGRAPHY

The Replacement of the Main Water Transmission Line Project corridor from McCauley Hill, Johnsonville to Congo Town traverses gently undulating terrain with pockets of low-lying wetlands. Geotechnical investigations reveal that the land gradually rises to the higher elevation region from 0 km towards 15.2 km. The proposed project location is not a protected area nor a proposed protected area network. The terrain has been significantly modified by decades of urban expansion, road construction, and informal settlement development.

5.2.3 HYDROLOGY & GROUNDWATER:

The corridor intersects streams and wetlands that form part of the local drainage system. Groundwater levels vary, but shallow tables are common in critical sections. Seasonal rainfall (wet season May–October, dry season November–April) significantly influences groundwater recharge and turbidity downstream. Existing drainages along the corridor are often open and clogged with

domestic and commercial-related wastes, thereby creating more suitable conditions for prolonged flooding.

5.2.4 CLIMATE

The project area experiences a humid tropical climate characterized by high rainfall, particularly between May and October, and a short dry season from December to April. Montserrado County experiences average annual rainfall of around 3,550-3,620 mm. Heavy rainfall events contribute to surface runoff, localized flooding, and erosion risks—factors that must be considered during construction. Temperature remains relatively stable year-round, averaging 25-27°C, with little seasonal variation.

- **Rainfall Patterns**
  - **Annual totals (2021-2025)**; Between 3,500 mm and 3,620 mm.
  - **Seasonal variation**:
    - Dry season (December -April): Rainfall is low, typically 50-250 mm/month
    - Rainy season (May -November): Rainfall peaks at 600-700 mm/month in June-July, tapering off by November.
- **Temperature Trends**
  - Annual mean temperature: ~27°C (81°F)
  - Monthly variation: Very limited, ranging from 25°C in June-August to 27°C in February-April.

Climate Graphs (2021-2025)

Below are visualizations of rainfall and temperature trends for Montserrado County.

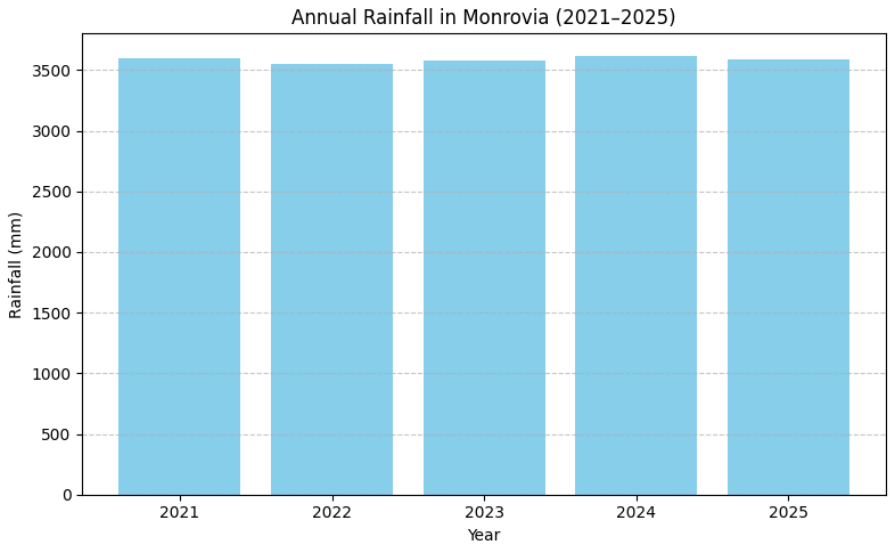

Figure 4: Annual Rainfall in Monrovia (2021-2025)

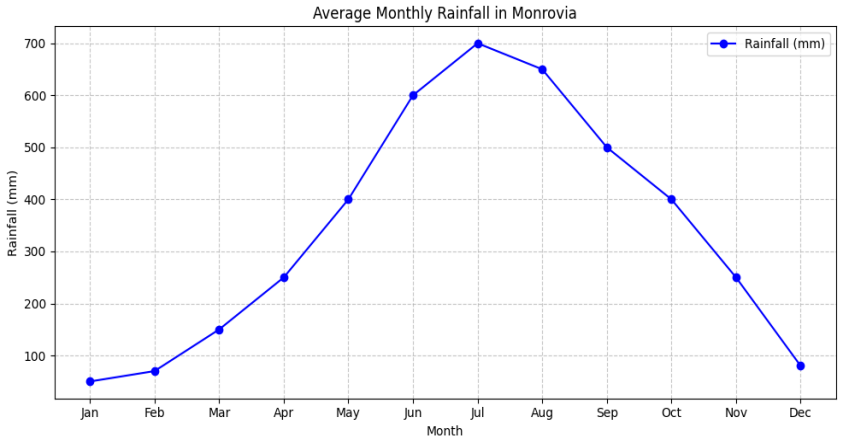

Figure 5: Average Monthly Rainfall in Monrovia

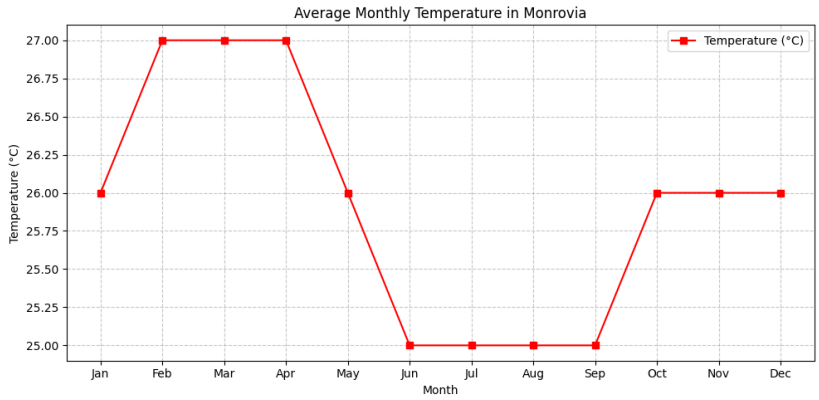

Figure 6: Average Monthly Temperature in Monrovia

5.2.5 NOISE QUALITY:

Baseline noise levels at the project corridor were measured and revealed 50 dBA, which is below the 75 dBA permissible limit. Communities are accustomed to relatively quiet ambient noise. Construction machinery and night works will introduce significant noise increases, so mitigation (barriers, scheduling, monitoring) is critical to avoid disturbing schools, clinics, and households. However, due to the increase in anthropogenic, commercial, and industrial activities in sections of the corridor, the result revealed steady to high noise levels. The outcome of the result indicates that the noise level is safe for the inhabitants and residents of the project corridor. During construction, the noise levels are expected to have an exponential increase, which would require a specific environmental and social management process to ensure that public health and safety are not compromised. See results below;

Table 7: Sound Quality Results with Coordinates

Sample Code	Location	Coordinates (29N UTM)	Date/Time	Noise Level (dBA)	Standard Limit
SQ-001	Whein Town Junction	X: 0313128 Y: 0699032	Nov 13, 2025 – 1:10 pm	50.08	75.0
SQ-002	McCauley Hill	X: 0313698 Y: 0705148	Jan 14, 2026 10:00 am	49.0	75.0
SQ-003	Red Light	X: 0312934 Y: 0695855	Jan 14, 2026 2:00 pm	69.5	75.0

SQ-004	Duport Road	X: 0312740 Y: 0693907	Jan 14, 2026 2:30 pm	58.0	75.0
SQ-005	Congo Town	X: 0310482 Y: 0692732	Jan 14, 2026 4:30 pm	52.0	75.0

5.2.6 AIR QUALITY:

Ambient air quality of the project corridor was measured at designated sampling locations. The outcome of the air quality result indicates that all samples taken (CO, SO_2, PM2.5, PM10, VOCs, NO_2) were below WHO thresholds. The current clean air means construction dust, emissions, and machinery emissions will be noticeable changes. During construction, the current threshold will be elevated due to excavation activities, the movement of transport vehicles, the operation of diesel generators, site clearing & trenching. These impacts are temporary; strict dust suppression and equipment maintenance will be essential to keep air quality within safe limits. See details below;

Table 8: Air Quality Results with Coordinates

Parameter	AQ-001 (Kpelleh Town Junction) Nov 13, 2025 12:20 pm	AQ-002 (McCauley Hill) Jan 14, 2026 10:00 am	AQ-003 (Red Light) Jan 14, 2026 2:00 pm	AQ-004 (Duport Road) Jan 14, 2026 2:30 pm	AQ-005 (Congo Town) Jan 14, 2025 4:30 pm	WHO Standards
CO	7.20	7.0	7.9	8.0	7.5	50.0
CO_2	13.10	7.5	7.8	10.5	9.6	5000.0
H_2S	<0.000	0	0	0	0	NS
SO_2	0.056	0.006	0.053	0.055	0.054	2.0
VOC		<0.001	<0.001	<0.001	<0.001	0.75
PM2.5	8.0	7.0	7.0	7.0	7.0	35.0
PM10	10.0	8.0	8.5	8.0	8.0	50.0
NO_2	<0.001	<0.001	<0.001	<0.001	<0.001	1.00
Coordinates	X: 0313335 Y: 0701351	X: 0313698, Y: 0705148	X: 0312934 Y: 0695855	X: 0312740, Y: 0693907	X:0310482, Y: 0692732	-

5.2.7 SOIL AND GEOLOGY

Soils along the corridor consist predominantly of sandy loam and lateritic materials, which are moderately erodible when exposed. Excavation activities are likely to encounter mixed fill materials, especially in areas where previous utility works or road improvements have occurred. . To address this, mitigation and best practice measures such as dewatering techniques, trench shoring, and groundwater monitoring are typically recommended at locations where the potential for water ingress has been observed.

The soils are fertile with high organic matter but show low nutrient retention capacity (CEP). Heavy metals (lead, zinc, and iron) are at safe levels. Excavation and spoil disposal could degrade soil fertility further if not managed. Baseline shows no contamination, so improper waste disposal or chemical spills during construction would represent a new risk.

Soil Quality Results with Coordinates

Table 9: Soil Quality Results with Coordinates

Sample Code	Location	Coordinates (29N UTM)	Date & Time	pH	Organic Matter (%)	Organic Carbon (%)	Nitrate (ppm)	CEC	Iron (ppm)	Lead (ppm)	Sulfate (ppm)
SS-01	LWS 332 +08	X: 0313698 Y: 0705148	Nov 13, 2025 – 10:00 am	5.32	54.0	0.54	<0.001	<0.001	0.44	<0.001	<0.001
SS-02	Kpelleh Town Junction	X: 0313335 Y: 0701351	Nov 13, 2025 – 12:00 pm	6.0	49.0	0.46	<0.001	<0.001	0.39	<0.001	<0.001
SS-03	Whein Town Junction	X: 0313128 Y: 0699032	Nov 13, 2025 – 1:00 pm	6.80	52.0	0.60	<0.001	<0.001	0.47	<0.001	<0.001
SS-04	McCauley Hill	X: 0313698 Y: 0705148	Jan 14, 2026 – 10:00 am	6.0	52.0	0.56	<0.001	<0.001	0.42	<0.001	<0.001
SS-05	Congo Town, Paynesville	X: 0310482 Y: 0692732	Jan 14, 2026 – 2:30 am	6.8	54.0	0.54	<0.001	<0.001	0.39	<0.001	<0.001

A couple of low-lying areas were identified along specific sections of the corridor, as presented in the table below. These areas present an increased risk of water ingress during trenching activities.

Table 10: Name & Coordinate of Low-lying Sections along the Project Corridor

Name of Location	UTM Coordinates	
Pipeline Supermarket Community	300428	069842
Pipeline Community	313499	703104

5.2.8 WATER QUALITY

The baseline water quality samples were conducted within the project corridor. The result indicates that the water is clean, safe, and compliant with Liberia Water Quality Standards and WHO guidelines. There has been no microbial contamination detected (zero coliforms, E. coli, Salmonella)—communities currently enjoy safe water sources. There The results further provided a slight exceedance of Chromium VI at one stream location (WS-003). This indicates localized contamination risk that must be monitored during construction. The project must ensure that construction activities (excavation, spoil disposal, pipe laying) do not worsen heavy metal leaching or water contamination. See the table below for results.

Table 11: Water Quality Results and Coordinates

Parameter	LWQS Class I Standard	WS-001	WS-002	WS-003	WS-004	WS-005
Location / Coordinates / Date-Time	—	Creek (Down McCauley Hill) X: 0313672 Y: 0704867 Nov 11, 2025 – 11:07 am	Stream X: 0313631 Y: 07041747 Nov 11, 2025 – 11:20 am	Stream X: 0314314 Y: 0701747 Nov 11, 2025 – 11:37 am	GSA Junction Creek X: 0312301 Y: 0692877 Jan 14, 2026 – 2:30 pm	Congo Town/Paynesville Car Wash X: 0310482 Y: 0692732 Jan 14, 2026 – 4:30 pm
pH	6.5 – 8.0	7.19	7.51	7.30	7.18	7.48
Turbidity (NTU)	≤ 1.0	0.25	0.017	0.53	0.15	0.25
Nitrate (mg/L)	≤ 40.0	0.36	0.20	0.52	0.51	0.01
Chromium VI (mg/L)	≤ 0.05	0.01	0.004	0.052	0.002	0.003
Mercury (mg/L)	ND	<0.001	<0.001	<0.001	<0.001	<0.001

5.3 BIOLOGICAL ENVIRONMENT

5.3.1 VEGETATION

Vegetation along the corridor is sparse and largely degraded due to urbanization. It consists mainly of grasses, shrubs, and scattered ornamental trees. No critical habitats or protected ecological zones are located within the immediate project footprint. However, small wetland patches and drainage buffers support limited vegetation that contributes to local stormwater regulation. Importantly, these are low-lying areas and are relatively small depressions that become inundated during heavy rainfall. There are two such locations, and they are situated at an approximate distance of 100 meters from the pipeline route. They are also not permanent waterbodies but temporary rain-fed pools that form during storms. There are no other surface waterbodies present along the water transmission line corridor.

5.3.2 BIRDS

Montserrado County hosts a mix of forest, savanna, and urban habitats, making it rich in bird diversity. Liberia overall has 692 recorded bird species, with 21 globally threatened. The Crowned Eagle stands out as one of the few Near Threatened species regularly observed in the area, highlighting conservation concerns. During the bird survey, the following highlighted bird species were observed. However, photographic documentation of bird species within the project corridor was not possible due to limited time, and logistical challenges. Additionally, much of the natural vegetation has been cleared or degraded, reducing suitable habitats and making species more difficult to capture visually.

Common Bird Species in Monrovia (with IUCN Status)

Table 12: Common Bird Species in Monrovia with IUCN Status

Bird Species	Scientific Name	IUCN Classification	Notes
African Gray Hornbill	Lophoceros nasutus	Least Concern	Widespread across West Africa; recognizable by its large curved bill.
Great Blue Turaco	Corythaeola cristata	Least Concern	Striking blue plumage; often seen in forested areas.
Crowned Eagle	Stephanoaetus coronatus	Near Threatened	Powerful raptor; declining due to habitat loss.
Yellow-mantled Weaver	Ploceus tricolor	Least Concern	Common in wooded and savanna habitats; known for intricate nests.
Gray-headed Bushshrike	Malaconotus blanchoti	Least Concern	Loud, distinctive calls; found in forest edges and woodlands.
African Red-rumped Swallow	Cecropis melanocrissus	Least Concern	Aerial insectivore; often seen in open areas near water.

5.4 SOCIOECONOMIC ENVIRONMENT

5.4.1 POPULATION AND SETTLEMENTS

The project corridor passes through densely populated communities with high concentrations of residential dwellings, informal structures, and roadside businesses. Settlements are characterized by mixed land use, including homes, shops, markets, schools, technical colleges, universities, hospitals, and small industrial activities. According to the 2022 Liberia National Population and Housing Census, the project corridor lies within Montserrado County, which has an estimated population of 1,920,965 people. The corridor from McCauley Hill, Johnsonville to Congo Town, Greater Monrovia passes through peri-urban and urban settlements.

5.4.2 LIVELIHOODS AND ECONOMIC ACTIVITIES

Economic activities along the corridor include petty trading, transportation services (commercial motorcycling), small workshops, food vendors, and informal markets. Other sectors of employment include public institutions, many households rely on roadside commerce for daily income. Construction activities may temporarily affect access to these businesses.

5.4.3 PUBLIC INFRASTRUCTURE AND UTILITIES

The project corridor contains multiple layers of public infrastructure, including electricity lines, telecommunication cables, existing water distribution pipes, roadside drains, and culverts, as well as pedestrian walkways and access ramps. These utilities are highly vulnerable to accidental damage during excavation activities, underscoring the need for careful mapping and coordination. In addition, the drainage systems within the corridor are often inadequate, leading to localized flooding during the rainy season and placing further stress on the physical environment.

5.4.4 TRAFFIC AND MOBILITY

Traffic volumes along the corridor are consistently high, particularly at major intersections where diverse modes of transport converge. The corridor accommodates a heterogeneous mix of private

vehicles, commercial taxis, motorcycles, and pedestrians, each competing for limited road space. This multimodal interaction contributes to frequent congestion, especially during peak commuting hours in the morning and evening. Many sections of the road are narrow, limiting lane capacity and maneuverability for larger vehicles, while the absence of dedicated lanes for motorcycles and pedestrians increases the risk of conflicts and accidents. Informal roadside activities such as street vending, parking, and loading encroach on carriageways, reducing effective road width and creating unpredictable traffic flow. Construction activities will further restrict road space, requiring careful phasing and diversion planning, implementation of a comprehensive traffic and pedestrian management plan as temporary closures or detours may intensify congestion without robust management.

5.4.5 COMMUNITY HEALTH AND SAFETY

Communities along the corridor face existing vulnerabilities, including limited pedestrian infrastructure, poor drainage, and exposure to traffic hazards. Open drains, uneven surfaces, and informal crossings are common. Construction activities—if not properly managed—could exacerbate these risks, especially for children, the elderly, and persons with disabilities.

5.4.6 WATER SUPPLY

The Water and Sewer facilities along the project corridor are in poor and fragile condition. The Liberia Water and Sewer Corporation is struggling to maintain aging infrastructure. The 36-inch pipeline installed in 1953 has suffered repeated ruptures, causing frequent service interruptions. Only a fraction of these infrastructure and residents rely heavily on the LWSC piped borne water supply; the majority of residents along the corridor are dependent upon wells, and hand pumps as a source of water supply. The situation has contributed to elevated risks of waterborne diseases, including cholera, diarrhea, and typhoid, particularly among vulnerable groups. The project corridor currently experiences high non-revenue water losses, which significantly reduce the efficiency and reliability of the supply system. The Replacement of the Main Water Transmission Line Project will therefore address the critical public health need, ensuring improved access to clean and safe drinking water for thousands of residents along the corridor.

5.4.7 EMPLOYMENT AND SKILLS BASELINE

The employment and skills baseline along the 15.2 km project corridor reflects a labor environment dominated by informal economic activities, limited formal employment opportunities, and a youthful population seeking income through small-scale enterprises. Unemployment and underemployment remain high, particularly among young people and women, making the corridor highly dependent on informal livelihoods. The informal sector is especially vibrant and constitutes the primary source of income for a large proportion of households. This sector includes petty traders, who sell food items, household goods, clothing, and mobile phone accessories along the roadside. It also includes a significant number of commercial motorcyclists ("pen-pen riders") and tricycle operators ("keh-keh riders**"**), who provide essential transportation services in areas where public transit is limited or unreliable. In addition to these groups, the corridor hosts street vendors**,** mobile money agents**,** mechanics and roadside auto repair workers**,** artisans such as welders and carpenters**,** food stall operators, tailors**,** barbers and hairdressers, and small-scale construction laborer**s** who offer daily hire services. Unemployment and underemployment are high in

communities along the corridor. The project is expected to employ 350–400 skilled and unskilled workers**,** providing income opportunities and on-the-job training in pipeline installation, environmental management, and occupational safety.

5.4.8 DEMOGRAPHICS OF THE PROJECT CORRIDOR

The project corridor traverses several densely populated urban and peri-urban communities within Montserrado County, including Johnsonville, Pipeline Community, Red Light, Duport Road Junction, Police Academy Junction, GSA Junction, ELWA Junction, Paynesville City, Boulevard Junction, and Congo Town's White Flower Community. These areas are characterized by rapid urbanization, high population density, and diverse socio-economic groups, ranging from informal traders and transport operators to middle-income households and professionals. Paynesville City, the largest municipality in Liberia, accounts for a significant share of the corridor's population, reflecting the broader trend of rural-urban migration that continues to swell the county's demographics. The corridor hosts a youthful population, consistent with Liberia's median age of approximately 19 years, and is marked by overcrowded market centers such as Red Light, alongside mixed residential and commercial zones in communities like Duport Road and Congo Town.

5.4.9 HEALTH & HEALTH CARE

Communities along the project corridor face significant health challenges. Common illnesses include malaria, diarrheal diseases, respiratory infections, and maternal and child health complications, which are worsened by poor sanitation and seasonal flooding. Health care facilities are unevenly distributed, with larger hospitals such as ELWA Hospital, Benson Hospital, and James N. Davies in Paynesville serving as referral centers, while smaller community clinics in Johnsonville, Pipeline, and Duport Road often operate with limited resources. Many residents rely on these local clinics for primary care services such as immunization, malaria treatment, and maternal health, but shortages of medicines, equipment, and trained staff remain persistent problems.

5.4.10 SOCIAL (GBV, SEA/SH)

Liberia has one of the highest rates of GBV in West Africa, with intimate partner violence and sexual assault widely reported. The Mano River Institute for Strategic Studies (MRISS) notes persistent challenges in addressing GBV despite strengthened laws and policies. The project corridor is highly vulnerable to GBV, SEA, and SH risks, particularly in markets, schools, and densely populated settlements. Studies by MRISS, the World Bank, and national action plans confirm that infrastructure projects in Liberia have historically triggered SEA/SH incidents. Anticipated changes, such as labor influx and urban growth will intensify risks unless robust mitigation measures (codes of conduct, survivor-centered grievance mechanisms, awareness campaigns, and institutional strengthening) are implemented.

5.5 CLIMATE CHANGE

Climate change is likely to affect the project area through increased rainfall variability, more frequent extreme weather events, and rising temperatures. These changes may intensify flooding along low-lying sections of the corridor, accelerate erosion of embankments, and disrupt construction schedules. Prolonged dry seasons could reduce water availability for communities and construction activities, while heat stress may affect worker safety and productivity. Climate-

driven pressures increase the likelihood of damage to infrastructure, raise maintenance costs, and heighten social vulnerability in surrounding communities.

The project may also contribute to climate change if not carefully managed. Construction activities generate greenhouse gas emissions from heavy machinery, material transport, and energy use. Land clearing and vegetation removal can reduce carbon sequestration capacity, while increased traffic volumes along the corridor may lead to higher long-term emissions. Integrating climate-resilient design, low-carbon construction practices, and community adaptation measures will be essential to reduce risks and ensure long-term sustainability.

In addition, green procurement offers a pathway to mitigate climate impacts by embedding sustainability into project inputs. This approach emphasizes the selection of goods, services, and construction materials that minimize environmental impacts throughout their life cycle. For the Replacement of the Main Water Transmission Line Project, adopting green procurement practices means prioritizing low-carbon, energy-efficient, and sustainable sourced materials, as well as prioritizing low-carbon, energy-efficient, and sustainably sourced materials, as well as suppliers who demonstrate compliance with environmental and social standards.

5.6 VULNERABLE AND EXCLUDED SOCIAL GROUPS

The project corridor hosts multiple vulnerable and excluded groups, including women, children, youth, elderly persons, persons with disabilities, low-income households, migrants, and health-vulnerable residents. These groups face discrimination, exclusion, and under-service compared to mainstream society. Disaggregated data highlights their specific vulnerabilities without compromising confidentiality, ensuring that project design, operation, and mitigation measures can be tailored to protect and empower them. Details of key vulnerable and excluded groups are provided below;

5.7 WOMEN AND GIRLS

Women and girls in the project corridor are particularly vulnerable due to limited access to formal employment, reliance on informal trading, and exposure to gender-based violence (GBV), sexual exploitation and abuse (SEA), and sexual harassment (SH). Their exclusion from decision-making processes and unequal access to resources make them underserved compared to mainstream society.

5.8 CHILDREN AND YOUTH

Children face risks from poor pedestrian infrastructure, traffic hazards, and exposure to unsafe water and sanitation conditions. Youth, especially those engaged in informal transport services such as motorcycle riding (“pen pen”), are underemployed and excluded from formal labor markets. This group is highly vulnerable to economic shocks and unsafe working conditions.

5.9 ELDERLY PERSONS

Elderly residents are disproportionately affected by poor mobility infrastructure, limited access to health services, and exposure to waterborne diseases. Their reduced physical capacity makes them vulnerable to construction-related risks such as restricted access, noise, and dust.

5.10 PERSONS WITH DISABILITIES

Persons with physical or sensory disabilities are excluded from mainstream society due to inadequate pedestrian walkways, inaccessible public facilities, and limited tailored health services. They are highly vulnerable to construction impacts and require targeted mitigation measures.

5.11 LOW-INCOME HOUSEHOLDS AND INFORMAL TRADERS

Households dependent on petty trading, roadside vending, and informal workshops are underserved by formal economic systems and excluded from stable employment opportunities. They are vulnerable to income disruption during construction, as access to roadside businesses may be restricted.

5.12 MIGRANT AND DISPLACED POPULATIONS

The corridor hosts migrants and displaced persons who often settle in informal structures with limited tenure security. These groups are excluded from mainstream housing and service delivery systems, making them vulnerable to eviction, resettlement, and loss of livelihoods.

5.13 COMMUNITY HEALTH-VULNERABLE GROUPS

Residents relying on wells and hand pumps for water are underserved compared to those with piped connections. They face elevated risks of waterborne diseases such as cholera, diarrhea, and typhoid, particularly affecting children, women, and the elderly.

5.14 DISAGGREGATED DATA (NON-CONFIDENTIAL)

- Women and girls: Majority engaged in informal trading; high exposure to GBV/SEA/SH risks.
- Youth: Median age ~19 years; high unemployment and reliance on informal transport.
- Elderly: Limited mobility and health access; vulnerable to construction impacts.
- Persons with disabilities: Excluded from infrastructure and services; require inclusive design.
- Low-income households: Predominantly petty traders and informal workers; vulnerable to income disruption.
- Migrant/displaced groups: Settled in informal housing; excluded from mainstream service delivery.
- Health-vulnerable groups**:** Dependent on unsafe water sources; high disease burden.

5.15 CONTEXTUAL RISKS

The project corridor faces contextual risks rooted in Liberia's political economy, institutional capacity, socio-economic vulnerabilities, security dynamics, gender inequalities, and climate pressures. These risks may affect the ability of the project to be carried out in a manner consistent with Operational Safeguards and international human rights obligations. Addressing them requires robust institutional strengthening, transparent governance, inclusive stakeholder engagement, gender-sensitive safeguards, and climate-resilient design.

5.16 POLITICAL ECONOMY

Fragile governance structures, limited institutional capacity, and a high degree of dependency on donor financing characterize Liberia's political economy. These factors may affect the project's ability to consistently apply Operational Safeguards, as weak enforcement of environmental and social regulations can undermine compliance. Political transitions and shifting priorities within government agencies may also delay approvals, disrupt coordination, or reduce accountability in project implementation.

These risks are moderate because Liberia has successfully navigated political transitions, reducing the likelihood of abrupt policy shifts. This stability enables continuity in project approvals, coordination, and oversight. Clear accountability mechanisms, such as independent audits and parliamentary reviews, can further safeguard against delays or reduced compliance. Most

importantly, the project is a flagship water infrastructure initiative under the Government's AAID program.

5.17 INSTITUTIONAL AND REGULATORY RISKS

Implementation and regulatory institutions may face resource and capacity constraints, which can limit effective monitoring of safeguard requirements. Inadequate staffing, technical expertise, and budgetary support may hinder the enforcement of environmental and social standards, increasing the risk of non-compliance with international obligations.

These risks are moderate due to the satisfactory capacity, including staff, budget, equipment, and experience of the LWSC's Project Implementation Unit to implement environmental and social measures on the project. The LWSC has a dedicated PIU responsible for implementing donor-funded projects. can be mitigated through strengthening institutional capacity by investing in training, staffing, and technical resources. These regulatory agencies can more effectively enforce environmental and social safeguards, reducing the risks of non-compliance.

5.18 SOCIO-ECONOMIC RISKS

High poverty levels, unemployment, and reliance on informal livelihoods along the corridor create vulnerabilities that may intensify during construction. If not properly managed, disruptions to roadside businesses and informal settlements could lead to social unrest, grievances, or exclusion of vulnerable groups, undermining compliance with human rights standards on equity and non-discrimination. These socio-economic risks are substantial, and the disturbances are mostly related to impacts on traffic and temporary disruption of entrance ramps to community houses during construction (excavation and laying of 48" water pipeline). These disturbances will be mitigated by replacement or restoration to an equal or better state immediately after pipes are laid. In addition, there are economic disturbances that would include impacts to petty traders with temporary structures (especially at the Red-Light Market) that are doing business along the RoW. These economic disturbances are temporary and under the control of the proponent/contractor and easily mitigated by work scheduling (works done at night, on Sundays, and in sections) as well as slight backward movement of street traders, and only when excavation for pipe laying gets to their locations.

5.19 SECURITY AND STABILITY RISKS

Liberia's urban areas, including Greater Monrovia, experience periodic social tensions linked to economic hardship, land disputes, and political grievances. Such instability can affect project timelines, increase risks of labor unrest, and compromise the safety of workers and communities. While security and stability risks may challenge the project's ability to uphold OS requirements on community health, safety, and stakeholder engagement, they are moderate due to stable governance and transitional stability enjoyed by the people of Liberia. This creates a more predictable environment for stakeholder engagement. To mitigate these risks, regular consultations with communities, civil society, and vulnerable groups will help identify risks early and ensure that mitigation measures are inclusive and transparent. This reduces grievances, disenchantments, and strengthens compliance with international human rights standards.

5.20 GENDER AND HUMAN RIGHTS RISKS

Persistent gender-based violence (GBV), sexual exploitation and abuse (SEA), and sexual harassment (SH) in Liberia pose significant risks in infrastructure projects. Labor influx and

unequal power dynamics may exacerbate these risks, making it difficult to ensure compliance with international human rights obligations on gender equality and protection of vulnerable groups.

Gender and human rights risks are substantial and will require practical steps and coordinated efforts from regular Any risks related to project-affected people (PAP) will be limited due to the lack of physical displacements and land acquisitions. The project will involve any minor, temporary disturbances during pipe laying in the right-of-way of major roads.

5.21 CLIMATE AND ENVIRONMENTAL RISKS

Climate variability, including heavy rainfall and flooding, may disrupt construction schedules and damage infrastructure. These risks can undermine compliance with OSs related to environmental sustainability and resilience, while also affecting the rights of communities to safe water and sanitation. Climate and Environmental risks are substantial and will require implementation of management strategies and implementation plans, including recommendations and mitigation measures from the environmental and social impact assessment, environmental and social management plan, traffic management plan, pedestrian management plan, grievance redress mechanism, stakeholder engagement plan, and emergency preparedness and response plan.

5.22 CUMULATIVE DEVELOPMENT ACTIVITIES AND RISKS

The Replacement of the Main Water Transmission Line Project must be informed by other ongoing and proposed development activities within the project area that, although not directly connected, may cumulatively influence its environmental and social impacts. Proposed road expansion projects in Paynesville and Congo Town are expected to increase traffic congestion and dust emissions, which could compound construction-related air quality and mobility risks along the corridor. Similarly, ongoing drainage rehabilitation works at Duport Road and ELWA Junction affect local hydrology and may intensify flooding risks when combined with pipeline trenching activities. These overlapping activities highlight the importance of integrated planning, coordinated scheduling, and adaptive monitoring to ensure that cumulative impacts are effectively managed and that safeguard compliance is maintained.

CHAPTER 6: ENVIRONMENTAL AND SOCIAL RISKS & IMPACTS

6.1 IMPACT IDENTIFICATION AND ANALYSIS

The Replacement of the Main Water Transmission Line Project involves extensive excavation, trenching, pipe laying, backfilling, and reinstatement of public structures along a dense and highly populated urban corridor. These activities generate a range of environmental, social, health, and economic impacts that must be assessed for their significance to guide appropriate mitigation and enhancement measures.

The project also introduces substantial positive impacts, including improved access to clean and safe drinking water, employment opportunities for 350–400 skilled and unskilled workers, capacity building for local labor, increased revenue generation for LWSC, and a long-term, uninterrupted water supply for Monrovia and surrounding communities.

6.2 KEY NEGATIVE ENVIRONMENTAL & SOCIAL RISKS & IMPACTS

- **Risks of Traffic Congestion, Mobility Disruption**

Excavation, trenching, lane narrowing, and diversions along the McCauley Hill, Johnsonville – Congo Town, White Flower Community will significantly disrupt traffic. This corridor is a critical urban artery with roadside trading, schools, and heavy commuter flows. Lane closures and diversions will cause congestion, queuing, and delays, which increase accident risks and slow emergency response times. Vulnerable groups such as school children, roadside traders, and commuters will be disproportionately affected, as their daily activities depend on smooth mobility. Prolonged disruptions may also reduce business productivity and erode public confidence in project management.

- **Risks of Noise Pollution**

Heavy machinery, trucks, and compaction equipment will generate noise levels beyond baseline urban conditions. Residences, schools, clinics, and shops along the corridor will experience disturbances, particularly during early mornings and evenings when sensitivity is highest. Noise can interfere with learning in schools, disrupt sleep patterns in households, and equipment will generate noise levels beyond baseline urban conditions. Residences, schools, clinics, and shops along the corridor will experience disturbances, particularly during early mornings and evenings when sensitivity is highest. Noise can interfere with learning in schools, disrupt sleep patterns in households, and hinder patient recovery in clinics. Workers themselves face risks of hearing loss if protective equipment is not enforced. Long-term exposure may also contribute to stress, hindering patient recovery in clinics. Workers themselves face risks of hearing loss if protective equipment is not enforced. Long-term exposure may also contribute to stress, fatigue, and reduced community tolerance of the project.

- **Risks of Dust & Air Quality Deterioration**

Piles, haul routes, and uncovered loads will release dust, especially during the dry season. Roadside traders, schools, and residents. Excavation, spoil piles, haul routes, and uncovered loads will release dust, especially during the dry season. Roadside traders, schools, and residents are highly sensitive to dust exposure. Dust reduces visibility, deposits on goods and buildings, and causes respiratory irritation. Children, elderly populations, and those with respiratory conditions

are highly sensitive to dust exposure. Dust reduces visibility, deposits on goods and buildings, and causes respiratory irritation. Children, elderly populations, and those with pre-existing respiratory conditions are particularly vulnerable. Traders face economic losses from dust settling on food and merchandise, while reduced visibility increases accident risks. Without suppression measures, pre-existing respiratory conditions are particularly vulnerable. Traders face economic losses from dust settling on food and merchandise, while reduced visibility increases accident risks. Without suppression measures, complaints and health burdens will escalate.

- **Risks of Improper Waste Disposal**

Spoil, asphalt debris, packaging, and pipe offcuts will accumulate during construction. Limited stockpile space and inadequate disposal facilities heighten risks of improper dumping. Waste can clog drains, cause & Disposal** Spoil, asphalt debris, packaging, and pipe offcuts will accumulate during construction. Limited stockpile space and inadequate disposal facilities heighten risks of improper dumping. Waste can clog drains, cause sedimentation, and create unsanitary conditions. Poor management may lead to regulatory non-compliance, reput sedimentation, and create unsanitary conditions. Poor management may lead to regulatory non-compliance, reputational damage, and increased haul trips to distant disposal sites. Communities may perceive waste mismanagement as negligence, fuelling damage, and increased haul trips to distant disposal sites. Communities may perceive waste mismanagement as negligence, fuelling grievances and distrust.

- **Risks of Occupational Health & Safety Accidents**

Deep trenches, lifting of ductile iron (DI) pipes, proximity to traffic, and handling of chemicals pose serious risks to workers. Hazards include trench collapse, struck-by incidents, slips/trips, and chemical exposure. With a large workforce and subcontractor mix, strict OHS protocols are essential. Failure to workers. Hazards include trench collapse, struck-by incidents, slips/trips, and chemical exposure. With a large workforce and subcontractor mix, strict OHS protocols are essential. Failure to enforce safety to enforce safety measures could result measures could result in lost-time injuries, fatalities, and project delays. Inadequate training or PPE provision may also expose in lost-time injuries, fatalities, and project delays. Inadequate training or PPE provision may also expose contractors to legal liabilities and donor scrutiny.

- **Risks of Community Health & Safety Accidents**

Open trenches, equipment movement, diversions, and night works expose communities to hazards. Vulnerable groups such as children, the elderly, and disabled individuals face risks of falling into trenches or colliding with vehicles. Poor fencing and inadequate lighting exacerbate these dangers. Community grievances are likely if safety measures are not visible and effective. Accidents involving community members could severely damage the project's reputation and trigger demands colliding with vehicles.

- **Risks of Damage to Public Structures**

Construction activities may interfere with drains, culverts, ramps, and sidewalks. Dense roadside infrastructure increases the likelihood of damage. Temporary loss of drainage or ramps can cause localized flooding of damage. Temporary loss of drainage or ramps can cause localized flooding and restrict access for businesses and households. Stakeholders expect full restoration, and for businesses and households. Stakeholders expect full restoration, and failure to rein failure to reinstate structures could lead to complaints, reputational harm, and potential legal claims.

- **Risks of Wetland/Drainage Disturbance**

Crossing low-lying inundation zones and sediment release during trench release during trenching will disturb wetlands and drainage systems. Altered flow paths, ponding, and turbidity can affect vegetation and aquatic habitats. Although no permanent waterbodies are directly impacted, short-term ecological disturbance and community concerns about flooding are expected. Poor lying will disturb wetlands and drainage systems. Altered flow paths, ponding, and turbidity can affect vegetation and aquatic habitats. Although no permanent waterbodies are directly impacted, short-term ecological disturbance and community concerns about flooding are expected. Poorly managed drainage may also increase mosquito breeding, raising public health risks.

- **Risks of Soil Disturbance & Erosion**

Excavation and exposure of soils during rainfall increase erosion risks. High rainfall, sloped verges, and open drains exacerbate siltation, undermining pavements and increasing desilting demand. Sediment runoff can clog drainage systems, leading to localized flooding and higher maintenance costs for municipal authorities. Long-term erosion may weaken foundations pavements and increase desilting demand. Sediment runoff can clog drainage systems, leading to localized flooding and higher maintenance costs for municipal authorities. Long-term erosion may weaken foundations and destabilize roadside properties.

- **Risks of Water Contamination**

Runoff, spills, disinfection chemicals, and trench water can contaminate community water sources. Many households rely on shallow hand-pumped wells, which are vulnerable during heavy rainfall. Polluted water increases risks of gastrointestinal illness and undermines community trust in the project unless protective measures are implemented. Contamination incidents could trigger regulatory sanctions and reputational damage.

- **Risks of Poor Fuel & Chemical Handling**

Storage and use of fuels and use of fuels, lubricants, and, lubricants, and disinfectants at space-constrained sites pose contamination and fire risks. disinfectants at space-constrained sites pose contamination and fire risks. Without bunded storage and spill kits, leaks can pollute soil and water. Workers face slip and fire hazards, while nearby communities may be exposed to chemical odors or spills. Poor handling could escalate into emergencies requiring costly remediation Without bunded storage and spill kits, leaks can pollute soil and water. Workers face slip and fire hazards, while nearby communities may be exposed to chemical odors or spills. Poor handling could escalate into emergencies requiring costly remediation.

- **Risks of Utility Disruption**

Excavation near telecom, electricity, and water lines risks damaging co-located utilities. Short-term outages can disrupt businesses, households, and essential services. Rapid repair is critical, but even temporary disruptions can cause economic losses and community frustration. Repeated incidents may erode trust in project management and trigger compensation claims.

- **Labor-Related Risks**

Weak HR systems-Related Risks** Weak HR systems, subcontracting opacity, and workforce influx create risks of poor worker welfare, exploitation, and gender-based violence (GBV), non-issuance of employment contracts. Donor safeguards emphasize fair employment, but without strict enforcement, reputational damage and project stoppages may occur. Social tensions between workers and communities can escalate if grievances are ignored, undermining project stability.

- **Improper Sanitary Waste Management & Disposal**

Worker camps and sanitation facilities generate human waste. Limited local waste infrastructure raises hygiene concerns. Poor disposal can spread disease, attract pests, and create nuisance conditions. Communities expect proper sanitation management to avoid health risks. Failure to meet expectations may result in grievances and regulatory penalties.

- **Industrial Accidents (Construction)**

Heavy equipment, lifting operations, and trench collapse risks are heightened by high workforce density and limited emergency response capacity. Severe injuries or fatalities could halt construction, trigger legal liabilities, and damage public trust in the project. Donors may suspend funding if safety standards are not met. Transport trucks and offloading activities obstruct roads and roadside businesses. Narrow roads and trading zones amplify congestion and accident risks. Poor coordination of deliveries can disrupt daily commerce and community mobility. Repeated disruptions may fuel grievances and reduce tolerance for construction activities.

- **Risks of Spread of HIV/AIDS & STD**

Interactions between contractor staff and local populations increase risks of HIV/AIDS and STD transmission. Stakeholders highlight vulnerabilities among youth and women. Without awareness programs and preventive measures, trench collapse risks are heightened by high workforce density and limited emergency response capacity. Severe injuries or fatalities could halt construction, trigger legal liabilities, and damage public trust in the project. Donors may suspend funding if safety standards are not met.

- **Risks of Improper Temporary Stockpiling of Soils & Stones**

Spoil heaps along roads obstruct traders and schools in limited space environments, and removal expose roadside activity and pedestrians to hazards. Dense roadside environments increase risks of injury, dust, noise, and restricted access. Communities may resist construction if safety measures are inadequate. Poorly managed excavation may also damage adjacent properties.

- **Risks of Cumulative Impacts**

Road expansion in Paynesville and Congo Town, drainage rehabilitation at Duport Road and ELWA Junction, and urban settlement growth overlap with pipeline construction. These activities increase flooding, congestion, and air quality deterioration.

- **Risks of Inadequate Security & Theft of Materials:**

If proper security measures are not in place, construction materials and equipment may be stolen or vandalized, leading to project delays, increased costs, and disruption of planned activities.

- **Risks of Contractor Non-compliance (failure to implement project specification and E&S Measures):**

When contractors fail to follow technical specifications or environmental and social safeguard measures, the quality of work may be compromised, regulatory violations may occur, and negative impacts on communities and the environment can arise.

- **Risks of Extreme Weather Events (Heavy rainfall, flooding, climate variability):**

Severe weather conditions such as heavy rainfall, flooding, or unpredictable climate patterns can damage infrastructure, delay construction schedules, and increase safety hazards for workers and surrounding communities**.**

6.3 KEY POSTIVE ENVIRONMENTAL & SOCIAL IMPACTS

- **Uninterrupted Water Supply**

The project will ensure an uninterrupted water supply by replacing aging pipelines and strengthening transmission capacity, which reduces leakages and pressure losses. This improvement means households, schools, clinics, and businesses will receive water consistently without frequent service interruptions. Communities will benefit socially, as women and children will spend less time fetching water, while businesses that depend on water will operate more efficiently. In the long term, uninterrupted supply will build resilience against climate variability and urban growth pressures.

- **Increased Revenue Generation for the Utility**

Reliable water service will increase revenue generation for the utility by encouraging more households and businesses to connect formally, thereby reducing illegal connections. Improved metering and billing systems will capture revenue more effectively, strengthening the financial sustainability of the utility. With higher revenue, the utility can reinvest in expanding networks to underserved areas and allocate funds for maintenance, reducing future breakdowns. This financial growth will also build donor confidence and enable the utility to deliver more equitable access to safe water across communities.

- **Enhanced Public Health Outcomes**

The project will enhance public health outcomes by reducing waterborne diseases such as cholera, diarrhea, and typhoid through the provision of safe, treated water. Reliable supply will also support hygiene and sanitation practices, including handwashing, food preparation, and the functioning of sanitation facilities. Vulnerable groups such as children, the elderly, and immunocompromised individuals will benefit disproportionately from reduced disease burdens. In the long term, healthier communities will be more productive, with fewer days lost to illness, while public trust in government and donor-backed projects will grow as tangible health benefits become visible.

6.4 ENVIRONMENTAL & SOCIAL RISKS & IMPACTS ANALYSIS

Table 13: Environmental & Social Risks & Impacts Analysis

Project Phase	Project Activities Giving Rise to Risks/Benefits	Negative Risk (Potential Problems)	Impacts (Actual/likely Effects)
Preconstruction Phase	Donor negotiations, institutional capacity assessments, project planning	Contextual Governance Risks (Weak institutions, Donor Dependency)	•Project delays due to financing bottlenecks. •Reduced accountability and transparency. •Reputational damage with donors & stakeholders •Institutional fragility undermining sustainability
Preconstruction Phase	Recruitment planning, contractor selection, and workforce mobilization	Labor-related Risks (GBV/SEA/SH & Discrimination)	•Social tension within communities. •Increased risks of conflict between workers & residents. •Reputational harm to the project and implementing agencies. •Reduced trust in the grievance redress mechanism.
Preconstruction Phase	Employment planning, job allocation, and recruitment campaigns	Risks of Uneven Job Distribution	•Perceptions of favoritism or exclusion •Social tensions among local communities. •Reduced morale and productivity among workers. •Potential grievances against project management
Construction Phase	Excavation, pipe laying, and spoil disposal	Risks of Improper Waste Disposal: Improper dumping, limited disposal facilities, and clogged drains.	•Unsanitary conditions •Flooding from blocked drains •Environmental degradation •Community grievances
Construction Phase	Trenching, heavy equipment use, and manual labor	Risks of Occupational Health & Safety Hazards: Trench collapse, struck-by incidents, slips/trips, inadequate PPE	• Worker injuries/ facilities • Lost productivity • Reputational damage •increased insurance/ compensation costs
Construction Phase	Open trenches near communities, equipment movement	Risks of Community Health & Safety: Accidents involving residents.	• 5-10 projected community accidents. • Trust erosion if fencing/ lighting inadequate • Legal liabilities
Construction Phase	Trenching near wells, rainy season runoff	Risks of Water Contamination: Runoff, & surface water, and trench water entering wells may be possible, especially during the rainy season.	• Gastrointestinal illness incidence rise (5-10%) • Household health risks • Loss of community trust
Construction Phase	Excavation in wetlands, drainage alteration	Risks of Wetland Disturbance: Could lead to high turbidity level, ponding, and mosquito breeding.	• Flooding • Vector-borne diseases • Ecological degradation

Project Phase	Project Activities Giving Rise to Risks/Benefits	Negative Risk (Potential Problems)	Impacts (Actual/likely Effects)
Construction Phase	Haulage, road closures, equipment movement	Risks of Traffic Congestion & Mobility Disruption: Congestion, accident risks, and slowed emergency response	• Peak-hour delays (+20-30%) • Accident risk rises (10-15%) • Emergency response delays (5-10 minutes)
Construction Phase	Use of heavy machinery, poor scheduling	Risks of Noise Pollution: Excessive machinery noise, poor scheduling.	• WHO threshold exceeded (85-95 dB) • Disturbance to schools/ clinics • Sleep disruption for residents
Construction Phase	Haul routes, spoil heaps, dust emissions	Risks of Poor Air Quality: Poor suppression, dust from haul routes	• PM10/PM 2.5 exceedances (+50-100 $\mu g/m^3$) • Visibility reduction (30-40%) • Health risks to ~2,000-3,000 roadside traders/ students/residents
Construction Phase	Excavation near utilities, pipe replacement	Risks of Utility Service Disruption: Service outages can occur if appropriate measures are not in place.	• 500-1,000 households/businesses affected per outage • Grievance and reputation harm
Construction Phase	Worker camps, close community interaction	Increase Risks of Disease Transmission: High risks of disease transmission among the workers, staff & community	• HIV/AIDS/STD incidence rise (5-10%) • Community health risks • Reduced workforce productivity
Construction Phase	Fuel storage, chemical handling, and equipment fueling	Risks associated with improper management of fuel and chemicals include spills, leaks, and fire hazards.	• Soil/water contamination • Fire/explosion hazard • Reputational damage
Construction Phase	Overlapping civil works, corridor congestion	Risks of Cumulative Impacts: Intensified congestion, flooding may lead to other ongoing compounded civil works within the corridor.	• Intensified traffic delays (20-25%) • Drainage capacity reduced (15-20%) • Overlapping grievances
Construction Phase	Material storage, unsecured sites	Risks of Inadequate Security & Theft of Materials	• Loss of pipes/equipment • Project delays • Increased costs
Construction Phase	Contractor procurement, safeguard enforcement	Risks of Contractor Non-Compliance: Risks of contractor failure to implement the project based on the specification, risk of contractor failure to implement E&S measures	• Delays in safeguards implementation • Increased donor scrutiny • Reputational harm

Project Phase	Project Activities Giving Rise to Risks/Benefits	Negative Risk (Potential Problems)	Impacts (Actual/likely Effects)
Construction Phase	Rainy season works, climate variability	Extreme Weather Events: Heavy rainfall, flooding, changes in the climatic conditions	• Work stoppages • Damage to trenches and materials • Increased costs • Project delays
Operation Phase	Routine maintenance, asset management	Risks of Poor Maintenance	• Long-term service disruptions • Reduced reliability of water supply • Financial instability for LWSC • Increased repair costs
Operation Phase	Commissioning, testing, and handover	Risks of Delays in Commissioning	• Service disruptions • Community grievances • Reputational damage with donors • Increased project cost
Operation Phase	Tariff setting, billing, and community consultations	Risks of Tariff Disputes	• Financial disputes affecting LWSC sustainability • Reduced community trust • Potential non-payment and revenue loss
Operation Phase	School connections, water supply works	Risks of Temporary School Disruptions	• Short-term disturbance to learning environments • Reduced student attendance • Community grievances
Operation Phase	Continuous water supply operations	Reliable Water Supply (Positive)	• ~100,00-250,000 households' benefit • Reduced waterborne illness • Increase household productivity • Improved community trust
Operation Phase	Water quality monitoring, health campaigns	Improve Health Outcomes (Positive)	• Reduction in gastrointestinal illness incidence • Lower healthcare costs for households • Improved child and maternal health
Operation Phase	School WASH programs, hygiene promotion	Educational Performance (Positive)	• Better student health and attendance • Improved learning outcomes for ~90,000 students • Reduced school absenteeism
Operation Phase	Billing, metering, and financial management	Increased LWSC efficiency (Positive)	• 15-20% revenue improvement • Strengthened financial sustainability • Enhanced institutional credibility • improved customer satisfaction

6.5 RISKS CHARACTERIZATION MATRIX

Table 14: Risks Characterization Matrix

Project Phase	Project Activity	Risk (Potential Problem)	Impact Magnitude	Extent	Duration	Reversibility	Significance
Pre-Construction	Donor negotiations, institutional capacity assessments, project planning	Contextual Governance Risks (Weak institutions, Donor Dependency)	Medium	Institutional/ national	Long-term	Partially reversible	High
	Recruitment planning, contractor selection, and workforce mobilization	Labor-related Risks (GBV/SEA/SH & Discrimination)	High	Workforce/community	Medium-term	Reversible with enforcement	High
	Employment planning, job allocation, and recruitment campaigns	Risks of Uneven Job Distribution	Medium	Local communities	Short-term	Reversible	Medium
	Workforce hiring, training programs, and vocational partnerships	Employment creation & skills Development (Positive Impact_	High	Local communities /workforce	Long-term	Irreversible (Positive gain)	High (beneficial)
Construction	Excavation, pipe laying, and spoil disposal	Risks of Improper Waste Disposal: Improper dumping, limited disposal facilities, and clogged drains.	High	Corridor-wide	Short-term	Reversible	High
	Trenching, heavy equipment use, and manual labor	Risks of Occupational Health & Safety Hazards: Trench collapse, struck-by incidents, slips/trips, inadequate PPE	Medium	Schools, clinics, households	Short-term	Reversible	Medium
	Open trenches near communities, equipment movement	Risks of Community Health & Safety: Accidents involving residents.	Medium	Corridor communities	Short-term	Reversible	Medium
	Trenching near wells, rainy season runoff	Risks of Water Contamination: Runoff, & surface water, and trench water entering wells may be	High	Local environment	Medium-term	Reversible with cleanup	High

		possible, especially during the rainy season.					
	Excavation in wetlands, drainage alteration	Risks of Wetland Disturbance: Could lead to high turbidity levels, ponding, and mosquito breeding.	High	Workers	Short-term	Reversible (with treatment)	High
	Haulage, road closures, equipment movement	Risks of Traffic Congestion & Mobility Disruption: Congestion, accident risks, and slowed emergency response	High	Vulnerable groups	Short-term	Reversible	High
	Use of heavy machinery, poor scheduling	Risks of Noise Pollution: Excessive machinery noise, poor scheduling.	High	Households	Short-term	Reversible with treatment	High
	Haul routes, spoil heaps, dust emissions	Risks of Poor Air Quality: Poor suppression, dust from haul routes	Medium	Businesses, households	Short-term	Reversible	Medium
	Excavation near utilities, pipe replacement	Risks of Utility Service Disruption: Service outages can occur if appropriate measures are not in place.	Medium	Households/ Businesses	Short-term	Reversible with restoration	Medium
	Worker camps, close community interaction	Increase Risks of Disease Transmission: High risks of disease transmission among the workers, staff & community	High	Workforce/community	Medium-term	Partially reversible	High
	Fuel storage, chemical handling, and equipment fueling	Risks associated with improper management of fuel and chemicals include spills, leaks, and fire hazards.	Medium	Corridor-wide	Medium-term	Reversible	Medium
	Overlapping civil works, corridor congestion	Risks of Cumulative Impacts: Intensified congestion and flooding may lead to other ongoing compounded civil works within the corridor.	Medium	Workers/community/ corridor-wide	Medium-term	Reversible	Medium

	Material storage, unsecured sites	Risks of Inadequate Security & Theft of Materials	Medium	Project sites	Short-term	Reversible with recovery	Medium
	Contractor procurement, safeguard enforcement	Risks of Contractor Non-Compliance: Risks of contractor failure to implement the project based on the specification, risk of contractor failure to implement E&S measures	High	Institutional/ project-wide	Long-term	Partially reversible	High
	Rainy season works, climate variability	Extreme Weather Events: Heavy rainfall, flooding, changes in the climatic conditions	High	Corridor-wide	Short-term (episodic)	Reversible with recovery	High
Operation	Routine maintenance, asset management	Risks of Poor Maintenance	Medium	City-wide	Short-term	Reversible	Medium
	Commissioning, testing, and handover	Risks of Delays in Commissioning	Medium	Consumers	Medium-term	Reversible	Medium
	Tariff setting, billing, and community consultations	Risks of Tariff Disputes	High	LWSC, communities	Long-term	Reversible with investment	High
	School connections, water supply works	Risks of Temporary School Disruptions	Low	Schools	Short-term	Reversible	Low
	Continuous water supply operations	Reliable Water Supply (Positive)	High	City-wide	Long-term	Irreversible (positive gain)	High (beneficial)
	Water quality monitoring, health campaigns	Improve Health Outcomes (Positive)	High	City-wide/community	Long-term	Irreversible (positive gain)	High (beneficial)
	School WASH programs, hygiene promotion	Educational Performance (Positive)	Medium	Schools/students	Long-term	Irreversible (positive gain)	Medium–High (beneficial)
	Billing, metering, and financial management	Increased LWSC efficiency (Positive)	High	Institutional/ national	Long-term	Irreversible (positive gain)	High (beneficial)

6.6 SIGNIFICANCE RATING METHODOLOGY

The significance rating methodology provides a structured and transparent approach for evaluating the environmental and social impacts associated with the project. It ensures that all potential impacts are assessed consistently and objectively, allowing decision-makers to prioritize mitigation measures based on the severity and likelihood of each impact. The methodology evaluates each impact using four key criteria: Magnitude, Extent, Duration, and Probability. These criteria are scored numerically and combined to determine an overall Significance Score, which is then classified as Minor, Moderate, or Major.

Table 15: Significance Rating Methodology

Criterion	Definition
Magnitude (M)	Severity of the impact
Extent (E)	Spatial coverage of the impact (site-specific to regional)
Duration (D)	How long will the impact last (short-term to long-term)
Probability (P)	Likelihood of the impact occurring

6.6.1 CRITERIA SCORING

Each criterion is scored from 1 (lowest) to 4 (highest).

Table 16: Criteria Scoring Matrix

Criteria	Score 1 (Low)	Score 2 (Medium)	Score 3 (High)	Score 4 (Critical)
Magnitude	Minor disturbance, negligible effect	Noticeable but manageable	Severe impact on environment/community	Very severe, unacceptable
Extent	Site-specific	Local (community level)	Regional (district/county)	National/international
Duration	Short-term (<6 months)	Medium-term (6 months–2 years)	Long-term (>2 years)	Permanent
Probability	Unlikely (<20%)	Possible (20–50%)	Likely (50–80%)	Almost certain (>80%)

6.6.2 SCORE RANGES

The total score is calculated by summing the four criteria (Magnitude + Extent + Duration + Probability).

Table 17: Score Ranges Matrix

Total Score Range	Significance Rating	Interpretation
4–6	Low	Minor, easily managed impacts
7–9	Medium	Noticeable impacts, require mitigation
10–12	High	Serious impacts, strong mitigation required
13–16	Critical	Severe/unacceptable impacts, may require redesign or avoidance

6.6.3 SIGNIFICANCE RATING MATRIX

Table 18: Significance Rating Matrix

Project Phase	Activity	Risk (Potential Problem)	Magnitude (M)	Extent (E)	Duration (D)	Probability (P)	Total Score	Significance Rating
Preconstruction	Donor negotiations, institutional capacity assessments, project planning	Contextual Governance Risks (Weak institutions, Donor Dependency)	3 (High)	4 (National)	3 (Long-term)	3 (Likely)	13	Critical
Preconstruction	Recruitment planning, contractor selection, workforce mobilization	Labor-related Risks (GBV/SEA/SH & Discrimination)	3 (High)	2 (Local)	2 (Medium-term)	3 (Likely)	10	High
Preconstruction	Employment planning, job allocation, and recruitment campaigns	Risks of Uneven Job Distribution	2 (Medium)	2 (Local)	1 (Short-term)	2 (Possible)	7	Medium
Preconstruction	Workforce hiring, training programs, and vocational partnerships	Employment Creation & Skills Development (Positive Impact)	3 (High, beneficial)	2 (Local)	3 (Long-term)	3 (Likely)	11	High (beneficial)
Construction	Excavation, pipe laying, and spoil disposal	Risks of Improper Waste Disposal: Improper dumping, limited disposal facilities, and clogged drains	3 (High)	3 (Regional)	1 (Short-term)	3 (Likely)	10	High
Construction	Trenching, heavy equipment use, and manual labor	Risks of Occupational Health & Safety Hazards: Trench collapse, struck by incidents, slips/trips, inadequate PPE	2 (Medium)	2 (Local)	1 (Short-term)	3 (Likely)	8	Medium
Construction	Open trenches near communities, equipment movement	Risks of Community Health & Safety Risks: Accidents involving residents	2 (Medium)	2 (Local)	1 (Short-term)	3 (Likely)	8	Medium
Construction	Trenching near wells, rainy season runoff	Risks of Water Contamination: Runoff, & surface water, and trench water entering wells may be	3 (High)	2 (Local)	2 (Medium-term)	3 (Likely)	10	High

Project Phase	Activity	Risk (Potential Problem)	Magnitude (M)	Extent (E)	Duration (D)	Probability (P)	Total Score	Significance Rating
		possible, especially during the rainy season						
Construction	Excavation in wetlands, drainage alteration	Risks of Wetland Disturbance: Could lead to high turbidity levels, ponding, and mosquito breeding	3 (High)	2 (Local)	1 (Short-term)	3 (Likely)	9	Medium–High
Construction	Haulage, road closures, equipment movement	Risks of Traffic Congestion & Mobility Disruption: Congestion, accident risks, and slowed emergency response	3 (High)	2 (Local)	1 (Short-term)	3 (Likely)	9	Medium–High
Construction	Use of heavy machinery, poor scheduling	Risks of Noise Pollution: Excessive machinery noise, poor scheduling	3 (High)	2 (Local)	1 (Short-term)	3 (Likely)	9	Medium–High
Construction	Haul routes, spoil heaps, dust emissions	Risks of Poor Air Quality: Poor suppression, dust from haul routes	2 (Medium)	2 (Local)	1 (Short-term)	3 (Likely)	8	Medium
Construction	Excavation near utilities, pipe replacement	Risks of Utility Service Disruption: Service outages can occur if appropriate measures are not in place	2 (Medium)	2 (Local)	1 (Short-term)	2 (Possible)	7	Medium
Construction	Worker camps, close community interaction	Increase Risks of Disease Transmission: High risks of disease transmission among the workers, staff and communities	3 (High)	2 (Local)	2 (Medium-term)	3 (Likely)	10	High
Construction	Fuel storage, chemical handling, and equipment fueling	Risks associated with improper Fuel & Chemical management, including spills, leaks, and fire hazards	2 (Medium)	3 (Regional)	2 (Medium-term)	2 (Possible)	9	Medium

Project Phase	Activity	Risk (Potential Problem)	Magnitude (M)	Extent (E)	Duration (D)	Probability (P)	Total Score	Significance Rating
Construction	Overlapping civil works, corridor congestion	Risks of Cumulative Impacts: Intensified congestion and flooding may lead to other ongoing compounded civil works within the corridor.	2 (Medium)	3 (Regional)	2 (Medium-term)	2 (Possible)	9	Medium
Construction	Material storage, unsecured sites	Risks of Inadequate Security & Theft of Materials	2 (Medium)	2 (Local)	1 (Short-term)	2 (Possible)	7	Medium
Construction	Contractor procurement, safeguard enforcement	Risks of Contractor Non-Compliance: Risks of contractor failure to implement the project specifications & the E&S requirements	3 (High)	3 (Regional)	3 (Long-term)	3 (Likely)	12	High
Construction	Rainy season works, climate variability	Risks of Extreme Weather Events: Heavy rainfall, flooding, changes in the climatic conditions	3 (High)	3 (Regional)	1 (Short-term episodic)	3 (Likely)	10	High
Operation	Routine maintenance, asset management	Risks of Poor Maintenance	2 (Medium)	3 (Regional/city-wide)	1 (Short-term)	3 (Likely)	9	Medium
Operation	Commissioning, testing, and handover	Risks of Delays in Commissioning	2 (Medium)	2 (Local/consumers)	2 (Medium-term)	2 (Possible)	8	Medium
Operation	Tariff setting, billing, consultations	Risks of Tariff Disputes	3 (High)	3 (Regional/LWSC)	3 (Long-term)	3 (Likely)	12	High
Operation	School connections, water supply works	Risks of Temporary School Disruptions	1 (Low)	2 (Local/schools)	1 (Short-term)	2 (Possible)	6	Low

Project Phase	Activity	Risk (Potential Problem)	Magnitude (M)	Extent (E)	Duration (D)	Probability (P)	Total Score	Significance Rating
Operation	Continuous water supply operations	Reliable Water Supply (Positive Impact)	3 (High, beneficial)	3 (Regional/city-wide)	3 (Long-term)	3 (Likely)	12	High (beneficial)
Operation	Water quality monitoring, health campaigns	Improve Health Outcomes (Positive Impact)	3 (High, beneficial)	3 (Regional/city-wide)	3 (Long-term)	3 (Likely)	12	High (beneficial)
Operation	School WASH programs, hygiene promotion	Educational Performance (Positive Impact)	2 (Medium, beneficial)	2 (Local/schools)	3 (Long-term)	3 (Likely)	10	High (beneficial)
Operation	Billing, metering, and financial management	Increased LWSC Efficiency (Positive Impact)	3 (High, beneficial)	3 (Regional/national)	3 (Long-term)	3 (Likely)	12	High (beneficial)

6.6.4 INTERPRETATION

- **High significance risks (10–12):** Governance weaknesses, GBV/SEA/SH, improper waste disposal, water contamination, wetland disturbance, disease transmission, contractor non-compliance, extreme weather events, tariff disputes, poor maintenance.
- **Medium significance risks (7–9):** Uneven job distribution, occupational health & safety hazards, community safety risks, traffic congestion, noise pollution, dust/air quality deterioration, utility disruption, cumulative impacts, fuel/chemical mismanagement, delays in commissioning.
- **Low significance risks (≤6):** Temporary school disruptions.
- **Positive impacts (beneficial, scored separately):** Employment creation, skills development, reliable water supply, improved health outcomes, LWSC efficiency, better education outcomes.

6.6.5 MAJOR RISKS / IMPACTS (HIGH SIGNIFICANCE)

High Significance Risks / Impacts (10–12 score)

High Significance Risks / Impacts (10–12 score) These are serious risks requiring strong mitigation and continuous monitoring.

- **Governance Weaknesses & Donor Dependency (Pre-construction)**
  - Risk: Institutional fragility, financing delays.
  - Impact: Project delays, reputational damage, reduced accountability.
- **GBV/SEA/SH & Discrimination (Pre-construction)**
  - Risk: Worker influx, weak HR systems.
  - Impact: Social tensions, community conflict, reputational harm.
- **Improper Waste Disposal (Construction)**
  - Spoil volume: ~15,000–20,000 m³; packaging/pipe offcuts ~5–10 tons.
  - Impact: Unsanitary conditions, flooding, environmental degradation, grievances.
- **Water Contamination (Construction)**
  - Shallow wells: ~50–70 at risk; contamination probability 10–20%.
  - Impact: Gastrointestinal illness incidence could rise by 5–10%; household health risks.
- **Wetland Disturbance (Construction)**
  - Area affected: ~2–3 ha; turbidity increase >50 NTU.
  - Impact: Flooding, vector-borne diseases, ecological degradation.
- **Disease Transmission in Worker Camps (Construction)**
  - Risk: High worker–community interaction.
  - Impact: HIV/AIDS/STD incidence could rise 5–10%; reduced workforce productivity.
- **Contractor Non-Compliance (Construction)**
  - Risk: Weak safeguard enforcement.
  - Impact: Delays in safeguards, donor scrutiny, and reputational harm.
- **Extreme Weather Events (Construction)**
  - Risk: Heavy rainfall, flooding, climate variability.
  - Impact: Work stoppages, trench damage, increased costs, delays.
- **Poor Maintenance (Operation)**
  - Risk: Inadequate O&M budgets, lack of training.
  - Impact: Long-term service disruptions, reduced reliability, financial instability for LWSC.
- **Tariff Disputes (Operation)**
  - Risk: Unaffordable tariffs, weak consultation.

- Impact: Financial disputes, reduced trust, non-payment, revenue loss.

6.6.6 MODERATE RISKS / IMPACTS (MEDIUM SIGNIFICANCE)

Medium Significance Risks / Impacts (7–9 score) Noticeable but manageable risks requiring standard safeguards and monitoring.

- **Uneven Job Distribution (Pre-construction)** → Social tensions, reduced morale.
- **Occupational Health & Safety Hazards (Construction)**
  - Incident frequency: 2–3 lost-time injuries per 100 workers.
  - Impact: Worker injuries/fatalities, reputational damage, reduced productivity.
- **Community Health & Safety Risks (Construction)**
  - Open trenches: ~10–15 km exposed.
  - Impact: 5–10 community accidents projected; trust erosion if fencing/lighting inadequate.
- **Traffic Congestion & Mobility Disruption (Construction)**
  - Congestion: peak-hour delays +20–30%.
  - Accident risks: projected rise of 10–15%.
  - Emergency response delays: 5–10 minutes.
- **Noise Pollution (Construction)**
  - Machinery noise: 85–95 dB; WHO threshold exceeded.
  - Sensitive receptors: ~5–10 schools/clinics affected.
- **Dust & Air Quality Deterioration (Construction)**
  - PM10/PM2.5 exceedances: +50–100 µg/m³.
  - Visibility reduction: 30–40%.
  - Health risks: ~2,000–3,000 roadside traders, students, residents affected.
- **Utility Disruption (Construction)** → 500–1,000 households/businesses affected per outage.
- **Cumulative Impacts (Construction)** → Traffic delays compounded by 20–25%; drainage capacity reduced by 15–20%.
- **Fuel & Chemical Handling (Construction)**
  - Storage: ~10,000–15,000 liters.
  - Spill risk: 2–3 minor, 1 major possible.
  - Impact: Soil/water contamination, fire/explosion hazard.
- **Delays in Commissioning (Operation)** → Service disruptions, grievances.

6.6.7 POSITIVE / BENEFICIAL IMPACTS

Positive / Beneficial Impacts (Cross-cutting Benefits): These outweigh risks if mitigation is applied.

- **Employment Creation (Pre-construction & Construction)** → ~200–300 local jobs created; household income boosted.
- **Skills Development (Pre-construction & Construction)** → ~100–150 workers trained in OHS and technical pipe-laying.
- **Community Awareness & Engagement (Construction)** → Transparency and trust strengthened.
- **Short-term Economic Activity (Construction)** → Local procurement stimulates small businesses.
- **Improved Access to Safe Water (Operation)** → ~100,000–250,000 household's benefit; reduced waterborne illness.
- **Long-term Supply Reliability & Climate Resilience (Operation)** → Stable water supply for ~100,000+ residents.

- **Increased LWSC Revenue & Efficiency (Operation)** → 15–20% revenue improvement; financial sustainability strengthened.
- **Improved Educational Performance (Operation)** → Better student health and learning outcomes for ~90,000 students.

6.7 MEASURES TO ENHANCE POSITIVE IMPACTS & OPPORTUNITIES

Key measures and recommendations to enhance positive impacts and opportunities include;

- **Employment & Skills Development**
  - Prioritize local hiring to maximize community benefits.
  - Provide structured OHS and technical training programs for workers, leaving a legacy of improved workforce capacity.
- **Infrastructure Improvements**
  - Upgrade drainage and utility systems beyond baseline to reduce future flooding and outages.
  - Reinstate sidewalks and ramps with improved accessibility standards.
- **Community Trust & Engagement**
  - Establish a transparent Grievance Redress Mechanism (GRM).
  - Hold regular stakeholder meetings to build confidence in project management.
- **Economic Opportunities**
  - Support roadside traders with dust shields, temporary relocation assistance, and compensation.
  - Encourage small local suppliers to participate in material delivery contracts.
- **Health & Awareness**
  - Implement HIV/AIDS and GBV awareness programs, creating long-term social benefits.
  - Provide PPE not only to workers but also distribute masks to vulnerable community members during peak dust periods.

6.8 FEASIBILITY OF MITIGATION MEASURES

- **Technical Feasibility**

The proposed mitigation measures for the Replacement of the Main Water Transmission Line Project are technically feasible because they rely on proven construction practices such as dust suppression, fencing/ barricading of trenches, bunded fuel storage, erosion control, and traffic management. These measures can be implemented with locally available materials and skills, making them practical under project conditions. More specialized interventions, such as bunded chemical storage or advanced noise barriers, may require imported materials, but they remain achievable within the project's logistics framework.

- **Capital and Recurrent Costs**

The capital costs of mitigation measures include the procurement of personal protective equipment, fencing, signage, spill kits, and drainage control structures. Recurrent costs cover activities such as continuous dust suppression, regular occupational health and safety training sessions, operation of the grievance redress mechanism, and routine monitoring. These costs are moderate compared to the overall project budget and are justified by the reduction in accident risks, community grievances, and potential donor compliance issues.

- **Suitability under Local Conditions**

The measures are suitable under local conditions because dust suppression is effective during Liberia's dry season, erosion control is critical during heavy rainfall, and drainage management aligns with the flooding risks common in Monrovia's urban corridors. Socially, fencing, signage,

and awareness campaigns are culturally appropriate and easily understood by communities, while grievance redress mechanisms are consistent with AfDB's expectations and local governance structures.

- **Institutional Requirements**

Institutional arrangements are feasible because contractors can establish dedicated occupational health and safety units, environmental officers, and community liaison staff. Government agencies and the utility's Project Implementation Unit can oversee compliance, coordinate utility relocation, and enforce environmental regulations. Donors will provide oversight through periodic audits and safeguard reviews to ensure standards are met.

- **Training Requirements**

Training requirements are realistic because workers can be inducted on occupational health and safety, personal protective equipment use, and safe excavation practices. Awareness programs on HIV/AIDS, gender-based violence, and community relations can be delivered through workshops and campaigns. Specialized training for handling chemicals, spill response, and emergency preparedness will strengthen workforce capacity, while local contractors will gain valuable experience in donor safeguard compliance and monitoring.

- **Monitoring Requirements**

Monitoring requirements are achievable because environmental monitoring can be conducted through weekly dust and noise checks, monthly water quality sampling, and quarterly erosion inspections. Social monitoring can be carried out through regular stakeholder meetings, grievance tracking, and community safety audits. Institutional monitoring will be ensured through ESMP compliance reports submitted to donors and government agencies.

- **Residual Impacts and Acceptability**

Residual impacts such as minor congestion, background noise, seasonal dust peaks, and residual accident risks will remain even after mitigation. However, these impacts are temporary, reversible, and acceptable under donor standards provided mitigation is enforced and monitoring is continuous. High-risk residuals such as occupational accidents, HIV/AIDS transmission, gender-based violence, and water contamination require ongoing vigilance and institutional commitment, but they are manageable within the proposed framework.

CHAPTER 7: ENVIRONMENTAL AND SOCIAL MITIGATION MEASURES

The Environmental and Social Mitigation Measures section outlines the actions required to prevent, minimize, or offset the potential adverse impacts associated with the Replacement of the Main Water Transmission Line Project. Although the project will significantly improve water supply reliability, reduce leakage, and enhance public health outcomes, its construction activities may generate short-term environmental and social risks. These include soil disturbance, dust and noise emissions, waste generation, traffic disruption, occupational health and safety hazards, community health and safety concerns, and temporary impacts on roadside businesses and vulnerable groups.

This chapter provides a structured approach to managing these risks in accordance with the Environmental Protection Agency (EPA) of Liberia's ESIA Guidelines, the African Development Bank's Integrated Safeguards System (ISS), and international best practice. The mitigation measures presented here form the foundation of the Environmental and Social Management Plan (ESMP) and will guide the contractor, supervising engineer, and Project Implementation Unit (PIU) in ensuring that project activities are implemented responsibly, safely, and sustainably.

7.1 MITIGATION HIERARCHY

Impacts identification and assessment have been undertaken through a process comprising consultation, on-site observations, literature review, and expert opinion based on experience of similar projects. These modeling and assessment results have been reviewed and verified. The general rule in designing such measures is:

Table 19: Mitigation Hierarchy

No.	*Mitigation Hierarchy*
1.	**Avoidance**: The priority is to avoid impacts altogether by careful planning, route selection, and design optimization. For this project, avoidance measures include using the existing utility corridor to prevent new land disturbance and avoiding sensitive ecological areas.
2.	**Minimization**: Where impacts cannot be fully avoided, they are minimized through best-practice construction methods, erosion control, dust suppression, traffic management, and strict occupational health and safety protocols.
3.	**Mitigate / Restoration / Rehabilitation**: Areas disturbed during construction—such as excavated trenches, temporary access routes, and material storage areas—will be restored to their original condition or improved through re-vegetation and site rehabilitation.
4.	**Compensation / Offset**: Where residual impacts remain after avoidance, minimization, and restoration, compensation measures may be applied. These include temporary livelihood support for affected petty traders or community benefit measures where appropriate.

7.2 MITIGATION MEASURES FOR ENVIRONMENTAL AND SOCIAL RISKS

Table 20: Mitigation Measures for Environmental and Social Risks & Impacts

Project Phase	Potential Risk	Impacts	Avoidance Measures	Mitigation Measures	Indicative Cost (LRD / USD)
Preconstruction Phase	Contextual Governance Risks (Weak institutions, Donor Dependency)	•Project delays due to financing bottlenecks. •Reduced accountability and transparency. •Reputational damage with donors & stakeholders •Institutional fragility undermining sustainability	• Early institutional capacity assessment • Secure multi-donor funding commitments • Establish governance framework before project start	• Strengthen institutional frameworks via donor-aligned training • Establish transparent reporting & audit systems • Early donor coordination workshops Independent monitoring and evaluation.	900,000 LRD / 5,000 USD
Preconstruction Phase	Labor-related risks (GBV/SEA/SH) & Discrimination)	•Social tension within communities. •Increased risks of conflict between workers & residents. •Reputational harm to the project and implementing agencies. •Reduced trust in the grievance redress mechanism.	•Screening contractors for HR compliance • Zero-tolerance policy in contracts • Community sensitization before worker influx	• Mandatory Codes of Conduct • Gender-sensitive HR policies & recruitment • Awareness campaigns & training on GBV/SEA/SH •Accessible grievance redress mechanisms with community oversight. •Implementation of Stakeholders Engagement Plan	720,000 LRD / 4,000 USD
Preconstruction Phase	Risks of Uneven Job Distribution	•Perceptions of favoritism or exclusion •Social tensions among local communities. •Reduced morale and productivity among workers. •Potential grievances against project management	Labor market survey before recruitment • Public disclosure of hiring criteria	• Implement transparent recruitment criteria • Public disclosure of hiring processes •Local hiring quotas to ensure inclusion. • Community oversight committees •Implementation of Stakeholders Engagement Plan •Implementation grievance	450,000 LRD / 2,500 USD

				redress mechanisms for fair job allocation	
Preconstruction Phase	Employment Creation & Skills Development (Positive Impact)	•Creation of ~200-300 local jobs, boosting household income. •Training of ~100-150 workers in OHS and technical skills. • Strengthen local capacity for future infrastructure projects. •Enhanced community trust and buy-in through visible benefits.	• Prioritize local hiring • Align training with national skills gaps	• OHS & technical training programs. • Apprenticeship and mentorship schemes. • Partnerships with vocational institutions. • Monitoring of skill transfer and job placement outcomes	810,000 LRD / 4,500 USD
TOTAL	----	-----	-----		**2,880,000 LRD 16,000 USD**
Construction Phase	Risks of Labor and Working Conditions	•Unsafe working environment •Accidents, injuries, unfair labor practices, •Social tension	•Develop labor management plan •Ensure compliance with national labor laws & ILO standards •Provide induction training	•Provide PPE and safety training •Establish grievance redress mechanism •Monitor labor practices	Quoted under Labor-related risks (GBV/SEA/SH & Discrimination)
Construction Phase	Risks on Petty Business Traders	•Temporary displacement of roadside traders •income loss; •Reduced customer access	Map and identify traders early •schedule works to minimize disruption •communicate work schedule/ timelines clearly	•Provide temporary relocation spaces •Schedule work for holidays, weekends, and Sundays •Consult traders in engagement Monitor impacts regularly	
Construction Phase	Risks of Improper Waste Disposal: Improper dumping, limited disposal facilities, and clogged drains.	•Unsanitary conditions •Flooding from blocked drains •Environmental degradation •Community grievances	• Site selection avoiding sensitive drainage zones • Pre-approved disposal sites	• Develop & Implement Waste Management Plan • Implement waste Segregation & recycling • Designate approved disposal sites Monitor contractors' compliance • Routine inspections of disposal sites	630,000 LRD / 3,500 USD
Construction Phase	Risks of Occupational Health & Safety Hazards: Trench collapse, struck-by	• Worker injuries/ facilities • Lost productivity	• Contractor prequalification on OHS	• Provide PPE and enforce usage	1,080,000 LRD / 6,000 USD

	incidents, slips/trips, inadequate PPE	• Reputational damage •increased insurance/ compensation costs	• Design trenches with safe slopes	• Train workers on OHS protocols, Safety drills & toolbox talks • Supervise trenching and lifting operations •Incident reporting system • Daily site safety audits •Ensure emergency response plans in place	
Construction Phase	Risks of Community Health & Safety: Accidents involving residents.	• 5-10 projected community accidents. • Trust erosion if fencing/ lighting inadequate • Legal liabilities	• Avoid trenching near schools/markets • Phase works to minimize exposure	• Secure & barricade trenches • Conduct community safety awareness campaigns •Restrict access to hazardous zones • Emergency response protocols • Install clear signage near work zones	810,000 LRD / 4,500 USD
Construction Phase	Risks of Water Contamination: Runoff, & surface water, and trench water entering wells may be possible, especially during the rainy season.	• Gastrointestinal illness incidence rise (5-10%) • Household health risks • Loss of community trust	• Avoid trenching near shallow wells • Seasonal scheduling to avoid rainy season	• prevent runoff into wells with barriers. • Monitor water quality during civil works Provide alternative water supply if needed. • Ensure chlorination & water quality testing •Implement drainage control measures	540,000 LRD / 3,000 USD
Construction Phase	Risks of Wetland Disturbance: Could lead to high turbidity level, ponding, and mosquito breeding.	• Flooding • Vector-borne diseases • Ecological degradation	• Avoid routing through wetlands • Use alternative alignments	• Controlled excavation • Silt traps & turbidity monitoring • Wetland buffer zones • Seasonal scheduling to avoid peak rainfall •Monitor turbidity and mosquito breeding	180,000 LRD / 1,000 USD

Construction Phase	Risks of Traffic Congestion & Mobility Disruption: Congestion, accident risks, and slowed emergency response	• Peak-hour delays (+20-30%) • Accident risk rise (10-15%) • Emergency response delays (5-10 minutes)	• Avoid peak-hour works • Route planning before construction	• Prepare & Implement Traffic management plan (signage, detours, coordination with police) • Signage & diversions •Schedule works during off-peak hours • deploy trained marshals at critical junctions to guide vehicles and pedestrians safety •Monitor traffic conditions and adjust mitigation strategies (rerouting, timing changes) as needed •Work with local transport providers to adjust schedules or routes during peak construction activities	360,000 LRD / 2,000 USD
Construction Phase	Risks of Noise Pollution: Excessive machinery noise, poor scheduling.	• WHO threshold exceeded (85-95 dB) • Disturbance to schools/ clinics • Sleep disruption for residents	• Avoid night works • Select low-noise equipment	• Noise barriers near schools/clinics •use noise barriers and mufflers • Restricted working hours at night •Ensure regular Equipment maintenance • Monitoring noise levels near schools and clinics	270,000 LRD / 1,500 USD
Construction Phase	Risks of Poor Air Quality: Poor suppression, dust from haul routes	• PM10/PM 2.5 exceedances (+50-100 $\mu g/m^3$) • Visibility reduction (30-40%) • Health risks to ~2,000-3,000 roadside traders/ students/residents	• Avoid haul routes near schools/clinics • Pre-watering of roads	• Conduct regular Water spraying along haul roads • Covering of spoil heaps and trucks transporting materials Enforce dust suppression protocols. • Air quality monitoring • Vehicle emission checks	270,000 LRD / 1,500 USD

Construction Phase	Risks of Utility Service Disruption: Service outages can occur if appropriate measures are not in place.	• 500-1,000 households/ businesses affected per outage • Grievance and reputation harm	• Utility mapping before excavation • Coordination with service providers	• Coordinate with utility providers before excavation •Advance notice to households •Map and mark existing utilities • Rapid response & repair teams • Alternative service provision	270,000 LRD / 1,500 USD
Construction Phase	Increase Risks of Disease Transmission: High risks of disease transmission among the workers, staff & community	• HIV/AIDS/STD incidence rise (5-10%) • Community health risks • Reduced workforce productivity	• Avoid overcrowded camps • Pre-employment health screening	• Provide adequate sanitation, health HIV/AIDS awareness • Partner with local health facility Health screening • Enforce camp hygiene standards • Distribution of protective supplies	270,000 LRD / 1,500 USD
Construction Phase	Risks of improper management of fuel and chemicals: spills, leaks, and fire hazards could be prevalent.	• Soil/water contamination • Fire/explosion hazard • Reputational damage	• Avoid storage near water bodies • Pre-approved storage facilities	•Store fuel and chemicals in Secure storage facilities • Spill kits & training • Train staff in spill emergency Ensure that fire extinguisher and emergency drills Emergency fire response • Regular inspections of storage areas	270,000 LRD / 1,500 USD
Construction Phase	Risks of Cumulative Impacts: Intensified congestion, flooding may lead to other ongoing compounded civil works within the corridor.	• Intensified traffic delays (20-25%) • Drainage capacity reduced (15-20%) • Overlapping grievances	• Avoid overlapping schedules with other contractors • Corridor planning	• Integrated monitoring of traffic & drainage • Adaptive scheduling • Coordination with other contractors	180,000 LRD / 1,000 USD
Construction Phase	Risks of Inadequate Security & Theft of Materials	• Loss of pipes/equipment • Project delays • Increased costs	• Avoid unsecured storage yards • Pre-contract security planning	• Establish secure storage yards with fencing and controlled access.	270,000 LRD / 1,500 USD

				• Deploy night security patrols and surveillance (CCTV where feasible) • Maintain inventory tracking systems and regular audits. •Use tamper-proof locks and restricted access protocols •Engage local community watch groups to strengthen oversight and trust.	
Construction Phase	Risks of Contractor Non-Compliance: Risks of contractor failure to implement the project based on the specification, risk of contractor failure to implement E&S measures	• Delays in safeguards implementation • Increased donor scrutiny • Reputational harm	• Avoid weak contractor selection • Pre-qualification on safeguard	•Include strict safeguard clauses in contracts with clear penalties for violations. • Ensure the contractor submit an Advance Payment Guarantee and an E&S Performance Guarantee prior to contracting •Conduct regular compliance audits and inspections. • Require contractors to submit monthly E&S performance reports - Establish independent monitoring and third-party verification. - Provide training and capacity building for contractors on E&S standards. - Enforce corrective action plans promptly when non-compliance is detected.	270,000 LRD / 1,500 USD
Construction Phase	Extreme Weather Events: Heavy rainfall, flooding, changes in the climatic conditions	• Work stoppages • Damage to trenches and materials • Increased costs • Project delays	• Avoid rainy season scheduling • Climate risk assessment	• Adopt weather-responsive scheduling (avoid peak rainy season for critical works) • Install emergency drainage systems and diversion channels. • Provide protective covering for materials and equipment. -Develop contingency/emergency response plans for flooding and • Integrate climate-resilient design features (e.g., elevated	450,000 LRD/ 2,500 USD

				structures, reinforced trenches). • Monitor weather forecasts and establish early warning systems for site staff.	
SUB-TOTAL	--	--	--	--	**6,120,000 LRD 34,000 USD**
Operation Phase	Risks of Poor Maintenance	• Long-term service disruptions • Reduced reliability of water supply • Financial instability for LWSC • Increased repair costs	• Avoid underfunding O&M • Early capacity building	• Dedicated O&M budget allocation • Training of LWSC staff in preventive maintenance • Schedule inspections and the asset management system • Community reporting channels for service issues • Preventive maintenance	450,000 LRD / 2,500 USD
Operation Phase	Risks of Delays in Commissioning	• Service disruptions • Community grievances • Reputational damage with donors • Increased project cost	• Avoid unrealistic timelines • Early readiness checks	• Early testing & phased commissioning • Contingency planning for delays • Clear communication with stakeholders • Independent verification of readiness	360,000 LRD / 2,000 USD
Operation Phase	Risks of Tariff Disputes	• Financial disputes affecting LWSC sustainability • Reduced community trust • Potential non-payment and revenue loss	• Avoid sudden tariff hikes • Pilot tariff schemes	• Transparent tariff consultations with communities • Social safeguards for vulnerable groups • Gradual tariff adjustments with subsidies • Public awareness campaigns on cost recovery	360,000 LRD / 2,000 USD
Operation Phase	Risks of Temporary School Disruptions	• Short-term disturbance to learning environments • Reduced student attendance • Community grievances	• Avoid schoolwork during term • Early coordination with schools	• Schedule construction works during holidays, weekends, or after school hours • Notify school administrations, teachers, and parents well ahead of planned works.	180,000 LRD / 1,000 USD

				• Provide alternative water supply (e.g., tanks, standpipes) to ensure uninterrupted access. • Install fencing, signage, and restricted access zones around active work areas. • Work closed with the Ministry of Education and school management to align with academic calendars. • Establish feedback channels with schools to quickly address grievances or unforeseen issues.	
Operation Phase	Reliable Water Supply (Positive)	• ~100,00-250,000 households' benefit • Reduced waterborne illness • Increase household productivity • Improved community trust	• Avoid under sizing the transmission line • Design redundancy in system	• Continuous monitoring of water quality and pressure • Climate-résilient infrastructure upgrades • Préventive maintenance programs • Community feedback mechanisms	270,000 LRD / 1,500 USD
Operation Phase	Improve Health Outcomes (Positive)	• Reduction in gastrointestinal illness incidence • Lower healthcare costs for households • Improved child and maternal health	• Avoid contamination sources • Align with public health standards	• Regular water quality testing • Public health awareness campaigns • Collaboration with the Ministry of Health for monitoring • Emergency response protocols for contamination	270,000 LRD / 1,500 USD
Operation Phase	Educational Performance (Positive)	• Better student health and attendance • Improved learning outcomes for ~90,000 students • Reduced school absenteeism	• Avoid poor WASH in schools • Early coordination with the education sector	• Reliable water supply to schools • Hygiene and sanitation programs • Integration of WASH education into the curriculum • Coordination with the Ministry of Education	180,000 LRD / 1,000 USD
Operation Phase	Increased LWSC efficiency (Positive)	• 15020% revenue improvement • Strengthened financial sustainability	• Avoid manual billing inefficiency • Early staff training	• Implementation of smart metering and billing systems	342,000 LRD / 1,900 USD

		• Enhanced institutional credibility • improved customer satisfaction		• staff training in financial management • Transparent reporting and audits • Customer service improvement programs	
SUB-TOTAL:	--	--	--	--	**$2,412,000 LRD / $13,400 USD**
GRAND TOTAL:	--	--	--	--	**11,412,000 LRD 63,400 USD**

7.3 MEASURES TO ENHANCE POSITIVE IMPACTS & OPPORTUNITIES

- **Employment & Skills Development**
  - Prioritize local hiring to maximize community benefits.
  - Provide structured OHS and technical training programs for workers, leaving a legacy of improved workforce capacity.
- **Infrastructure Improvements**
  - Upgrade drainage and utility systems beyond baseline to reduce future flooding and outages.
  - Reinstate sidewalks and ramps with improved accessibility standards.
- **Community Trust & Engagement**
  Establish a transparent Grievance Redress Mechanism (GRM).
  - Hold regular stakeholder meetings to build confidence in project management.
- **Economic Opportunities**
  - Support roadside traders with dust shields, temporary relocation assistance, and compensation.
  - Encourage small local suppliers to participate in material delivery contracts.
- **Health & Awareness**
  - Implement HIV/AIDS and GBV awareness programs, creating long-term social benefits.
  - Provide PPE not only to workers but also distribute masks to vulnerable community members during peak dust periods.

7.4 FEASIBILITY OF MITIGATION MEASURES

7.4.1 TECHNICAL FEASIBILITY

The proposed mitigation measures for the Replacement of the Main Water Transmission Line Project are technically feasible because they rely on proven construction practices such as dust suppression, fencing/ barricading of trenches, bunded fuel storage, erosion control, and traffic management. These measures can be implemented with locally available materials and skills, making them practical under project conditions. More specialized interventions, such as bunded chemical storage or advanced noise barriers, may require imported materials, but they remain achievable within the project's logistics framework.

7.4.2 CAPITAL AND RECURRENT COSTS

The capital costs of mitigation measures include the procurement of personal protective equipment, fencing, signage, spill kits, and drainage control structures. Recurrent costs cover activities such as continuous dust suppression, regular occupational health and safety training sessions, operation of the grievance redress mechanism, and routine monitoring. These costs are moderate compared to the overall project budget and are justified by the reduction in accident risks, community grievances, and potential donor compliance issues.

7.4.3 SUITABILITY UNDER LOCAL CONDITIONS

The measures are suitable under local conditions because dust suppression is effective during Liberia's dry season, erosion control is critical during heavy rainfall, and drainage management aligns with the flooding risks common in Monrovia's urban corridors. Socially, fencing, signage, and awareness campaigns are culturally appropriate and easily understood by communities, while grievance redress mechanisms are consistent with AfDB's expectations and local governance structures.

7.4.4 INSTITUTIONAL REQUIREMENTS

Institutional arrangements are feasible because contractors can establish dedicated occupational health and safety units, environmental officers, and community liaison staff. Government agencies and the utility's Project Implementation Unit can oversee compliance, coordinate utility relocation, and enforce environmental regulations. Donors will provide oversight through periodic audits and safeguard reviews to ensure standards are met.

7.4.5 TRAINING REQUIREMENTS

Training requirements are realistic because workers can be inducted on occupational health and safety, personal protective equipment use, and safe excavation practices. Awareness programs on HIV/AIDS, gender-based violence, and community relations can be delivered through workshops and campaigns. Specialized training for handling chemicals, spill response, and emergency preparedness will strengthen workforce capacity, while local contractors will gain valuable experience in donor safeguard compliance and monitoring.

7.4.6 MONITORING REQUIREMENTS

Monitoring requirements are achievable because environmental monitoring can be conducted through weekly dust and noise checks, monthly water quality sampling, and quarterly erosion inspections. Social monitoring can be carried out through regular stakeholder meetings, grievance tracking, and community safety audits. Institutional monitoring will be ensured through ESMP compliance reports submitted to donors and government agencies.

7.4.7 RESIDUAL IMPACTS AND ACCEPTABILITY

Residual impacts such as minor congestion, background noise, seasonal dust peaks, and residual accident risks will remain even after mitigation. However, these impacts are temporary, reversible, and acceptable under donor standards provided mitigation is enforced and monitoring is continuous. High-risk residuals such as occupational accidents, HIV/AIDS transmission, gender-based violence, and water contamination require ongoing vigilance and institutional commitment, but they are manageable within the proposed framework.

CHAPTER 8: STAKEHOLDER CONSULTATIONS & GRM

8.1 STAKEHOLDER CONSULTATIONS

The stakeholder consultations were carried out in accordance with national EPA's regulations and requirements, and the African Development Bank's Integrated Safeguards System (ISS), particularly OS1, and OS10 including III.5. Grievance mechanisms and accountability.

8.3 STAKEHOLDER IDENTIFICATION & MAPPING

Stakeholder identification and mapping are critical throughout the entire project lifecycle. This process ensures inclusivity, reduces risks, improves project outcomes, and aligns with both funding requirements and national regulatory standards. More importantly, it guarantees that the voices of both powerful actors and vulnerable groups are captured, prevents anticipated conflicts and grievances, and builds trust, legitimacy, and shared ownership of decisions among stakeholders.

To ensure a successful stakeholder engagement, the following steps are applied in identifying stakeholders relevant to the project:

8.3.1 MAPPING DIRECTLY AFFECTED PARTIES

This step involves identifying Project Affected Persons (PAPs), including landowners, tenants, businesses, and communities located along the project corridor. It also covers workers and contractors who are directly engaged in project implementation. These stakeholders are the most immediately impacted and therefore require continuous consultation and mitigation measures.

8.3.2 IDENTIFYING INDIRECTLY AFFECTED GROUPS

Indirectly affected stakeholders include residents impacted by traffic diversions, noise, or environmental changes resulting from project activities. This category also encompasses vulnerable groups such as women, youth, the elderly, and persons with disabilities living along the corridor. Their concerns may not be as visible as those of directly affected parties, but they are critical to ensuring equity and inclusivity in project outcomes.

8.3.3 RECOGNIZING INSTITUTIONAL STAKEHOLDERS

Institutional stakeholders include government ministries, municipal authorities, and regulatory agencies such as the Environmental Protection Agency (EPA). Development partners and financiers, including the African Development Bank (AfDB) and the OPEC Fund, also fall within this category. In addition, non-governmental organizations (NGOs) and civil society organizations play important roles in advocacy, monitoring, and community mobilization. These institutions hold significant influence over project design, compliance, and sustainability.

8.3.4 ANALYZING INTERESTS AND INFLUENCE

The final step involves assessing the interests and influence of each stakeholder group. Stakeholders with high decision-making power, such as financiers and government authorities, must be engaged strategically to ensure compliance and resource support. At the same time, stakeholders with strong personal or community concerns, such as local residents and PAPs, must be prioritized to prevent grievances and foster community ownership. This dual approach ensures

that both institutional authority and community perspectives are integrated into project decision-making.

8.4 CATEGORY OF STAKEHOLDERS

Key stakeholders identified include the following:

Primary Stakeholders: Directly affected communities (McCauley Hill, Whein Town, Red Light, Pipeline, Police Academy, Duport Road, Paynesville Joe Bar, ELWA Junction, Paynesville City).

Secondary Stakeholders: Indirectly affected groups (Bike Riders Association, Petty Traders Union, Liberia Marketing Association, business representatives).

Tertiary Stakeholders: Institutional stakeholders (Liberia Water & Sewer Corporation, local authorities, township representatives).

8.4.1 STAKEHOLDER IDENTIFIED & MAPPED

Table 21: Stakeholder Identified and Map

Category	Stakeholder Group	Description
1. Primary Stakeholders (Directly Affected Parties)	Project Affected Persons (PAPs) including community members and roadside traders	• Landowners along the 15.2km Pipeline Corridor • Tenants and households • Local businesses impacted by construction activities (petty traders, motorcyclists, etc.) • Communities situated along the pipeline route
	Workers, Consultants, Contractors and Subcontractors	• Construction Workers • Sub-contractors and service providers
2. Secondary Stakeholders (Indirectly Affected Groups)	Local Residents	• Residents affected by traffic congestion, noise, dust, and temporary disruptions
	Vulnerable Groups	• Women (market women, household caregivers) • Youth (students, informal workers) • Elderly residents • Persons with disabilities
3. Tertiary Stakeholders (Institutional Stakeholders)	Government Ministries, Agencies and Regulators (including service providers)	• Ministry of Public Works (MPW) • Environmental Protection Agency of Liberia (EPA) • Liberia National Police (LNP) • Liberia Electricity Corporation (LEC) • Ministry of Labor (MOL) • Paynesville City Corporation (PCC)
	Development Partners & Donors	• African Development Bank (AfDB) • OPEC Fund for International Development (OFID)
	Civil Society & NGOs	• Local NGOs advocating for environmental and social safeguards, Media Group. Etc. • Community-based organization (CBOs) • Civil Society Watchdogs

8.9 STAKEHOLDER CONSULTATION & ENGAGEMENT CONDUCTED

During the preparation and update of this ESIA report, two major stakeholder consultation meetings were conducted with the three categories of stakeholders, namely: Primary Stakeholders (Directly Affected Parties); Secondary Stakeholders (Indirectly Affected Groups); and Tertiary Stakeholders (Institutional Stakeholders). Details of the consultations are presented below;

- **DATES AND LOCATIONS OF CONSULTATIONS**
  - **Second Meeting**: November 20, 2025 – Paynesville City Corporation Hall

- **STAKEHOLDERS CONSULTED**
  - **Primary Stakeholders:** Directly affected communities (McCauley Hill, Whein Town, Pipeline Community, Red Light Community, Police Academy Community, Duport Road, Paynesville Joe Bar, ELWA Junction Community, Paynesville Community, Congo Town, etc.)
  - **Secondary Stakeholder:** Indirectly affected groups (Bike Riders Association, Petty Traders Union, Liberia Marketing Association, Business Community representatives).
  - **Tertiary Stakeholders:** Institutional Stakeholders (Liberia Water and Sewer Corporation, Environmental Protection Agency of Liberia, Ministry of Public Works, Paynesville City Corporation, Johnsonville Township, Township of Congo Town, Office of the Representation of the District No. 2, Montserrado County, etc.).

- **Venue of First Stakeholders Consultations - Johnsonville Township Commissioner's Office**
  - The name of participants/ stakeholders is found in the Annex 3A

- **RISKS & IMPACTS PRESENTED**

  The consultation session focused on Project technical scope, works, and how the project will affect or influence the affected communities. Participants were presented with key issues to ensure clarity, transparency, and accountability in project implementation.

  Key Discussion Points:

  - **ENVIRONMENTAL RISKS**
    - Dust and air quality deterioration from excavation and haulage.
    - Noise pollution from heavy machinery and night works.
    - Improper waste disposal leading to flooding and unsanitary conditions.
    - Wetland disturbance (turbidity, mosquito breeding, ecological degradation).
    - Water contamination risks from trench runoff and chemical storage.
    - Fuel and chemical handling risks (spills, leaks, fire hazards).

  - **SOCIAL RISKS**
    - Traffic congestion and mobility disruption affecting commuters and emergency response.
    - Occupational health and safety hazards (trench collapse, struck-by incidents).
    - Community health and safety risks (accidents involving children, the elderly, disabled).
    - Labor-related risks (GBV/SEA/SH, discrimination, uneven job distribution).
    - Disease transmission risks in worker camps.
    - Stakeholder grievances due to poor communication or service disruptions

  - **ECONOMIC RISKS**
    - Utility service disruption (electricity, telecom, water outages).
    - Damage to public structures (ramps, drains, walkways).

- Roadside accidents and trader losses during haulage.
- Cumulative impacts from overlapping urban works (congestion, flooding).
- Tariff disputes during the operation phase are affecting LWSC's sustainability.
- Economic displacement of traders during construction.

- **POSITIVE IMPACTS**
- **Improved water quality and reliability** → Reduced risk of contamination, cleaner supply for households.
- **Reduced reliance on unsafe sources** → Less pressure on wetlands, streams, and shallow wells.
- **Climate resilience** → Modernized infrastructure better withstands flooding and climate variability.
- **Reduced waste and pollution** → Proper disposal systems and improved drainage management lower environmental degradation.
- **Employment creation** → Local jobs during planning, construction, and operation phases.
- **Skills development** → Workforce training in OHS, technical operations, and community engagement.
- **Community health improvements** → Reliable, safe water reduces waterborne diseases (cholera, diarrhea, typhoid).
- **Enhanced education outcomes** → Better school sanitation improves student health, attendance, and learning.
- **Gender and inclusion benefits** → Women and vulnerable groups benefit from reduced burden of fetching unsafe water.
- **Transparency and accountability** → Stakeholder engagement builds trust and strengthens governance.
- **Short-term local economic activity** → Procurement of goods and services from local businesses during construction.
- **Reduced healthcare costs** → Fewer waterborne illnesses lower household and national health expenditures.
- **Improved LWSC financial sustainability** → Smart metering, reduced losses, and better billing systems increase revenue.
- **Business productivity gains** → Reliable water supply supports traders, small industries, and service providers.
- **Compensation and livelihood restoration** → Fair resettlement and grievance mechanisms protect the incomes of affected traders.

Table 22: Main Concerns Raised by Stakeholder/Participants

No.	Issues/Concerns Raised	Responses Provided
1	**Mr. James T. Ngandee (0777385580):** He asked about the allowable distance from the road to the pipeline and expressed concern about the Johnsonville cemetery, which is very close to the road, with graves almost on the roadside. (Roadside Seller)	The project requires at least three meters of working space to conduct civil works, trenching, and pipe laying. The pipeline alignment will be deflected as much as possible to avoid disturbing the cemetery.
2	**Jacob Boakai (0777145944):** As a businessman selling in a container located in the alley, asked whether he would be allowed to bring back his container after removing it for the pipeline construction.	LWSC/PIU clarified that it is not responsible for enforcing laws regarding the protection or maintenance of alleys. Therefore, LWSC cannot approve the reinstatement of containers in alleys. However, should such rare instances occur, the Project design will consider

		re-alignment of the water pipeline to avoid removal of any structure.
3	**Alphons D.N. Teah Jr. (077760784):** Raised concern about his structure built on public property, asking whether the entity would rebuild it if removed or demolished during construction.	The project does not involve resettlement, and no compensation requirement exists. There will be re-alignment of the water pipelines should such rare instances occur.
4	**Unnamed Participant:** Asked whether off-route communities, such as Kpah Town, would be connected to the water supply services.	The project's target is to construct the outstanding 15.2 km of pipeline corridor using a 48-inch ductile iron (DI) pipeline. Off-route communities are not included in the current scope.
5	**Abu J.S. Kromah:** Explained that removing his roadside container would cost around US$50–60 and asked if the project would cover this.	The project does not have the resources to cover container removal costs. In instances where containers are within the project corridor and need to be relocated, the project will first consider re-alignment of the pipeline to avoid relocating such containers.
6	**Hon. Randall Johnson (0775228395):** Emphasized that Johnsonville Township has no water and demanded access. He also highlighted similar concerns from White Plains Township and Louisiana, noting that water currently flows straight to Monrovia while these communities remain underserved.	The concern was welcomed. Since the project is still in its early stages, inclusion of underserved communities such as Johnsonville, White Plains, and Louisiana will be recommended during the design phase.

- **KEY OUTCOME SUMMARY**
  - Participants gained clarity on the distinction between primary, secondary, and tertiary stakeholders, and their respective roles in project implementation.
  - Stakeholders noted that consultative meetings and engagement is a legal and compliance requirement.
  - Stakeholders acknowledged several risks requiring consultation and mitigation,
  - The GRM was presented as a key to address complaints fairly and promptly. Stakeholders were informed about the available grievance platforms (written, verbal, hotlines, anonymous filing) and filing methods accessible to all groups, including vulnerable populations
  - The GRM was highlighted as essential for building trust, preventing conflicts, and strengthening accountability. Confidentiality principles were emphasized to ensure sensitive grievances are handled discreetly.
  - Stakeholders expressed acceptability of the project and hope that the project's positive impacts could be translated immediately.

8.10 GRIEVANCE REDRESS MECHANISM

The Replacement of the Main Water Transmission Line shall establish the grievance mechanism procedures that will provide a means for the public to communicate problems, file complaints, and relate issues arising from the project in a timely and effective. The grievance procedure is conducted as part of the ESIA study. A Grievance Redress Mechanism is a system by which queries or clarifications about the project are responded to, problems that arise out of implementation are resolved, and grievances are efficiently and effectively addressed. The

Grievance Redress Mechanism (GRM) provides a formal process for stakeholders to raise concerns, complaints, or suggestions related to project activities. It ensures that grievances are addressed promptly, fairly, and transparently.

The objectives of the Grievance Redress Mechanism (GRM) are to;

- Establish a formal and accessible process through which project-affected persons (PAPs) and other stakeholders can raise concerns or grievances.
- Respond promptly to grievances to minimize disruption to project activities and reduce risks of escalation.
- Strengthen stakeholder confidence in the project by demonstrating fairness, transparency, and responsiveness in handling complaints.
- Protect the interests of vulnerable groups (women, youth, elderly, persons with disabilities) by ensuring their voices are heard and addressed.
- Use grievance feedback to identify weaknesses in project processes, enhance mitigation measures, and improve service delivery.
- Provide a structured mechanism to resolve disputes at the community level, thereby minimizing potential litigation and reputational damage.
- Maintain records of grievances and resolutions to inform future projects, improve institutional learning, and enhance safeguard compliance.
- Encourage continuous dialogue between the project, contractors, and communities, ensuring inclusive participation and collaboration.

The Grievance Redress Mechanism Committee seeks to achieve the following objectives;

- Provide Affected Parties with a platform to submit their feedback, comments or grievances;
- Record-Receive Grievances and comments- all inputs received through the engagement process should be recorded via meeting records and the grievance log;
- Generate Responses- the Grievance Redress Mechanism Committee (GRMC) team will review comments received and generate comments/responses after each phase of engagement;
- Communicate Responses to Stakeholders who have Raised Comments- all opinions and concerns noted during stakeholder engagements should be recorded by the GRMC and a summary of the feedback and comments is maintained.

8.11 IMPORTANCE OF GRIEVANCE REDRESS

1. INTRINSIC

- Gives voice to the marginalized;
- Builds greater trust and mutual respect between citizens and project authorities;

2. INSTRUMENTAL VALUE

- Helps project management by enhancing efficiency as resources are targeted properly;
- Provides feedback in a systematic and timely manner;
- Generates awareness and demand among citizens to utilize the services properly;
- Deters project-related fraud and corruption;
- Allows beneficiaries to express their voices, creating a sense of ownership;

8.12 GRIEVANCE REDRESS PRINCIPLES

The Grievance Redress Principles are standards that govern an effective and efficient grievance redress mechanism. To achieve environmentally sound and socially stable projects, it is imperative to ensure that the grievance process and procedures are consistent with the following;

- Confidential
- Transparent
- Proportional
- Objective
- Accountable
- Easy
- Fast and accurate
- Participative

8.13 PROCESS OF HANDLING GRIEVANCES

The Grievance Redress Process for the Replacement of the Main Water Transmission Pipeline Project is summarized below;

Step 1: Receipt of Grievance

- Grievances may be submitted verbally, in writing, via phone, email, or through community leaders.
- Complaints are logged into the Grievance Register by the Grievance Redress Committee (GRC).
- Each grievance is assigned a reference number and acknowledged within a specified timeframe (e.g., 48 hours).

Step 2: Screening and Categorization

- The GRC screens the grievance to determine its nature, severity, and eligibility.
- Grievances are categorized as:
  - Minor (easily resolvable at the site level)
  - Moderate (requiring contractor or PIU intervention)
  - Major (involving significant risks, requiring escalation to LWSC, PIU, or Funding agencies).

Step 3. Investigation and Assessment

- A field investigation is conducted to verify facts and collect evidence.
- Stakeholder consultations are held with complainants, contractors, and relevant parties.
- Findings are documented and shared with the GRC.

Step 4. Resolution and Action

- Corrective measures are identified and implemented (e.g., repairs, compensation, access restoration, safety improvements).

- Contractors and PIU are responsible for executing agreed actions.
- Complainants are informed of the resolution and asked to confirm satisfaction.

Step 5: Escalation (if Unresolved)

- If grievances remain unresolved at this level (Project Community Level), they are escalated to;
- PIU/LWSC Senior Management Level for further review
- If the PIU cannot resolve it, the complainant may decide to seek litigation.

Step 6: Closure and Documentation

- Once resolved, grievances are marked as Closed in the register.
- Documentation includes:
  - Nature of grievance.
  - Action taken
  - Resolution outcome
  - Date of closure.
- Records are maintained for accountability and future audits.

The Replacement of the Main Water Transmission Line Project's Grievance Redress Mechanism (GRM) will adopt both the Project Community Level and the Project Implementation Unit (PIU) Level GRM. See next section for more details.

8.14 GRIEVANCE REDRESS MECHANISM PLATFORMS

A two-tier grievance resolution mechanism has been adopted to receive and resolve grievances from the project implementation activities. These includes;

8.14.1 PROJECT COMMUNITY LEVEL GRIEVANCE REDRESS MECHANISM

This is the first tier of grievance handling, closest to the affected people. Community members can lodge complaints verbally, in writing, through suggestion boxes, or via community leaders. A Community Grievance Committee (CGC) is often established, including representatives of women, youth, elders, and vulnerable groups. Minor grievances (e.g., restricted access, dust, noise, minor damages) are addressed quickly at the site level by contractors or community liaison officers. All grievances are logged in a minor register with details of the complainant, nature of the grievance, date, and action taken. Feedback is provided directly to the complainant, ensuring they know the status of their grievance.

The Project Community Level GRM ensures accessibility and rapid resolution. The Project Community Level GRM shall have the following composition;

- Monitoring and Supervision Consultant-Chair
- Representative of each Project Affected Communities-Members
  - Youth
  - Women
  - Elder
  - Vulnerable group
- PIU's E&S Specialist-Member
- Contractor E&S Officer-Member

- Contractor Health and Safety Officer -Member
- Consultant Environmental Officer -Member

8.14.2 PIU LEVEL GRIEVANCE REDRESS MECHANISM

This is the second tier of grievance handling, managed by the Project Implementation Unit (PIU) of LWSC. Grievances unresolved at the community level are referred to the PIU. The PIU level has the authority to enforce corrective actions, update method statements, and ensure compliance with the AfDB Integrated Safeguards Systems. Their role will include consolidating grievance data, tracking resolution timelines, preparing reports, and ensuring grievances are resolved in line with contractual obligations, safeguard frameworks, and legal requirements.

Advantages of the PIU Level GRM include providing oversight and ensuring consistency in grievance handling, strengthening accountability to funding agencies, and enabling systemic improvements by analyzing grievance trends and lessons learned.

The PIU Level GRM shall comprise the following members;

- Project Coordinator-Co-Chair
- E&S Safeguard-Chair
- M&E Engineer
- Managing Director-LWSC
- Deputy Managing Director for Technical Service
- Internal Audit-Member
- Project Affected Persons Representative (Female)
- Project Affected Persons' Representative (Male)

The PIU Level GRM Committee shall ensure that all relevant grievances are resolved within fifteen (15) days from the day the case was escalated from the Project Community Level. The Chairperson of the committee shall communicate the committee's decision to the aggrieved PAPs in writing. The decision reached at the PIU GRM Committee level will be the final decision. If the PAP is not satisfied with the GRM process set for the project, the PAP will have the right to seek a remedy through the court. The committee shall keep a record of all decisions related to each case.

8.15 COMPOSITION OF THE GRM COMMITTEE

The committee will consist of an odd number, such as seven, nine or eleven persons and a co-chair by the Project's Environmental & Social Safeguard Expert and the Project Coordinator. The members of the GRM Committee will be determined and nominated by the leadership of the respective project communities found within the Project Corridor Replacement of the Main Water Transmission Line Project.

8.16 MONITORING AND REPORTING

The Environmental and Social Safeguard Officer will maintain a Stakeholder Engagement Log that records all stakeholder engagements undertaken throughout the project implementation. The Engagement Log includes location and dates of meetings, workshops, and discussions, and a description of the project-affected parties and other stakeholders consulted. A comprehensive result of the inquiries and issues raised by project-affected stakeholders during every stage of the

project implementation will be presented during quarterly stakeholders' engagement meetings within the project-affected communities. Further, a quarterly Steering Committee meeting will be held with interested parties such as Government Ministries, Agencies, Commissions, Non-governmental Organizations, Civil Society, Community-based Organizations, etc. Findings from continuous engagements will be used as a tool to assess the project acceptance level, intervention impacts, and performance in compliance of the project's environmental and social safeguards instruments.

8.17 CAPACITY BUILDING

To successfully implement this ESIA, it is essential that relevant stakeholders have adequate and appropriate capacity. To achieve this capacity of relevant stakeholders needs to be built. Training will be organized by the PIU who should engage qualified consultants with approval from the Bank. The goal of the training for the PIU, employees and Contractor Personnel is to help them in Understanding

- The mitigation measures in the ESMP and how it can be implemented during the course of work
- To allow for the understanding of occupational health and safety rules, at the construction site
- Understand the GRM processes and procedures
- To understand the roles and responsibilities of all stakeholders involved.
- To help in dealing with emergency situations and incidents
- To understand the manner of dealing with any grievances that may arise, such as enquiries, questions, etc
- Importance of sensitizing the concerned communities

In addition, participants will be trained on how to respond effectively to emergencies and incidents, as well as how to manage grievances such as community enquiries or complaints. The training will emphasize the importance of sensitizing affected communities to project activities, risks, and benefits. This capacity-building plan is designed to address identified training gaps and ensure that safeguards are implemented effectively throughout the project cycle

This capacity-building plan is designed to address the identified training gaps highlighted in the Table below.

Table 23: Budget for Capacity Building and Training Plan

Capacity Need	Target Participants	Duration	Facilitator	Project Phase	Unit Cost ($)	No. of Sessions	Total Cost ($)
AfDB's Integrated Safeguard Systems	Contractors, Supervising Engineer, Environmental & Safety Officers, relevant MDAs	½ day	Environmental & Social Safeguards Specialist	Pre-construction	250	10	2,500
Impact Identification & Mitigation Processes	PIU staff, Contractors, Supervisors	½ day	Environmental & Social Safeguards Specialist	Pre-construction & Construction	250	13	3,250
ESMP Monitoring & Evaluation	PIU, Supervisors, AfDB reps	½ day	Environmental & Social Safeguards Specialist	Pre-construction & Construction	250	13	3,250
Occupational Health & Safety / Community Health & Safety	Contractors, Workers	½ day each	Environmental & Social Safeguards Specialist	Construction	250	20	5,000
Hazards in Construction	Contractors, Workers, Supervisors	½ day	Engineering Consultant	Pre-construction & Construction	250	19	4,750
Public Health & Waste Management	PIU, Contractors, Community reps	½ day	Environmental & Social Safeguards Specialist	Construction	250	15	3,750
Communicable Disease Awareness & Prevention	Workers, Community reps	½ day	Environmental & Social Safeguards Specialist	Construction	250	15	3,750
Community & Stakeholder Engagement	Stakeholders along the corridor	½ day	Environmental & Social Safeguards Specialist	Pre-construction & Construction	250	15	3,750
GBV/SEA/SH & Child Labor Prevention, GRM, Code of Conduct	Contractors, Workers, PIU, Community reps, MDAs	½ day	Environmental & Social Safeguards Specialist	Pre-construction & Construction	250	24	6,000
Emergency Preparedness & Incident Response	PIU, Contractors, Supervisors	½ day	Environmental & Social Safeguards Specialist	Construction & Operation	250	26	6,500
International Training – Project Management & E&S Safeguard Certification Training	PIU staff, Contractors, Supervisors	5 days	International Project Management Institute (PMP/PRINCE2 trainers)	Construction & Operation	1,400	5	7,000
Grand Total	—	—	—	—	—	—	**$49,500**

CHAPTER 9: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

This section of the report covers all items required, including;

- Impact-specific mitigation measures
- EOHS clauses for contracts
- Capacity-building
- Environmental Monitoring Matrix
- Risk Management Matrix
- ESMP Matrix (8-column format)
- Key ESMP Indicators
- Grievance Redress Mechanism
- Roles and Responsibilities
- Costed ESMP Budget

9.1 RISK/IMPACT MANAGEMENT MEASURES

A *Measures for Significant and Moderate Impacts*

- **Traffic and Mobility Disruption**
- Implement phased construction to avoid full road closures.
- Deploy traffic wardens at peak hours.
- Install directional signage and barriers.
- Provide advance public notices (radio, flyers, town criers)/consultation & engagement

- **Noise Pollution**
- Restrict high-noise activities to daytime hours.
- Maintain machinery to reduce noise emissions.
- Provide ear protection for workers.

- **Dust and Air Quality Deterioration**
- Regular water spraying along work zone
- Cover trucks transporting spoil.
- Limit excavation during high winds.

- **Waste Generation and Spoil Disposal**
- Segregate waste at source.
- Dispose spoil at EPA-approved sites.
- Reuse excavated soil where feasible
- Maintain waste manifests.

- **Occupational Health and Safety (OHS) Risks**
- Mandatory PPE (helmets, boots, gloves, reflective vests).
- Daily toolbox meetings.

- Trench shoring and safe exaction practices.
- Emergency response plan on site.

- **Community Health and Safety**
- Fence all open trenches.
- Install warning signs and reflective tape.
- Provide safe pedestrian crossings.
- Conduct community awareness campaigns.

- **Damage to Public Structures (drains, culverts, ramps, pavements (asphalt/concrete)**
- Pre-construction condition survey.
- Reinstatement to equal or better condition (included in BOQ).
- Coordination with MPW, PCC & MCC.

- **Vegetation Loss**
- Minimize clearing footprint.
- Replant trees (1:2 replacement ratio)
- Protect remaining green patches.

- **Wetland and Drainage Disturbance**
- Maintain temporary drainage channels.
- Install silt fences and sediment traps.
- Avoid dumping spoil in wetlands.

- **Water Contamination Risks**
- Store chemicals in bounded areas.
- Prevent fuel spills, provide spill kits.
- Protect wells within 50-100 m of works

- **Hazardous Materials**
- Safe handling of chlorine for pipe disinfection.
- Train workers on chemical safety.

- **Labor Conditions and Worker Welfare**
- Enforce fair labor practices.
- Prohibit child labor and forced labor.
- Provide potable water and sanitation facilities.

9.2 EOHS CLAUSES FOR WORKS CONTRACTS

a) General Hygiene, Health & Safety (HHS)

- Mandatory PPE for all workers.
- First aid kits and trained first aiders on site.
- Safe trenching and excavation procedures.
- Fire extinguishers and emergency exits.

b) STD/HIV Awareness

- Conduct monthly awareness sessions.
- Provide free condoms and IEC materials.
- Partner with local health facilities.

c) Worker-Community Relations

- Code of Conduct for all workers.
- Zero tolerance for harassment, intimidation, or misconduct.
- Protection of minors and vulnerable persons.

d) Gender Equity, GBV, SEA/SH Prevention

- Mandatory GBV/SEA training for workers.
- Confidential reporting channels.
- Immediate dismissal for SEA/SH violations.
- Female-friendly grievance.

e) Chance Find Procedure

The following steps shall be adopted and implemented during a Chance Find occasion;

Step 1: Immediate Stop-Work

- The worker or supervisor who identifies a potential cultural object must stop all work immediately in the area.
- A 50-meter buffer zone is established around the find.
- Machinery is shut down and secured.

Step 2: Secure and Protect the Site

- The site is cordoned off using tape or barriers.
- No objects may be touched, moved, or removed.
- Security personnel or designated staff guard the area to prevent theft or disturbance.

Step 3: Notify Authorities

The contractor must notify:

- Supervising Engineer / PIU Safeguards Officer
- Ministry of Information, Cultural Affairs and Tourism (MICAT)
- Local authorities (if required)
- Notification must occur within 24 hours.

Step 4: Preliminary Assessment

The PIU Safeguards Officer and MICAT conduct an initial assessment to determine:

- Whether the find is of cultural significance
- Whether it requires preservation, documentation, or relocation
- Whether further archaeological investigation is needed

Step 5: Decision on Next Step

MICAT, in consultation with the PIU, will decide whether:

- Work can resume immediately
- The site requires controlled excavation
- The find must be removed and preserved

- The project design must be modified to avoid the site
- A written decision is issued within 72 hours**.**

Step 6: Documentation

If required, MICAT will:

- Record the location (GPS)
- Photograph and describe the find
- Conduct controlled excavation
- Arrange for safe storage or relocation

Step 7: Resumption of Works

Work may only resume after:

- Written authorization from MICAT
- Clearance from the PIU Safeguards Officer
- Implementation of any required mitigation measures

Step 8: Reporting

The PIU prepares a Chance Finds Report **including:**

- Description of the find
- Actions taken
- Decisions by authorities
- Any changes to project design
- This report is submitted to: AfDB, EPA, MICAT

9.3 ENVIRONMENTAL AND SOCIAL MONITORING PLAN (ESMP)

9.3.1 ENVIRONMENTAL & SOCIAL MONITORING PLAN – PRE-CONSTRUCTION PHASE

Table 24: Environmental and Social Monitoring Plan- Preconstruction Phase

Project Activity	Negative Risks & Impacts	Rating	Mitigation Measures	Indicator(s)	Mode of Measurement	Mitigation Responsibility	Mitigation Cost	Monitoring Frequency	Monitoring Responsibility	Monitoring Cost
Planning, recruitment, governance	Weak institutions, donor dependency → delays, reputational damage	High	Capacity building, clear roles, transparent reporting, donor coordination	Institutional capacity strengthened	Review of governance reports, donor feedback	LWSC, EPA, Donors	Captured under capacity building	Quarterly	LWSC Safeguards Unit	$9,000
Recruitment, labor mobilization	GBV/SEA/SH, discrimination → social tensions, reputational harm	High	Codes of conduct, gender-sensitive recruitment, awareness training, and grievance redress	% of workforce trained; # of GBV cases resolved	Training records, GRM logs	Contractors, LWSC HR	Refer to Mitigation Measures Matrix	Monthly	LWSC/PIU HR & Safeguards	
Recruitment	Uneven job distribution → community grievances	Medium	Transparent hiring, equal opportunity policies, and community oversight	% of local hires; community satisfaction	HR records, community feedback	LWSC HR, Township Commissioners	Refer to Mitigation Measures Matrix	Bi-monthly	LWSC HR	
Traffic Management	Traffic congestion Increased risk of road traffic accidents and injuries	Medium	Develop and implement a Traffic Management Plan (TMP)	Compliance with TMP Number of road signs and traffic officials present.	TMP report	Contractor	Quoted under the mitigation measures	Daily	LWSC PIU, Engineer	

				Number of community complaints received on traffic issues.						
Labor Influx	Risk of an increase in petty crime as the influx of people increases	Low	Engage more of the local labor with guarantors from the project community.	Number of local labor engaged in the workforce	Percentage of local labor engaged in the workforce	Contractor	Refer to Mitigation Measures Matrix	Monthly	LWSC PIU	
Occupational Health and Safety	Risks of occupational accidents, injuries, and diseases	Low	Develop and implement an HSE plan for site-specific activities.	Number of workers using PPE Compliance with the HSE plan	% of workers using PPE HSE Report	Contractor	Quoted under the mitigation measures	Weekly	PIU Supervising Engineer	$2,000
	Risks of Construction materials and equipment being stolen Risk of vaccine and drugs being stolen(First Aid)	Medium	Working hours should not exceed 5 pm daily The time of start and closure of construction work should be boldly displayed [with reflective writings] at the entrance and within the premises of the construction site	Working hours included in CoC Staff log out book/register	Daily inspection	Contractor	Refer to Mitigation Measures Matrix	Daily		$2,500
	Conflicts and grievances between the facility and the community		◦ Operationalization of the GRM ◦ Put up signposts indicating restricted areas	Complaint from the community	Grievance Log Number of conflicts	GRC	Capture under Stakeholder Engagement Plan	Daily	PIU	

			◦ Staff training and orientation on work ethics, expected roles and responsibilities, as well as penalties/punishments ◦ Development of guidelines for – ▪ Contractors' Code of Conduct ▪ Managers' Code of Conduct ▪ Employees' Code of Conduct Community safety Management Plan							
SUB-TOTAL			◦				**$2,430,000 LRD** **$13,500 USD**			
			◦							

9.3.2 ENVIRONMENTAL & SOCIAL MONITORING PLAN – CONSTRUCTION PHASE

Table 25: Environmental and Social Monitoring Plan - Construction Phase

Project Activity	Negative Risks & Impacts	Rating	Mitigation Measures	Indicator	Mode of Measurement	Responsibility	Cost Estimate	Monitoring Frequency	Monitoring Responsibility	Monitoring Cost
Excavation trenching, pipe laying	Traffic & mobility disruption → delays, accidents	High	Traffic management plan, signage, detours, police coordination	# of accidents; traffic flow reports	Police records, site logs	Contractor, Police	Quoted under Mitigation Matrix	Weekly	LWSC Safeguards	$10,000
	Risks of Community Health and Safety: Accidents involving residents	High	Avoid open trenches near schools, Fencing, lighting, signage, awareness campaigns.	Visible safeguards, GRM Low # of incidents or complaints	Physical inspection Monthly reports	Contractor		Weekly	PIU Safeguards	
Heavy machinery operation	Increase in noise pollution & vibration from the use of machinery & motorized equipment, due to excavation works, increases disturbance to schools/clinics	Medium	Limit night works, barriers, monitoring, Use of mufflers/silencers,	Noise levels < 75 Db	Noise monitoring equipment	Contractor		Weekly	EPA, LWSC	
Excavation, haulage	Dust/air quality deterioration → respiratory irritation	Medium	Dust suppression, covering trucks, monitoring, sprinkling during the dry season	PM10, SO_2, CO, CO_2, NO_2 levels < WHO limits	Air quality monitoring	Contractor	Quoted under Mitigation Matrix	Weekly	EPA	

Project Activity	Negative Risks & Impacts	Rating	Mitigation Measures	Indicator	Mode of Measurement	Responsibility	Cost Estimate	Monitoring Frequency	Monitoring Responsibility	Monitoring Cost
Spoil disposal, packaging	Improper waste disposal → flooding, grievances	High	Develop and implement a Waste Management Plan Approved disposal sites, segregation, monitoring Develop a waste management plan Use principles of waste management.	% waste disposed of at licensed sites, Waste tracking	Disposal records, visual complaints from persons, and in situ testing	Contractor		Monthly	EPA, PIU Safeguard	
	Wetland/drainage disturbance Soil disturbance and erosion	Low	Avoid trenching during heavy rains, Avoid excavation during peak rainfall. Implement erosion control, silt traps, and slope stabilization.	# of erosion-related complaints	Physical inspection	Contractor	-	Weekly	PIU Safeguard	
Trenching, lifting	OHS hazards → worker injuries/fatalities	High	PPE enforcement, OHS training, supervision	# of accidents; % PPE compliance	OHS reports	Contractor	Quoted under mitigation measures	Weekly	PIU Safeguard	$1500
Open trenches, poor fencing	Community health & safety risks → accidents	High	Fencing, lighting, awareness campaigns	# of community accidents	Site inspection reports	Contractor		Weekly	PIU Safeguard	
Excavation near wells	Water contamination → illness, loss of trust	High	Barriers, water monitoring, alternative supply	Water quality meets WHO standards	Lab tests	Contractor, LWSC		Weekly	EPA, LWSC	$2,000

Project Activity	Negative Risks & Impacts	Rating	Mitigation Measures	Indicator	Mode of Measurement	Responsibility	Cost Estimate	Monitoring Frequency	Monitoring Responsibility	Monitoring Cost
Utility relocation	Utility disruption → outages	Medium	Coordination with providers, contingency plans	# of outages; restoration time	Utility records	Contractor, Utility Companies		Monthly	LWSC	$2,000
Wetland excavation	Wetland disturbance → flooding, vector diseases	High	Drainage controls, turbidity monitoring	Turbidity < EPA limits	Water sampling	Contractor		Monthly	EPA	$1,500
	Risk of increased cases of assault of workers by touts of the community Molestation of project workers by touts.	High	Adequate security should be provided within the compound. Surveillance cameras to be installed at sensitive locations to deter theft and or to identify one if it occurs. Consultations with the head of the touts in the community to provide/recommend skilled youths amongst them to work in the construction site.	MoU between the security agency/personnel and the implementing agency.	Daily inspection	Contractor	Quoted under Stakeholder Engagement budget	Daily	PIU	$10,000
Worker camps	Disease transmission → public health burden	Medium	Sanitation facilities, health checks, awareness	# of health incidents	Health records	Contractor	Costed under community health risks & accidents.	Monthly	Ministry of Health	
Fuel/chemical storage	Spills, leaks, fire hazards	High	Bunded storage, spill kits, fire safety	# of spill incidents	Inspection reports	Contractor		Monthly	LWSC/ PIU Safeguard	$2,000

Project Activity	Negative Risks & Impacts	Rating	Mitigation Measures	Indicator	Mode of Measurement	Responsibility	Cost Estimate	Monitoring Frequency	Monitoring Responsibility	Monitoring Cost
Sub total							**$5,220,000 LRD $29,000 USD**			

9.3.3 ENVIRONMENTAL AND SOCIAL MONITORING PLAN – OPERATION PHASE

Table 26: Environmental and Social Monitoring Plan-Operational phase

Project Activity	*Risks & Impacts*	Rating	Mitigation Measures	Indicator	Mode of Measurement	Responsibility	Cost Estimate	*Monitoring Frequency*	Monitoring Responsibility	Monitoring Cost
Commissioning of the pipeline	*Delays in commissioning → service disruption*	Medium	Phased testing, contingency plans	% of households connected	LWSC service records	LWSC	N/A	*Quarterly*	LWSC Ops Unit	$1,500
Tariff adjustments	*Tariff disputes → grievances*	Medium	Consultations, transparent billing, subsidies	# of disputes resolved	GRM logs	LWSC	Quoted in the SEP/GRM Framework	*Quarterly*	LWSC Finance	$1,500
Routine O&M	*Poor maintenance → unreliable services*	High	Staff training, O&M budgets, preventive maintenance	% of preventive maintenance completed	LWSC O&M records	LWSC	$1,000	*Quarterly*	LWSC Ops Unit	$2,500
	Risks of poor services	High	Lack of capacity building & training	% of staff trained in a specific category	Training Report, Monthly reports	LWSC/PIU	$1,000	*Quarterly*	LWSC/PIU	$1,000
School sanitation improvements	*Temporary disruption → short-term disturbance*	Low	Schedule works during holidays, temporary facilities	# of schools disrupted	School records	LWSC, Ministry of Education	$1,000	*Bi-annual*	LWSC Safeguards	$500

SUB-TOTAL							$1,260,000 LRD $7,000 USD
GRAND TOTAL							$8,910,000 LRD $49,500 USD

9.4 COST ESTIMATES FOR ESMP IMPLEMENTATION

The indicative cost of implementing the ESMP is valued at **Thirty-Two Million One Hundred Fifty-Five Thousand Two-Hundred Liberian Dollars Only (L$32,155,200)** equivalent to **One Hundred Seventy-Eight Thousand, Six Hundred Forty United States Dollars (US$178,640)**. The breakdown is shown in the table below;

Table 27: Indicative Cost of ESMP Implementation

Measures	Description	Cost (LRD)	Cost (USD)
Mitigation	Preconstruction Phase	2,880,000	16,000
	Construction Phase	6,120,000	34,000
	Operation Phase	2,412,000	13,400
Subtotal Mitigation		**11,412,000**	**63,400**
Monitoring	Preconstruction Phase	2,430,000	13,500
	Construction Phase	5,220,000	29,000
	Operation Phase	1,260,000	7,000
Subtotal Monitoring		**8,910,000**	**49,500**
Capacity Building	Training of relevant stakeholders & staff	8,910,000	49,500
Subtotal: Capacity Building		**8,910,000**	**49,500**
Sum of Subtotals		**29,232,000**	**162,400**
Contingency (10%)		2,923,200	16,240
Grand Total		**32,155,200**	**178,640**

- *Currency: Liberian Dollars (LRD); Exchange Rate: US$1 = L$180*

9.5 KEY ESMP IMPLEMENTATION INDICATORS

1. Number of accidents/incidents reported monthly.
2. Percentage of Sub-Plans Implemented on Schedule (TMP, WMP, PMP)
3. Number of Grievances received and resolved.
4. Compliance rate with PPE usage.
5. Number of environmental monitoring reports submitted on time.

9.6 CONSTRUCTION CAMP MANAGEMENT PLAN (CCMP)

The Construction Camp Management Plan ensures that any worker camp established for the project is sited, constructed, and operated in a manner that protects the environment, safeguards worker welfare, and prevents negative impacts on nearby communities.

9.7 CAMP SITING REQUIREMENTS

The construction camp must:

- Be located at least 500 m from homes, schools, clinics, and markets
- Avoid wetlands, flood zones, and ecologically sensitive areas
- Be established on previously disturbed land
- Have safe access to existing roads
- Not require resettlement or displacement
- Be approved by the EPA and local authorities

9.8 CAMP DESIGN AND FACILITIES

The camp must include:

- Sleeping quarters with adequate ventilation
- Potable water supply
- Sanitary toilets and bathing facilities
- Waste bins and segregation areas
- First-aid station and emergency equipment
- Fire extinguishers and fuel storage in bunded areas
- Perimeter fencing and controlled access

9.9 CAMP OPERATION REQUIREMENTS

- Maintain high standards of hygiene and housekeeping
- Provide adequate lighting and security
- Implement a worker Code of Conduct (including SEA/GBV prevention)
- Prohibit alcohol abuse, weapons, and illegal activities
- Ensure safe food storage and preparation
- Provide OHS training and PPE
- Maintain a worker grievance mechanism

9.10 WASTE AND WASTEWATER MANAGEMENT

- Solid waste is segregated and disposed of at EPA-approved sites
- Wastewater treated through septic systems
- No discharge into water bodies
- Hazardous waste stored in labelled, secure containers

9.11 COMMUNITY RELATIONS

- Conduct regular engagement with nearby communities
- Avoid noise, dust, and traffic disturbances
- Prohibit workers from entering communities without authorization
- Enforce strict rules against harassment or misconduct

9.12 CAMP DECOMMISSIONING

At project completion:

- Remove all temporary structures
- Restore land to its original condition
- Dispose of waste and debris
- Replant vegetation where necessary

CHAPTER 10: CONCLUSION AND RECOMMENDATIONS

The Environmental and Social Impact Assessment (ESIA) for the Replacement of the Main Water Transmission Line Project demonstrates that the proposed intervention is both environmentally justified and socially beneficial. The existing transmission infrastructure is severely aged, undersized, and prone to frequent leakage, resulting in high non-revenue water losses, unreliable supply, and increased public health risks. The replacement of the 15.2 km pipeline is therefore essential to improving water security, strengthening public health outcomes, and enhancing the operational efficiency of the Liberia Water and Sewer Corporation (LWSC).

The ESIA findings show that the project will generate a number of short-term negative impacts**,** primarily during the construction phase. These include traffic disruption, dust and noise emissions, soil erosion, waste generation, disturbance of drainage channels, occupational health and safety risks, community safety concerns, and temporary impacts on roadside businesses and utilities. Based on the significance rating methodology, several of these impacts fall within the Major category before mitigation, particularly those related to traffic, OHS, soil erosion, drainage disturbance, and community safety.

However, the ESMP embedded within this ESIA provides a comprehensive set of mitigation, monitoring, and management measures that effectively reduce all major risks to Moderate or Low significance. The ESMP outlines clear responsibilities, monitoring indicators, cost estimates, and institutional arrangements to ensure that environmental and social safeguards are implemented consistently throughout the project lifecycle. With proper adherence to the ESMP, the project's adverse impacts will be temporary, localized, and fully manageable.

Overall, the ESIA concludes that the Replacement of the Main Water Transmission Line Project is environmentally sound, socially beneficial, and technically feasible. With strict implementation of the ESMP, the project can proceed without causing significant or irreversible harm to the environment or surrounding communities.

RECOMMENDATIONS

. The following are recommended;

1. Strict Implementation of the ESMP LWSC, the Contractor, and the PIU should ensure full compliance with all mitigation, monitoring, and reporting requirements outlined in the ESMP. This includes daily site inspections, weekly environmental and social monitoring, and monthly reporting to the EPA.
2. Strengthen Contractor Environmental and Social Capacity**:** The Contractor should prepare a detailed Contractor ESMP (C-ESMP) aligned with the ESIA and ESMP. Dedicated environmental, social, OHS, and community liaison officers should be assigned to the project.
3. Enhance Traffic and Community Safety Measures Given the dense urban setting, a traffic management, pedestrian safety, and community protection plan shall be developed and prioritized by the Contractor. Adequate signage, barriers, lighting, and controlled access should be maintained at all times.

4. Maintain Effective Stakeholder Engagement Continuous communication with affected communities, local authorities, and vulnerable groups is essential. The Grievance Redress Mechanism (GRM) should remain active, accessible, and responsive throughout construction.

REFERENCE

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- Liberia Water and Sewer Corporation (LWSC). **(**2024). *Project Concept Note: Replacement of the Main Water Transmission Line (P-LR-EAC-002-REMAWATL-MR).* Monrovia.
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- The Climate-Data.org
- The Liberia Meteorological Service (LMS)The FAO AQUASTAT database
- The U.S. National Oceanic and Atmospheric Administration (NOAA) Global Climate Data
- The Final Petty Trader Resettlement Action Plan (RAP) Addendum for the Liberia Road Asset Management Project (LIBRAMP 6.1 KM), Prepared by the Ministry of Public Works, Infrastructure Implementation Unit, Liberia.

ANNEX 1: EOHS CLAUSES FOR WORK CONTRACTS

EOHS CLAUSES FOR WORKS CONTRACTS

a) General Hygiene, Health & Safety (HHS)

- Mandatory PPE for all workers.
- First aid kits and trained first aiders on site.
- Safe trenching and excavation procedures.
- Fire extinguishers and emergency exits.

b) STD/HIV Awareness

- Conduct monthly awareness sessions.
- Provide free condoms and IEC materials.
- Partner with local health facilities.

c) Worker-Community Relations

- Code of Conduct for all workers.
- Zero tolerance for harassment, intimidation, or misconduct.
- Protection of minors and vulnerable persons.

d) Gender Equity, GBV, SEA/SH Prevention

- Mandatory GBV/SEA training for workers.
- Confidential reporting channels.
- Immediate dismissal for SEA/SH violations.
- Female-friendly grievance.

ANNEX II: CHANCE FIND PROCEDURES

Chance Find Procedure

The following steps shall be adopted and implemented during a Chance Find occasion;

Step 1: Immediate Stop-Work

- The worker or supervisor who identifies a potential cultural object must stop all work immediately in the area.
- A 50-meter buffer zone is established around the find.
- Machinery is shut down and secured.

Step 2: Secure and Protect the Site

- The site is cordoned off using tape or barriers.
- No objects may be touched, moved, or removed.
- Security personnel or designated staff guard the area to prevent theft or disturbance.

Step 3: Notify Authorities

The contractor must notify:

- Supervising Engineer / PIU Safeguards Officer
- Ministry of Information, Cultural Affairs and Tourism (MICAT)
- Local authorities (if required)
- Notification must occur within 24 hours.

Step 4: Preliminary Assessment

The PIU Safeguards Officer and MICAT conduct an initial assessment to determine:

- Whether the find is of cultural significance
- Whether it requires preservation, documentation, or relocation
- Whether further archaeological investigation is needed

Step 5: Decision on Next Step

MICAT, in consultation with the PIU, will decide whether:

- Work can resume immediately
- The site requires controlled excavation
- The find must be removed and preserved
- The project design must be modified to avoid the site
- A written decision is issued within 72 hours**.**

Step 6: Documentation

If required, MICAT will:

- Record the location (GPS)
- Photograph and describe the find
- Conduct controlled excavation
- Arrange for safe storage or relocation

Step 7: Resumption of Works

Work may only resume after:

- Written authorization from MICAT
- Clearance from the PIU Safeguards Officer
- Implementation of any required mitigation measures

Step 8: Reporting

The PIU prepares a Chance Finds Report, including:

- Description of the find
- Actions taken
- Decisions by authorities
- Any changes to project design

ANNEX 3A: NAME OF STAKEHOLDER ENGAGED

Name of Participants/Stakeholders- Johnsonville Commissioner Office

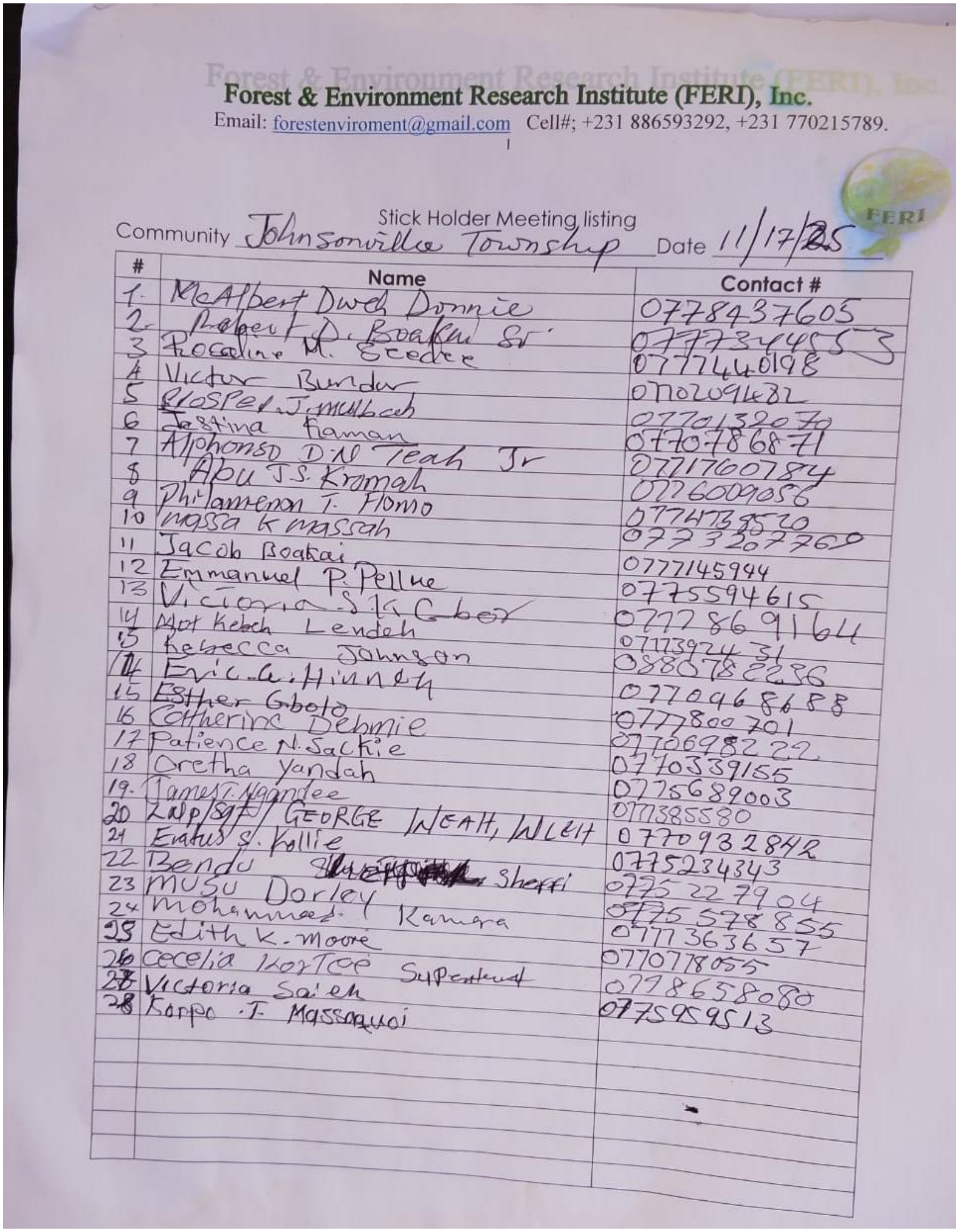
No.	Name	Address	Cell number	Date
1.	Augustine Jallah	Morris Farm, Paynesville	0775813209	November 17, 2025
2.	Sr David K Varla	Wood Camp, Duport Road	0880536708	November 17, 2025
3.	G Augustine Joemah	Parker Paint	0777232306	November 17, 2025
4.	Beacon M. Moore	West Bank, Paynesville	0775956054	November 17, 2025
5.	Francis S Saydee	Red Light Community	0777844523	November 17, 2025
6.	Enoch N F Guah	Pipeline Bookor Farm	0777248459	November 17, 2025
7.	Teto K Sehongbay Jr	Kpelle Town, Benard Farm	0775999060	November 17, 2025
8.	P David S Romeo	Keuema Community	0777024904	November 17, 2025
9.	Joseph G Mehdeh	SKD Sport Complex	0777044287	November 17, 2025
10.	Francis Varney	1108 Bassa Town Community	0777338674	November 17, 2025
11.	Sunday Ezaka	Watch Tower Community	0775242241	November 17, 2025
12.	Peter S Ward	Garzah, Paynesville	0777593408	November 17, 2025
13.	Foday B Toure	Omega Towel Community	0889172365	November 17, 2025
14.	Oumar Barrie	Pipeline Community	0778165317	November 17, 2025
15.	Diggs J Pennoh	GSA Road Community	0778352499	November 17, 2025
16.	Grimes A Boldy	Omega Redhill	0778229027	November 17, 2025
17.	Jimmy Wesseh Sr	Police Academy Community	0770572504	November 17, 2025
18.	Ekenneh G Sahn	Duport Road Community	0777845145	November 17, 2025
19.	Vision G S Mandeh	Duport Road waterside	0773018999	November 17, 2025
20.	John W Tohn Sr	Omega Old Field	0777234688	November 17, 2025
21.	Prince Mulbah	Police Academy Junction	0778086658	November 17, 2025
22.	Bishop Elijah T Peter	Cross River Estate Community	0776073514	November 17, 2025
23.	Joseph Saah Bonda	Liberia Water & Sewer Corporation	0886817987	November 17, 2025
24.	Albert Gardian	OSIWA Community	0886800908	November 17, 2025
25.	Derick D Dunbar	O	0772395967	November 17, 2025

ANNEX 3B: NAME OF STAKEHOLDERS ENGAGED

Name of Participants/Stakeholders- Paynesville City Corporation Hall

No.	Name	Address	Cell Number	Date
1	Robert D. Boakai Sr.	ELWA Community	0777344553	November 20, 2025
2	Jimmy Wessehtue	Duport Road	0770572504	November 20, 2025
3	Ekenneh G. Sahn	Redlight Community	0778229027	November 20, 2025
4	Grimes A. Blody	Johnsonville Community	0778229027	November 20, 2025
5	Vision G.S. Mandeh	Paynesville Community	0773018999	November 20, 2025
6	Peter S. Ward	Congo Town	0777593408	November 20, 2025
7	Thomas T. Dolo	Johnsonville Community	0776213951	November 20, 2025
8	Oscan Sippi	Police Academy Community	0777421003	November 20, 2025
9	Winifred S. Taylor	Paynesville Townhouse Community	0770440156	November 20, 2025
10	Arthur Z. Garuoloquoi	GSA Road Community	0777319267	November 20, 2025
11	Douglas M. Doegan	Duport Road	0777000021	November 20, 2025
12	David S. Nulah Jr.	Pipeline Road	0776375703	November 20, 2025
13	Oumar Barrie	Police Academy Community	0778165397	November 20, 2025
14	Bishop Elijah T. Peters	Paynesville City	0776073514	November 20, 2025
15	John W. Tahn Sr.	Congo Town	0777234688	November 20, 2025
16	Zegbeh K. Sorwor	GSA Road community	0886493117	November 20, 2025
17	Musu K. Browne	Redlight community	0880221636	November 20, 2025
18	Marthaline Siaker	Duport Road	0776207891	November 20, 2025
19	Massa Addison	Pipeline community	0777514286	November 20, 2025
20	J. Morlu Kennedy	Paynesville City	0886438188	November 20, 2025
21	Cyrus D. Wesseh	Congo Town	0886210405	November 20, 2025
22	Joseph S. Bonda	ELWA Community	0886817987	November 20, 2025
23	Albert Gardian	Duport Road	0886800908	November 20, 2025
24	Derick D. Dunbar	Paynesville Joebar Community	0772398962	November 20, 2025

ANNEX 4A: STAKEHOLDER ATTENDANCE LISTING



Forest & Environment Research Institute (FERI), Inc.

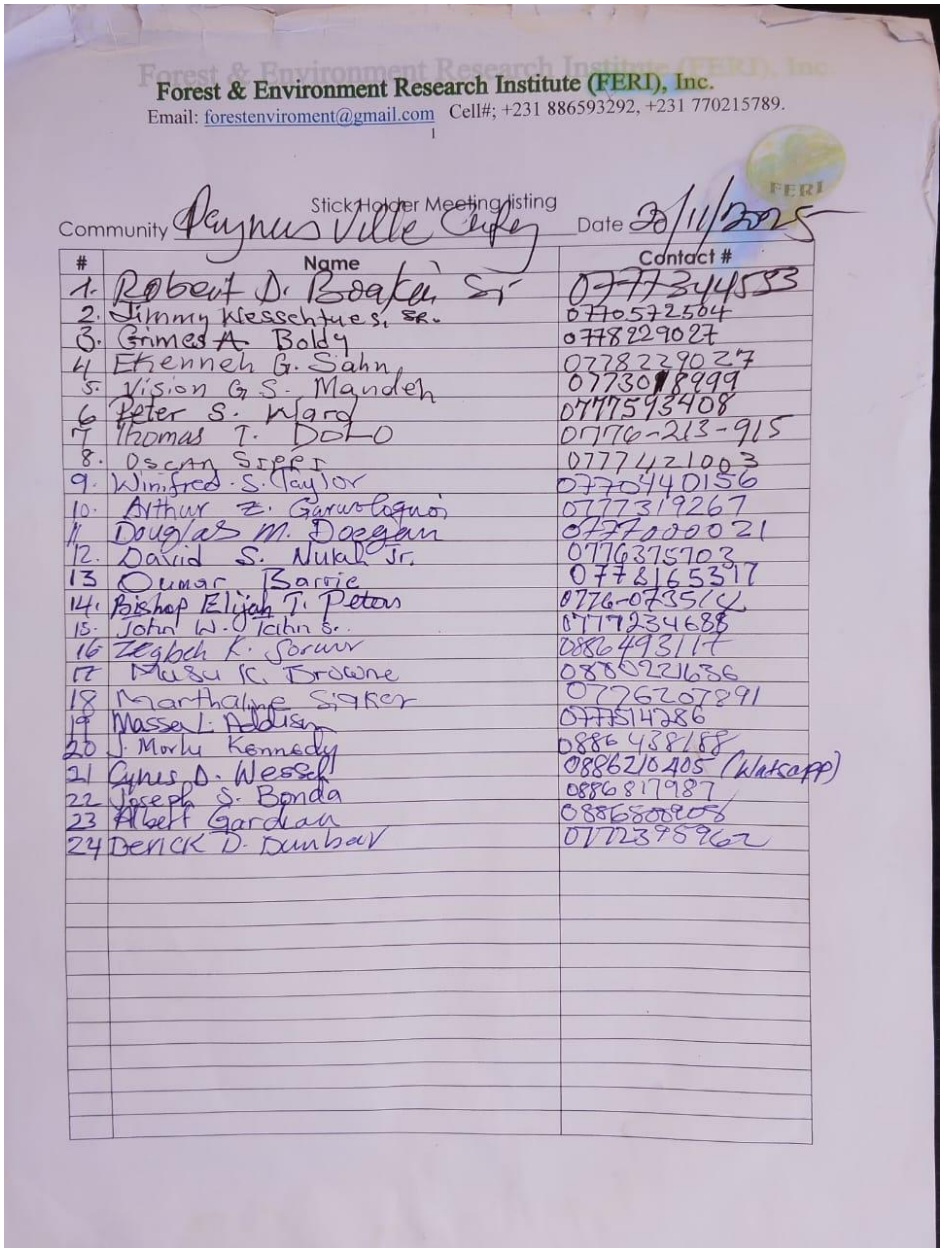
Email: forestenviroment@gmail.com Cell#; +231 886593292, +231 770215789.

Stick Holder Meeting listing

Community Johnsonville Township Date 11/17/25

#	Name	Contact #
1.	McAlbert Dweh Donnie	0778437605
2.	Robert D. Boakai Sr.	0777734455
3	Roseline M. Scedee	0777440198
4	Victor Bundor	0770209482
5	Prosper J. Mulbah	0770132070
6	Jestina Kaman	0770786871
7	Alphonso D.N Teah Jr	0771760784
8	Abu J.S. Kromah	0776009056
9	Philamenon T. Flomo	0774738520
10	Massa K Massah	0773207769
11	Jacob Boakai	0777145944
12	Emmanuel P. Pellue	0775594615
13	Victoria S.K. Gbor	0777869164
14	Mot Kebeh Lendeh	077739243[illegible]
15	Rebecca Johnson	0880782236
14	Eric G. Hinneh	0770468688
15	Esther Gboto	0777800701
16	Catherine Debmie	0770698222
17	Patience N. Sackie	0770339155
18	Oretha Yandah	0775689003
19.	James T. Ngandee	0777385580
20	LNP/Sgt/ GEORGE WEAH, WLEH	0770932842
21	Eratus S. Kollie	0775234343
22	Bendu [illegible] Sherri	0775227904
23	Musu Dorley	0775578855
24	Mohammed Kamara	0777363657
25	Edith K. Moore	0770778055
26	Cecelia Kortee Supertend	0778658080
27	Victoria Saieh	0775959513
28	Korpo T. Massaquoi	

ANNEX 4B: STAKEHOLDER ATTENDANCE LISTING



Forest & Environment Research Institute (FERI), Inc.
Email: forestenviroment@gmail.com Cell#; +231 886593292, +231 770215789.

Stick Holder Meeting listing

Community Paynesville City Date 20/11/2025

#	Name	Contact #
1.	Robert D. Boakai Sr.	0777344533
2.	Jimmy Wesschtues, Sr.	0770572504
3.	Grimes A. Boldy	0778229027
4	Ekenneh G. Sahn	0778229027
5.	Vision G.S. Mandeh	0773018999
6	Peter S. Ward	0777593408
7	Thomas T. Dolo	0776-213-915
8.	Oscar Sieh	0777421003
9.	Winifred S. Taylor	0770740156
10.	Arthur Z. Garwolaquoi	0777319267
11	Douglas M. Doegan	0777000021
12.	David S. Nuku Jr.	0776375703
13	Oumar Barrie	0778165317
14.	Bishop Elijah T. Peters	0776-073514
15.	John W. Tahn Sr.	0779234688
16	Zegbeh K. Sorwor	0886493117
17	Musu K. Browne	0886221636
18	Marthaline Sieh	0776207291
19	Massel Addison	0775514286
20	Morlu Kennedy	0886 438188
21	Cyrus D. Wesseh	0886210405 (Whatsapp)
22	Joseph S. Bonda	0886817987
23	Albert Gardiah	0886808056
24	DERICK D. Dunbar	0772375962

ANNEX 5: LABORATORY ANALYSIS RESULTS

UL CIVIL ENGINEERING LABORATORY
College of Engineering
University of Liberia, P.O. Box 9020
Fendall Campus 1000 Monrovia 10, Liberia WA

Analytical Results

Order ID: ***UL LAB/LWSC/0089/2025***

Client: Liberia Water and Sewer Corporation (LWSC)

Location: Pipeline Corridor from McKollie Hill to Baptist Compound, Congo Town

Date of Assessment: November 11, 2025

Sample Matrix: water, air, sound, and soil

Analysis Start Date: November 25, 2025

Laboratory: University of Liberia Civil Engineering Laboratory

Table 1: Water Sample Information

Sample Code	Location	GPS Coordinates (29N UTM)		Date	Time
		X	Y		
WS-001	Creek	0313672	0704 867	November 11, 2025	11:07 am
WS-002	Stream	0313631	07041747	November 11, 2025	11:20 am
WS-003	Stream	0314314	0701747	November 11, 2025	11:37 am

WS=Water sample

Table 2: Soil Sample information

Code	Location	Coordinates (29 N UTM)		Date	Time
		X	X		
SQ-001	LWS 332 +08	0313698	0705148	**November 13, 2025**	**10:00 am**
SQ-002	Kpelleh Town Junction	0313335	0701351	**November 13, 2025**	**12:00 pm**
SQ-003	Whein Town Junction	0313128	0699032	**November 13, 2025**	**1:00 pm**
SQ-04	McKollie Hill	0313698	0705148	**November 13, 2025**	10.00 am
SQ-05	Congo Twon	0310482	0692732	**November 13, 2025**	2:30 pm

SQ=Soil Quality

Table 3: Air Quality Sampling Information

Code	Location	Coordinates (29 N UTM)		Date	Time
		X	Y		
AQ-001	Kpelleh Town Junc.	0313335	0701351	**November 13, 2025**	**12:20 pm**
AQ-002	McCauley Hill	0313698	0705148	**January 14, 2025**	10:00 am
AQ-003	Redlight	0312934	0695855	**January 14, 2025**	2:00 pm
AQ-004	Duport road	0312740	0693907	**January 14, 2025**	2:30 pm
AQ-005	Congo Town	0310482	0692732	**January 14, 2025**	4:30 pm

AQ= Air Quality

Table 4: Sound Monitoring Point

Code	Location	Coordinates (29 N UTM)		Date	Time
		X	X		
SQ-001	Whein Town Junction	031313128	0699032	**November 13, 2025**	**1:10 pm**
SQ-002	McCauley Hill	0313698	0705148	**January 14, 2025**	10:00 am
SQ-003	Redlight	0312934	0695855	**January 14, 2025**	2:00 pm
SQ-004	Duport road	0312740	0693907	**January 14, 2025**	2:30 pm
SQ-005	Congo Town	0310482	0692732	**January 14, 2025**	4:30 pm

SQ=Sound Quality

Table 5: Legend for water, air, and sound qualities.
Sample Information & Acronyms

Sample ID	Meaning of Sample ID
WS	Water Sample
SQ	Sound Quality
AQ	Air Quality
Mg/L	Milligram per Liter
ML	Milli Liter
dBA	A-Weighted decibels
NTU	Nephelometric Turbidity Unit
LWQS Class I	Liberia Water Quality Standards Class I
WHO	World Health Organization
EPA	Environmental Protection Agency

Table 6: Water Quality Results

Parameters (Units)	WS-001	WS-002	WS-003	WS-004	WS-005	Liberia Water Quality Standards Class I (LWQS)
pH	7.19	7.51	7.30	7.18	7.48	6.5 – 8.0
Turbidity (NTU)	0.25	0.017	0.53	0.15	0.25	1.0
Nitrate (mg/L)	0.36	0.20	0.52	0.51	0.01	≤ 40.0
Copper (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	≤ 0.01
Lead (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	≤ 0.1
Mercury (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	ND
Calcium (mg/L)	2.35	1.37	4.0	2.25	2.45	200.0
Arsenic (mg/L)	<0.000	<0.001	<0.001	<0.001	<0.001	≤ 0.05
Total Bacteria count (c/100ml)	0	0	0	0	0	0
Coliform Count (c/100ml)	0	0	0	0	0	0
E-Coli (c/100ml)	0	0	0	0	0	0
Salmonella (cc/100ml)	0			0	0	0
Nitrite (mg/L)	0.05	0	0	0	0	≤ 0.1
Phosphate (mg/L)	0.024	0.02	0.046	0.008	0.006	≤ 0.1
Sulfate (mg/L)	2.01	0.05	4.0	2.25	3.62	≤ 150.0
Chromium (VI) (mg/L)	0.01	0.004	0.052	0.002	0.003	≤ 0.05
Total Dissolved Solids (mg/L)	8.0	4.0	17.0	9.0	8.0	≤ 500.0
Total Hardness (mg/L)	14.0	6.0	25.05	18.0	21.0	≤ 190.0
Chlorides (mg/L)	2.15	1.0	3.0	2.0	4.0	≤ 250.0
Total Iron (mg/L)	0.0140	0.0035	0.018	0.005	0.007	≤ 0.1
Fluoride (mg/L)	0.022	0.020	0.032	0.005	0.006	≤ 1.5

NOTE: The value highlighted red is above the permissible limit.

Table 7: **Air Quality Results**

Parameter	Unit	Analytical Method (Instrumentation)	AQ1	AQ2	AQ3	AQ4	AQ5	WHO STANDARDS
CO	Ppm	Air Quality Meter	7.20	7.0	7.9	8.0	7.5	50.0
CO_2	Ppm	Air Quality Meter	13.10	7.5	7.8	10.5	9.6	5000.0
H_2S	Ppm	Air Quality Meter	<0.000	0	0	0	0	NS
SO_2	Ppm	Air Quality Meter	0.056	0.006	0.053	0.055	0.054	2.0
VOC	Ppm	Air Quality Meter	<0.001	<0.001	<0.001	<0.001	<0.001	0.75
$PM_{2.5}$	Ppm	Air Quality Meter	8.0	7.0	7.0	7.0	7.0	35.0
PM_{10}	Ppm	Air Quality Meter	10.0	8.0	8.5	8.0	8.0	50.0
NO_2	Ppm	Air Quality Meter	<0.001	<0.001	<0.001	<0.001	<0.001	1.00

Table 8: Soil Quality Results

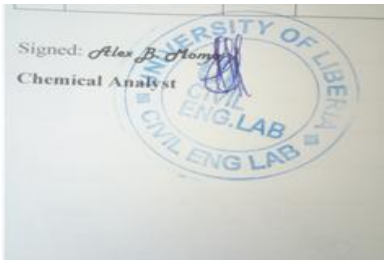
Parameters (Unit)	Instrumentation	SS-01	SS-02	SS-03	SS-04	SS05
Ph	pH Meter	5.32	6.0	6.80	6.0	6.8
Organic Matter (%)	Gravimetry	54.0	49.0	52.0	52.0	54.0
Organic Carbon (%)	Gravimetry	0.54	0.46	0.60	0.56	0.54
Nitrate (ppm)	Colorimeter	<0.001	<0.001	<0.001	<0.001	<0.001
CEC	Digital Titration	<0.001	<0.001	<0.001	<0.001	<0.001

Lead (ppm)	Spectrophotometer	<0.001	<0.001	<0.001	<0.001	<0.001
Iron (ppm)	Colorimeter	0.44	0.39	0.47	0.42	0.39
-	Colorimeter	0.06	0.08	0.09	0.05	0.06
Sulfate (ppm)	Colorimeter	<0.001	<0.001	<0.001	<0.001	<0.001

Table 9: Sound Quality Results

No	Parameter	Unit	Analytical Method (Instrumentation)	SQ1
1	Sound Quality	dBA	Sound Meter PCE	50.08
2.	Sound quality McKollie Hille	dBA	Sound Meter PCE	49.0
3.	Redlight	dBA	Sound Meter PCE	69.5
4.	Duport Roaad	dBA	Sound Meter PCE	58.0
5.	Congo Town	dBA	Sound Meter PCE	52.0
				75.0 dBA.

Signed: *Alex B. Momo*
Chemical Analyst



ANNEX 6: PICTORIAL VIEW OF THE CONSULTATION MEETINGS

Johnsonville Consultation & Engagement

Participants at the Engagement Meeting

Cross section of Precipitants

Cross section of Precipitants