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MINISTRY OF WATER AND ENERGY
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Environmental and Social Impact Assessment

Fecal Sludge Treatment Plant Subproject for Arba Minch Town

Southern Ethiopia Region

Second Urban Water Supply and Sanitation Project

Green Sober Environmental Management Consultant

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List of Acronyms

AMT	Arba Minch Town
AMTWSSE	Arba Minch Town Water Supply Sewerage Enterprise
CDMP	Community Disease Management Plan
CEC	Code of Ethical Conduct
COB	Code of Behavior
CWIS	City-Wide Inclusive Sanitation
CT	Communal toilets
EHSP	Environmental Health and Safety Plan
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
EDB	Existing Drying Bed
ETB	Ethiopian Birr
EDB	Existing Drying Bed
FDRE	Federal Democratic Republic Of Ethiopia
FEPA	Federal Environmental Protection Authority
FGDs	Focus Group Discussions
FS	Fecal Sludge
FSM	Fecal Sludge Management
FSTP	Fecal Sludge Treatment Plant
GBV	Gender-based violence
GSEMC	Green Sober Environmental Management Consultants
GZEPO	Gamo Zone Environmental protection Office
HW	Hazardous Waste
HWMP	Hazards Waste management Plan
MASL	Meter above Sea Level
MSDA	Material Safety Data Sheets
MoWE	Ministry of Water and Energy
OSHA	Occupational Safety and Health Administration,
PAHS	Project affected Household
PAPS	Project affected persons
PT	Public toilets
SER	Southern Ethiopia Region
SWMS	Solid Waste Management System
TMP	Traffic Management Plan
ToR	Terms Of Reference
UWSSR II	second Urban Water Supply and Sanitation Program.

Definition of Terms

Citywide Inclusive Sanitation: means everybody benefits from adequate sanitation service delivery outcomes; human waste safely managed along the whole sanitation service chain; effective resource recovery and re-use are considered; and onsite and sewerage solutions are combined in either centralized or decentralized systems in urban centers.

Cut-off date: The c date is the last day for eligibility or the baseline survey. Those who arrive in the area after the survey or cut-off date, won't be eligible for compensation or assistance. Affected households will be informed of the cut-off date for each component of the project and anybody residing in the project area after this date will not be compensated or supported.

Eligibility: Eligible persons are those residing in the area affected by the project, subproject, or other components of the subproject and those (i) whose livelihood is adversely affected (ii) with rights, ownerships, or announcement of rights on any land area (agriculture land, grazing land, temporary or permanent) or (iii) with productive assets such as those for businesses, jobs, working space, residence or (iv) whose access to assets is adversely affected

Environmental and Social Impact Assessment (ESIA): It is a process of identifying, predicting, and evaluating the biophysical, social, cultural, and other relevant effects on the environment of activities before their authorization avoiding or minimizing negative impacts and enhancing the positive benefits. It is a tool used to ensure that environmental factors are brought into consideration during the planning of, decision-making on, and implementation of, proposed projects.

Environmental Scoping: it is the key step in the ESIA study process, which defines the key issues that should be included in the environmental assessment; it is a step where the Terms of Reference (TOR) are developed for the ESIA study.

Environmental Screening: This is the initial step in the ESIA study process. It aims to determine whether an ESIA study is required for a particular project or not.

Fecal Sludge - Fecal sludge (FS) comes from onsite sanitation technology that has not been transported through a sewer. It is raw or partially digested, slurry or semisolid, and results from the collection, storage, or treatment of a combination of excreta and black water, with or without grey water. Examples of onsite technologies include pit latrines, non-severed public ablution blocks, septic tanks, and dry toilets.

Fecal Sludge Management (FSM) includes the storage, collection, transport, treatment, and safe end use or disposal of FS

Industrial liquid waste Industrial liquid waste is wastewater generated from industries during manufacturing and processing. It is usually constituted of a variety of chemical compounds.

Integrated Solid Waste Management The comprehensive management of generation, storage, collection, transfer and transport, processing, and disposal of all types of solid waste following the best principles of public health, economics, engineering, conservation, and response to public attitudes

Open Defecation (OD) means indiscriminate defecation in the open and leaving the feces exposed.

Project Affected People (PAP): individuals that are directly affected socially and economically by intended projects caused by the involuntary taking of land and other assets that results in (i) relocation or loss of shelter; (ii) loss of assets or access to assets; or (iii) loss of income sources or means of livelihood, whether or not the affected persons must move to another location (those with livelihood impacted permanently or temporarily).

Project Impacts: Any impact directly related to biophysical resources, socio-cultural resources, land acquisition, or legal limits in land use of the selected land area or reserved area. People directly affected by acquisition might lose their houses, farming land, business operation opportunities or other livelihood means.

A public toilet is a facility that is open for public use that has custodians and where those intending to use the toilets are mostly required to pay fees.

Resettlement Involuntary Resettlement: covers all the direct or indirect losses caused by loss of land/assets restrictions to resources access. Resettlement is not limited to physical resettlement. Resettlement entitlement might, depending on specific cases, include (a) acquisition of land and structures on land including those for commercial purposes; (b) physical dislocation; and (c) economic rehabilitation for affected households to improve (or at least restore) their livelihood and income level.

Sanitation - generally refers to the provision of facilities and services for the safe disposal of human urine and feces.

A septic tank is a watertight chamber made of concrete, fiberglass, PVC, or plastic, through which black water and grey water flow for primary treatment. Settling and anaerobic processes reduce solids and organics, but the treatment is partial, not complete. In the Ethiopian context, the use of septic tanks is very rare, and septic tanks are often confounded with cesspools.

Solid waste - means any garbage, refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility, and other discarded materials including solid, liquid, semi-solid, or contained gaseous material, resulting from residential, industrial, commercial, mining, and agricultural operations.

Urban sanitation: embraces Industrial liquid waste, Integrated Solid Waste Management, and Total sanitation and includes the collection, transportation, treatment, re-use, or disposal of excreta, liquid, and solid waste in ways that improve or sustain human health and decrease negative impacts on the environment.

Vulnerable group: refers to distinct groups of people who might suffer disproportionately or be marginalized by the effects of resettlement and specifically include: (i) female-headed households without support, (ii) disabled household heads, (iii) children and elderly households with no other means of support, (iv) Landless households, and (v) ethnic minorities.

Executive Summary

Ethiopia is among the Sub-Saharan African nations with inadequate sanitary infrastructure, a problem made worse by the country's quick urbanization. As a result, people in many towns lack access to adequate sanitation systems, consequently causing environmental and social problems (ESMF, 2017). Incremental growth in the number and size of Ethiopian towns has been observed in the last two decades. Such trends will result in enormous pressure on the existing urban infrastructure and the need for more basic urban services and infrastructure in the years to come. The government of Ethiopia has set out to transform the country from a rural to an urban one with economy-led industrialization. Meeting this goal is dependable on the towns' ability to meet basic urban standards of living. One of these urban living standards is access to improved urban sanitation facilities. Thus, the government of Ethiopia and the World Bank have launched the second Urban Water Supply and Sanitation Project (UWSSP II).

The UWSSP-II is a six-year project that aims to increase access to enhanced water supply and sanitation services in cities and towns of Ethiopia. The project is intended to aid in the government's efforts to eliminate open defecation, raise the proportion of the population using a "safely managed" sanitation service, and improve current water supply services through increased operational effectiveness and expansion of water supply service to underserved areas of urban centers. The project is financed by the World Bank and has three key components: i) Addis Ababa Sanitation and Water Supply Services Improvement, (ii) Secondary Cities and Towns Sanitation and Water Supply Services Improvement, and (iii) Project management and institutional strengthening. Thus, as part of the objective of UWSSP-II, this project aims to build fecal sludge treatment plants in Arba Minch town (AMT), using current state-of-the-art technology.

As part of the contract, this ESIA is developed for the construction of fecal sludge treatment plants and associated structures. The implementation of Components 1 and 2 of the projects do have potentially adverse environmental and social impacts that need mitigation actions. Therefore, the Federal Democratic Republic of Ethiopia's (FDRE) Ministry of Water and Energy (MoWE) hired Green Sober Environmental Consultant (GSEMC) Pvt. Ltd. Co. to conduct an Environmental and Social Impact Assessment (ESIA)for the proposed fecal sludge treatment plant (FSTP) construction subproject under UWSSP-II in AMT in Ethiopia. As an objective, the GSEMC identified major environmental and social impacts during the life cycle of the fecal sludge treatment plant and its management and recommended appropriate mitigation measures. Furthermore, to minimize the possible adverse impact and enhance the positive one, GSEMC prepared environmental and social management and monitoring plans.

Proposed Project Scope of works: The purposed project scope is limited to the UWSSP-II - sub-project that is going to be implemented in AMT. The proposed scope of work is delimited to ESIA study on sub-projects of fecal sludge treatment plant and associated component development that will be commenced in the UWSSP-II Program of AMT. following the components of the project, specifically, the scope of the work demarcated by seven interrelated tasks. These include a review of pertinent policy, legal instruments, standards and guidelines,

and institutional regulatory frameworks, public participation and consultations, assessment of the baseline condition of the project (Biological, physical, social, cultural, and economic), impact identification, characterization, and evaluation, analysis of alternatives, impacts mitigations and management plan development, institutional arrangement, human resources, and capacity building plan development, Grievance Redress mechanism.

Methodology: To conduct the ESIA of sub-projects, the GSEMC used a mixed approach to produce all-inclusive baseline information. Based on the EIA guideline of Ethiopia, the GSEMC utilized both quantitative and qualitative data from primary and secondary sources. The ESIA was conducted by collecting and analyzing the socioeconomic and environmental data that have direct and indirect associations with the proposed project over survey, focus group discussions, and experimental methods. Information related to the biophysical, socio-cultural, and economic environment of the proposed project was collected exclusively on environmental safety, social acceptance, and economic viability as key points of project implementation. Moreover, through structured questionnaires, observational checklists, and key informant interviews both primary and secondary data were collected related to socioeconomic, and environmental issues of the town. Information related to project-affected households like vulnerable groups' land acquisition, access to job opportunities, compensation, relocation, and infrastructure facilities were also collected and examined. The GSEMC was involved in the stakeholder consultation process, social and environmental surveys using structured questionnaires accordingly analyzed, and key informant interviews with institutions, lead organizations, and surrounding community consultations. Based on these findings and expert judgment, the GSEMC brings together the projected social and environmental negative and positive impacts arising from proposed project activities. The Environmental and Social Management (ESMP) and Monitoring Plans which detail how adverse impacts and risks will be reduced and by whom are also presented. In general, this ESIA typically used a range of methods including scoping, baseline studies, stakeholder engagement, impact prediction, impact assessment, risk assessment, mitigation measures, monitoring, and evaluation.

Policies, Legislations, and Institutional Framework: Relevant National Policies and Strategies, proclamations, regulations, regulatory frameworks, and the World Bank safeguard policies, World bank Group(WBG), and Environmental health and safety (EHS) guidelines related to the proposed project have been reviewed. The Constitution of the FDRE, adopted in 1995, provides the overriding principles and legal provisions for all legislative frameworks in the country. The Environmental Policy of Ethiopia (EPE), issued in 1997, has the overall policy goal to improve and enhance the health and quality of life of all Ethiopians, to promote sustainable social and economic development through sound management and use of natural, human-made and cultural resources and their environment as a whole. ESIA policies are included in the cross-sectorial environmental policies and they emphasize the early recognition of environmental issues in project planning, public participation, mitigation and environmental management, and capacity building at all levels of administration.

Other pertinent policies issued by the Government include the Ethiopian Water Resources Management Policy, the Health Policy, and the National Policy on Women and others. Applicable strategies and programs include the Conservation Strategy of Ethiopia (CSE), and the Second Urban Water Supply and Sanitation Program (2017 to 2022). Moreover, the country's legislations related to the Expropriation of Land, Payments of Compensation and Resettlement proclamation (No. 1161/2019), Environmental Impact Assessment Proclamation No. 299/2002, Environmental Impact Assessment Guidelines (2002), Proclamation on Environmental Pollution Control (NO 300/2002), Labor Legislation (Proclamation No.1156/2019) Health Proclamation No 200/2000, Proclamation on Environmental Pollution Control (NO 300/2002), Expropriation of Land, Payments of Compensation and Resettlement proclamation (No. 1161/2019), Resettlement Regulation No 472/2020 and others reviewed.

Physical Environment: AMT is found in the Southern Ethiopia region. The town has an overall area of 56 km²and is located in the southern part of Addis Ababa at a distance of 505km via the Shashemene route. Geographically AMT is located between 60^{o} 40' North latitude and 36^{0}.4' East longitude. The average altitude of the town is about 1285 meters above sea level and it ranges from1, 150 to 1500 MASL. The monthly average temperature is 20.78^{O}C while the temperature varies from 17.83^{O}C (minimum) to 29.63 ^{O}C (maximum). The monthly average rainfall of AMT is about 69.42mm which ranges from 35mm (minimum) to 129mm (maximum). The monthly rainfall pattern of the AMT is bimodal with peak average rainfalls of 129 mm in May (maximum) of the Belg season and 105 mm in October of the Meher Season. The potential evapotranspiration is as high as 144.6mm in March which can be directly attributed to the maximum wind speed and high temperature in this month. The annual average humidity of AMT is 58%. The maximum humidity is recorded at 67% in May and the minimum is recorded at 48% in December and January.

Biological Environment: The AMT FSTP site was designed about 9 km away in south west direction from the town center on the way to Arba Minch Konso highway road in "Gizola" province. The flora of FSTP environs has few scattered plant species. Common plants like *Ximenia American* locally named "Inkoye" and *Terminalia brownie Fresen* local name "Weybeta" and *Balanites species*. Shrubs like *Solanium incanum, Lantana camara,* and different grass species are also observed. Since the area is a settlement area, domestic animals and cultivated crops are dominantly observed. However, rich biodiversity is observed at Nech Sar national Park which is found in the town.

Description of the Proposed Subprojects: The FSTP project has four major components that include rehabilitation of the existing fecal drying bed (EFDB), construction of a new FSTP, and development of public and communal toilets.

Rehabilitation of the existing fecal drying beds: The existing fecal drying bed (EFDB) was built in 2018 G.C. The built drying beds in general have a total of 80 beds with dimensions of 10 m in length and 5m in width for each and a total area of 4,000 m^2. The EFDB has never been operational because, the drying bed lacks gravel road access, maneuvering area, bridge, power supply, administration office facilities /buildings guard house, fence, and provision for the

treated effluent disposal from the ponds and other technical factors. So rehabilitating the existing fecal drying bed is one of the components of the project.

Construction of new Fecal sludge treatment plant (FSTP): During the project's medium-term phase, it is anticipated that AMT will generate about 62.94m^3 and 62.13 m^3 of fecal sludge per day during the dry and wet seasons respectively. Consequently, the following treatment units will be included in the newly planned FSTP. Fecal sludge and septage receiving and screening unit, Settling – thickening tanks, Sludge drying beds, Flow equalization tank, and pumping station, Anaerobic baffled reactor, Wetlands feeding pumping station, Constructed wetlands. Both the new and existing fecal drying beds are located side by side at "Gizola" in the southwest direction of AMT within the coordinates of 5°59' 2.02" N and 37°31' 55.59" E with an elevation of 1,340m. The required area for the FSTP is about 48.68 ha which increased from 8.6ha when 400 meter buffer zone secured after the the conversation made with second round consultation. In the course of the second round stakeholder consultation the AMT administration secured 400m buffer zone and total area become 48.68 ha. In this proposed area a total of 356 households and 1,412 individuals (only 50 households were residents in the project site) will be affected by the implementation of the project. This was accepted by the town mayor and the utility during the RAP data collection by the same consultant to that of the ESIA.

Stakeholder Consultation: first round and second Public consultation (PC) was held at AMT from 19-24 May 2023 and August 2024 respectively. Participants of the PC were communities at the proposed FSTP, project sites. Grass-roots participation was done for the period of the visit to the subproject sites. The PC meeting, participants were the local community members comprised of the youth, women, vulnerable community groups and sector experts, and institution leaders.

Moreover, stakeholder meetings were also conducted at the AMT water supply and sewerage enterprise office with representatives from offices like the Environmental Protection Authority, Agriculture and natural resources department, Health Department, Education department, Culture and Tourism department, municipality, town urban development, and construction. Consultations were also made with Nech Sar national park experts at the Nech Sar Park office. Consensus on the proposed site and technology alternatives was reached through tripartite consultation meetings between the clients (MoWE), Design, and ESIA consultants. The total number of PC and stakeholders who participated was 109 of which 37 were females and 72 were males.

The outcomes of the consultations conducted with the aforementioned actors reveal that all the stakeholders have concerns about the implementation of the project. The main issues/concerns raised by the stakeholders and recommendations provided include the following:

- Loss of property and livelihood especially at the FSTP construction site
- Low level of public consultation related to the coming project;
- How are PAHs, and enterprises compensated? If relocation is necessary who will be responsible? how it will be done appropriately following rules and regulations;

- How is the livelihood restoration of the likely displaced people managed?
- Best alternatives for the site and technology alternatives were discussed and an agreement was reached to adopt the designed technology in the selected locality.

The second round PAH consultation was conducted in the Gizola FSTP construction site on 12 August 2024 serious of discussions were held among representative participants of AMT mayor office, Gamo zone administration, Project affected persons, PAHs and stakeholders. About 43 induviduals were participated in the discussion of which most are project affected individuals. During the consultation they raised a question why the resettlement process suspended for more than 6 months? The mayor representative replied that awareness creation activities for the Gamo zone, Arbainch zuria Woreda and town administration officials and experts on the WB safeguard issues and importance of the project, common understanding among the town and Gamo zone about the FSTP and the search for resettlement land took long time than expected. Following the clarity discussion, the PAHs also agreed and asked for proper compensation on time. Thus, it was confirmed to compensate all the PAHs following the findings of the RAP by the independent consultant.

Project site and technology alternatives: For FSTP in AMT two different project site alternatives are considered and site locations are compared with their potential environmental and social impacts. The first alternative FSTP site is found nearby and within the existing non-functional sludge drying bed Southwest of AMT at Gizola village (rural but included as urban part and the second one is found between the teacher training college and Nech Sar National Park. The optimal location was chosen after the project site alternatives' suitability compared to each other through various assigned criterion parameters with a score for each indicator parameter ranging from 1 to 5, where 1 is the worst (low) and 5 is the best(excellent). Scoring (weighting) of indicators was given based on legislative directions and best practices and was defined through expert judgment, stakeholders 'analysis, and knowledge considering the characteristics of the area. The score for each parameter was multiplied by the weighting factor. From the assessment of environmental and social factors, the most suitable site against other sites with a site score of 73.75% is Site 1 located in Gizola village AMT. In this particular location, the main social issue is the resettlement of the PAH from the project site which should be managed through due implementation of country laws, RPF, and RAP guidelines.

The best technology option for FSTP in AMT comprises of combination of process technologies that include Settling–thickening tanks, unplanted sludge drying beds, and constructed wetlands with an anaerobic baffled reactor (ARB). The technology sequentially consisted, of fecal sludge and septage receiving and screening unit- Settling – thickening tanks-Sludge drying beds-Flow equalization tank and pumping station-Anaerobic baffled reactor–Wetlands feeding pumping station- Constructed wetlands.

Potential Impacts and Mitigation Measures: The sub-projects are proposed mainly to improve the quality of the social and natural environment of AMT. The lack of efficient sanitation facilities has triggered the deterioration of the social and natural environment with adverse consequences on human health, which is allied with water, air, and soil pollution resulting from

inappropriate fecal waste disposal. Though the construction and operation of the planned subprojects is a well-recognized solution to overwhelm the current environmental pollution and allied health impacts, some impacts are anticipated to occur during the construction, operation, and decommissioning phases of the project. In this ESIA both positive and adverse environmental and social impacts are identified. Adverse impacts are labeled by type, magnitude, nature, spatial extent, and duration of impact, and assessed for significance.

Positive impacts at construction and operation phases: The development and operation of the proposed project will have substantial direct or indirect positive environmental and social impacts on the local people, city, and region at large. The main positive impact during the construction phases is job creation for skilled and unskilled workers, mainly for the jobless youth in the project area, and for national and international contractors and consultants, Improved Income to material/ equipment suppliers, Skill, and technology transfer boost to the local economy and others. The operational phase of the project will have an economic, environmental, or social beneficial impact, such as enhanced water quality, improved public health status hygiene and household health status, urban service infrastructure improvement (sanitation facilities), skill and technology transfer, and creation of employment opportunities, fertilizer, and biogas production are some of the positive impacts of the project at its operational phase.

Adverse Impacts during pre-construction and construction Phases

- Involuntary displacement land acquisition and property damage of households at FSTP sites. Loss of land due to land requirement for construction of the proposed treatment plants.
- Soil compaction and soil erosion caused by project activities including site clearing, excavation in soil, and hauling of spoils to disposal sites, which would involve the operation of heavy-duty equipment and dump trucks.
- Air and noise pollution, air pollution due to dust emission caused by traffic movements on unpaved access roads, land clearing, excavation, and earth moving activities, and transport of spoil materials to disposal sites; and gaseous emissions from vehicles and construction equipment. Noise pollution is caused by the operation of construction vehicles and equipment.
- Removal of Vegetation and land use pattern alteration, around the construction sites especially at FSTP
- Occupational Health and Safety (OHS)Impacts on occupational health and safety resulting from construction activities, operation of project vehicles and equipment, storage and use of hazardous chemicals and explosives, dust and exhaust emissions, etc.
- Social Misdemeanor: The increased labor force may violet some social norms of the society and may result in incidences of Gender-Based Violence(GBV), Sexual harassment (SH), and sexual exploitation(SE) on the job site or in the neighborhood.
- Water resources Pollution: Pollution of water bodies due to insufficient handling and spillage of pollutants (like fuel, oils, greases, and paints), and release of solid and liquid wastes from construction camps and workshops.
- Solid waste: properly unmanaged solid wastes can lead to environmental issues like pollution, health and safety issues related to accidents, and harboring dangerous animals.

- Increased traffic congestion or obstruction of normal traffic flows and traffic accidents on the existing roads connecting both Treatment Plants (TPs)
- The spread of communicable diseases like HIV/AIDS and other sexually transmitted infections due to the entrance of construction workers and relationships with local women including commercial sex workers.

- The identified impacts are predicted to be moderate to high, short-term, reversible, and direct adverse impacts. They can be minimized to acceptable levels by adopting appropriate mitigation measures including the following: a total of 356 PAHs and 1,412 (PAPs) individuals (only 50 PAHs dweller) will be affected by the implementation of this project. RAP has to be done after detail screening undertaken by the relevant UWSSP Implementing Agencies- water and sanitation utilities, with the use of the screening tool as attached to the RPF guideline. Resettle the physically displaced PAHs at the appropriate area in town administration, compensate economically affected PAHs as well as offer comparable land or replacement cost those who lost their land The resettlement site must have urban infrastructure commensurate with their original areas.
- Land is the most valuable asset of the PAHs/PAPs. Thus Land-for-land compensation must be practiced; proper and timely cash and in-kind compensation, relocation, and land delivery works must be undertaken.
- Re-vegetation perimeters of the FSTP ("Gizola")to commensurate the number of trees, buses, and grasses lost during site clearance; as much as possible re-plant indigenous vegetation in place of a removed tree species; Topsoil and subsoil removed from the site during site preparation will be stored properly for reuse elsewhere or for backfilling and reinstatement;
- Use modernized technology or recent equipment in excavation works that will minimize dust generation from earthen materials and noise emissions and vibration.
- Develop a waste management plan before the start of construction activities;
- The contractor shall develop a TMP (Traffic Management Plan) and incorporate proposed arrangements for traffic diversions with details of all necessary budgets and signals.
- Consistent inspections and maintenance of vehicles and equipment to reduce excessive exhaust emissions, and prevent fuel spills by filling fuel at only designated fuel stations.

Impacts during Operation Phase: The main potential adverse impacts during the operation phase include:

- Water Pollution: Improper collection, transport, treatment, and disposal of fecal sludge can lead to the contamination of groundwater and surface water sources due to infiltration through permeable soils. This can lead to the spread of waterborne diseases, and soil and groundwater pollution. In adequate operation could potentially damage aquatic life and the environment as a whole and result in an adverse effect on the local population and the water quality of groundwater and Lake Chamo which receives treated water sources.
- Foul odor: Fecal sludge treatment processes can generate foul odors and greenhouse gases, such as methane and carbon dioxide, which contribute to climate change and can

also cause respiratory problems for nearby residents. Some offensive odor at and around the FSTP sites is mainly due to the release of hydrogen sulfide resulting from anaerobic digestion.

- Occupational Risks: FSTP can pose several occupational health risks to workers involved in the collection, transportation, and treatment of fecal sludge. Fecal sludge contains a variety of harmful pathogens which can cause serious infections and diseases. Untreated or improperly treated fecal sludge can lead to the spread of diseases and infections, such as diarrhea, hepatitis, and parasitic infections;
- The construction of FSTP along the selected open area will permanently change the surrounding landscape scenery into a walled-in enclosure.
- Fecal sludge reuse: utilization of fecal sludge for another purpose may have its own risk to the environment.

The identified adverse impacts of the operation phase are possible, reversible, of moderate to high significance, and long-term. They can be mitigated through:

- Constructing the FSTP foundation and direct influence areas with concrete lining to avoid leakage of wastewater through permeable soils and weathered and fractured rocks into the groundwater system;
- Leakages from treatment ponds and sludge drying beds will be avoided or minimized by regular monitoring and maintenance of the network;
- Establishing water and wastewater quality testing laboratory for the regular monitor of the effluent and adherence to national rules and regulations and appropriate contract specifications and guidelines;
- Adequate OHS personnel protective gear will be provided to the employees of FSTP;
  Standardized fecal sludge management practices have to be exercised. Apply aeration, proper chemical dosing, and oxidation or pH adjustment to reduce offensive odor from FSTP; apply adequate treatment of fecal sludge through anaerobic digestion, composting, and thermal treatment.
- Maintaining appropriate buffer zones around the treatment plants and planting trees to prevent the spread of nuisance odor and improve aesthetic view of the treatment sites;
- Proper handling of chemicals and other materials to be used in the treatment process and keeping good personal hygiene;
- Utilize effective sludge management through careful planning, appropriate technologies, and regulatory requirements.
- Minimize potential risk and ensure suitability of sludge reuse, by applying regular monitoring and testing of sludge quality.
- Conduct public health education campaigns to raise awareness among farmers, communities, and consumers about the safe use and benefits of fecal sludge. Provide training and capacity-building programs for personnel involved in fecal sludge management.

Impacts during decommissioning Phases: The adverse impact during the **decommissioning** phases includes:

- Decommissioning a fecal sludge treatment plant can result in the release of contaminants or pollutants into the surrounding environment, particularly if the plant has not been properly maintained or cleaned.
- Workers involved in decommissioning may be exposed to hazardous materials through inhalation, ingestion, or contact with the skin or eyes that can pose a risk to their health.
- Decommissioning a fecal sludge treatment plant, and communal and public toilets will stop working and may have economic impacts on the surrounding community, particularly if the plant has been a source of employment or revenue.

The identified adverse impacts of the decommissioning phase are possible they can be mitigated through:

- ✓ Conducting a site assessment to identify potential environmental and health risks associated with the plant.
- ✓ Consider review of plant records, site inspections, and environmental sampling to identify potential contaminants or pollutants that may need to be addressed.
- ✓ Recruiting a qualified health and occupational safety officer who will oversee OHS matters on-site
- ✓ Based on their skill, knowledge, experience, and interest, vulnerable community groups must be transferred to another secured job opportunity;

Environmental and Social Management Plan (ESMP): To minimize the adverse impact of the sub-project, and enhance the positive impacts environmental and social management plan is required. ESMP is a plan of action and a key to certifying that the environmental and social quality of the project influence area does not deteriorate due to the implementation of the proposed development project covering all aspects of project implementation in its different phases. It is generally used as the basis for establishing the environmental and socio-economic behavior that the proposed project entails during its various stages together with the decommissioning phase. The ESMP for the proposed project consists of a set of feasible and cost-effective mitigation and official measures to be assumed during the different phases of the project to remove or reduce to tolerable levels for the recognized adverse environmental and social impacts. Therefore, the ESMP is focused on mitigating, minimizing, or controlling negative impacts rising all over the different phases of the project. This ESMP outlines the roles and responsibilities of various stakeholders for guaranteeing well-integrated implementation and monitoring of the project operations.

Environmental and Social Monitoring Plan: The environmental monitoring plan is developed to provide a basis for evaluating the efficiency of the proposed mitigation measures and for updating the actions and impacts of baseline data. It also gives information for the adoption of additional mitigation measures if the proposed measures are found insufficient. Environmental monitoring is an important component of environmental management as it provides the basis for rational management decisions regarding impact control. Monitoring should be performed during

all stages of the project development to ensure that the impacts are no greater than predicted, and to verify the impact predictions. The monitoring program will indicate where changes to procedures or operations are required, to reduce impacts on the environment or local population.

Implementation measures and capacity building: The responsibility for implementing the ESMP of the supplement ESIA during construction will be of the contractor, AMTWSSE, and the office of environmental protection. During the operation and maintenance of the development works, the responsibility will be mainly under the AMTWSSE. The environmental sustainability of the sub-projects is dependent on the capacity of institutions at all levels (i.e., recruitment of Environmental Safeguard staff, training, and other essential support services) to carry out the associated ESMP implementation work. Thus, AMTWSSE already allocated environmental and social development specialist for the overall environmental and social safeguard issues, training and capacity building activities. Excluding the RAP, the estimated Environmental and social safeguard management and monitoring plan ,capacity building and training budget for the Arba Minch town FSTP project is **168,831.10 (One hundred sixty eight thousand eight hundred thirty one) USD.** These efforts will not only benefit the authorities but will also build local capacity to undertake other development initiatives.

Conclusion: AMT requires modern advanced suitable sanitary facilities. The available sanitary infrastructure in the town is deficient in addressing the needs of urban dwellers and town infrastructure. So inadequate facilities for disposal of human excreta, and refuse material is observed. Therefore there is a pressing need for the development of sanitation infrastructure at AMT which is vital for the improvement of the quality of life of the people, generating economic development, and creating employment.

The implementation of the proposed FSTP at AMT will bring major solutions in minimizing the prevailing poor sanitation conditions and associated factors in the town and downstream areas. The subproject will assist as a very important intervention for the protection of the socio-economic and biophysical environment of the AMT. The positive impacts of the project are enhanced through the implementation of enhancement measures outlined in each project phase. The identified adverse impacts of -sub-projects are of low to moderate significance and can be easily mitigated to an acceptable level by properly applying the mitigation measures of each impact stated in this report.

Therefore, it is suggested that the enhancement and mitigation measures for the identified potential positive and negative impacts correspondingly have to be implemented. The benefits of implementing these measures by far are more important than the costs to be incurred. Moreover, saving life supports environmental resources and ecosystems from further pollution and deterioration would be of utmost significance. Monitoring of identified mitigation measures is a key to sound environmental and social safeguard management. So it is advisable to use both compliance and effects monitoring plans during the project lifecycle. The compliance monitoring mechanism will ensure that the various project-concerned institutions are implementing the

provisions of the ESMP effectively, whereas the effects monitoring part will check on the impacts that the project is having on the receiving physical, biological, and social environment by regular measuring of indicators.

1. Introduction

1.1 Background

Urban sanitation is indispensable for human health, social well-being, and economic development. It helps to prevent the spread of contagious diseases and environmental pollution through the use of improved sanitary facilities like flush toilets and fecal sludge treatment technologies. Fecal Sludge Management (FSM) is a global concern, particularly in low-income countries that predominantly rely on on-site sanitation technologies. That is why, in poor and growing urban areas of low-income countries like Ethiopia, fecal sludge management represents a growing challenge; generating significant negative public health, social wellbeing, and environmental risks.

Ethiopia is one of the Sub-Saharan African countries with poor sanitation services, and rapid urbanization is exacerbating the situation (Oliver, 2015). As a result, people in many cities and towns lack access to adequate sanitation systems, consequently causing environmental and social problems (ESMF, 2017).

In addition, cities and towns have increased in size and number over the past 20 years. Such trends will result in the need for more basic urban services and infrastructure in the years to come, including adequate sanitation. Meanwhile, the government of Ethiopia has set out to transform the country from a rural to an urban one with economy-led industrialization. Meeting this goal is dependable on the cities' and towns' ability to meet urban standards of living. And one of these urban living standards is access to improved urban sanitation. Thus, the government and the World Bank have launched the second Urban Water Supply and Sanitation Program (UWSSP II).

UWSSP-II aims at increasing access to enhanced water supply and sanitation services in cities and towns of Ethiopia.

The UWSSP-II is intended to aid in the government's efforts to eliminate open defecation, raise the proportion of the population using a "safely managed" sanitation service, and improve water supply services through increased operational effectiveness and expansion of water supply service to underserved areas. Therefore, the Federal Democratic Republic of Ethiopia's (FDRE) Ministry of Water and Energy (MoWE) hired Green Sober Environmental Consultant Pvt. Ltd. Co. to conduct an ESIA for the fecal sludge treatment plant (FSTP) construction project under UWSSP-II in 22 towns in Ethiopia. The UWSSP-II is a five-year program co-financed by the government of Ethiopia and the World Bank. As part of the contract, this ESIA is developed for the AMT FTSP construction project.

1.2 Objective of the ESIA

1.2.1 General Objective

The main objective of the consultancy service is to carry out an environmental and social impact assessment on FSTP subprojects to be constructed within seven UWSSP-II implementing towns/cities, including Arba Minch town. The GSEMC is expected to identify

environmental and social impacts during the life cycle of the fecal sludge treatment plant and recommend appropriate mitigation measures. Further, the consultant will prepare environmental and social management and monitoring plans. Additionally, under the ESIA process, the consultant will develop an indicative socio-economic survey for the preparation of resettlement action plans (RAPs/ARAPs) for potentially affected individuals.

1.2.2 Specific Objectives

The specific objectives are:

- Examination of the National and the World Bank environmental safeguard policies and regulations that will be triggered by the subproject activities at any development phase of the sub project and these shall include but not be limited to the project ESMF, Gender Action Plan (GAP), World Bank's Gender strategy and GBV requirements.
- Describe the views and concerns of the public and stakeholders towards the implementation of the subproject.
- Establish baseline features of the biophysical, socio-economic, and cultural attributes in the subproject influence area.
- Identification and evaluation of significant impacts (both beneficial and adverse) due to the subproject implementation that requires appropriate mitigation measures.
- Propose specific mitigation for inclusion in the subproject detail design and management plan to reduce or avoid significant adverse environmental and social impact including gender and potential GBV risks.
- Conduct an analysis of alternatives to the proposed sub-projects in terms of technology, design, and operation, including the "without project" situation.
- Assessment and identification of capacity gap and propose training and capacity building requirements for implementation of environmental mitigation and monitoring plans.
- Preparation of Environmental and Social Management Plan.
- Cost estimate for each proposed mitigation measure and monitoring program.
- Develop a monitoring program that will be followed during the project implementation.
- Recommend environmental and social compliance requirements, design measures, and staffing that should be included in the works contract documents.

1.3 Scope of the ESIA Study

One of the scopes of the ESIA was pertinent policy, legal instruments, standards and guidelines, and institutional arrangement review. The other was a collection of city-wide biophysical, socioeconomic, and cultural baseline data. Thus, an all-encompassing baseline data on soil mapping, land use and cover, water and hydrology, landscape and visual, archaeological and cultural heritage, air quality and noise, biodiversity and ecology, and socio-economic environment was collected. The stakeholder consultation and indicative household survey for the likely project-affected households were also made. The fourth scope was impact identification and development of possible

mitigation measures. Finally proposal of human resources, capacity building, and monitoring plan with time and cost implications.

1.4 Rationale of the Project in the Area

AMT is one of Ethiopia's populated urban hubs and is surrounded by a massive underserved informal and peri-urban population. It is known that Ethiopia's social and economic development is constrained by its poor sanitation facilities. A more integrated and inclusive approach is required to address all urban regions to accomplish the Sustainable development goal (SDG) "urban" goals and provide a citywide inclusive sanitation (CWIS) solution. The foundation of CWIS is equitable services for all urban residents.

The municipal government of AMT by its vacuum truck provides fecal sludge collection and disposal services from residents' septic tanks and toilets. Fecal sludge waste is improperly deposited in the fields close to the forest in southwester districts. This is because there is a lack of suitable fecal sludge disposal and treatment facilities in the town. The construction and development of fecal sludge disposal facilities are vital for access to hygienic treatment of fecal sludge in a sustainable manner. The proposed development's construction and operation will aid AMT in managing effectively its fecal sludge production, proper collection and treatment of wastewater, reducing the spread of disease and polluting ground and surface waters, and improving hygiene, which will benefit the region's social and economic conditions. The long-term and medium solution is to use a combined approach that includes options like decentralized or small-scale systems for areas too far from existing sewers or too dense for household solutions, onsite sanitation systems with fecal sludge management (FSM), and piped sewers which makes sense (such as urban areas and high water volume consumers).

1.5 Organization of the ESIA Report

This report is organized into 11 chapters. The contents of this ESIA report are as follows the executive Summary, **Chapter One** is an introduction and indicates the purpose of the ESIA; presents an overview of the proposed project, as well as the project's purpose and needs. **Chapter Two** discusses related policy, legal, institutional, and administrative frameworks. It presents the relevant environmental and social policies of the World Bank, as well as the relevant national legal requirements for the project. **Chapter Three** deals with the ESIA study approaches and methods. **Chapter Four** outlines the description of the project and its justification. This chapter discussed the project components and their area of influence including a map showing the project's location. **Chapter five** presents a description of the baseline environment like the project's physical, biological, and socio-economic environments within the proposed project-affected area. **Chapter six** addresses the procedural aspect of public consultations aims objectives and identifications of the project. The views and concerns of the affected communities and other key stakeholders on the project have also been presented. **Chapter Seven** focuses on the baseline socioeconomic background of project-affected households. **Chapter Eight**: addresses an analysis of the project

alternatives including the "without project" option. **Chapter Nine** discussed the potential project impacts on the physical, biological, and socio-economic environments. The unit also presented mitigation /enhancement measures and complementary initiatives to prevent, minimize, mitigate, or compensate for adverse environmental and/or social impacts. **Chapter ten** summarizes the environmental social management and monitoring activities and the proposed monitoring indicators derived from the baseline survey. Also, it identifies the roles and responsibilities of stakeholders in the implementation as well as the estimated cost of the activities. **Chapter 11** in this chapter summary of the conclusion. The last section reference and annex are contained within the ESIA report.

1.6 Team in charge of the ESIA

Ten experts from different disciplines have been involved in this ESIA study. Most hold second degrees (MSc, MA) two of them have PhD, and others are near to finishing their PhD. All of them have experience in research, and conducting ESIA studies including base line data collection, analysis of project alternatives, public consultations, and others. The participants of this ESIA study their role, educational background is annexed

2. Policy Legal Frameworks and Institutional Arrangement

The implementation of the AMT FSTP subproject has the potential to cause environmental and/or social impacts that shall be addressed by relevant Ethiopian legislation as well as the requirements of the World Bank Environmental and Social safeguards and standards. The subsections below provide more details on the applicable legislative framework for the ESIA.

2.1 Policy and legal Frameworks

2.1.1 Constitution of the Federal Democratic Republic of Ethiopia

The Constitution is the supreme law of the country, whose provisions must be complied with by all other policies, regulations, and institutional frameworks. The Constitution of the FDRE (Proclamation No. 1/1995 as amended) is the foundation for human rights, natural resources, and environmental management. The concepts of sustainable development and environmental rights are enshrined in the constitution of the FDRE through articles 43 and 44, which state among others the right to development and the right to live in a clean and healthy environment.

Article 44(2) of the Constitution states that all persons who have been displaced, or whose livelihood has been adversely affected as a result of state programs have the right to commensurate monetary or alternative means of compensation including relocation with adequate State assistance. The government shall pay fair compensation for property found on the land but the amount of compensation shall not take into account the value of land. Moreover, the Constitution states that, without prejudice to the right to private property, the government may expropriate private property for public purposes subject to payment in advance of compensation commensurate to the value of the property (Article 40(8). Moreover, Article 43 (2) dealing with the rights to development states that nationals have the right to participate in national development and, in particular, to be consulted concerning policies and projects affecting their community.

2.1.2 Environmental Policy and Strategies

To further amplify the Constitutional provisions on environmental protection, the Environmental Policy of Ethiopia was approved in 1997 (EPA, 1997). The policy goal is to improve the health and quality of life of the people of Ethiopia and to promote sustainable social and economic development through sound management and use of natural, human-made, and cultural resources and the environment.

The policy seeks to:

Ensure that essential ecological processes and life support systems are sustained, biological diversity is preserved and renewable natural resources are used in such a way that their regenerative and productive capabilities are maintained and where possible enhanced so that the satisfaction of the needs of future generations is not compromised; where this capability is already impaired.

2.1.3 Land Tenure Policy

The Constitution of the Federal Democratic Republic of Ethiopia (FDRE) states that the right to ownership of rural and urban land, as well as all the natural resources, is exclusively vested in the State and People of Ethiopia. Article 40 of the Constitution

indicates that land is a common property of the Nations, Nationalities, and the People of Ethiopia, and shall not be subjected to sale or other means of transfer. The constitution of FDRE retained land under the control of the people and government of Ethiopia thus, prohibiting its buying and selling. Article 4(5) of the proclamation 94/1994 also deals with the provision of land for the conservation, development, and utilization of state forests or protected areas. However, this can be effective only after the consultation and consent of the peasantry and subject to the assurance of their benefits.

2.1.4 National and Regional Conservation Strategy

Since the early 1990s, the Federal Government of Ethiopia has undertaken many initiatives that aim to develop regional, national, and sectorial strategies to conserve and protect the environment. Paramount among these was the conservation strategy of Ethiopia (CSE, 1996). This document provides a strategic framework for integrating the environment into new and existing policies, programs, and projects. It is also an important policy document, which views environmental management as an important component of development. It recognizes the importance of incorporating environmental factors into development activities from the outset.

The major environmental and natural resources management issues facing Ethiopia are well documented in the CSE (FDRE, 1997). The CSE sets out detailed strategies and action plans as well as the institutional arrangements required for the implementation of sect oral as well as cross-sectorial interventions for the management of Ethiopia's natural, man-made, and cultural resources.

2.1.5 National Biodiversity Policy

The National Biodiversity Policy (NBP) was established in 1998 based on a holistic ecosystem approach to conserve, develop, and utilize the country's biodiversity resources. The policy guides effective conservation, rational development, and sustainable utilization of the country's biodiversity, and contains comprehensive policy provisions for the conservation and sustainable utilization of biodiversity. Integration of biodiversity conservation and development in federal and regional sect oral development initiatives, and mobilization of international cooperation and assistance, have been identified as the principal strategies for implementation of the policy.

This policy framework provides direction and regulatory tools for the overall conservation and sustainable development of the country. In line with this, the proposed project will have and be expected to support the conservation of nature including the forest resource as has been required.

2.1.6 Ethiopia's Climate Resilient Green Economy Strategy

To cope with the prevailing environmental problems such as land degradation and climatic hazards (rainfall fluctuation, increasing temperature, flooding), and speed up its socioeconomic development, the Government of Ethiopia has planned a climate-resilient green economy as a development strategy. This development direction promotes environmental protection, reducing fossil fuel consumption which releases greenhouse gases into the atmosphere. With the demand for energy growing with the

increasing population, industrialization, and urbanization, the government realized that harnessing clean and renewable energy sources such as wind, solar, hydro, and geothermal energy sources was critical. It has indicated that these natural resources would deliver electricity at virtually zero GHG emissions. The generated electricity is a fundamental enabler of modern economic development, from powering cities and fueling industrial activity to pumping water for irrigation purposes in agriculture. The government also decided to increase its income through exporting electric power generated from clean sources to neighboring countries.

2.1.7 Ethiopian Water Resources Management Policy

The overall goal of water resources policy is to enhance and promote all national efforts towards the efficient, equitable, and optimum utilization of the available water resources of Ethiopia for significant socioeconomic development on a sustainable basis. The policy has three sub-polices: water supply and sanitation policy, irrigation policy, and hydropower policy. For this particular ESIA study Water Supply and Sanitation Policy objectives are summarized here as follows:

The Water Supply and Sanitation policy objectives are the provision of, as much as conditions permit, sustainable and sufficient water supply services to all the peoples of Ethiopia; satisfying water supply requirements for livestock, industries, and other users as much as conditions permit; carrying out operation and maintenance of all water supply and sanitation services sustainably and efficiently; promoting sustainable conservation and utilization of the water resources through protection of water sources, efficiency in the use of water as well as control of wastage and pollution; creating sustainable capacity building in terms of the enabling environment, including institutions, human resources development, legislation and regulatory framework for water supply and sanitation; and enhancing the wellbeing and productivity of the people by creating conducive environment for the promotion of appropriate sanitation services (FDRE, 2010).

2.1.8 National Policy of Women

The national Policy of Women (NPW) was issued in March 1993. In this policy it is indicated that government policies, laws, regulations, plans, programs, and projects should be based on the following objectives: to ensure the participation of women in the formulation of government policies, laws, regulations, programs, and projects that directly or indirectly benefit and concerns of women; to insure participation and involvement of women in implementation and decision-making processes; and to ensure equal access of men and women to the country's resources.

2.1.9 National Health Policy

Ethiopia had a low level of health coverage even in comparison with other Sub-Saharan countries. This is largely related to low levels of income and widespread poverty, low levels of education, nutritional deficiencies, poor environmental conditions, and inadequate access to health services.

Health Sector Development Plans and Strategies have been designed to implement the stated health principles within a defined period. The strategies include raising

awareness of personal and environmental health care and sanitation through Information, Education, and Communication; control of disease; and promotion of primary health care through community participation.

2.1.10 National Policy on HIV/AIDS

The 1998 Policy on HIV/AIDS of the Federal Democratic Republic of Ethiopia urges communities at large, including government ministries, local governments, and civil society to feel responsibility for carrying out HIV/AIDS awareness and prevention campaigns "to provide an enabling environment for the prevention and control of HIV/AIDS in the country". So it is expected that sufficient awareness exists within the community. In addition, all the workers and contractors working in the proposed sub-projects shall be treated fairly per the policy.

2.1.11 Urban Wastewater Management Strategy

MoWIE issued this strategy in 2017. The purpose of this strategy is to provide a common understanding of the strategic vision to guide wastewater management partners towards an effective and coordinated response through prioritized interventions and targeted programs, whilst encouraging efficient and sustainable use of resources. The objectives of the strategy are geared toward the development of strong wastewater management institutions, master plan preparation, implementation methods, protecting of the environment from wastewater discharge, social and cultural sustainability, wastewater collection and treatment, wastewater collection transportation, and treatment and reuse of treated effluent and sludge.

2.1.12 Integrated Urban Sanitation and Hygiene Strategy

The Ministry of Health (MoH) issued the strategy in 2016. The goal of the strategy is to mitigate the negative impacts of poor urban sanitation and hygiene on health, the environment, society, education, and the economy by promoting full sanitation and hygiene systems. The basic premise for the MoH to formulate this strategy was issues around urban sanitation and hygiene, which are complicated due to cross-sectorial interventions and differences between towns. The implementation of the strategy is expected to have a positive impact on the economy of the country, the natural environment, health and wellbeing of all urban dwellers, including the most vulnerable ones. The strategy encourages all sanitation-related interventions to be based on town and town development plans, taking advantage of economies of scale, sharing of best practices within the country, and involvement of the private sector and Community Based Enterprises (CBEs).

2.2 Proclamations

2.2.1 Environmental Impact Assessment (Proclamation No, 299/2002)

Proclamation (No 299/2002) aims primarily at making the ESIA mandatory for schedule I and schedule II category projects and programs. The proclamation specifies the projects and activities that will require an ESIA. The proponent of the project must prepare the ESIA following the format specified in the legislation. The proclamation requires, among other things:

- ✓ Licensing agencies to ensure that the requisite authorization has been duly received before issuing an investment permit, a trade or operating license, or a work permit to a business organization;
- ✓ Specified categories of projects to be subjected to an ESIA and receive authorization from the competent or the relevant regional environmental agency before commencing implementation of the project;
- ✓ The authority or the relevant regional environmental agencies may issue an exemption from carrying out an ESIA in projects supposed to have an insignificant environmental impact;
- ✓ A licensing agency may suspend or cancel a license that has already been issued where the institution responsible for the environment at the federal level or the relevant regional environmental agency suspends or cancels environmental authorization;
- ✓ Procedures that need to be followed in the process of conducting an environmental impact assessment are described in the Proclamation. Thus, a project developer is expected to act as follows: Undertake a timely environmental impact assessment; Identify the likely adverse impacts, incorporating the means of their prevention, and submit the environmental impact study report accompanied by the necessary documents to the institution responsible for environment at the federal level or the relevant regional environmental agency for review and approval.

Based on the proclamation the EPA Guideline (2003) developed, proposed projects are assessed and classified as one of the following schedules:

- ✓ **Schedule 1:** Projects which may have adverse and significant environmental impacts, and may, therefore, require full ESIA;
- ✓ **Schedule 2**: Projects whose; type, scale, or other relevant characteristics have the potential to cause some significant environmental impacts but are not likely to warrant a full EIA study.
- ✓ **Schedule 3**: Projects that have negligible direct environmental impacts and hence do not require environmental impact assessment.

Therefore, AMT FSTP construction activities fall under category B (schedule II) which can cause some environmental and social impacts but are not likely to warrant a full ESIA.

2.2.2 Environmental Pollution Control proclamation (No.300/2002)

Ethiopian environmental pollution control proclamations No-300/2002 prove that some social and economic development activities may cause environmental harm that could jeopardize production. Article 3/1 of the proclamation explains environmental standards and simultaneously prohibits any person shall polluting or causing any other person to pollute the environment by violating the relevant environmental standard. Article 4 of this same proclamation elucidates the management of wastes, chemicals, and radioactive substances by the producer.

2.2.3 Solid Waste Management Proclamation (No.513/2007)

The main objective of the solid waste management proclamation (No 513/2007) is to enhance all stakeholders' capacity to manage the possible adverse impacts while creating environmentally, economically, and socially beneficial resources out of solid waste.

In article 17(1), it is depicted that without obtaining authorization, a person who implements a solid waste management project that requires a special permit before its implementation as determined in a directive issued by the relevant environmental agency commits an offense and shall be liable according to the relevant provision of the Criminal Code. Article 17(3) states that any manufacturer, importer, or seller who violates the provision of this Proclamation commits an offense and shall be liable according to the relevant provision of the Criminal Code.

2.2.4 Hazardous Waste Management and Disposal Control Proclamation

The objectives of the Hazardous Waste Management, Disposal Control Proclamation (Proc. No.1090/2018) are to create a system for the environmentally sound management and disposal of hazardous waste and to prevent damage to human or animal health, the environment, biodiversity, and property due to the mismanagement of hazardous waste. The law addresses the management of hazardous waste including the application of cleaner production principles to minimize hazardous waste, the responsibilities of hazardous waste generators, transportation of hazardous waste, precautionary measures to be taken during transportation and storage of hazardous wastes, and reuse, recycling, and disposal of hazardous wastes. In this proclamation wastewater in general terms has been categorized as hazardous waste in Annex One of this Proclamation and any waste that has substances or wastes containing viable microorganisms or toxins that are known or suspected to cause disease in animals or humans is also considered to be hazardous.

Under the proclamation the hazardous waste generator shall have the responsibilities to collect, segregate, and dispose or cause to be collected, recycled, or disposed of hazardous waste by an authorized body; ensure that the containers of hazardous waste are properly packed and conspicuously labeled with Amharic and English languages or other languages of the country as may be necessary; keep record on the type and quantity of hazardous waste that exist at the temporary hazardous waste storage facility; and show the record at any time when requested by inspector, and not to store hazardous waste at a temporary storage facility for a period exceeding one month. The relevance of this proclamation for the subproject is that it is a legal base regarding the way wastewater and sludge are handled managed, and discharged to the environment as well as workers' welfare.

2.2.5 Expropriation of Land, Payments of Compensation and Resettlement Proclamation

The Expropriation of Land holdings for Public Purposes, Payments of Compensation and Resettlement Proclamation (No. 1161/2019) has revoked proclamation No. 455/2005 and is applicable throughout the country in rural and urban centers on matters

relating to land expropriation, payment of compensation and resettlement of landholders whose land is expropriated for public purpose. The Proclamation defines public purpose as a decision that is made by the cabinet of a regional state or city administration or the appropriate federal authority based on an approved land use plan/development plan / structural plan under the belief that the land use will directly or indirectly bring better economic and social development to the public.

2.2.6 Labour Legislation (Proclamation No.1156/2019)

The labor proclamation obliges that an employer shall take the necessary measures to adequately safeguard the health and safety of the workers. To ensure workers' safety and job security the need to respect this proclamation has been clearly stated in this document. Under this proclamation, the following specific issues have been found relevant and important to be recognized and implemented accordingly during the operation of the plants under process. Freedom of association and collective bargaining: the right of all workers to form and join trade unions and bargain collectively. Representatives should not be subjected to discrimination and shall have access to all workplaces necessary to enable them to carry out their representation section.

Living wages: wages and benefits paid for a standard working week should meet at least legal or industry minimum standards and always be sufficient to meet the basic needs of workers and their families and to provide some discretionary income. Pay should be in cash, direct to the workers, promptly and in full. Information on wages should be available to the workers in an understandable and detailed form.

Equal handling: workers should have access to jobs and training on equal terms, irrespective of gender, age, ethnic origin, color, marital status, sexual orientation, political opinion, religion, and social origin. Physical harassment or psychological oppression, particularly of women workers must not be tolerated.

2.2.7 Cultural Heritage Conservation

The objectives of the Research and Conservation of Cultural Heritage Proclamation No. 209 /2000 are among others to carry out registration and supervision of cultural heritage, to protect cultural heritage against man-made and natural disasters. There is an Authority for the Research and Conservation of Cultural Heritage accountable to the Minister of Culture.

2.3 World Bank Group Environmental, Health, and Safety Guidelines

The general approach to the management of Environmental, Health, and Safety (EHS) issues at the facility or project level is for the effective inclusion of EHS considerations into corporate and facility-level business processes in an organized, hierarchical approach that includes the following steps:

- ✓ Identifying EHS project hazards(threats to human health and what they value) and associated risks as early as possible in the facility development or project cycle, including the incorporation of EHS considerations into the site selection process, product design process, engineering planning process for capital requests, engineering work orders, facility modification authorizations, or layout and process change plans;

- ✓ Involving EHS professionals, who have the experience, competence, and training necessary to assess and manage EHS impacts and risks, and carry out specialized environmental management functions including the preparation of project or activity-specific plans and procedures that incorporate the technical recommendations
- ✓ Understanding the likelihood and magnitude of EHS risks, based on:
  - ❖ The nature of the project activities, such as whether the project will generate significant quantities of emissions or effluents, or involve hazardous materials or processes;
  - ❖ The potential consequences to workers, communities, or the environment if hazards are not adequately managed, may depend on the proximity of project activities to people or to the environmental resources on which they depend.
  - ❖ Prioritizing risk management strategies achieves an overall reduction of risk to human health and the environment, focusing on the prevention of irreversible and/or significant impacts.
  - ❖ Favoring strategies that eliminate the cause of the hazard at its source, for example, by selecting less hazardous materials or processes that avoid the need for EHS controls. When impact avoidance is not feasible, incorporating engineering and management controls to reduce or minimize the possibility and magnitude of undesired consequences, for example, with the application of pollution controls to reduce the levels of emitted contaminants to workers or environments.
  - ❖ Preparing workers and nearby communities to respond to accidents, including providing technical and financial resources to effectively and safely control such events, and restoring workplace and community environments to a safe and healthy condition.

The WBGEHS guideline of wastewater and ambient water quality set a standard for basic parameters for sanitary discharge limit (Table 1).

Table 1: Indicative value for treated sanitary sewage discharges

Pollutant	Unit	Maximum value
pH	pH	6-9
BOD	mg/l	30
COD	mg/l	125
Total Nitrogen	mg/l	10
Total Phosphorus	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50

Source: WBG EHS (2007) standard of Wastewater and ambient air quality

Thus, it is important to comply with the required discharge limit for all effluent parameters during the entire operation period which implies that it is possible to use the treated fecal sludge for different purposes.

2.4 World Bank Safeguard Policies

WB has several Operational Polices (OP) to ensure that the environment and human populations are protected during the development process. Five of the ten WB safeguards Policies are triggered as part of the implementation of the UWSSP II (Environmental Assessment (OP/BP 4.01), Safety of Dams (OP/BP 4.37), Physical Cultural Resources (OP/BP 4.11), Involuntary Resettlement (OP/BP 4.12) and Projects on International Waterways OP/BP 7.50). Besides, the World Bank Group (WBG) Environment, Health and Safety Guideline (EHSG) shall be applicable as deemed necessary. However, the following safeguards policies are more relevant and applicable as part of the implementation of the proposed FSTP subproject activities; Environmental Assessment (OP/BP 4.01); Involuntary Resettlement (OP/BP 4.12); and Physical Cultural Resources (OP/BP 4.11).

Environmental and Social Assessment (OP 4.01): This policy requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making. According to the WB OP 4.01, Environmental Assessment (EA), and the National EIA guideline (2003) the proposed project falls under category B and schedule II, respectively. The proposed UWSSP II triggers the WB OP 4.01, Environmental Assessment Policy. Thus, according to the WB categorization of ESIA study reports AMT FSTP was grouped under category 'B' which was again endorsed by the WB as a financier.

Natural Habitats (OP 4.04): This policy is triggered for environmentally sustainable development through protecting, conserving, maintaining, and rehabilitating natural habitats and functions. Moreover, when there is a potential for significant degradation of natural habitats, directly through construction or indirectly through human activities induced by the project. However, OP 4.04 will not be triggered due to the absence of any natural habitat in AMT FSTP or other components of the project.

Projects on International Waterways (OP 7.50)*:* This policy is relevant if a project activity adversely impacts the quality and quantity of international waterways shared with one or more countries. This project triggers OP 7.50 given that it is located within the Ethiopian Rift Valley water Basin, which is shared with the Kenyan ground water sources.

Indigenous Peoples (OP 4.10): The objective of this policy is to (i) ensure that the development process fosters full respect for the dignity, human rights, and cultural uniqueness of vulnerable and historically under-served communities and peoples; (ii) ensure that they do not suffer adverse effects during the development process; and (iii) ensure that such communities and peoples receive culturally compatible economic benefits. In AMT FSTP, No indigenous people will be affected, so it does not trigger OP 4.10.

Physical Cultural Resources (OP 4.11): The objective of this policy is to assist countries in avoiding or mitigating the adverse impacts of development projects on physical cultural resources (PCR). For purposes of this policy, "physical cultural resources" are defined as movable or immovable objects, sites, structures, groups of

structures, natural features, and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. The chance finds procedure, under OP 4.11, shall at least be applicable as part of the excavation activities of the FSTP.

Involuntary Resettlement (OP/BP 4.12): The WB Involuntary Resettlement Policy OP 4.12 requires that all projects with land acquisition implications are guided by a Resettlement Policy Framework (RPF), which outlines processes and procedures to be followed for the preparation of site-specific RAPs during project implementation. The UWSSP-II project will apply both WB requirements and the Ethiopian government's guidelines regarding compensation and resettlement of PAP and where there are gaps between these two, the most stringent policy will prevail.

2.5 Comparison of the World Bank Safeguard and National Polices

The summary of the Ethiopian and the World Bank safeguard policy comparison is indicated in table (2).

Table 2 Ethiopian and the World Bank policy comparison

Theme	The Ethiopian legislations	WB safeguard OP	Comparison	Measures
Social issues in ESIA	EIA proclamation 299/2002 overlooked social issues. That is the proclamation title itself was written as "Environmental Impact Assessment (EIA)" not as Environmental and Social Impact Assessment (ESIA) and the public disclosure of the ESIA is not mandatory. Preliminary social screening was not stated.	The Bank's operational policy OP 4.01 emphasizes both environmental and social impact assessment of programs or subprojects. It also made the public disclosure of category A & B ESIA mandatory.	The EIA proclamation 299/2002 overlooked social assessment of subprojects and programs and public disclosure of the ESIA whereas OP 4.01 gives a special focus on them	When the government legislation is found less stringent in addressing issues compared to the WB procedures, the safeguard policies of the WB will be applied
Eligibility for compensation	Proclamation No1161/2019, Article 8(1) allows landholders to be eligible for compensation when the landholders or their agents whose landholdings are to be expropriated shall submit landholding certificates or other proofs that show their landholding rights over the lands that are decided to be expropriated to the urban or rural land administration office on the schedule of the office. This gives entitlement only to those who have formal legal rights over their land holdings	World Bank OP4.12 gives eligibility to: those who have formal legal rights to the land; those who do not have formal legal rights to land, but have a claim to such land; and those who do not have recognizable legal rights or claims to the land.	According to World Bank OP4.12 eligibility for compensation is granted to all affected parties but the Ethiopian Legislation only grants compensation to those with lawful possession of the land that is expropriated. It does not recognize those without a legal right or claim as eligible for compensation.	Eligibility criteria for compensation and assistance shall be in line with the WB eligibility for benefits

Concern for the indigenous people's right	The Expropriation of Land holdings for Public Purposes, Payments of Compensation and Resettlement Proclamation No. 1161/2019 does not clearly articulate the rights of indigenous people. Moreover, it is not importance for separate social assessments to address how indigenous people are closely tied to land, forests, water, wildlife, and other natural resources,	The World bank BP 4.10- gives focuses on Indigenous Peoples' separate social assessment and the need for indigenous people plan (IPP) preparation to manage their wisdom sustainably.	The World bank BP 4.10- necessitates the need for separate social assessment and also gives special consideration to land and related natural resources to address how Indigenous Peoples are closely tied to them but the Proclamation No. 1161/2019 overlooked it.	When the livelihood of the indigenous might be affected social assessment and preparation of IPP should be in line with the world bank BP 4.10.
Actions for livelihood restoration and assistance to vulnerable groups	There are no specific laws or regulations specifying support for livelihood restoration and transition& and moving allowances. Ethiopian law makes no specific accommodations for potentially vulnerable groups such as women, children, the elderly, ethnic minorities, indigenous people, the landless, and those living under the poverty line.	Livelihoods and living standards are to be restored in real terms to pre-displacement levels or better. OP 4.12 further requires attention to be given to the needs of vulnerable groups like people with disabilities below the poverty line, landless, elderly, women and children, indigenous groups, ethnic minorities, and other disadvantaged persons	Ethiopian policy and legislation would need to be aligned with the Bank's policy to effectively guarantee the rights of all affected persons by involuntary resettlement. Vulnerable groups are at the highest risk or prone to experience negative effects due to resettlement and should receive special consideration during the preparation of a resettlement policy framework.	The treatment of the vulnerable and historically under-served community groups should be per *OP 4.10*

2.6 UWSSP II Specific Legal Frameworks

2.6.1 Environmental and Social Management Framework (ESMF)

The overall objectives and purposes of the ESMF of UWSSP II can be summarized as follows:

- Review Ethiopia's environmental policies, legislation, regulatory and administrative frameworks in conjunction with the World Bank's ten safeguard policies. Where there are gaps between these policies make recommendations as to how to bridge these gaps in the context of the proposed project as appropriate;
- Develop a stakeholder consultation process that ensures that all key stakeholders, including potentially affected persons, are aware of the objectives and potential environmental and social impacts of the proposed project;
- Assess the current ability at the regional and/or city level to implement the recommendations of the ESMF, and make appropriate recommendations;
- Assess the potential environmental and social impacts of planned sector investments and rehabilitation activities in the urban areas;
- In light of the available information, develop an environmental and social screening process for the future rehabilitation and construction activities referred to above; and,
- Prepare an Environmental and Social Management / Monitoring Plan (ESMP), including monitoring indicators, for the UWSSP.

2.6.2 Resettlement Policy Framework (RPF)

The main objective of this RPF is to ensure adequate management of the land acquisition process the World Bank Operational Policy as well as the country's legal requirements and provide guidance for the preparation and implementation of Resettlement Action Plans (RAP) for the subprojects of the UWSS-II Project. This RPF aims to ensure that any possible adverse impacts of proposed project activities are addressed through appropriate mitigation measures. It addresses issues of land acquisition, loss of property or access, or more of livelihoods resulting from the implementation of waste water treatment plant, public and communal toilets, trunk line and a pipe line and in some cases access roads under the proposed project.

2.7 Administrative and Institutional Framework

The FDRE Environmental Protection Authority (FEPA) is an autonomous public institution of the Federal Government of Ethiopia entrusted with the protection and conservation of natural resources in Ethiopia. The general role of the FEPA is to provide for the protection and conservation of the broad environment, through the formulation of policies, strategies, laws, and standards, which foster social and economic development in a manner that enhances the welfare of humans and the safety of the environment. following the principles of government decentralization, each national regional state shall establish an independent Regional Environmental Agency or designate an existing agency that shall, based on the Ethiopian Environmental Policy and Conservation Strategy and ensuring public participation in the decision-making process, be responsible for Coordinating the formulation, implementation, review, and revision of regional Environmental monitoring, protection, and regulation.

2.8 SER Environmental Protection Authority

SER Environmental Protection Authority (REPA) is responsible for environmental protection matters in the region. It has the mandate of enacting regional environmental proclamations, regulations, standards, and guidelines. The REPA is responsible for the review and approval of ESIA of development proposals under the mandate of the Regional Government. The review and approval of the current ESIA for the FSTP and PCT is the responsibility of REPA. It is also mandated to follow up construction and execution of the project at least on a semiannual basis. It can conduct environmental and social safeguard audits every two years and give technical assistance and guidance to the zone and city administration environmental regulatory agencies.

2.9 Gamo Zone Environmental Protection Office (GZEPO)

GZEPO is mandated to ensure concerned stakeholder involvement in the FSTP and the PCT planning, construction, and operation. Community follow-up of the implementation of ESIA recommendations of such proposals becomes a joint responsibility of regional and Zone EPA. Zone EPA should follow up every quarter and compile progress reports to the regional EPA. The regional EPA at least should visit twice per year and give written feedback to the developer. Therefore, project proponents in the Region should operate in close cooperation with both the regional and Zone EPA to ensure that the adverse environmental and social effects of development proposals are properly identified and their mitigation or management actions incorporated in the project design, planning, and implemented at the right time.

3. ESIA Approach and Methods

3.1 Approach/Design

The ESIA study requires the collection and evaluation of comprehensive socioeconomic and environmental data. In line with the type of assessment being conducted, and the nature of data sources being collected, the mixed assessment method was selected as the best approach. This mixed approach method was selected because; the assessment was relatively complex and required a more comprehensive understanding of the phenomenon being studied. Following the EIA guideline of Ethiopia, the GSEMC utilized both quantitative and qualitative data from primary and secondary sources and data described and explained at the required scale.

Description of data preferred to assess the impact of the project on receiving biophysical, socio-cultural, and economic environment as they are on the ground. Descriptive assessment design sets out to describe and interpret what is. It looks at individuals, groups, institutions, methods, and materials to describe, compare, classify, analyze, and interpret the entities and events that constitute the various fields of inquiry. Moreover, as a supplement explanatory design was given by professionals when elaboration and enrichment of socioeconomic, cultural, and environmental issues on the ground.

3.2 Period of Field Data Collection and Site Visits

The required ESIA field data was collected from May 18 –June 4 /2023 and August 12/8/2024. A team of experts participated in the collection of information from the public, stakeholders, project owners, experts, sample analysis, and proposed project sites.

3.3 Assessment Method

The ESIA method comprises a wide variety of methods. Information related to the biophysical, socio-cultural, and economic environment of the proposed project was collected exclusively on environmental safety, social acceptance, and economic viability as key points of project implementation. Moreover, data related to vulnerable groups' management, land acquisition, access to job opportunities, compensation, relocation, and infrastructure facilities were also collected and examined. ESIA typically involves a range of methods including scoping, baseline studies, stakeholder engagement, impact prediction, impact assessment, risk assessment, mitigation measures, monitoring, and evaluation.

Scoping: Scoping is used for identifying potentially significant environmental impacts of the proposed project. This involves detecting the environmental components that might be affected by the project, such as air, water, soil, ecology, human health, and cultural heritage.

Baseline studies: Baseline data collection is one source of information that involves collecting data on the current environmental and social conditions like data on the physical, biological, and social environment, as well as information on the existing land use, infrastructure, and other activities in the project area. This method is used to establish a baseline against which the potential impacts of the project can be compared.

Impact and risk assessment: Impact assessment covers identifying and assessing the potential environmental, and social impacts of the project. Impact and risk assessments are conducted using various methods, such as Screening, Checklists, Matrix methods, and Expert judgment.

- Checklists are also used as a method to list potential environmental impacts that may be caused by the proposed project. The checklist is used to identify potential impacts and to determine the scope of the impact assessment.
- The matrix assessment method is also applied for assessing the potential environmental impacts of a project and to evaluate the significance of the impacts.
- expert judgment is also utilized which consists of obtaining the opinions of experts in relevant fields, such as ecologists, hydrologists, environmentalists, sociologists, and others to assess the potential environmental impacts of the proposed project.
- Geographic Information System (GIS) mapping is one of the methods applied for visualizing and analyzing spatial data. GIS is used to identify and delineate areas that may be sensitive to the potential environmental impacts of the proposed project.

Stakeholder engagement: individuals or groups who may be affected by the proposed project or who have an interest in the project have been consulted. This method is applied to assess the stakeholder's interests and obtain their values, concerns, and perspectives on the proposed project and its potential environmental impacts.

Mitigation measures are employed methods to reduce or avoid the potential environmental impacts of the project done by mitigation measures. Project alternatives change to the project design modifications, use of alternative technologies, or operational measures.

Monitoring and evaluation: Monitoring and evaluation methods include developing a plan to monitor and evaluate the environmental and social impacts of the project over time.

3.4 Data Sources

Project-linked data sources were obtained from both primary and secondary data sources. The primary data sources used were structured surveys, experiments, and observation while secondary data sources were obtained from government statistics, institution reports, academic research, public records, and others.

The type of data collected comprises qualitative and quantitative ones. A qualitative assessment method involves collecting non-numerical data from Key Informant Interviews (KII), observations, or open-ended survey responses. This assessment method is typically used when the required information, involves Focus group discussions (FGD), exploring people's experiences, opinions, or attitudes towards FSTP, Communal and Public toilets. The quantitative approach addresses data collected through survey (questionnaire) and experimental (environmental samples) methods.

3. 5 Data Collection Tools

Data collection tools are instruments or methods used to collect data from primary or secondary data sources. Collecting physical, chemical, and biological data from the project site and

surrounding areas was done by using direct observation, sampling, Stakeholder engagement, and Geographical Information Systems (GIS) remote sensing. The data collection instruments are presented as follows.

3.5.1 Survey

Surveys are questionnaires or interviews designed to collect large amounts of data at a particular point in time. Surveys are vital to describe the nature of existing conditions, to identify standards, determine the relationships of specific events. Thus, to acquire appropriate information about the existing situation of the physical, social, and cultural environment, and institutional-level survey was done by using a questionnaire. The office data collection questionnaire dealt with demographic characteristics, human resources and capital, natural resources, and settings, infrastructural facilities of the city, and cultural and economic resources within and around the project site as a receiving environment.

3.5.2 Public Consultation Checklist

Public consultation was one form of data collection tool. Representatives of local government (Kebele), community members composed of elders, the youth, women, religious leaders, and vulnerable community groups which are found nearby of the project site were engaged in this event. Consultation was held by using a checklist and data related to public views, concerns, questions, and comments of local communities documented through minutes. The consultation was freely carried out without any persuasion or interference to push the interests of the consultant.

3.5.3 Focus Group Discussion (FGD):

FGD was another data collection tool which included participants between 8 and 12 individuals. The moderator was responsible for asking open-ended questions and guiding the discussion. Focus group discussions can be particularly useful for gaining insights into complex or sensitive topics, where individual perspectives and interactions among participants can provide a deeper understanding of the issues at hand. Discussions were made on particular issues and information documents though Minutes. FGD conducted at FSTP and stakeholders.

3.5.4 Key Informant Interview (KII)

The KII method is used to collect in-depth data on a particular topic or issue by interviewing an individual who has specialized knowledge or experience relevant to the project. Project--related semi-structured question items were prepared for the interviewee. Data was collected by a semi-structured interview guide, which includes a list of open-ended questions designed to elicit detailed information on the topic of interest. Semi-structured interview items have flexibility advantages in which new questions could be forwarded during the interview based on the responses of the interviewee.

3.5.5 Informal Interview

Another data collection tool used in this study was a spontaneous and on-site informal interview using a guideline during field visits. Though this tool, informative and suggestive data about individuals, local communities, households, kebele, and city officials was collected.

3.5.6 Observation

Observations are typically conducted in a natural environmental setting, such as project sites workplaces, or communities. Direct observation involves visually inspecting the project site and surrounding areas to identify potential environmental impacts. This may involve documenting the presence of sensitive ecosystems, wildlife habitats, or cultural heritage sites. By using experts' deep observation, GSEMC assessed the social settings, physical characteristics, economic activities, environmental features, plants, and crops found in and around the proposed project sites. The observation activities were also supported by taking photographs and video recordings.

3.5.7 Hand-Held GPS

A global positioning system (GPS) (Model: GPS Map 76 CSx) Hand, GPS is used to collect (X, Y) coordinate points of the study site and development of GIS-based maps. GPS coordinates are collected at site-level investigation points for the identification of location features and to ensure accurate mapping, analysis, and visualization of environmental parameter data. Remote sensing is also applied by using satellite imagery technologies to gather information on the project site and surrounding areas. This method is utilized for identifying land use patterns, vegetation cover, or other environmental features. The collected data was analyzed using various software tools, including ArcGIS for preparing different maps, DEM 12.5X12.5m by Sulfer software for preparing 3-D geomorphological maps, and other software for data analysis and visualization.

Data collected for the hydro-geological and geological maps involved office-level analysis and site-level investigations. Office-level analysis focused on reviewing existing maps and data sources to identify key features of the hydro-geological and geological formations in the catchment area. While site-level investigations involved collecting detailed information on the hydrogeological and geological formations at specific locations within the catchment area.

3.5.8 Water Physico-chemical Quality Testing

Sampling involves collecting water samples to assess the baseline environmental conditions or potential impacts associated with the proposed project. A sterilized sample bottle was used to collect water samples from rivers in and around the proposed project sites. Before sampling, sample collection containers were properly cleansed with distilled water and rinsed with the sample water. After a brief flow of about two–three minutes, groundwater samples were taken. Before water sample analysis, testing instruments were calibrated by using calibrating solutions supplied by the company. In situ (on-site) physicochemical analysis for temperature, pH, Total dissolved solids (TDS), and Electrical Conductivity (EC) done by using portable TechPro II™

Series Model THP1 (MYRON L® COMPANY USA) per the guidelines of the instrument manual.

Furthermore, other physicochemical parameters like Nitrite, Sulphate, Potassium, Iron, Phosphate, Ammonia, Fluoride, and Total alkalinity were measured Ex situ (in the laboratory by using Wagtech WTD Palintest Photometer 7100 at Dilla University research laboratory.

3.6 Impact Identification and Analysis

The type and sources of collected data greatly vary according to the analysis. Analysis was done through the evaluation of the baseline conditions, risk assessment, and stakeholder analysis, and information was triangulated to see their associations.

Stakeholder analysis comprises identifying and analyzing the interests, values, and concerns of stakeholders who may be affected by the project. For each identified impact risk assessment was done through quantifying the likelihood and severity of potential environmental, social, and health impacts of the project. The significance of the predicted or identified impacts has been quantified and evaluated by considering the magnitude of the effect and the sensitivity, value, and importance of the affected resource or receptor. For the quantification and evaluation of impacts checklists and interaction matrices were applied. Each major impact is evaluated using the criteria assigned by experts' professional judgment based on the impact intensity, extent, duration, and sensitivity of the receiving biophysical and socio-cultural environment. After the evaluation of impacts, appropriate and justified mitigation measures for the negative impacts and enhancement measures for the positive impacts are forwarded.

The collected baseline data was encoded in SPSS (Statistical Package for the Social Sciences) a software package (IBM, SPSS Inc model 20). Information was analyzed and thus, data interpretation was made with the help of simple statistics like mean, maximum, minimum, frequency, and percentage which are presented in tables, figures, pictures, and charts.

4. Description of the Proposed Sub-Project

In this section, the overall description of the proposed development is presented. The subprojects include the Fecal Sludge Treatment Plant (FSTP).

4.1 Project area description

The proposed sub-project includes the development of a fecal sludge treatment plant and the rehabilitation of the existing drying bed. The sub-projects are described as follows:-

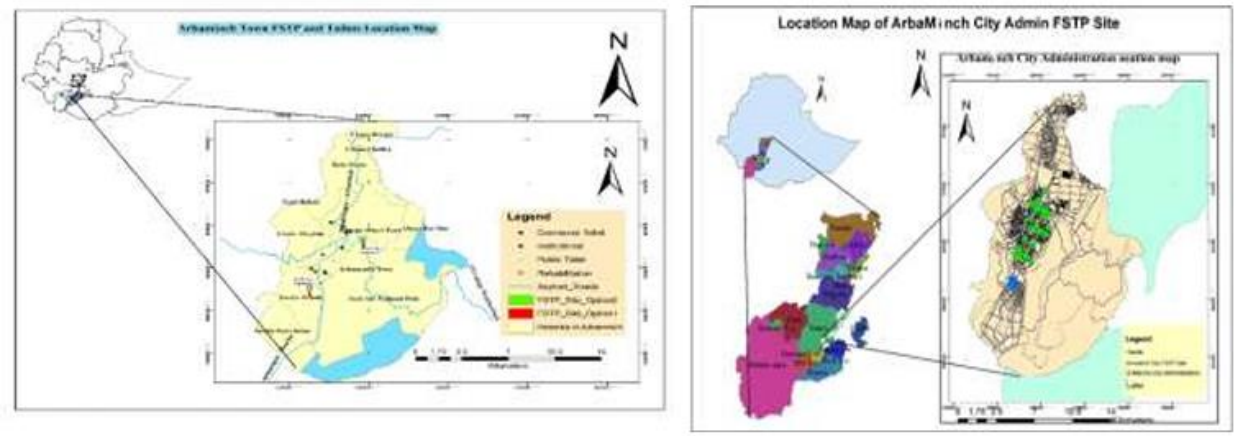

Figure 1 Location map of the sub-project area in AMT

4.1.1 Existing Fecal drying bed (EFDB)

EFDB is located in the southwest direction of AMTat Gizola locality which is approximately 1.21 kilometers on the right side of the main route from Arba Minch to Konso, near to Ethiopian Electric Utility (EEU)electric power poles production site. EFDB infrastructure was built in 2018 GC by SMEC International Ltd with financial support obtained from the African Development Bank (ADB). The scheme was designed and developed as a component of the "Improved Sanitation Value Chain in AMT" project. EFDB has about two hectares of land composed of a concrete slab with a 1% slope to the drainage outlet at the bottom with four rows of ten beds. The drying bed has two outlet channels, one for each bed.

The built drying beds in general had a total of 80 beds (4,000 m^2) area. Each drying bed has dimensions of 10 m in length and 5 m in width. The retaining walls of the drying bed are built by using a local concrete masonry block work and have a total height of 0.75 meters. The drying beds had a bottom layer of 3 to 25 mm effective diameter gravel material and a height of 100 to 200 mm. The geotextile layer was kept on the gravel layer. As the top layer of the drying beds, a 0.3 to 0.75 mm-diameter sand layer with a height of 100-200 mm was utilized over the geotextile. Fecal sludge was thought to be permitted to extend 200 mm over the sand layer, with a minimum freeboard. The fecal sludge treatment system has two parallel anaerobic ponds two aerated aerobic ponds with overland flow and a built wetland with a capacity of 113 m^3/day.

The anaerobic pond was built with a 25-day retention period to give the organic load time to settle and the oxygen requirement time to drop. Each drying bed's drainage drains via perforations in the bottom of the bed into an outlet channel, which leads to the first polishing pond. The aerobic dam, which is intended for four days of retention, receives the partially treated wastewater through an overflow weir structure. The reed bed receives the overflow from the aerobic pond and polishes the effluent by allowing bacteria, fungi, and algae to break down any leftover untreated sewage. Each drying bed is built to have an inlet chamber with a rake screen that must be cleaned by hand for the disposal of feces. The satellite image of the existing drying bed is presented in Figure (2).

Figure 2 Satellite image of Existing drying beds at AMT

The EFDB has never been operational because the drying bed lacks gravel road access (vacuum trucks), maneuvering area, bridge, power supply, administration office facilities /buildings guard house, fence, and provision for the treated effluent disposal from the ponds. However, during the field assessment period, the GSEC team observed the newly constructed bridge, administration building, and compound fences.

The planned short-term treatment interventions deal with the immediate work required for the functioning of the current FSTP. So, in the short-term sanitation interventions period plan of AMT, the missing parts of EDB structures such as access roads, a bridge, guard houses, compound fences, administration, and ticket office buildings were constructed. Aside from the basic infrastructure works, the present FSTP requires maintenance due to its material degradation and construction failure. Figure 3 indicates the existing drying beds' structural failures.

Figure 3 Partial view of Existing drying beds structural problems AMT

- ✓ The materials (gravel, geotextile, and sand) have typically been laid in drying beds incorrectly, following the slope of the bed bottom. In certain circumstances, the top of the sand layer is lower than the top of the drainage outlet holes as a result, allowing the fecal sludge to run wet and untreated to the outflow channel. This results in very low gravel and sand height near the downstream end of the drying bed.
- ✓ The sand used to cover the top layer of drying beds (DBs) is of poor quality for the job; it is unclear, contains huge particles, and in some drying beds, plants have sprouted in the sand.
- ✓ The structure missed inlet bar screens.
- ✓ The geotextile has not been installed correctly; in particular, it has not been placed at the sides of each bed, and in many cases, it is exposed to the sun and damaged.
- ✓ As a result of being exposed to the weather (effects of ultraviolet radiation on exposed surfaces, potential loss of liner flexibility, the requirement to verify the abrasion and perforation resistance leak rate tolerance probable cracks on the bottom, etc.)
- ✓ The lining of the polishing ponds has been destroyed. The structure needs a system to remove water and sediments from interior ponds.

To be functional and efficient, restoration and rebuilding of the damaged structural parts of the existing drying bed is recommended. Rehabilitating the existing drying is one of the short-term intervention phase activities for the CWIS project in AMT.

4.1.2 Rehabilitation of existing drying beds

The EFDB will be treated more effectively and efficiently by upgrading the existing drying beds. Several improvements were suggested by the GSEMC consultant to address the principal issues and limitations of the existing drying beds that prevent their efficient operation. It is advisable to include the following adjustments for the rehabilitation of the EFDB projects such as:

- ✓ The upper portion of the gravel layer, the geotextile, and the sand layer shall be removed.
- ✓ Reinstall the gravel layer up to a 0.20 m height with 5 to 30 mm gravel diameter. Level upper gravel layer horizontally about 600m^3.Install 4000 m^2 area of the structure by optimum permeability geotextile.

- ✓ Installation of the sand layer requires about 800m^3 of sand and the structure of EDB needs to be filled up to 0.20 meters high. Emphasis has to be given to the quality of the sand and it should be river sand, adequately cleansed, with a homogeneity coefficient of no more than 4.0 and a diameter ranging from 0.3 to 0.74 mm.
- ✓ Installation of 80 pieces of 0.60m x 0.60m fecal sludge inlet bar screens with 50mm bar spacing. Stainless steel will be used to make the screens.
- ✓ HDPE 2000 micron thick liner is supplied and installed at the polishing/effluent ponds' bottom. To create a watertight containment in the ponds, all liners must be installed according to the supplier's instructions. The liner must be securely fastened with welding, and it must be shielded from harm. The liner is 6,000 m^2 in size.
- ✓ The compartmentalized rock barriers between the effluent ponds had to be taken down and repositioned so that the liner could be put in.

4.1.3 Fecal sludge treatment plant (FSTP)

The FSTP requires about 48.68 ha of land with the inclusion of 400m beffer zone. The computed area is based on the presumption that fecal sludge would be produced from the communities and transported by vacuum trucks during the rainy and dry seasons of the year in AMT for a 20-year design horizon.

During the project's medium-term implementation phase, it is anticipated that AMT will generate about 62.94m^3 and 62.13 m^3 of fecal sludge per day during the dry and wet seasons respectively. The best technology option to treat fecal sludge in AMT comprises of combination of process technologies that include settling–thickening tanks, unplanted sludge drying beds, and constructed wetlands with an anaerobic baffled reactor (ARB). The Proposed FSTP Components include sequentially consisted of

- Fecal sludge and septage receiving and screening unit-
- Settling – thickening tanks
- Sludge drying beds
- Flow equalization tank and pumping station
- Anaerobic baffled reactor
- Wetlands feeding pumping station
- Constructed wetlands.

Figure 4 Partial view of FSTP existing and expansion area

5 Description of Baseline Environmental and Socio-Economic Conditions

This section gives baseline information on the physical, biological, socioeconomic, and cultural environments present in the area of AMT.

5.1 Climate

According to the Koeppen classification, generally, the climate of Arba Minch city is equatorial climate with Savannah and dry summer. The limiting climatic parameter of the net primary production potential of the area is precipitation.

5.1.1 Annual Rainfall

The observed annual rainfall amount of AMT from 1981 to 2018 shows non-significant (with a coefficient of determination r^2 of 9.65%) increasing trends. Minimum annual rainfall of 586.7 mm which is far below the annual average of 868.3mm was recorded in 1990 and a maximum annual rainfall of 1247.6 mm was recorded in 1997. The increasing trend of rainfall is consistent with global and regional predictions of rainfall in East Africa. However, the increment is due to increased rainfall amounts in short periods which may lead to flooding and landslides (figure 5).

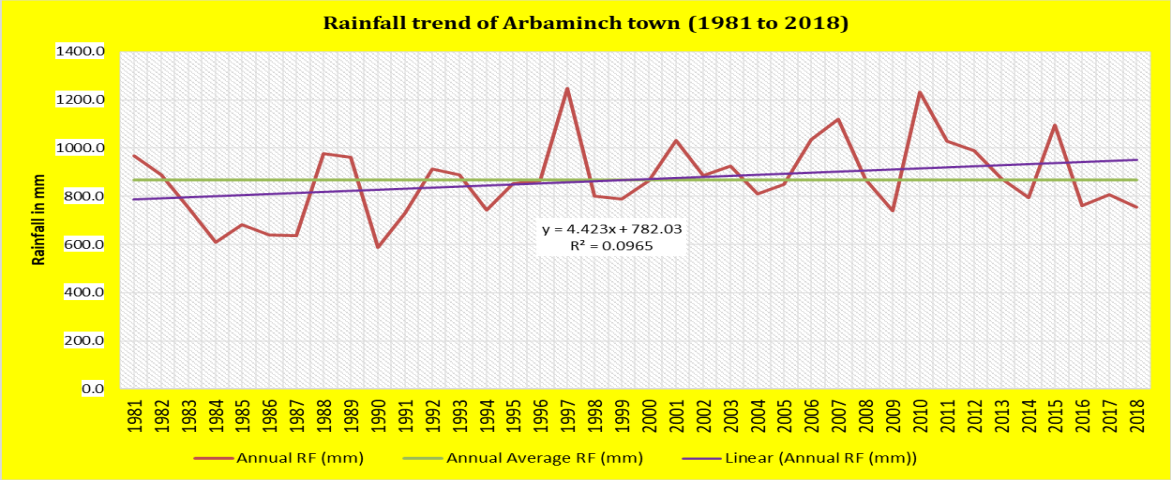

Figure 5 Rainfall trendsAMT from 1981-2018

5.1.2 Annual Temperature

The average temperature is showing increasing trends with a coefficient of determination (r^2) of 22.85%. In the period between 1981 and 2018, the maximum temperature range was 5.5^{o}C with the evidence that a maximum temperature of 31.5^{o}C and 26^{o}C was recorded in 2015 and 1986 respectively. The minimum temperature record also shows a range of 5^{o}C in the last 3 to 4 decades in Arba Minch. The increasing temperature will result in high evapotranspiration leading to a shortage of water availability for different purposes(figure 6).

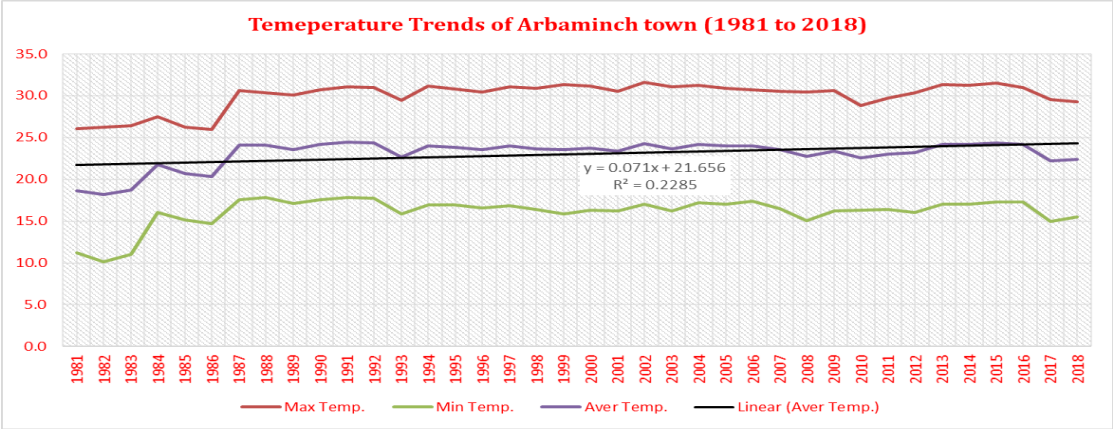

Figure 6 Temperature trends of AMT from 1981-2018

5.1.3 Monthly climate characteristics

The monthly rainfall pattern of the Arba Minch is bimodal with peak rainfalls of 129 mm on average in May (maximum) of the Belg season and 105 mm in October of the Meher Season. Regarding potential evapotranspiration of the area, it is almost lower than the actual precipitation for the months of April and May which indicates the presence of adequate moisture from precipitation is challenging. The potential evapotranspiration is as high as 144.6 in March mm in March which can be directly attributed to the maximum wind speed and high temperature in this month.

Table 3: Monthly Climatic Characteristics of AMT

Climate Variables	Unit	Max	Min	Average
Temperature	^{O}C	29.63	17.83	20.78
Rainfall	mm/month	129.00	35.00	69.42
Potential evapotranspiration	mm/month	144.60	100.80	116.47
Wind speed	Km/h/month	7.2	2.88	4.26

(Source: FAO NewLocClim_10)

5.1.4 Humidity

Humidity is the presence of water vapor in the atmosphere. The more water evaporates in a given area, the more water vapor rises into the air, and the higher the humidity of that area is. Hot places tend to be more humid than cool places because heat causes water to evaporate faster. The annual average humidity of AMT is 58%. The maximum humidity is recorded at 67% in May and the minimum is recorded at 48% in December and January.

5.1.5 Wind Speed and Direction

The prevailing wind direction in Arba Minch varies depending on the time of year. Wind speed and direction are detrimental factors in selecting and deciding several planning issues including waste treatment sites, tree planting patterns, and building orientation to avoid or mitigate

unwanted impacts affecting the dwellers. According to the wind directional estimating tools, the prevalent wind direction of AMT is to the West and Northwest. According to data obtained from the FAONewLocClim-10 database, the average annual wind speed of the city ranges between 2.88 km/h in November and December to 7.2 km/h in March. The average annual wind speed value for the year 2021 was around 2.0 m/s. The highest values seem to be occurring during the period June-July primarily and November-December secondly and are higher than 3 and up to 4m/s (Roikos and ZA, 2022).

5.2 Topography

Topographically, the town has an attractive landscape and its elevation ranges from 1,200 to 1,400 meters above sea level. The town is located in the southern sector of the Main Ethiopian Rift (MER), which has undergone complicated geological processes and has relatively hot (kola) climate conditions.

5.2.1 Geomorphology

The gently sloping landmass extending from the town with drainages for streams and rivers that move eastwards into the Lake indicates a relatively smooth topography with a well-developed drainage system. The V-shaped channels and sub-dendritic drainage patterns formed by the rivers further highlight the erosion and transportation processes shaping the landscape. On the western side of the town, the presence of steep slopes severely damaged by gully erosion suggests a more rugged terrain and a higher susceptibility to erosion processes. This indicates an area of potential concern for preserving soil integrity and preventing further land degradation.

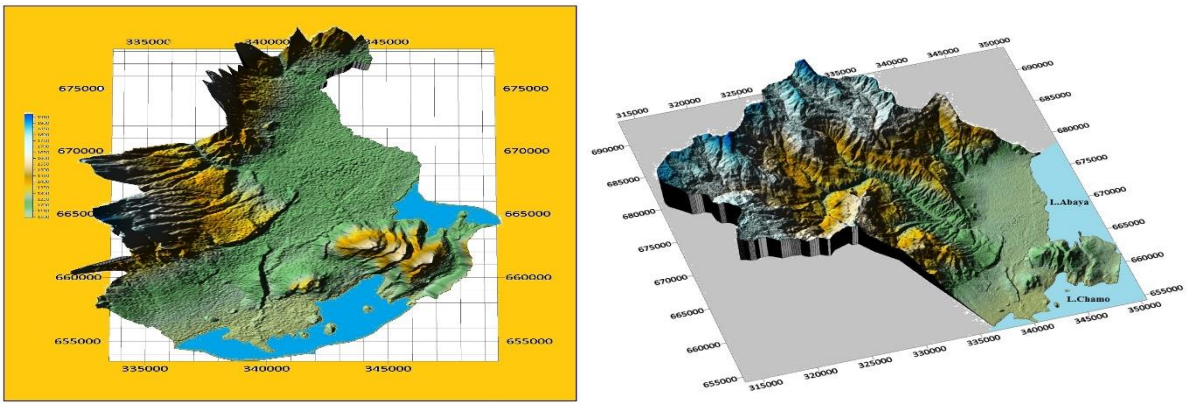

Figure 7 Geomorphological setting of AMT

The investigation area includes various landforms such as plateaus, trap ridges, escarpments, river valleys, and alluvial plains. These diverse features contribute to the overall geomorphological complexity of the region. Understanding these geomorphological characteristics is crucial for assessing groundwater quality as they influence surface water flow, infiltration rates, and potential sources of contamination. Additionally, knowledge of the alluvial plains and flat lake periphery can provide insights into potential sedimentation and nutrient

inputs into the water bodies.

5.2.2 Slope of the Study Area

The slope percentage in the Kulifo and Hare Site landscape varies between 0 and 30%. Upon reclassifying the study area based on the slope percentage, it was discovered that most of the landscape lies within the Kulifo catchment and is categorized as slope class 1 (0-2%), covering around 65% of the study area's steep slope. This suggests that a significant portion of the terrain in the study fecal sludge area has an undulating slope.

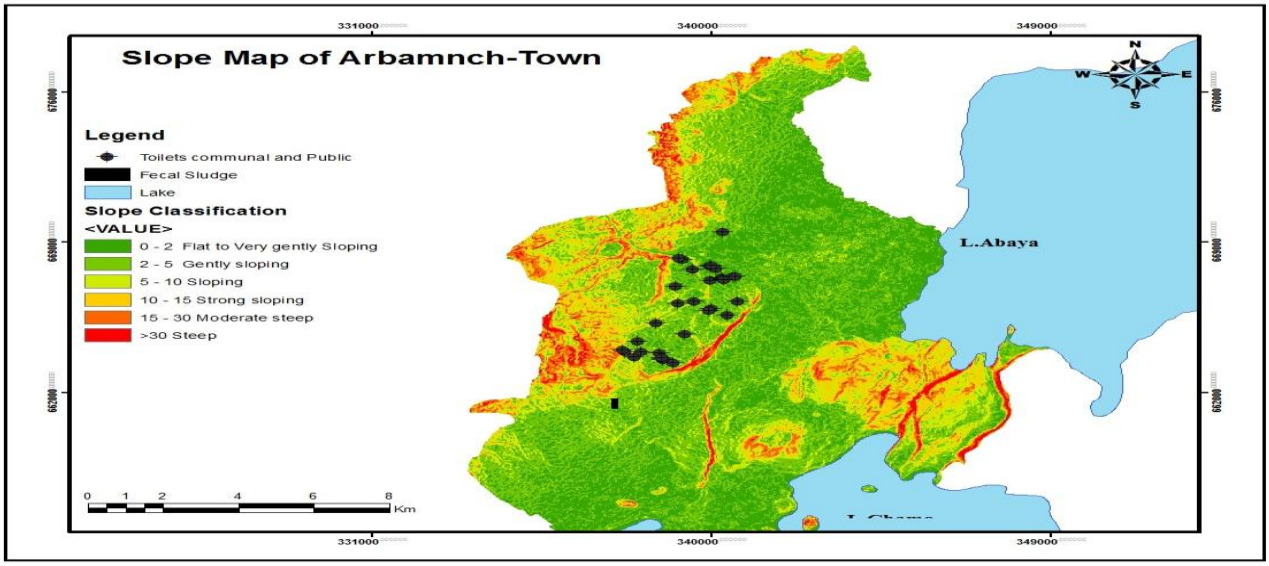

Figure 8 Slope map of AMT

5.3 Soil Characteristics

5.3.1 Physical Characteristics of the Soil

Soil physical properties play a critical role in the planning, design, and management of fecal sludge projects. The physical soil properties include texture, soil depth, color, and consistency. Understanding these properties can provide insight into how the soil will behave when subjected to different environmental conditions, such as the presence of waste materials, leachate, and gas generation. Proper management of fecal sludge requires a solid understanding of the soil's physical properties to ensure the safety of the landfill.

5.3.2 Effective Soil Depth

Soil depth refers to the thickness of the soil layer that provides structural support, nutrients, and water for plants. Soil series that have bedrock between 30 and 50cm from the surface are described as shallow, while those with bedrock between 50 and 100cm are moderately deep. Soils with bedrock greater than 150cm are classified as very deep. In the fecal sludge area under

consideration, most of the soil falls under the very deep category, with a soil depth of 150-190 cm.

5.3.3 Soil Color

Soil color is one of the most noticeable features of soil and can be easily identified by anyone. It is related to specific chemical, physical, and biological properties of the soil. In the Fecal Sludge area under consideration, the soil color ranges from red on the top layer and brownish in color at the bottom. The soil color can provide insight into the soil's composition and properties, such as the presence of organic matter, iron oxides, and other minerals.

5.3.4 Soil Texture

Soil texture is determined by the relative proportions of different particle sizes, particularly coarse with clay, and is an important factor in deciding the most suitable land use for a particular area. It has a direct impact on various soil properties such as infiltration, nutrient retention, drainage, and erosion susceptibility. During the field soil survey study, the texture of the soils was analyzed using the hand feeling test method. The results showed that the texture of the soils varied from Boulders, to coarse to fine texture in the top soils and the subsoil.

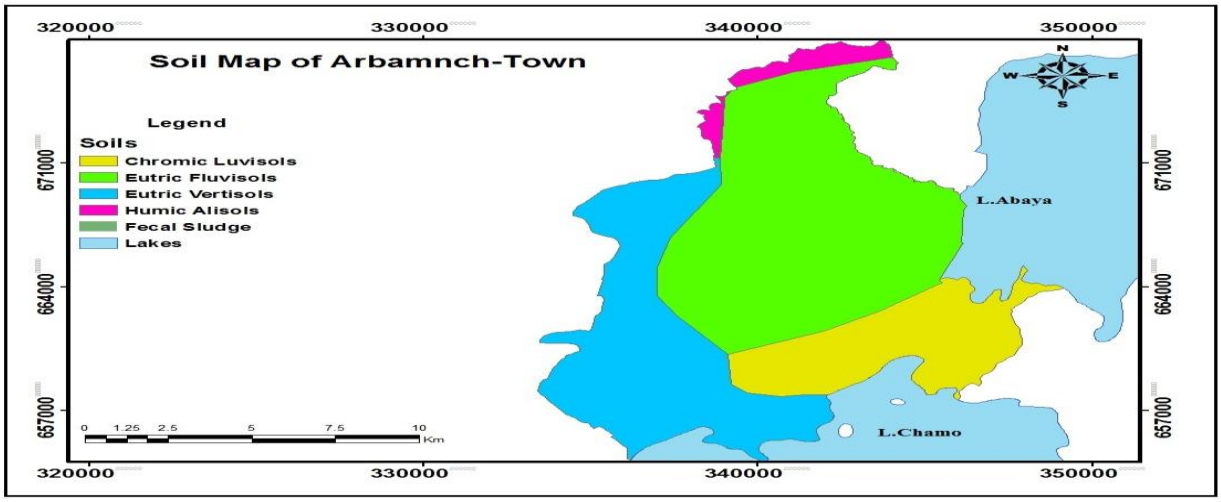

Figure 9 Soil map of AMT

5.4 Existing Water Supply of AMT

5.4.1 Inventory Wells

The water point inventory was designed to gather hydrogeological information directly from field sites, with a focus on wells deeper than 184 meters in the AMT area. The inventory utilized a sampling format that was outlined in the inception report, and data was collected from both the SNNPRS Region Water Bureau and through field surveys. The data collected included measurements of coordinates and elevation using GPS at each water point.

In particular, nine deep wells in AMT were drilled and constructed by the SNNPRS Region Water Bureau in 2012, with three of them designated as production wells. However, only the deeper wells that met the criteria of being deeper than 184 meters were considered for data collection during the inventory.

Table 4 Groundwater wells data At AMT

No	Well Name	X/Easting/	Y/Northing/	Z/elevation/	Depth/m/	SWL/m/
1	Erisha limat BH-1	340173	668266	1225	184	16.12
2	Cheriqacheriq BH-2	340715	667820	1220	174	20.52
3	Cheriqacheriq BH-3	340483	668223	1231	176	25.25
4	Airport	343836	668033	1204	100	19.8
5	ATF-BH10	341044	668541	1209	70	19
6	ATF-BH11	340880	668346	1225	61	18
7	ATF-BH12	341252	668346	1222	61	22
8	ATF-BH13	341010	668070	1225	70	19
9	ACF-BH14	345046	666302	1201	51	9
10	ACF-BH15	345057	666349	1192	74	7
11	ArmBH-1	340615	669775	1225	70	28.4
12	ArmBH-2	340699	669886	1208	70	22.1
13	ArmBH-3	340707	670049	1212	61	24.8

5.4.2 40-Springs

The primary water supply for AMT is sourced from the 40 springs. These springs not only provide water for the town but also play a critical role in supporting the local ecosystem and meeting the water needs of animals in the nearby Nech Sar National Park. The town water utility offices have confirmed that the springs are of high quality, which is reassuring for the town's residents. Additionally, it's worth noting that the current discharge rate for the town's water supply falls between 20 and 30 liters per second, indicating that there is a significant volume of water available from the Arba Minch Springs to meet the water demands of the town's water utility.

Figure 10 Partial picture of40 Springs Box (A) and Overflow Springs (B)

5.4.3 Existing Boreholes

In Arba Minch, various organizations have their boreholes, such as Eirsha Limat BH-1, Cherqacherq BH-2, and Cherqacherq BH-3, as well as those belonging to the Airport, ATF BH, ACF, and Arm BH. Boreholes are typically drilled wells that provide access to groundwater, and they can be used for a variety of purposes, including drinking water supply, irrigation, or industrial processes. By having their boreholes, these organizations can have a dependable and self-sufficient source of water.

Figure 11 Partial view of sampled boreholes A, Borehole-1 B, Borehole-2 C, Borehole-3

5.4.4 Water Quality Analysis

Hydrogeochemical water quality is an important aspect to consider when evaluating the usability of water for specific purposes in a given area. Water quality can be assessed based on the physical and chemical properties of the water, and the primary purpose of a water quality analysis is to determine the suitability of water for a proposed use, such as domestic (household), agricultural, or industrial use. Most of the tested water quality parameters are within the WHO and Ethiopian potable water quality standards and are within acceptable limits. However, the sampled water sources do have some variations concerning chemical water quality parameters. Potassium is a little bit higher at 2.63mg/L in the 40 spring water samples than in the three boreholes. The Iron level was higher (0.23mg/L) in BH1 while the phosphate level was relatively higher (7mg/L) and (5.6mg/L) at BH3 and 40 springs respectively. This variation

might be associated mainly with the hydrogeological nature of the area. The tested water parameters sampling points and results are presented in Table 5.

Table 5 Physical-chemical analysis sampled water borehole

	Sampled water sources				
Parameters	**40 Spring**	**BH1**	**BH2**	**BH3**	**WHO**
pH	6.71	6.66	6.77	6.8	6.5-8
Temp (^{O}C)	25.36	25.26	25.23	25.8	
TDS (PPM)	259.86	240.26	235.36	238.86	1000
Electrical Conductivity **µs/cm**	400.7	371.96	364.73	370.5	
Nitrite (mg/l)	0	0	0	0	45
Sulfate (mg/l)	0.33	0.66	1	2.66	400
Potassium (mg/l)	2.63	1.46	1.36	1.56	0
Iron (mg/l)	0.02	0.23	0.09	0.046	0.3
Phosphate (mg/l)	5.56	3.3	4.76	7	0
Ammonia (mg/l)	0	0.023	0.023	0	
Fluoride (mg/l)	0.73	0.77	0.73	0.57	1.5
Alkalinity (mg/l)	202.33	203.33	204.66	196	

NB. BH1: Borehole 1(Erisha Limat); BH2: Borehole 2(Cheriqacherq) BH3: Borehole 3(Cheriqacherq)

5.4.5 Lithological Logging of Wells

The lithology description provides important information about the type of rock, degree of weathering and fracturing, texture, sorting, grain arrangement, and other characteristics of the subsurface materials. These data can be used to determine the location of water-bearing zones and to understand the composition of the subsurface materials in a given area.

In the case of AMT, three boreholes were drilled for the town water supply, and the lithological formations were described for each borehole. Borehole-1 had a depth of 0-108m and consisted of coarse sand, gravel, and pebble deposits in the geological formation, while below 108m, in-situ fractured basalt rocks were present. Borehole-2 had a depth of 0-92m and consisted of boulders, clay, sand, and gravel deposits, and Borehole-3 had a depth of 0-114m and consisted of coarse sand, alluvial sand, gravel sand, silt sand, and pebble deposits, with fractured basalt rocks, present below 114m. Based on these results, it appears that the alluvial deposits in the Kulifo catchment have an average depth of 104m, although this thickness is not constant and may vary from year to year.

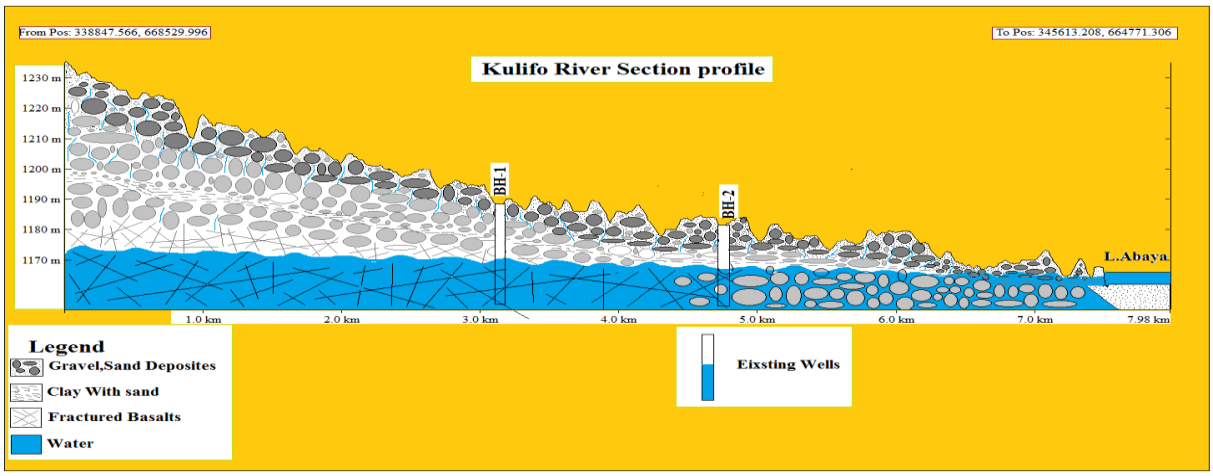

Figure 12 Cross-Sectional profile of Kulifo River

5.5 Groundwater Level and Flow Direction of Study Area

5.5.1 Groundwater Flow

Several factors influence groundwater circulation. These factors include the presence of recharge and discharge zones, the elevation of the groundwater table, as well as the occurrence of faults and fractures in the subsurface. According to the Piezometric Map, it indicates that the general direction of groundwater flow in the study area is from the western highlands towards Lake Abaya. Additionally, there is a southward flow towards Lake Chamo. This information provides valuable insight into the movement and direction of groundwater within the study area, highlighting the hydrological connection between the western highlands, the lakes, and the surrounding areas.

5.5.2 Groundwater Level

The static water level in the study region varies depending on the location. Previous data has shown that the static water level along the west side of Erisha Limat, Cheriqacheriq BH, and Airport measures 16.2m, 25.25m, and 20.5m, respectively. In the study area to the west of AMT, the static water level is below 28m, indicating that the water table is relatively deep in this region.

In the upper catchment area to the south of AMT, the static water level ranges between 16m and 28.4m which suggest that the water table is shallower in this area as compared to the western part of town. However, it's important to note that the static water level can vary depending on a range of factors such as the time of year, precipitation, and other environmental conditions. It's also noted that there are no drilling wells in the fecal sludge area, but a single hand-dug well was drilled near a farm site close to Chamo Lake. The static water level at this well was recorded as 4m, indicating that the water table in this location is relatively very shallow.

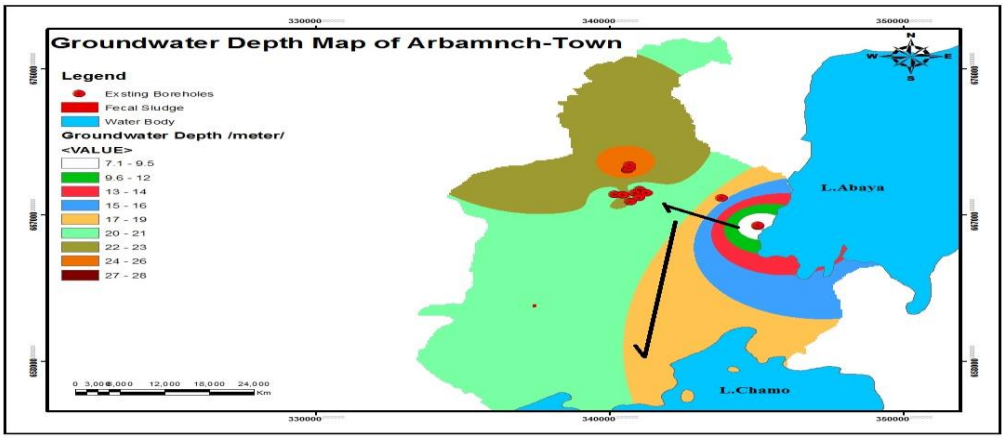

Figure 13 Groundwater level map of the project area

5.5.3 Geo-Hazard of Study Area

Gully erosion and earth flow in the study area can be expected impact on both the right and left sides of the Kulifo River hillside. It investigated how the combined forces of running water and mass movement erode the soil or other easily erodible materials, particularly in hillside areas and river floodplains or terraces. The study specifically analyzed the effects of these processes on the village of Kustba, which is highly affected by gully erosion and earthflow. It is recommended to keep any remaining vegetation along drainage lines and to stop grazing in these areas as a method of preventing gully erosion.

Figure 14 Risk of rapid accumulation of sediments (A) and Risk of Gully erosion and earthflow (B)

The western part of the Kulfo River is at risk of experiencing rapid sediment accumulation. This happens when the river carries a significant amount of sediments, and if the river's flow is unable to transport or move this sediment load, it will be deposited within the river channel. As a result, the height of the channel will increase, similar to what happens along the Hara River, affecting the banks of the river. This process is referred to as aggradation. Along with aggradation, this also leads to alterations in the hydraulic geometry and morphology of the river.

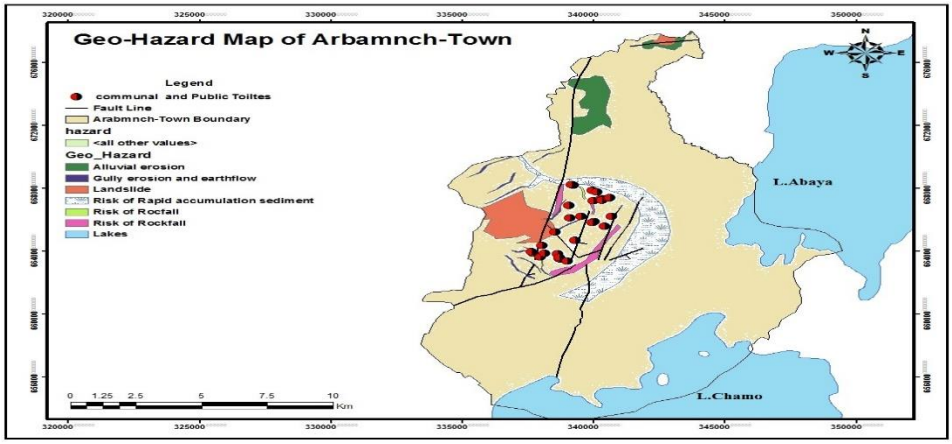

Figure 15 Geo-hazard map of AMT

5.6 Hydrology

The Kulfo River has its source in southern Ethiopia, close to the Guge highlands of the Great Ethiopian Rift Valley's western escarpment. Following the Nech Sar National Park, the river flows past Arba Minch village and enters Lake Chamo in a west-to-east direction. The Kulfo River splits directly southwest of Arba Minch Airport, and its lower reaches can also act as a spillway (overflow channel) for Lake Abaya into Lake Chamo during periods of severe rain. The Kulfo River has an average bed material diameter of 14 millimeters (gravel), a catchment area of around 300 km^2, is 20 m wide towards the mouth, has a slope gradient of 10 m/km, and all of these characteristics. Water for agriculture, bathing, washing clothes, and other needs is available to AMT residents from the Kulfo River.

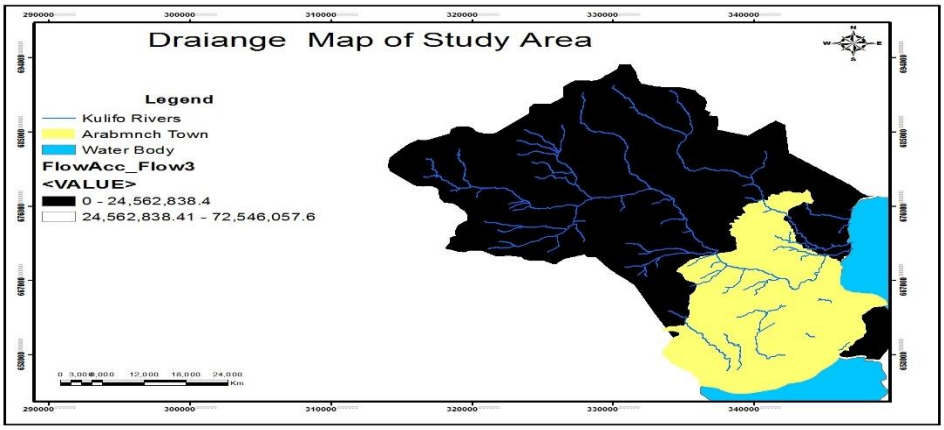

Figure 16 Drainage map of AMT

5.6.1 Hydrogeology

The hydrogeological map shows aquifers and aquicludes defined based on the character of the Groundwater flow (pores, fissures), the yield of springs, and the hydraulic characteristics of wells. The following aquifers and aquicludes were defined:

1. Extensive (746 km^2) and moderately productive or locally developed and highly productive Porous aquifers (T = 1.1–10 m2/d, q = 0.011–0.1 l/s.m, with spring and well yield Hydrogeology Hydrogeological Classification/Characterization Elements of the Hydrogeological System 92 Hydrogeology Q = 0.51–5 l/s). The aquifers consist of Quaternary alluvial and eluvial sediments (Qa, Qe), polygenetic infill of depressions (Ql), and volcano-sedimentary rocks (Qvs). The aquifers are shown in light blue.
2. Extensive (9,626 km^2) and moderately productive fissured aquifer (T = 1.1–10 m2/d,q = 0.011–0.1 l/s.m, with Q = 0.51–5 l/s). The aquifers consist of basalts of rift floor, ignimbrite, rhyolite, and trachyte of the highlands and escarpment (Qdi, Qwbp, Tig2, TV1, TV2, TV3, TV4, Ttr, q3N1a). The aquifers are shown in light green.
3. Extensive (5,400 km^2) and moderately or locally developed and highly productive mixed porous and fissured aquifers (T = 1.1–10 m^2/d, q = 0.011–0.1 l/s.m, with spring and well yield Q= 0.51–5 l/s). The aquifers consist of volcanic, sedimentary, and pyroclastic rocks of the Central volcanic complexes, and pumiceous pyroclastics of the Nazret group (Qwa, Qws, and Tig1). The aquifers are shown in light green with light blue horizontal hatching.
4. Extensive (1,449 km^2) low productive fissured aquifers (T = 0.11–1 m2/d, q = 0.0011–0.01 l/s.m, with spring and well yield Q = 0.051–0.5 l/s). The aquifers consist of high and low-grade metamorphic rocks and granite (Pg, Psm, Pumf, and Pgt). The aquifers are shown in brown/red.
5. Formation (15 km^2) consisting of a minor fissured aquifer with local and limited groundwater. Resources – Aquiclude. The formation consists of obsidian and pitchstone (Qwo). The rocks are shown on the hydrogeological map in light brown.

5.6.2 Local Hydrogeology

The field investigation conducted in the study area has revealed the occurrence of Quaternary Sediments and, Quaternary basalt rocks. Particularly fractured and weathered basalt and alluvial deposits are common. These volcanic rocks cover the largest surface area of the study area and are of extrusive origin, with enormous groundwater potential in most parts of the country. The basalt flow that has erupted and formed on the land surface has a greater capacity for water transmission and storage than do intrusive igneous rocks that formed and cooled beneath the earth's surface.

The aquifers associated with volcanic formations are related to a combined effect of during and after rock formations porosity and permeability. The porosity and permeability of the volcanic rocks are affected by various factors, including the degree of fracturing, weathering, and the size and distribution of the pores. Proper management and monitoring of groundwater resources in the study area are essential to ensure the sustainability and availability of water resources for the community, particularly in areas where the aquifers associated with volcanic formations have a high potential for groundwater extraction.

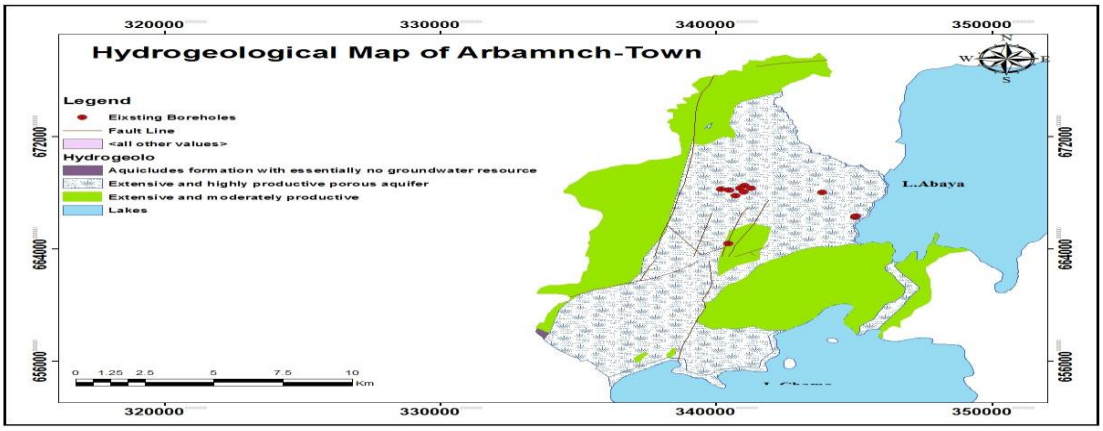

Figure 17 Hydrogeological Map of AMT

5.7 Regional Geology

5.7.1 Precambrian Metamorphic and Intrusive Rocks

The dominant rock type is biotite-quartz oligoclase gneiss, accompanied by medium-grained amphibolites occurring as bands. Undifferentiated gneiss and granites are found near Lake Abaya, while mafic and ultramafic rocks are weathered and altered to talc, chlorites, and epidote. Mica schist and lesser chlorite schist are also present, displaying strong weathering and friability. Granite formations appear predominantly in the southeastern part of the area, characterized by their hardness, compactness, coarse grain size, and pink color. These diverse lithological units contribute to the geological characteristics and processes observed in the study area.

5.7.2 Tertiary Volcanic Rocks

These include lower basalt, rhyolite, and trachyte, transitional basalt, and rhyolite, aphyric and porphyritic basalt with vesicular basalt, alkali trachyte flows, and tuffs, as well as various ignimbrites, basalts, and tuffs within the Nazret group formation. Additionally, there are alkaline and peralkaline silicic rocks such as rhyolite domes and ignimbrites, stratified silicic including tuffs, ash flows, rhyolites, and trachytes, and alkaline basalt, trachyte, and peralkaline rhyolitic ignimbrite in specific areas.

5.7.3 Quaternary Volcanic Rocks

The Dinoformation includes coarse unwelded pumiceous pyroclastic deposits, ignimbrites, and diatomite. The pyroclasts are light, highly friable, and have a light gray to yellowish color. The Quaternary basalts and scoria cones are characterized by dark gray basalts and slightly differentiated light gray trachy basalts. The peralkaline silicic undifferentiated units are light yellow in color and composed of rhyolite and trachyte rock fragments. The area also contains pumice and unwelded tuff deposits produced by rhyolitic eruptions, as well as weathered rhyolite lava and obsidian rich in crystals.

5.7.4 Quaternary Sediments

Eluvium (Qe) is composed of residual clayey to silty soils resulting from intense in-situ weathering of volcanic and metamorphic rocks. Alluvial deposits (Qa) are found at the mouths of rivers entering Lake Abaya, consisting of gravels, sands, and silts forming alluvial fans. The Bilate River forms a large delta on the northern edge of Lake Abaya, and a significant alluvial plain exists on its western banks north of Arba Minch.

5.8 Local Geology of the Study Area

5.8.1 Culluvial Sediments

The colluvial sediments consist of unsorted, matrix-supported deposits containing boulders primarily composed of welded ignimbrites. The varied grain size within these sedimentary materials reflects different forces and geological processes at work. The thickness of these sediments, reaching up to 10 meters, suggests a history of accumulation due to recurrent deep-seated rockslides and landslides.

Alluvial sediments are primarily found on erosion terraces surrounding Arba Minch and as intercalations within the syn-rift Nech-Sar basalts. These sediments display vertically stacked layering, indicating deposition over time. The alluvial deposits consist of sequences of reddish-brown clayey to fine-grained sandy soils, medium- to coarse-grained sands, and clast-supported conglomerates**.**

The study area around Lake Abaya exhibits lacustrine sediments, primarily composed of unconsolidated fine-grained materials such as mud and silt. These sediments are found along the lake's shorelines and surrounding swamps. The lithology of the sediments, including their color, mineral content, and grain size, is influenced by factors such as sediment transport and the flow rates of rivers and streams that enter the lake.

5.8.2 Alluvial Sediments

Alluvial sediments are soil or sediments eroded from land and transported by water, usually making their way to the sea. However, these deposits are found primarily on erosion terraces surrounding the town of Arba Minch, exhibiting a vertically stacked layering. They also exist as a few meters thick intercalations within the syn-rift Nech-Sar basalts. The Nech-Sar basalts refer to the basaltic rocks associated with the continental rifting. The alluvial deposits are composed of sequences or alternations of re-deposited reddish-brown clayey to fine-grained sandy soils, medium- to coarse-grained sands, and clast-supported conglomerates. The presence of clayey soils suggests periods of slow water flow that encourage the settling of these fine particles, while coarse-grained sands and conglomerates indicate periods of fast water flow capable of carrying larger sediment loads.

5.8.3 Lacustrine Sediments

Lacustrine sediments**,** often associated with lake environments, are found along the shorelines and surrounding swamps of Lake Abaya. These are primarily composed of unconsolidated fine-grained materials such as mud and silt. The lithology, or physical characteristics of these deposits such as color, mineral content, grain size, etc., is influenced by factors including sediment transport and river flow rates of streams that empty into the lake. As a result, alluvial sands and gravels may alternate in these lacustrine areas. This pattern suggests variations in deposition under different hydrodynamic conditions. During periods of fast water flow, heavier and larger particles like gravel can be transported and deposited. In contrast, during periods of slower water flow, lighter and smaller particles like silt and mud can be deposited. This alternating pattern of alluvial sands and gravels indicates the dynamic nature of this lacustrine environment around Lake Abaya.

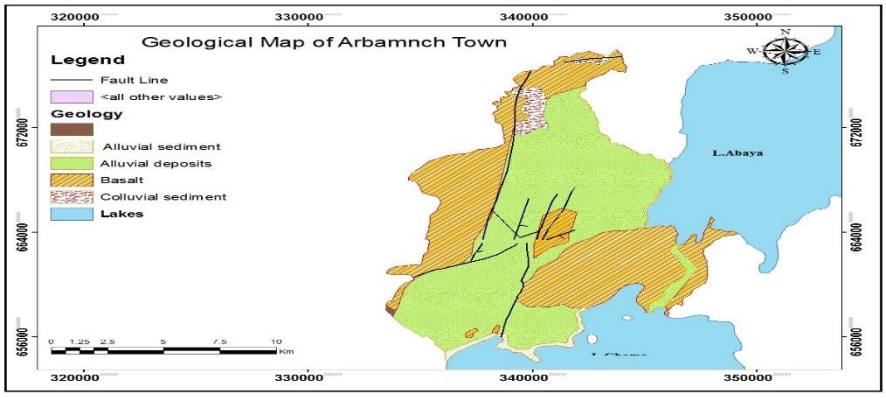

Figure 18 Geological Map AMT

5.8.4 Geological Structures

The primary fault in the study area is the NNE-SSW fault, which is an extension of the Wonji Fault Belt. This fault is believed to be the oldest in the region and has significantly influenced the current terrain. The impact of these faults can be observed at the "God's Bridge," a well-known local landmark that connects the two lakes. Additionally, the study area is affected by fault lines oriented in the NS (north-south) and NW-SE (northwest-southeast) directions, which have an impact on groundwater flow patterns. Understanding the hydrogeology and water movement patterns in the area is crucial due to the importance of these fault lines. The presence of faults and fractures can greatly impact groundwater circulation by creating pathways for water to move through the subsurface

5.9 Noise Emission

The main sources of noise in this area are vehicles, religious institutions, enterprises, and residences. Although the main route from Sodo-Arba Minch to Konso generates noise, traffic is often not heavy, so it is unlikely that noise levels inside and outside of the town will exceed legal limits.

5.10 Biological Environment

5.10.1 Flora

Arba Minch town FSTP environs have little vegetation or forestland. The project area is not covered with heavy vegetation there are a few *Ximenia american* plant species locally named "Inkoye" *Terminalia browni Fresen* local name "Weybeta" and *Balanites species*. Common shrubs and grasses are the dominant vegetation in the project site. Shrubs of *Solanum incanum (Solanaceae family), Lantana camara,* and others. The selected FSTP area has lost its natural vegetation due to human settlements. As a result, the vegetation was replaced by manmade crop plantations and home gardens. Very few endemic plant species were observed. However the presence of diverse flora species reported from NSNP. A partial view of the plant species at the project site is presented in Figure 19.

Figure 19 Partial view of flora in the project area

5.10.2 Fauna

In the project site, domestic animals and some wild animals (insects, birds) were observed. In the area, there are diverse types of butterflies(Lepidoptera species) like Golden Arab Tip (*Colotis chrysonome*), *Hypolimnas misippus, Junonia-hierta-cebrene*and others. The NSNP that is found in the town harbors a lot of fauna diversity of a variety of mammalian, avian, amphibian, reptilian, and fish fauna. Swayne's hartebeest (*Alcelaphus buselaphus swaynei*), Burchell's zebra (*Equus burchelli*), Grant's gazelle (*Nanger granti*), Waterbuck (*Kobus ellipsipprymus*), common Warthog (*Phacochoerus africanus*), Bohor reedbuck (*Redunca redunca*), Oribi(*Ourebia ourebi)* Greater kudu (*Tragelaphus strepsiceros*), Common Bushbuck (*Tragelaphus scriptus*), Guenther's dik-dik (*Madoqua guentheri*), Grey Duicker (*Sylvicapra grimmia*), Bush duiker (*Sylvicapra oreotragus*), Bush pig (*Potamocherus larvatus*) Anubis baboon (*Papioanubis),* Vervet monkeys (*Chlorocebus pygerythrus*) and Black and white colobus monkey (*Colobus guereza*) and others. Other interesting birds are also available like Lesser Flamingos, Pallid Harriers, several Kingfishers and Storks, Pelicans, and African Fish Eagles.

Figure 20 Partial view of fauna in AMT

5.11 Socio-economic Environment

5.11.1 Demographic Characteristics

Based on the CSA (2020) population and housing census report, the total population size of AMT is 211,276; with an estimated annual growth rate of 4.8%. The number of males and females is almost proportional. The majority of the population (63%) AMT belongs to the active age group (between 15- 64 years) 6% of the population belongs to the age group above 65 years and 31% of the total population falls into the young age group (0-14 years). This age structure of the town reveals that from total population dependency ratio consists of about 37% and the male population is slightly larger in urban areas with the exemption of Sile Erisha Limat rural kebele, but their proportional share is decreasing in the examined period 2007-2020 from 52.4% to 50.3% in the urban areas(Table 6).

Table 6 Distribution of Population by Sex and Age in AMT

Study area	2007					2020				
	Total	Male		Female		Total	Male		Female	
		No.	%	No.	%		No.	%	No.	%
AMT**	74,879	39,208	52.4%	35,671	47.6%	183,336	92,145	50.3 %	91,191	49.7%
Sile Erisha Limat *	4,920	2,587	52.6%	2,333	47.4%	6,185	3,252	52.6 %	2,932	47.4%
Kola Shara *	8,873	4,346	49.0%	4,527	51.0%	11,154	5,464	49.0 %	5,690	51.0%
Chano Chalba*	5,605	2,783	49.7%	2,822	50.3%	7,046	3,499	49.7 %	3,547	50.3%
Chano Dorga*	2,829	1,404	49.6%	1,425	50.4%	3,556	1,765	49.6 %	1,791	50.4%
Sub-total	22,227	11,120		11,107		27,941	13,980		13,960	
Total	97,106	50,328		46,778		211,277	106,125		105,151	

Sources: Roikos and ZA, (2022) NB: * Rural Kebele; **Urban Kebele

5.11.2 Education Facility

The education infrastructures include schools, academies, and universities, public and private. The education office informed that there are 13 public schools (8 primary and 5 secondary) and 27 Private schools in the city. All of the educational infrastructures in the town have toilets for

both students and teachers.AMT has seven higher institutions three of them are public higher institutions while others are private. Arba Minch University (AMU) is one of the public higher education institutions located in Arba Minch and has campuses in different areas in the project area (Feasibility study report,2022).

In AMT 51.5% of higher education students attend their classes in private colleges while the rest 48.5% them in government or public colleges. Almost half of higher education students are females 50.1% (5626/11233). All of the public and private colleges do have facilities of toilets with septic tanks and water utilization ranges from 112 m^3 in private colleges to 95 m^3 in public. The higher educational facilities with their students in AMT, 2014/2015 E.C. are presented in Table7 .

Table 7 Public and private colleges and universities in the year 2014/2015 EC AMT

College/university	College	Number of students				Average water use
	No	F	M	Total	%	M^3 Water/ use/month
Private	4	2576	3205	5781	51.5	112
Public	3	3050	2402	5452	48.5	95
Total	7	5626	5607	11233	100	207
%		50.1	49.9			

Source:A/M/A/E/Office,2023

According to the AMT administration educational office report, there are 79 privately and publicly owned schools in the town. Among these, are 43 KG schools, three primary schools (1-4), 23 secondary schools (5-8), and ten high schools (9-12). In the town, privately owned schools are much higher than government-owned owned. This can be seen in table (13) as 86% Kinder Garden, 100% in primary school, 65.2% in junior schools, and 50% in high schools. All of the schools do have school latrine facilities with septic tanks. The report also outlines that for 2014/15 EFY there are 24521 secondary and 9526 high school students attending their education.

Table 8 School data in the year 2014/2015EC AMT

NO	Institution	KG		Number of schools					
				Primary		Secondary		High School	
			%	1-4	%	5-8	%	9-12	%
1	Public	6	14	-	0	8	34.8	5	50
2	private	37	86	3	100	15	65.2	5	50
	Total	43		3		23		10	

Source: A/M/A/E/office, 2023

5.11.3 Health Facility

Health facilities vary in their size, scope, and services provided. Here are some common types of health facilities. There are 58 different health facilities in the town. The existing private and public health infrastructures that are giving service to the residents of AMT are 24 pharmacies, 18 clinics, six drug stores, three health centers, and three hospitals Table (9).

Table 9 Number and type of health infrastructure in AMT

	Health infrastructure	**Government**	**Private**	**Total**
1	Hospitals	02	01	03
2	Health centers	03	0	03
3	Clinics(medium higher)	0	18	18
4	Pharmacies	0	24	24
5	Drug stores	0	06	06
6	Diagnostic laboratories	0	01	01
7	Other	-	03	03
	Total	5	53	58

Source: A/M/A/E/office, 2023

Health professionals play a crucial role in promoting health, preventing illness, diagnosing and treating medical conditions, and supporting the overall well-being of individuals and communities. In AMT health facilities there are about 770 health professionals 428(55%) of them are females and the rest are males. Based on the profession 35.3percent (275) of them are nurses, 123(15.8%) midwifery nurses, 96(12.3%) health officers, 66 (8.5%) General and 17(2.2%) specialized doctors. Table (10) presents the professional categories of AMT health professionals and their relative number

Table 10 Number and type of health professional's available at AMT

	Health professionals	**Male**	**Female**	**Total**	**%**
1	General doctors /Physicians	44	12	66	8.5
2	Specialized Doctors	17	-	17	2.2
3	Health Officers	64	32	96	12.3
4	Nurses	83	192	275	35.3
5	Midwives	13	110	123	15.8
6	Radiologist	6	3	9	1.2
7	Laboratory technologist	36	23	59	7.6
8	Pharmacists	33	25	58	7.5
9	Environmental Health	2	4	6	0.8
10	Other	52	27	79	10.2
11	Total	350 (45%)	428(55%)	778	100

Source: A/M/A/E/office, 2023

Based on the available data and public health reports, the top ten diseases that have a significant impact on AMT are Pneumonia (20%), malaria by *Plasmodium falciparum* (14.3%) Urinary tract infection (UTI) 13.1% diarrhea (12.6%) and Malaria by *Plasmodium vivax* (8.5%) are top five diseases in AMT. Relatively females are more infected 53.5% than males by the top ten diseases

at AMT. The prevalence and number of cases of the top ten disease in AMT is presented in table (11).

Table 11 Prevalence and number of cases of the disease in AMT, 2023

Rank	Type of Diagnosis	No. of patients in 2014/15E.C			
		Male	Female	Total	%
1	Pneumonia	2989	3219	6208	20
2	Malaria(pf)	2050	2412	4462	14.3
3	Urinary tract Infection	2027	2050	4077	13.1
4	Diarrhea(functional	2007	1907	3914	12.6
5	Malaria(PV)	905	1735	2640	8.5
6	Pain disorder	1202	1271	2473	8
7	Giardiasis	1120	1216	2336	7.5
8	Tonsillitis (Acute Pharyngitis)	1019	1003	2022	6.5
9	Typhoid fever	697	969	1666	5.4
10	Helminthiasis	457	862	1319	4.2
	Total	14473	16644	31117	100
	Percent	46.5	53.5	100	

Source: A/M/A/E/office, 2023

5.11.4 Trade, Industry, and Other Services

The town has a diverse economy with various economic activities. The town is also home to some small and medium-sized enterprises, including manufacturing, construction, and service industries that produce products such as textiles, leather goods, and food products. Economic activities like trade (both wholesale and retail), banking and other financial services, public and private educational services, medical facilities, hotels, and truism other business and service functions play a significant role in the city's economy.

5.11.5 Agriculture

Agriculture is the main economic activity in the region. The area is known for its production of coffee, cotton, maize, and sorghum, among other crops. Several large-scale commercial farms in the area produce fruits and vegetables. The city is also known as a source of fruits including mango, banana, orange, apple, guava, and pineapple, and also a fish farm. So, this indicates that the Agricultural sector has a great contribution to the city's economic activity.

5.11.6 Tourism

Tourism is also an important economic activity in Arba Minch. Conversely, the city is endowed with abundant natural resources such as the two Great Rift Valley lakes of (Abaya and Chamo), the Kulfo River, the Bridge of Heaven (locally named TossaZoko) which separate the two lakes, the forty springs, Arba Minch Natural Reserve Forest which covers 1,030 hectares of land, Neche Sar National Parks, the famous crocodile ranch, side wall of the Great East African Rift Valley and Chenecha and Ganta Mountain around the city. The presence of these natural gifts has made the city a tourist center and has been attracting both local and international tourists.

Therefore, tourism is becoming an important sector contributing a great deal towards the economic development aspects of the city. The tourism infrastructure for the AMT comprises 38 hotels, lodges, and pensions (AM Zonal Tourism Office).

5.11.7 Energy and Power Supply

Arba Minch, like many other cities in Ethiopia, relies primarily on hydroelectric power as its main source of energy but Kerosene, and butane are also main sources of commercial energy in the town. In the domestic sector, about 90% of the population burns traditional solid fuels like firewood and charcoal. Low water levels in the hydroelectric dams cause frequent power cuts because the region still relies on the National Grid for its electricity source. Electricity lines cross through urban, small, and rural communities that are all connected. Even though many towns are close to an energy line, the level of access to power is low because of poverty.

5.11.8 Existing Municipal Infrastructure

Demands for investment in infrastructure come from the need to support new ways of working and living for an increasing population. Infrastructure development is a catalyst for economic growth that can contribute to economic development and also addresses the good governance issues in towns. The existing infrastructure coverage, the mainly municipal infrastructure of the city is 14.8km of asphalt road, 54.1km of cobblestone road, 21km of gravel and red ash road, 29.7km of pedestrian walkway, 933 steel poles of street light (with average of 30m interval it is nearly about 28km), 86.6.6km of masonry drainage, 49 bridge and culvert, 142.5km distribution and 13.1km transmission line of water, 9.4 hectares of urban greenery and public park and 42 public and communal toilet. The data considered here for all road network lengths is the actual one and they may increase if converted by considering 7m width (Arba Minch City Administration AMP, 2014-2016E.C),

5.11.9 Waste Management

In urban areas like Arba Minch with a high rate of urbanization and rapid population increase, wastewater management is a severe problem. There is no centralized or semi-centralized sewer network infrastructure built for Arba Minch and onsite sanitation is the dominant waste management practice on which the community uses septic tanks and pit latrines to collect all of the fecal sludge. The generated fecal sludge is often transported in vacuum trucks(commercial operators) and desludging takes place in open areas near Nech Sar National Park (vacuum trucks emptying in the National Park). AMTWSSE is in charge of managing fecal sludge and wastewater in Arba Minch. AMTWSSE is in charge of emptying septic tanks and pit latrines but neither the town utilities sector do municipalities own any vacuum trucks.

In the town of Arba Minch, solid waste is produced by households, businesses, institutions, industries public gathering places, governmental agencies, transportation hubs, building sites, demolition debris, medical facilities, and municipal services. Biodegradable solid waste predominated in the town. Solid waste is unlawfully disposed of along the Kulfo River, for

instance in locations between the new and old markets in Adisugedema ketene. The new transfer station (which is not yet operational) is a short distance away. In Arba Minch, waste segregation at the source is not a prevalent practice. There is only one SME, called "Egnannewumayet," that engages in the recycling or reuse of solid waste. Compost is produced by at least one SME, which sells it for 500–700 Birr per quintal. Several households in the "Weze" kebele also practice composting for their use. There are no private businesses or institutions producing biogas from solid waste in Arba Minch.

6. Stakeholder Consultation and Participation

As a prerequisite, stakeholders, project project-affected groups' engagement is vital to build relationships of trust and cooperation; and identify beneficial, and adverse impacts and their enhancement and mitigation measures respectively. For this reason first and second round stakeholder consultations were made in May 18 –June 4 /2023 and August 12/8/2024

6.1 First Round Stakeholders Consultations

6.1.1 Public Consultation (PC)

PC was held at the proposed FSTP sub-project sites. PC was started with the introduction of the consultant and the aim of the proposed project by AMTWSSE and the consultant representative. The PC meeting, participants were the local community members comprised of the youth, women, vulnerable community groups and sector experts, and institution leaders. The project nature and purpose of the consultation purpose was also elaborated by the consultant representative and hence asked the participants to raise issues related to the project which may have environmental and social concerns that need consideration. The total number of participants including the AMT representatives was 90 of which 35 were females and 55 of them were males.

The participants reflected on their positive attitude toward the coming development project. However, some raised administration, socioeconomic, and environmental issues which they believe are critical throughout the lifecycle of the project. Then they forwarded their fear, and concern about the project. The key issues reflected by the PC participants were:

- Most participants indicated that there was no proper formal consultation but they had rumor information about the project.
- What will be the fate of the PAHs? How are PAHs, and enterprises compensated? If it is necessary relocation has to be done appropriately. How is the Livelihood of the PAH restored?
- Who is going to manage the FSTP? How the government is going to manage the bad smell of FSTP?;
- How the development project of the city is going to manage the biodiversity of the sensitive protected area of Nech Sar National Park (NSNP)?

Figure 21 Partial view of the community consultations at selected project sites

6.1.2 Decision Makers/Stakeholders engagement

Effective stakeholder engagement assists good design, builds relationships with local communities, and reduces the potential for delays through the early identification of risks and issues. Stakeholder engagement was conducted between the members of the consultant and Nech Sar national park experts, administration, Arba Minch town administration sectorial offices (health, land education enterprise, etc), and Water and Sewerage enterprises. A partial view of the stakeholder's engagement is presented in Figure (22).

Figure 22 Partial view of the stakeholders' meeting at AMT

6.1.3 Key Informants Interview (KII)

KII are qualitative in-depth interviews with people who know what is going on in the community. The purpose of key informant interviews is to collect information from a wide range of people—including community leaders, professionals, or residents—who have first-hand knowledge about the community. In this ESIA study, KII was conducted by women, transport sector experts, residents, religious leaders, project-affected business owners, and others. The partial view of the KII is presented in Figure (23).

Figure 23 Partial view of key informant's interview at AMT

6.1.4 Tripartite Discussion among Stakeholders

The main agenda of the tripartite meeting was to reach a consensus on the technology and site alternatives for the proposed FSTP. For these purposes, the tripartite discussion was conducted virtually as well as face-to-face participation on 13th October 2023. The participants were the client (MoWE), ESIA consulting team members, and representatives of the design consultants for Arba Minch Woalita Sodo, Nekemete, Jimma, Assela, and Shsashemene towns. A total of 19 (two female) individuals were involved in the tripartite discussion. After thoroughly discussing the issue, participants agreed on the selected project alternative site and technology options designed by the design consultants. The selected project alternative site for FSTP has a relatively lower socioeconomic and environmental impact than alternative two and the proposed technology alternatives by the design consultant are also suitable for the town and effective in treating the generated fecal sludge Sustainable way and achieving the UWSSP-II project objectives. Hence ESIA consultants agreed on the technology options to be adopted and that it can be constructed.

6.1.5 Summary of Stakeholders Consultation

Overall, the interested parties recommended that the planned development should adhere to all the relevant legal standards. Furthermore, they think district administrators must meet with sector and town officers to discuss the problems with the implementation of the planned development in the Arba Minch area.

Table 12 Summary of community consultation related to FSTP at AMT, 2023

Issues raised	The response given by the ESIA team and officials
• Loss of properties and livelihoods of communities at FSTP site.	• Proper compensation and land replacement will be ensured through legal procedures • RAP will be prepared and implemented before the commencement of the project
▪ Loss of property and land ▪ Job opportunity for the local youth has to be given	▪ An commensurate amount of compensation shall be made by applying appropriate legislations and guidelines after a detailed land acquisition or RAP prepared ▪ Included in the ESMP and Proponent will consider the casual job opportunity. Priority will be given to the VCGs, PAHS, and local youth following their knowledge, skill, and interest
• Compensation for the asset and land they may lose due to project implementation • Small and Medium scale enterprises' business areas selected for Public toilet sites are given to Small and medium-scale enterprises	• A commensurate amount of compensation shall be made by applying appropriate legislations and guidelines and the recommendations to be made by RAP • Compensation and replacement will be given to sustain their business. RAP will be done by small and medium-scale enterprises
• FSTP may be poorly maintained, dirty, or even unsafe, can be a	• Efforts will be made to make FSTP safe clean and accessible

Issues raised	The response given by the ESIA team and officials
health hazard, and make people complain • Low level of public consultations about the project • We need development in the town but how do development projects of the town consider the sensitive protected area of Nech Sar National Park?	• Small and Micro enterprises will handle it and the AMTWSSE will monitor and control it • Adequate training will be given to Small and medium enterprises • local governments and businesses will work for timely maintenance • Roadsides are selected due to being an open area and the number of people needing such urban services is relatively larger. • The coming project aimed to manage the town's fecal sludge effectively in a modern way. The implementation will have the potential to reduce fecal contamination in the environment • The project will have multifaceted advantages to the town and the park in particular • Implementation of the project is regulated by considering national and international standards of environmental and Social safety, guidelines, and laws
• Tripartite discussion raised issues • Design of FSTP Technology alternatives • How FSTP site alternatives assessed	• The design of FSTP alternatives considers practicability, requirements, and environmental and social issues besides the expected waste treatment efficiency. The proposed technology option is environmentally friendly and feasible from an economic and technological perspective. Agreed on the implementation of the project design recommended. • To select the suitable project site alternative, Criteria were adopted and assessed based on it. Moreover, Stakeholders' opinions and the ground truth observation were also considered to selecting the site. Hence alternative site one is better than the other. Agreed to implement the design on the selected project alternative site one.

6.2 Second Round Stakeholders Consultations

The second round consultations were held from August 2024 (02/12/2016 to 12/12/2016 EFY). In this section, therefore, emphasis is given on the revision of the RAP based on the comment and guidance from World Bank and MoWE based on the submitted ESIA and first draft RAP report. The major comments raised by WB and MoWE was the missing the view of PAPs on their new relocation site and to consider the view of additional PAHs when the standard buffer zone between FSTP and nearby residence stretched from 250 meter to 400 meter. In this connection, some recommendations will also be forwarded reflecting analysis of data from the community and stakeholder consultations.

The public and stakeholders consultations were held with concerned government officials, PAHs, community elders and local officials with the following key objectives among others:

- To have discussions with key government higher officials level stakeholders in the form of entry meeting on how to conduct all data collection activities to carry out the RAP revision
- To strengthen/reestablish the former property valuation committees of that help to collect data for the RAP by taking standard buffer zone of 400 meter between FSTP and the nearby residence.
- To have discussions with the property valuation committee members on how to conduct the data collection activities in a collaborative, transparent and fair way
- To revise the first draft property valuation unit cost based on the current market price
- To evaluate the overall data collection process in combination with all property valuation committee members
- To approve the preliminary RAP report with property valuation committee members and other key stakeholders,
- Providing prior information about the overall activities as well as the benefits and impacts associated with the resettlement;
- Conduct on voluntary basis free from any coercion and intimidation;
- Providing PAHs including vulnerable groups an opportunity to express their views and raise their concerns about the proposed activities;
- Reach on consensus that all their concerns will be fairly addressed and eventually obtain broader community support of the resettlement program.

About four consultations meetings have been held with groups of stakeholders; (1) Arba Minch Town Water and Sanitation Enterprise (2) Concerned government officials of the town including Zonal level supporting committee and mayor of the town (3) selected experts from different offices of the town, Zuria Woreda and PAPs representatives who served as property valuation committee members established by town mayors in consultation with the consultant (4) community who are in a position to be either economically and/or physically affected as a result of the proposed project. Accordingly, the consultations that have been held and their respective purposes and results have been dealt in the subsequent sections.

6.2.1 Consultation Schedule and Entry meeting

Specific consultations scheduled for selected participants for the second time with desired purpose.

Entry Meeting: The overall revision of the RAP work has begun by carrying out an entry meeting with concerned bodies of AMTWSSE and project staffs of UWSSP-II. Team of the RAP study explained the purpose of the consultation. The team asserted that the revision of the RAP expected to be prepared as commented and recommended by the WB and MoWE for the proposed FSTP. The team explained that to complete the RAP study PAHs should be consulted about their views on the new relocation site. And even the relocation site should be visited and assessed by the study team to compare with the PAHs original residential site in terms of

infrastructure and basic service. Moreover, more emphasis was given on 400 meter buffer zone between the FSTP and residence while ESIA and RAP were revised.

The team leader of the ESIA and RAP has also explained that as a precondition the 400 meter buffer zone from the edge of the FSTP plant in all rounds should be delineated and free from any inhabitants. Accordingly, both ESIA and the RAP study should be revised by taking the buffer zone in to consideration. Hence, he explained, the purpose behind such meeting is to have discussions on how the ESIA and RAP can be prepared taking the aforesaid issues in to consideration.

AMTWSSE manager explained that the PAHs found within the 400 buffer zone have been identified and preliminary assessment has been conducted. The relocation site has already identified and site plan has also prepared. In terms of accessibility, the new relocation site is by far better from their displaced lands. And even road has been constructed to connect the new relocation site to link main nearby road. He explained that much has been done on the way PAPs are getting their equivalent replaced land for what they may lose as a result of the project induced displacement they are going to face.

The consultation has been wrapped up reaching to consensus to have another consultation with the Zone level technical committee which was formed to support the buffer zone delineation and make ready the relocation site by Zone higher officials. Moreover, consensus has been reached to visit and reassure the delineation of the buffer zone at the field level.

The list of consultation meetings with their purpose and participants is presented in table 13 below.

Table 13 Consultation Schedule and the Purpose of Consultation

Date	Participants	Purpose of the Consultation
02/12/2016 E.C	• AMTWSSE higher officials and staffs • Project staffs of UWSSP-II.	• Entry meeting to proceed the revision of ESIA and RAP by taking in to consideration the direction from WB and MoWE • Obtain latest status of securing 400 meter buffer zone and PAPs relocation process • Agree on ESIA and RAP revision procedure
03/12/2016 E.C	• Zone level technical committee • Zone Urban and Infrastructure Bureau • Mayor Office • Zuria Woreda Higher Officials • ATWSSE • UWSSP-II project staff • PAPs representatives • Municipality	• Give introduction about the ESIA and RAP revision • To obtain the latest status of the zone level committee operation on securing the buffer zone, relocation site identification process, fulfilling basic infrastructure like road, handover of replace land for PAPs • Discuss issues related to land acquisition • Agree on ESIA and RAP revision procedure
05/12/2016	• Mayor Committee	• Discuss on the ESIA and RAP revision

Date	Participants	Purpose of the Consultation
	• Municipality • Mayor office • ATWSSE • UWSSP-II project coordinator • Construction office • Zuria Woreda Water and Sanitation Office	• To obtain the latest status of the mayor committee efforts on securing the buffer zone, relocation site identification process, site plan preparation and handover of land replacement for PAPs • Discuss issues related to land acquisition • Agree on ESIA and RAP revision procedure
12/12/2016	• PAPs • Property Valuation Committee (Mayor office, municipality, construction, land, agricultural office, Zuria woreda , Ganta Kanchama Kebele and PAPs Representatives	• Discuss on the RAP revision procedure, disciplines, principles and methods • Information sharing and consultations in relation to land acquisition

6.2.2 Consultation with Zone Technical Committee

The Zonal committee has been established by Zone level, after MoWE have had repeated discussions with region, Zone, town level on the 400 meter buffer zone, relocation site for PAPs and relocating land for they will be going to lost.

Figure 24 Consultation on RAP Revision and Relocation Issues with Zonal Committee

The RAP study manager of Green Sober Environmental Consultant firm stated that it is important to have discussions with this Zone level technical committee and government officials of the town including the mayor. Because, he explained, it will be useful to understand the committee implementation status on identifying relocation site, delineating the buffer zone, consulting the PAPs, conducting preliminary assessment and identifying key issues and impacts delivery of lands for PAPs based on their consent. He also reaffirmed that the RAP study is going to be conducted based on WB safeguard policies and national legal frameworks within a very short time span in a transparent way commensurate of what the PAPs might lose. Then, both ESIA and RAP will be submitted for approval to the WB. Moreover, he explained that

consultation will be conducted with the mayor of the town and PAPs as part of the ESIA and RAP study.

Member of the RAP study team explained that the proposed project is going to be constructed and its 400 meter encircling buffer zone should be delineated. Accordingly, data on PAPs who will face both economic and physical displacement will be identified by the established property valuation committee. Then the final compensation with the listed individual PAPs should be displayed for five days according to the compensation laws.

Manager of ATWSSE, on his part, explained that the project 400 meter buffer zone site identification has been completed and PAPs have been consulted. Now, both the higher officials and PAPs were clearly understood and made advantageous to finalize the RAP revision. Next to him the deputy head of Zone urban bureau also explained that relocation site preparation, PAPs consultation, house ranking and land distribution have been completed. Moreover, GRM committee has been established and begun to see grievances raised. He also assured that the new relocation site is better in terms of accessibility to main road and proximity to the town. Finally, he affirmed that the involvement of key government level stakeholders is quite significant which might have suitable to resolve such compensation related challenges.

The following issues were raised by the PAPs representative in the Zonal technical committee during the consultation as follow:

- What is the plan for those who lost their land after buying from the original landholders? Replacement land should be arranged for all PAPs in the proposed relocation site for all type of land holders.
- The RAP study should be conducted carefully and PAPs should get appropriate compensation.
- Land expropriation and compensation payment should be implemented immediately due to the daily escalation of unit cost for the compensation.
- Compensation payment to PAPs should display to the public for comments and critiques.
- Discussion with higher officials is vital for overall RAP study process and its implementation.
- Who pay compensation for PAPs (WB or Ariba Minch Town)?

Leader of the RAP study team of the consultant stated that it is important to have discussions with higher level government officials of the town including the mayor. Because, he explained, it is the mayor office which is supposed to form compensation committee and give directions to each selected member to actively take part in the data collection for the RAP. He also reaffirmed that compensation payment will be executed by the Zone /Ariba Mich town and Zuria Woreda administration based on the project document.

He was also defined the principal activities to be undertaken as listed below:

- Evaluated/ estimated compensation for additional PAPs who are dwelling within 400 buffer zone

- Identifying and assessing relocation site for land expropriated PAPs
- Displaying compensation amount
- Addressing grievances
- Implementing RAP and compensation transfer using bank slips.

Finally, member of RAP declared that the RAP should be prepared in a careful, transparent and fair way so as to reduce grievances.

6.2.3 Consultation with Mayor Committee

The mayor committee consultation was carried out with mayor of the town and representing mayor office, municipality, Zuria Woreda Water Office, Construction office, ATWSSE and UWSSP-II project office.

The RAP study team and manager of the Green Sober Environmental Management Consulting PLC opened the consultation by explaining about the procedure of the draft RAP preparation. He stressed that the first draft RAP was done by taking 250 meters buffer zone but the WB commented to make the buffer zone up to 400 meters. The town was not responsive and supportive to arrange the revision of RAP and ESIA based on the comment and direction provided from WB. As a result, the revision of the RAP and approval of ESIA still not yet finalized for 8 months and above. But now the town demarcates and clearly indicates coordinate points for the 400 buffer zone as we see clearly on the letter written to MoA. Thus, the RAP study team comes again to revise the RAP and ESIA in a short period of time in the coming ten days as far as the stakeholders' collaboration and supports exist.

He also confirmed that based on consultation with PAPS, field assessment and observation, we assure that there will be a fertile ground to finalize the revision and implement properly the RAP if these higher official commitments exist and persist. He described that positive attitude was observed from PAPs on the relocation site and land replacement for expropriated land. He also added that the RAP should be properly implemented by keeping the right procedure as per the Ethiopian Expropriation of Land Holdings for Public Purposes and Compensation Payment in line with the Federal Proclamation and the World Bank involuntary Resettlement policy such as disclosing the compensation for public, addressing any complaints, PAPs should get appropriate compensation at full replacement cost with tangible evidence like bank slip.

Figure 25 Consultation on RAP Revision and Relocation Issues with Mayor Committee

Moreover, the issue of restoring the former or forming a property valuation committee consisting of experts drawn from concerned offices raised by the RAP study team. Project affected households will definitely get appropriate compensation at full replacement cost and will be relocated in areas where the basic infrastructure service is available before the start of the project construction. To finalize the RAP, there should be evidence for handover the land replacement for PAPs as per regulations.

Mayor of the town clarified that land has been arranged and provided for those PAPs expropriated their land. There is a resettlement and grievance addressing committee where PAPs are represented as a member and hence, the committee manages the implementation of the settlers. This committee will be functional throughout the implementation of the RAP.

The consultation has been concluded by nominating potential experts from urban agriculture, municipality, land administration, urban development, construction, land, and rural water and sanitation office with the support of ATWSSE. The committee has been recommended to undertake duties and responsibilities with due commitment while conducting data collection. The municipality was held responsible in coordinating and/or supervising the works of the committee.

6.2.4 Project Affected Peoples /PAPs/ Consultation

Community consultation was carried out in August 12/8/2024 with representatives of the project-affected peoples drawn from Gizola Village of Ganta Kachama Kebele Kebele in Arba Minch town. Detailed orientation was provided regarding the agenda for discussions after having made some introductory remarks on the purposes of the meeting. The core agenda items were listed below:

i. Give orientation on purpose of conducting community consultations. This briefing includes the FSTP buffer zone expansion up to 400 meter in all round from the structure

ii. Explore and extract the views of the PAPs towards the proposed actions plans (revision ESIA and RAP) by considering the 400 meter buffer zone.
iii. Explore the view of PAHs on the new relocation site which was identified and arranged by the town officials.

Following this introductory remark, the RAP preparation team discussed matters related to possible expropriation of properties, physical displacements and provisions like land to land compensations and monetary remunerations. Then, the PAHs were given the opportunity to freely and openly air out their views. As a result, a number of issues have been raised and openly discussed during the consultation. PAHs were quite happy on the identified relocation site which is better from their original displaced site in terms of accessibility and proximity for different services. All of the PAHs had the impression of willingly providing their land to the demanded project. Though they are willing and cooperative the FSTP project cause, they all demanded:

- To receive compensation payments before the project commencement and immediately after RAP approved.
- Compensation payment expected to be enough to restore their livelihoods
- Special support for different vulnerable groups like old ages, female and child headed families, physically disables and sick peoples that will be affected by the FSTP project
- One of the discussants who took part in the consultation reflected his reservation on the delay of the compensation/resettlement as follows.
- The compensation and grievance redress committee must have representatives from PAHs.

Figure 26 Public consultation with PAHs

The RAP study team and the discussants reached to consensus on the following main points which can be taken as the results of the consultation.

- It was pointed out that the Arba Minch town will implement the ESIA and RAP in line with the requirements of the World Bank and the legal requirements of the Country.
- All the discussants are well aware of the proposed project to be implemented in the places or parcels of the land where they are entitled right after appropriate compensation has been paid to what they are going to lose.

- All people, whose parcels of lands are in a position to be expropriated, have to be made available and get their assets registered by giving valid data. The discussants took the responsibility to take a call to all PAHs who are not living in the area and make their assets registered
- Without the presence and consent of the PAHs, assets will not be made to be registered. Because the already inventoried/collected assets are expected to be confirmed by the owner him/herself.
- An understanding has been reached that local officials will provide all required support in the implementation of the RAP and all support for households that may lose their land and assets.
- Project implementation will not be started before PAHs get compensated and/or resettled for what they are going to lose.
- The RAP study team appreciated the identified relocation site where the PAHs are going to be resettled and on the established and functional grievances committee. PAPs, who may have complains regarding the relocation site and land replacement distribution, were appeal to grievance redressing committee. And the project implementation will not be started before complains to be appealed have been resolved.

6.2.5 Summary of Issues Raised and Response

The overall summry of second round stakeholders consultations with issues raised and responses given is presented in Table 14 below (for more refer the minutes enclosed in appendix section).

Table 14 Summery of Second round consultation

Issues Raised	Response
During the consultation with Zone Technic Committee	
What is the plan for those who lost their land after buying from the original landholders? Is the city administration willing to pay land for land compensation?	Replacement land should be arranged for all PAHs in the proposed relocation site for all type of land holders. The city confirmed that 600 m^2 urban lease land is secured and transferred to all the PAPs in the same village.
Who will take full responsibility to conduct the RAP study in order to carefully address the concerns of the PAPs which means timely cash & compensation? Who and when the valuation result will be disclosed for the public?	Yes, the RAP should be conducted carefully in accordance with the national laws and WB safeguards requirements. The compensation amount should be disclosed for PAHs in the Gizola Village within one week after the completion of the study. The town mayor will disclose for the community. Besides Grievance redress system and committee is also established and it is in place.
Land expropriation and compensation payment should be implemented immediately due to the daily escalation of unit cost for the compensation. Do you think is this possible?	Compensation will be based on replacement cost and will be sufficient to replace assets, plus livelihood supports will be provided. To ensure compensation at replacement cost, planned compensation rates may be recalculated if the payment period is delayed due to

Issues Raised	Response
	inflation.
Of course, we, all the PAP, fully agree with the land for land compensation made to us. When and who will disclose the cash compensation for the public for comments and critiques?	The mayor office representative agrees to disclose or publicize the cash compensation payment amount for the PAHs immediately after RAP revision finalized. Moreover, grievance committee has been established and ready to redress any grievances related to RAP implementation. Consensus has reached that the zone technic and mayor committee to provide the required support during the implementation of RAP. The mayor also confirmed during the discussion in his office to pay all the compensations following the RAP findings,
Discussion with higher officials is vital for overall RAP study process and its implementation.	Consensus has been reached to discuss with the higher officials at Zone and town level. Accordingly, discussion has been conducted with Zone and town higher officials on the RAP study process and its implementation. Both the Zone and city agree to provide all their support and monitor the implementation of the RAP as per the proclamation and regulation.
Who pay compensation for PAPs (the WB or Ariba Minch Town)?	The compensation will be covered by Zone and city administration. This is clearly stated in the RAP document.
During consultation with the Mayor and his cabinet members	
The mayor apologized for the unwanted delay of the RAP study completion and asked Green Sober Consultant would you complete within a very start time to start the next phase? The town administration is ready to stick to and execute the findings of the RAP.	Consensus has been reached to implement RAP by keeping the right procedure as per the Ethiopian Expropriation of Land Holdings for Public Purposes and Compensation Payment in line with the Federal Proclamation and the World Bank involuntary Resettlement policy such as disclosing the compensation for public, addressing any complaints, PAHs should get appropriate compensation at full replacement cost with tangible evidence like bank slip.
Restoring the former or forming a property valuation committee consisting of experts drawn from concerned offices raised by the RAP study team.	Property Valuation committee is formed during consultation**.** Members from the project affected people, experts from urban agriculture, municipality, land administration, urban development, construction, land, and rural water and sanitation office are included in the committee.
Do relocation site identified for PAPs to be resettled on?	Mayor of the town clarified that land has been arranged and provided for those PAs expropriated their land. There is a resettlement and grievance addressing committee where PAPs are represented as a member and hence, the committee manages the implementation of the settlers. This committee will be functional throughout the implementation of the RAP.
During consultation with PAHs	

Issues Raised	Response
To receive compensation payments before the project commencement and immediately after RAP approved.	Project implementation will not be started before PAHs get compensated and/or resettled for what they are going to lose.
Compensation payment expected to be enough to restore their livelihoods	Compensation will be based on replacement cost and will be sufficient to replace assets, plus livelihood support should be included for physically displaced PAHs.
Special support for different vulnerable groups like old ages, female and child headed families, physically disables and sick peoples that will be affected by the FSTP project	Appropriate support and care for vulnerable households will be included in the RAP and responsible body will assist them in re-establishing their livelihood.

7. Socio-economic Characteristics of PAPs and Project Impact

7.1 Project Affected Households (PAHs) and Persons (PAPs)

The proposed rehabilitation of the existing FSTP (2Hectar) and the new treatment plant (6.6Hectar) required of 86,116.9m^2 (8.6 hectares) including the 400m buffer zone area, the total area required is about 48.68 ha which will be free from human settlements (figure 27). Hence,the results of the household census survey and asset inventory have shed light on the potential impact of a project on a community. According to the data collected, a total of 356 households and 1,412 individuals will be affected by the implementation of this project. Out

of the total PAHs only 50 PAHs (14.05%) were fully residing in the project site. Consensus have reached among the ESIA, the design consultants and the city government regarding on the site.

Figure 27 FSTP site with its buffer zone PAHs, AMT

7.1.1 Sex

Out of a total of 356 households surveyed, 90.45 percent (322 households) were male-headed, while only 9.55 percent (34 households) were female-headed. Moreover, when analyzing the demographic distribution of household members, the findings further underscore the male-dominated nature of this community. Of the total 1,412 household members, males constituted 54 percent (762 individuals), whereas females represented only 46 percent (650 individuals).

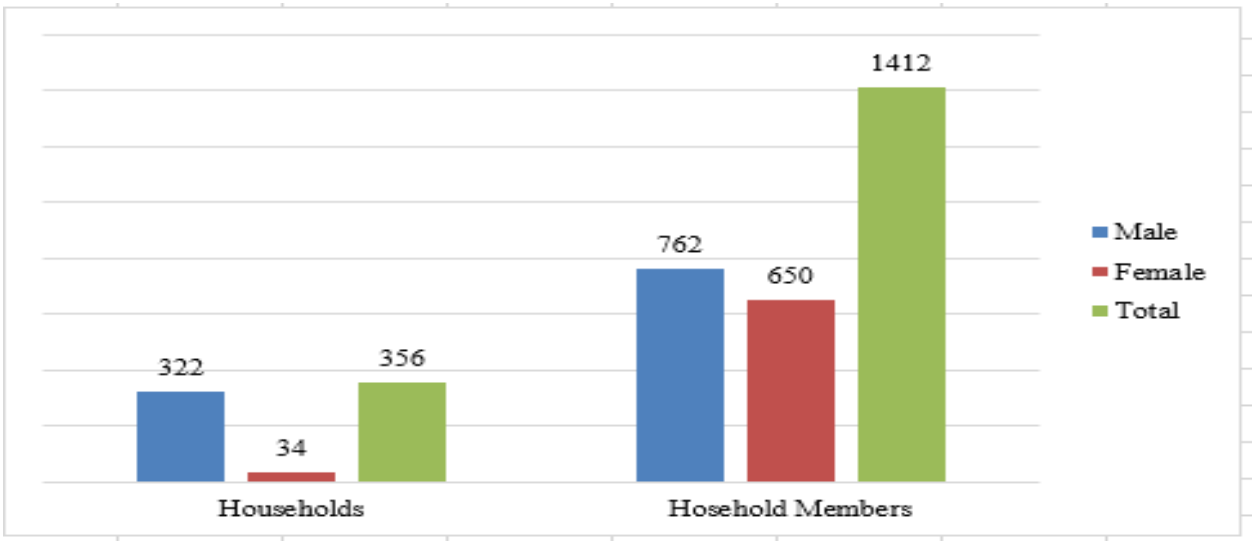

Figure 28 Total Number of Project Affected Households and their Members

7.1.2 Age

As presented in Table (20), the data reveals that among the 356 affected households, 47.19 percent (146 households) are youths. Adults make up 57.97 percent (185) households, while children and elderly individuals represent a mere 0.84 percent (three households).

Table 15 Age Composition of PAPs at AMT

	Age Category									
	<15 years		15-29 years		30-65 years		15-60 years		>60 years	
	No.	%	No.	%	No.	%	No.	%	No.	%
Number of Households	1	0.28	168	47.19	185	57.97	-	-	2	0.56
Households' Members	616	43.63	-	-	-	-	790	55.95	6	0.42

Note: No. = number

Source: Census and Asset Inventory Conducted by Property Valuation Committee, 2023

Despite there being only one-child head household (age <15years), which accounts for 0.28 percent of total households and will be affected by the planned project, it is important to note that this child has not been shouldering the household responsibility. Instead, he is a member of a given household with land ownership in his name. The survey conducted in the project area community reveals a significant demographic composition, with 43.63 percent of children residing within households. Moreover, the survey indicates that adult household members comprise 55.95 percent of the population surveyed. In contrast, elderly members constitute a mere 0.42 percent, suggesting limited involvement of older generations in these households.

7.1.3 Education Status

The data presented in Table (16) highlights the educational status of households and their members expected to be affected by the planned project. The table provides information on the percentage of households and their members with different levels of education, categorized into four groups: no formal education, primary education, secondary education, and college diploma or higher degree. It reveals that a majority of these households or their members have either an elementary level education or are illiterate.

Table 16 Education Status of PAHs and their Members at AMT

Education Status	Households		Households' Members	
	Number	Percent	Number	Percent
Illiterate	61	17.13	465	32.93
Primary School (Grade 1-8)	117	32.87	516	36.54
Secondary School (Grade 9-12)	89	25	285	20.18
Diploma and above	89	25	146	10.34
Total	356	100	1412	100

Source: Census and Asset Inventory Conducted by Property Valuation Committee, 2023

Specifically, 32.87 percent of the surveyed households have an elementary education, while 17.13 percent are illiterate. In contrast, only 25 percent of the households have a high school

level education, and the remaining 25 percent have a diploma or higher degree level. Similarly, when considering household members, about 32.93 percent are illiterate and 36.54 percent have only primary education. Comparatively, only 20.18 percent of household members have a high school education status and 10.34 percent possess an education status equal to or greater than college diploma. This data highlights the educational disparity among the PAHs and their members. The majority lack formal education beyond elementary level or are completely.

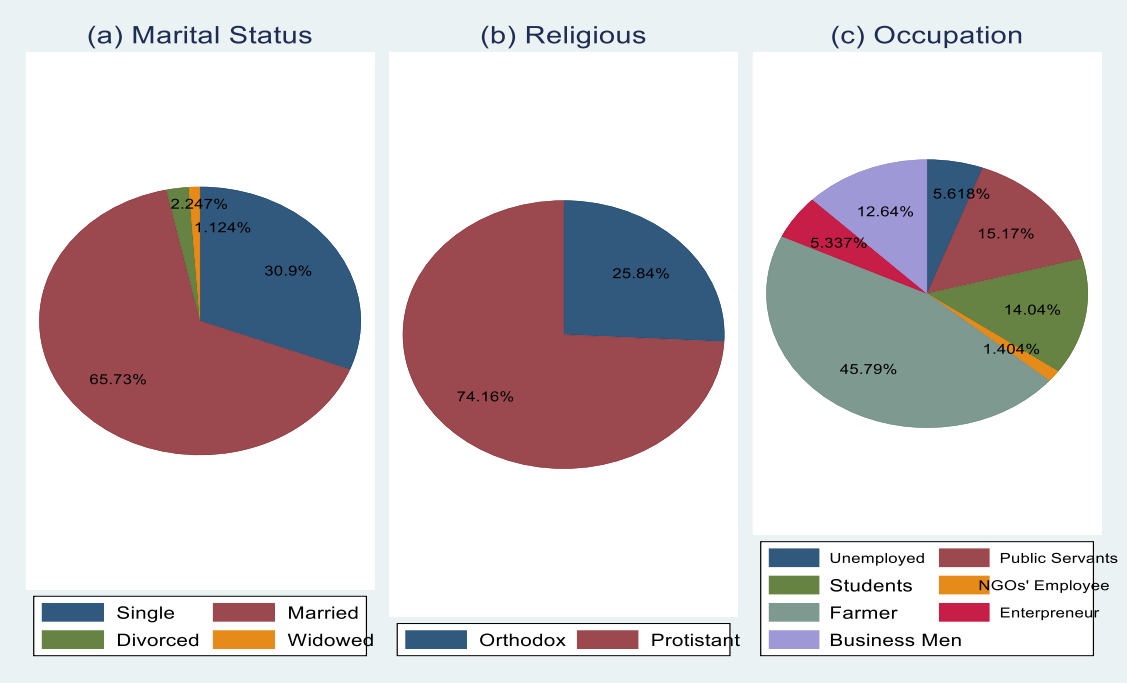

Figure 29 Marital Status, Religion, and Occupational Status of PAHs at AMT

7.1.4 Marital status, Religion and Occupation

Marital Status: Comparing the percentages, it is evident that married households make up the majority of those affected by the project, followed by single households. The data presented in Figure (29a) reveals that a significant proportion of PAHs are married, comprising about 65.73 percent (234 households). In contrast, single households account for approximately 30.90 percent (110 households). Divorced households constitute 2.25 percent (10 households), while widowed households make up the remaining 1.12 percent (4 households).

Religion: From a religious perspective, the PAHs can be divided into two main categories: followers of Orthodox religion and followers of Protestantism. Among these households, according to Figure (29b), majority of the affected households are Protestant, accounting for 74.16 percent (264 households). The remaining 25.84 percent (92 households) are followers of the Orthodox religion.

Occupation: The project-affected population consists of 7 main groups: farmers, students, businessmen/women, entrepreneurs, public servants, NGOs workers, and unemployed persons.

The census data presented in Figure (29c) highlights the occupation distribution among the PAPs population. It reveals that farmers constitute a significant share, accounting for 45.79 percent (163 households). This indicates the strong presence of agriculture such as crop production as a primary livelihood of the PAHs.

The area in which the project affected people are living is surrounded by common pastoral land, leading to a heavy dependence on livestock production and other off-farming activities. The majority of households rely on livestock production, such as fattening and goat husbandry, as well as crop production. Additionally, they supplement their livelihood by collecting firewood and grasses from the common land. This common land has made them privileged, as it provides them with additional resources to sustain their livelihoods

Non-farm activities, such as petty trade and weaving, have become prevalent in the project area alongside on-and-off farming activities. These practices, including the production and sale of local drink called *Chaka*, have provided alternative sources of income for the local community. For instance, Mr. Galebe Gaynita's wife has been producing a local drink called *Chaka* and selling it, which has not only provided a source of income for her family but also contributed to the local community. By producing and selling *Chaka*, Mr. Gaynita's wife has created a sustainable business that supports her household and benefits the local economy. The constructed shed, as shown in Figure (30), serves as a place where users were drinking Chaka.

Figure 30 Shed Serving for Selling Chaka (Local drink)

One interesting observation made by a consultant is that more than 60 percent of households in this area use weaving as a means of livelihood, alongside agriculture. This indicates that weaving plays a significant role in the economic activities of the community.

Figure 31 Weaving Activity in the Project Area

Following farmers, public servants make up 15.17 percent (54 households). Students make up about 14.04 percent (50 households), and businessmen/women represent constitute 13.03 percent (45 households). Furthermore, it is noteworthy that unemployed individuals account for only 5.62 percent (20 households). A small percentage, 5.34 percent (19 households), consists of entrepreneurs who are actively engaged in business ventures beyond traditional occupations. Lastly, employees of non-governmental organizations (NGOs) represent just 1.40 percent (5 households). Overall, this census data provides crucial information about the diverse occupational landscape within PAHs, emphasizing agriculture's dominance while also highlighting other key sectors such as education, business, public service, and entrepreneurship.

8. Outline of the Main Alternatives

Project alternative analysis involves the evaluation and comparison of different project alternatives to identify the one that minimizes potential environmental impacts while achieving the project's objectives.

8.1 Do-Nothing Option/ Without Project Alternative

The do-nothing option means that the project area will be left in its original state and ignores all positive impacts that the project has. The do-nothing alternative neglects the construction of FSTPs in favor of maintaining unsanitary conditions. This implies the existing situation prevails (status quo remains) i.e. no construction of sanitary facilities in the town is necessary.

Hence, the no-project option is the least preferred or viable alternative option from both the socio-economic, health and partly environmental perspectives. On this basis, the ‘No Project Alternative’ is rejected as an option to be carried forward for the project implementation option to be maintained.

8.2 Alternative Analysis for the Site Selection

The FSTP location was chosen with the help of specified criteria. The AMT FSTP development was suggested for two distinct alternatives. Analysis was done for these two alternative sites. The proposed site locations are compared with their potential environmental and social impacts. The coordinate points of the proposed sites are presented in Table (17) below and the location map is in Figure 25.

Table 17 Coordinate points of proposed sites for FSTP AMT

	Project Alternative 1			Project Alternative 2	
Coordinate	X	Y	Coordinate	X	Y
A	337324.268	661699.904	A	341252.875	666550.119
B	337500.160	661681.383	B	341241.511	666585.838
C	337524.029	661489.560	C	341401.042	666823.963
D	337518.737	661191.903	D	341545.241	666823.963
E	337370.570	661170.736	E	341771.460	666642.723
			F	341315.053	666363.589
	Area= **8.61 hectare**			Area= **10.248 hectare**	

Project Alternative Site 1: This site is found nearby and within the existing non-functional sludge drying bed Southwest of AMT (Gizola village) (Fig.32). The area is made up of recent slum development and agricultural land, which might have an adverse social impact on the acceptability of the location. The proposed site already has 1.21 km of all-weather access roads and a bridge, a guard house, an office, a fence, and all other necessary infrastructures for the fecal sludge treatment facility. The location is found within 15 Km distance from the city center and is close to the main road (1.2Km)and far from lakes (8Km) . So there is less economic and environmental problem concerning vacuum truck transportation cost and treated sludge disposal site, which might increase the site's suitability for the fecal sludge treatment plant location.

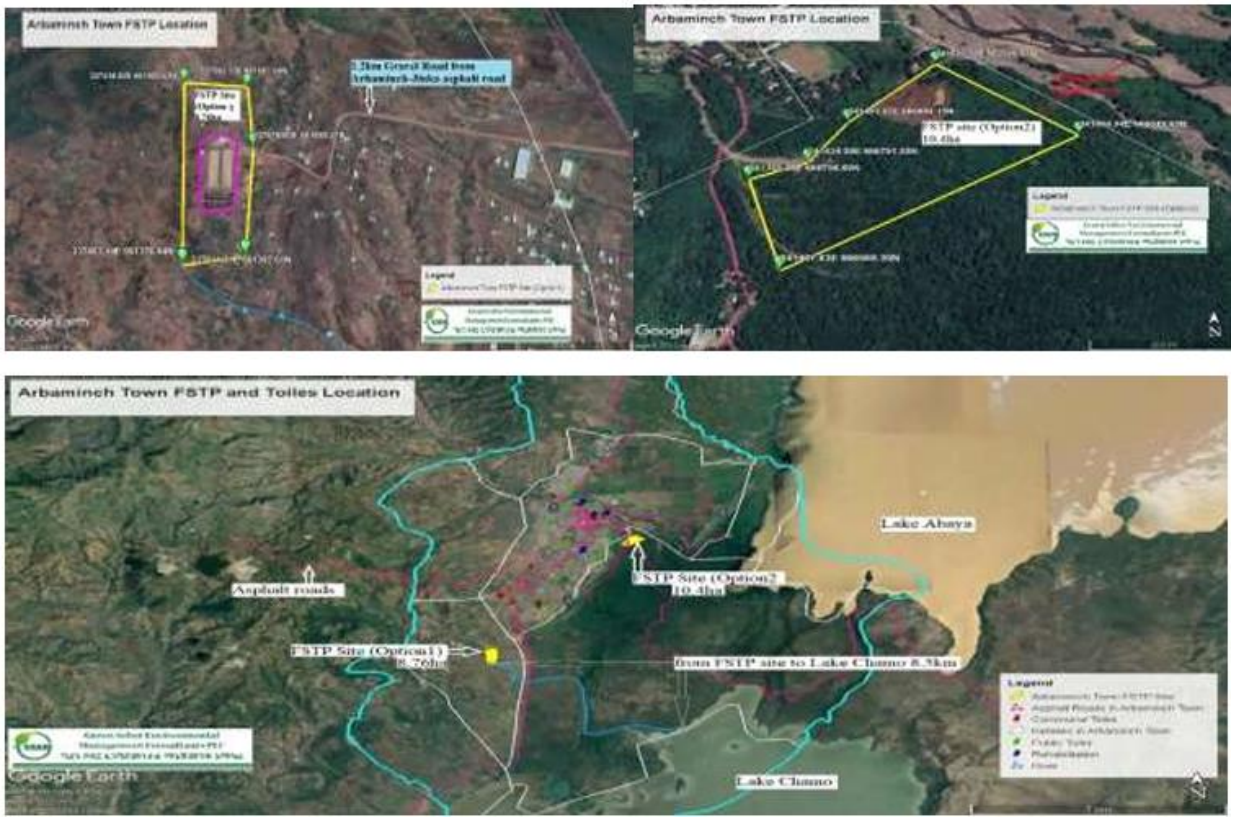

Figure 32 Map of project site Alternative 1&2 for the FSTP location in AMT.

Project Alternative Site 2 This site is situated between the teacher training College and densely forested Nech Sar National Park (NSNP) (Fig.32). It is located on the major Sikela-Airport route, northwest of the city's center, beside the Kulfo River. The planned site alternative is enclosed to the north by Teacher Training College and to the south by Nech Sar National Park. The proposed alternate site has issues with the environment and social aspects. The land is now covered with a variety of tree and shrub species because the suggested alternative is significantly closer to the NSNP. The proposed alternative site is also located in a low-lying area of the city, where stormwater from nearly the entire city has accumulated and been dumped through the valley that runs along the area; this could severely restrict its suitability for FSTP location.

Figure 33 Partial view of FSTP Project Alternative 1 and 2 at AMT

The optimal location was chosen after a comparison of the offered sites using fundamental environmental, social, and economic viability indices. Project site alternatives suitability were compared to each other through various assigned criterion parameters with a score for each indicator parameter ranging from 1 to 5, where 1 is the worst(low) and 5 is the best(excellent). The technique used for the weighting of the criteria and indicators was rating. Scoring (weighting) of indicators was given based on legislative directions and best practices and was defined through expert judgment, stakeholders 'analysis, and knowledge considering the characteristics of the area. The score for each parameter was multiplied by the weighting factor. The scores and weights are summed to give a final score for the site.

From the assessment of environmental and social factors, the most suitable site against other sites with a site score of 73.75% is Site 1 located in Gizola Village AMT. In this particular location, the main social issue is the resettlement of the PAHs from the project site which should be managed through due implementation of country laws, RPF, and RAP guidelines. The summary of the assessment is provided in Table (18) below.

Table 18 Parameters and scoring method used for alternative site assessment

	Criteria: indicators	Score Criteria (1-5)	Weights	Alternative site 2		Alternative Site 1	
1	**Biotic environment**			Score	Value	Score	Value
1.1	Biodiversity and habitats	1. Forests/significant wildlife reservoirs 2. Areas without significant human presence 3. Rural areas, have a fair amount of fauna species. 4. Wildlife species' presence is limited 5. Locations with little or no ecological interest	6.25	1	6.25	3	18.75
1.2	Proximity to wetlands, protected, Sensitive Areas	1. Inside wetlands /protected area 2. 0-99m; 3. 100-249m; 4. 250-500m; 5. ≥500m	11.25	3	33.75	5	56.25
2	**Natural environment**						
2.1	Topography of the site	1. Rough ≥3.5% 2. Relatively rough 2.5-3.49% 3. Relatively flat 1- 2.49% 4. Almost flat 0-0.99%; 5. Flat 0%	13.5	4	54	3	40.5
2.2	Proximity to a river, stream lake	1. < 50m; 2. 50-99m; 3. 100-249m; 4. 250-500m; 5.>500m	5	3	15	5	15
2.3	Site outside a flooding zone	1. Frequently flooding Zone 2. Occasionally flooding Zone 3. Rarely flooding zone 4. Extremely rarely flooding zone 5.No flooding zone	5	1	5	4	20

2.4	Type of soil / Ground Water / Geotechnical stability of the site	1. Unsuitable 2. Suitable requiring large-scale interventions 3. Suitable requiring medium-scale interventions 4. Suitable requiring small-scale interventions , 5. Suitable	3.5	2	7	3	10.5
2.5	Appropriate size	1. Not enough space 2. Not enough space for FSTP and expansion 3. Not enough space for all phases but potential expansion is possible 4. Enough space for the FSTP but any adjacent extension will be limited 5. Enough space for the FSTP for the whole town and future expansion	4.5	4	18	5	22.5
3	**Social environment**						
3.1	Proximity to residences, social structures	1.0-99m; 2. 100-199m; 3.200-249m; 4. 250-499m; 5.≥500m	7.5	2	15	5	37.5
3.2	Proximity to Cultural heritage and religious sites	1.0-99m; 2. 100-199m; 3.200-249m; 4. 250-499m; 5.≥500m	3.75	1	3.75	5	18.75
3.3	Population Density,	1. Inside urban tissue 2. Sparse suburban or village areas. 3. Areas with few residences, which can be resettled with the application of suitable measures. 4. Areas close to settlements or residences but without permanent residences within their boundaries 5. Industrial areas or even uninhibited locations	10	1	10	3	30
3.4	Traffic and dust pollution,	1. Urban and industrial areas or locations with heavy transportation loads or intense manmade activities 2. Areas with considerable transportation loads or manmade activities 3. Areas with moderate transportation loads 4. Natural areas, rural areas, or locations with low transportation and non-intense manmade activities 5. Natural areas, rural areas, or locations with no transportation and non-intense manmade activities	3.75	1	3.75	4	15
3.5	Socio-economic factors	1. The area includes Important socioeconomic resource(s) (e.g. important touristic resource) 2.The area includes considerable socioeconomic resource(s) (e.g.	5	1	5	4	20

		commercial or productive) 3. The area includes moderate significance socioeconomic resource(s)(e.g. agricultural) 4. The area includes socioeconomic resource(s) of low significance (e.g. sheepfolds) 5. The area does not include socioeconomic resource(s)					
3.6	Public opinion	1. Negative; 2. Mostly negative 3. Positive with significant reservations; 4. Positive with reservations ; 5. Positive	8.5	2	17	3	25.5
4	**Manmade environment**						
4.1	Existing Land use,	1. Urban/ important infrastructures (schools, hospitals, etc.) or natural areas (e.g. forests) 2. Sparse residential uses or land uses with considerable importance (e.g. touristic attractions etc.) 3. Land uses common in the wider area with moderate importance(e.g. rural areas) 4. Land uses with no significant importance (e.g. grassland, informal greenery) 5. Industrial areas or disrupted locations (e.g. inactive quarries or disposal sites)	6.25	1	6.25	3	18.75
4.2	Accessibility of the site by an existing road	1 . No access road / Access Road doesn't reach the site; 2. Existing gravel access road in poor condition; 3. Existing gravel road in good condition; 4 . Existing asphalt road in poor condition; 5. Existing asphalt road in good condition	2.5	1	2.5	3	7.5
4.3	Accessibility and infrastructure availability(road, electric water)	1.≥500m; 2.250-499m ; 3.100-249m ; 4.50-99m; 5.0-49m	3.75	3	11.25	1	3.75
			100	31 (38.8%)	213.5	59 (73.8%)	360.25

8.3 Technology Alternatives

8.3.1 Fecal sludge treatment technologies

The fecal sludge treatment technique typically consists of three stages: primary treatment, where the solid and liquid components of the waste are separated, sludge treatment, and liquid or leachate treatment, which is the last step of treatment and is produced by the first treatment. The primary and sludge treatment methods that are most suitable for AMT were identified through a literature analysis, feasibility study, and detailed study report assessment. This section gives an overview of the possible treatment technology alternatives, including their fundamental principles, advantages, and disadvantages from the perspectives of the environment, society, and the economy (Table 23).

8.3.1.1Technology Options for Primary Treatment

Primary treatment (Solid-liquid Separation) is used for solid-liquid separation (dewatering) as well as for the treatment of solid and liquid parts of fecal sludge that is generated from the septic tank, pit latrine, and other onsite sanitation systems. The technology options assessed for primary treatment are: 1) Unplanted Drying Bed (UDB), 2) Planted Drying Bed (PDB), and 3) Settling and Thickening (S&T) Tank.

Unplanted Drying Bed (UDB): this is a simple, permeable bed that has numerous drainage layers as demonstrated in Figure 34. When loaded with sludge, this structure collects leachate that has percolated through the bed and enables the sludge to dry by percolation and evaporation. Between 50 and 80 percent of the volume of the sludge flows out as liquid or evaporates. However, the sludge has not truly stabilized or sanitized. Before the dried sludge may be properly disposed of or utilized as a nutrient-rich soil additive in agriculture, it may require further treatment by composting.

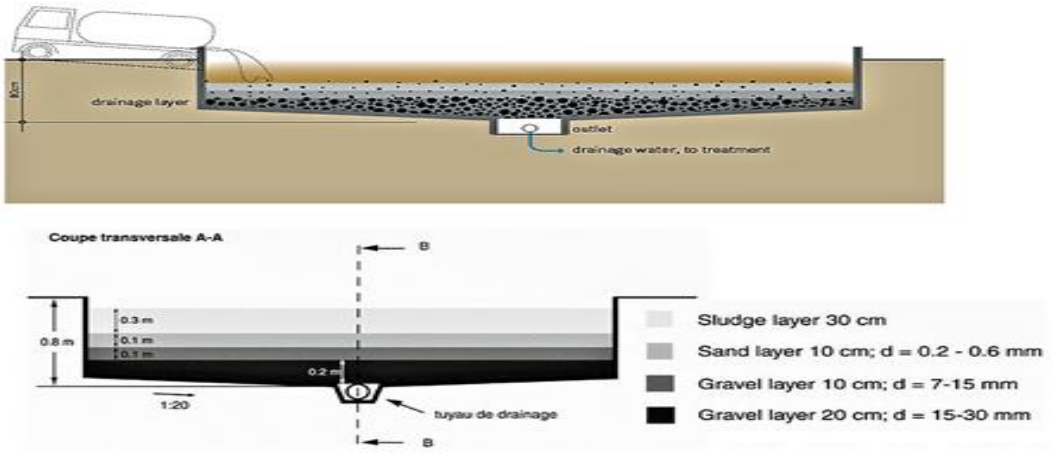

Figure 34 Schematic of an unplanted drying bed

The percolate has to be collected for treatment or regulated reuse since bacteria are still present. Before adding new sludge, unplanted drying beds must be desludged. Although frequent desludging necessitates huge surface areas, personnel, or mechanical power, drying beds are very simple to build and maintain (Table 19).

Table 19 Comparative analysis of Primary Treatment technologies

Technology Alternatives	Advantages	Disadvantages
Unplanted Drying Bed	• Relatively low capital costs; low operating costs • Good dewatering efficiency, especially in dry and hot climate • No energy requirements • Can be built and repaired with locally available materials • Simple operation, only infrequent attention required • No experts, but a trained community required	• High land requirements • Odors and flies are normally noticeable • Labor intensive removal • Limited stabilization and pathogen reduction • Leachate requires further treatment • Requires expert design and construction supervision
Planted Drying Bed (PDB)	• Can handle high-loading • Better sludge treatment than in unplanted drying beds • Easy to operate (no experts, but trained community required) • Can be built and repaired with locally available materials • Relatively low capital costs; low operating costs • No electrical energy required • Fruit or forage growing in the beds can generate income	• Requires a large land area • Odors and flies may be noticeable • Long storage times • Labor intensive removal • Requires expert design and construction supervision • Leachate requires further treatment • Only applicable during dry seasons or needs a roof and contour bund
Settling and Thickening (S&T) Tank	• Thickened sludge is easier to handle and less prone to splashing and spraying • Can be built and repaired with locally available materials • Relatively low capital costs; low operating costs • No electrical energy is required	• Requires a large land area • Odors and flies are normally noticeable • Long storage times • Requires front-end loader for desludging • Requires expert design and construction supervision • Effluent and sludge require further treatment

Planted Drying Bed (PDB): A planted drying bed is comparable to an unplanted drying bed as demonstrated in Figure 28, but the presence of plants adds the advantages of increased sludge treatment and transpiration. To separate the solid from the liquid part of fecal sludge from latrines, septic tanks, biogas reactors, trickling filters, etc., it is a sealed shallow pond filled with various drainage layers. By using a mix of percolation and evaporation, sludge is naturally dried. The filters do not need to be desludged after each feeding/drying cycle, which is the main advantage of the planted bed over the unplanted bed (Table 19).

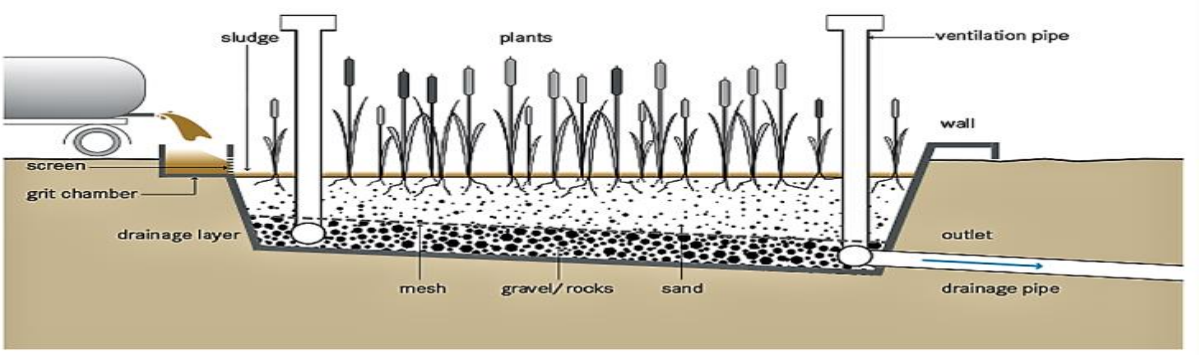

Figure 35 Schematic of a planted drying bed

The plants and their root systems maintain the porosity of the filter, allowing new sludge to be put directly over the preceding layer. Unlike unplanted drying beds, planted drying beds (also known as humification beds) only require desludging once every five to ten years. The removed sludge provides a nutrient-rich soil amendment that may be utilized right away in farming.

Settling and Thickening (S&T) Tank: Settling-cum the thickening tank (ST tank) primarily permits heavier septage particles to sink to the bottom of the tank due to gravity while lighter septage components (fats, oils, grease, and water) remain above. The supernatant is expelled from ST tanks by an outlet on the other side of the intake, which is rectangular in form. To stop the scouring of settled sludge and the separating of scum, a baffle can be put at the outflow. The tank primarily has two compartments, occasionally three compartments, which can be alternately utilized for loading septage as illustrated in Figure 36.

Figure 36 Schematic of a Thickening Pond

Each tank is loaded for a minimum of a week, after which the sludge is allowed to thicken and settle, stabilizing the settled solid through the anaerobic sludge digestion process. Then, at regular intervals, thickened sludge is injected into the sludge drying bed. If the sludge is not thick enough, it is often removed by vacuum truck, excavator, or pumping .

8.3.1.2 Decision matrix for primary treatment technology

The groundwater level, land need, energy requirement, skill required, capital cost (CAPEX), operational cost (OPEX), and sludge treatment technical possibilities were taken into consideration while creating the decision matrix for treatment technology. The selection of fecal sludge treatment technology for AMT also depends on the UWSSP-II sanitation goals, the minimum/indicative wastewater quality standard values set out within the UWSSP II ESMF/WBG EHSG as well as benefits to the environment and health, and the elimination of open defecation. The decision matrix compares the benefits of various technologies based on factors related to the economy, the environment, and social safety. The UDB and PDB require a lot of area but no energy is needed. Whereas, the groundwater level should be deep for S&T tanks, although the UDB and PDB do not depend on it for operation (Table 20).

Table 20 Main characteristics of the sludge dewatering process

CHARACTERISTICS	**UDB**	**PDB**	**S&T**
Land requirements	+++	+++	+
Energy requirements	-	-	+
CAPEX	+	+	+
OPEX	+	++	+
Groundwater level	+	+	++
Skill requirement	+	++	+
Discharge standard	++	++	++
Operational complexity	+	++	++
Maintenance requirements	+	++	++
Complexity of installation	+	++	++
Influence of climate	+++	+++	+
Sensitivity to the type of FS	+++	+++	+
Chemical product requirement	-	-	+
Dewatered sludge removal complexity	++	++	++
Level of dryness	+++	+++	+
Odors and vectors	+++	+++	
Noise and vibration	-	-	+
NB +: low favorability; ++: moderate favorability: +++: high favorability; -: no need			

The decision matrix compares the benefits of various technologies based on factors related to the economy, the environment, and social safety. The UDB and PDB require a lot of area but no energy. Based on the decision matrix analysis, PDB is the most appropriate and the UDP is the next option for AMT FSTP as liquid-solid separation. Moreover, evaluations conducted with drying beds have shown that they offer effective treatment, simple operation, and maintenance methods, resistance to shock loads, and climate adaption. Furthermore, sludge drying beds in general less sophisticated compared to other alternatives, more flexible, easier to operate, and use

less energy during operation than mechanical systems, which would make them the preferable dewatering option for AMT.

8.3.2 Technology alternative for sludge treatment and disposal

Sludge that has undergone partial treatment is produced after dewatering. This treated FS cannot be used directly in agriculture since it still contains pathogenic bacteria and parasite eggs. Further treatment is needed to raise the sludge's quality. This is the last step in the sludge treatment process before discharge. 1) Composting and 2) solar drying are the methods employed for further sludge treatment.

Co-composting: Fecal sludge and municipal solid waste co-composting is a biological process that uses microorganisms to break down organic material in an aerobic environment as shown in Figure 37. The processing of source-separated human feces has made extensive use of this technique. Fecal sludge is dewatered, and the partially treated sludge is combined in a ratio of 1:2 or 1:3 with the organic portion of municipal solid waste. The survival of microorganisms throughout the composting process depends on properly regulated moisture and aeration conditions. Municipal solid waste has strong bulking qualities and is rich in organic content; whereas, feces have a high moisture and nutrition content.

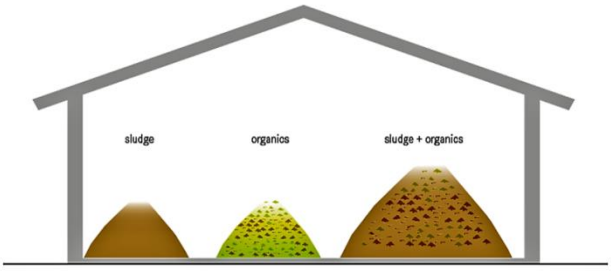

Figure 37 Schematic of the Co-compost

Stabilized organic matter that may be utilized as a soil conditioner is the outcome of co-composting. Furthermore, it includes nutrients that can act as a long-term organic fertilizer and have positive impacts. A high temperature (50-70^{o}C) is maintained during co-composting for 3 weeks to destroy helminth eggs and harmful bacteria. The co-composting procedure takes 10–12 weeks. A comparative analysis of Co-composting is given in Table 21. Only when a source of well-sorted biodegradable solid waste is available the co-composting technique be used.

Table 21 Comparative analysis of sludge treatment and disposal technologies

Technology Alternatives	Advantages	Disadvantages

Co-compost	• Relatively straightforward to set up and maintain with appropriate training • Provides a valuable resource that can improve local agriculture and food production • A high removal of helminths eggs is possible (< 1 viable egg/g TS) • Can be built and repaired with locally available materials • Low capital and operating costs • No electrical energy required	• Requires a large land area (that is well-located) • Long storage times • Requires expert design and operation by skilled personnel • Labor intensive • Compost is too bulky to be economically transported over long distances
Solar Drying	• High efficiency for dewatering • Low energy requirements • Low investment cost	• Large space requirements • Need mechanical means to turn sludge • Ventilate the greenhouses

Solar Drying: Treatment by solar drying is generally done in greenhouse structures with glassy covers, concrete basins, and walls. Sludge is disposed of into the concrete basin and processed for about 10–20 days. Options exist for batch or continuous operation, with devices to control the conditions in the greenhouse (e.g., ventilation, air mixing, temperature). The main factors influencing the evaporation efficiency in these systems are the solar variation, air temperature, and ventilation rate, with the initial dry solid content of the sludge and air mixing also influencing.

Figure 38 Schematic of solar drying

8.3.2.1 Decision matrix for sludge treatment technologies option

Based on the sludge treatment technical options, a decision matrix was prepared for WST concerning land requirement, energy requirement, skill requirement, CAPEX, OPEX groundwater level, and discharge standard (Table 22).

Table 22 Decision matrix for sludge treatment technology

Constraint	Co-composting	Solar drying
Land requirement	+++	+++
Energy requirement	+	+
Groundwater level	+	++

CAPEX	+++	++
OPEX	+++	++
Skill requirement	+	++
Discharge standard	+++	+++
NB +: low favorability; ++: moderate favorability: +++: high favorability; -: no need		

Based on the decision matrix, solar drying treatment is the best alternative sludge treatment technique that ESIA teams could provide based on the real conditions in AMT in terms of the selected solid-liquid separation treatment plant, current sanitation level, and climate consideration. Furthermore, co-composting was strongly advised for further treatment of dried sludge by an ESIA consultancy team as a secure solution for disposing of dried sludge. It is because keeping the dried sludge enclosed in the landfill for over a year causes the pathogens to perish and eliminates the moisture still present in the dried sludge. Co-composting also aids in the inactivation of pathogens and produces a product that is useful as a soil conditioner.

8.3.3 Technology for leachate /liquid effluent treatment

To meet the standards for water reuse or release into the environment, the liquid effluents from dewatering technology must first undergo further treatment. This liquid effluent frequently needs extra treatment to fulfill the criteria for discharge quality. Therefore, a low-cost technique should be used (e.g., wetlands, waste stabilization ponds). The prioritized technology alternative design for treating the produced fecal sludge in AMT comprises settling–thickening tanks, an unplanted sludge drying bed, and constructed wetlands with an anaerobic baffled reactor (ARB).

Waste Stabilization Ponds (WSP): The cheap capital and operating and maintenance expenses of WSP make them a viable choice for wastewater treatment in underdeveloped nations. In general, they are made up of several ponds with different names depending on what they are used for facultative, maturation, or anaerobic ponds for lowering organic, nutrient, and pathogen loadings through sedimentation and biodegradation under anaerobic, anoxic, and/or aerobic conditions (Figure 39).

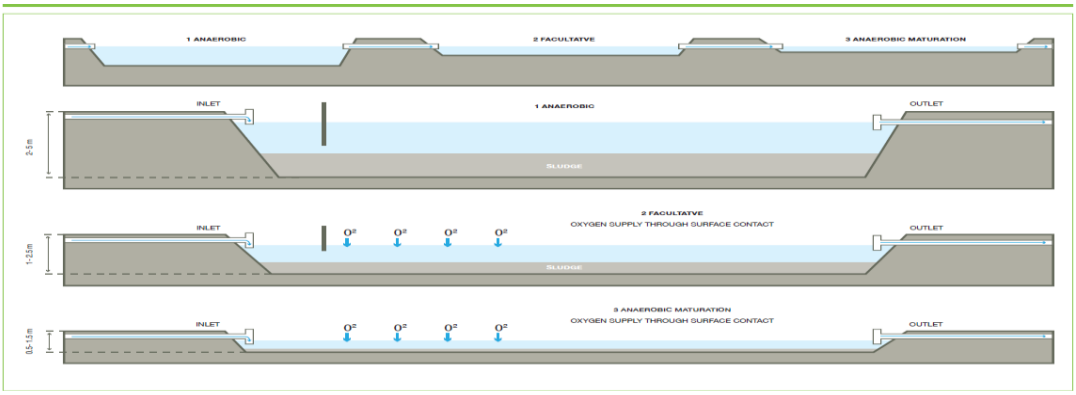

Figure 39 Typical scheme of a waste stabilization system

The ponds might be sealed with clay, asphalt, or any other impermeable material to stop water penetration. The properties of WSP will change depending on the scenario of liquid fecal sludge dewatering and thickening effluent. The effluent properties, which can be very diverse as indicated in Table 28, will dictate the number of ponds and the type of maintenance necessary.

Constructed Wetlands: - For the treatment of wastewater there are three types of constructed wetlands (Figure 40). The treated water flows horizontally and above ground in free water surface wetlands (FWSW), whereas it flows horizontally and underground (5 to 15 cm below the surface) in subsurface flow wetlands (SSFW). A planted drying bed is what the vertical-flow constructed wetland (VFCW) does. Of course, the direction of the wastewater flow channel is a key distinction between VFCW and FWSW/SSFW wetlands.

In contrast to the other two systems, which constantly function under aerobic circumstances, this causes occasional aerobic-anaerobic situations in the VFCW. The horizontal-flow systems, on the other hand, are more susceptible to clogging, which may be brought on by a high SS content in the liquid to be treated. As a result, they should primarily be employed to remove dissolved pollutants, with the VFCW being more successful at doing so. To properly treat wastewater, a hybrid unit can mix FWSW, SSFW, and VFCW.

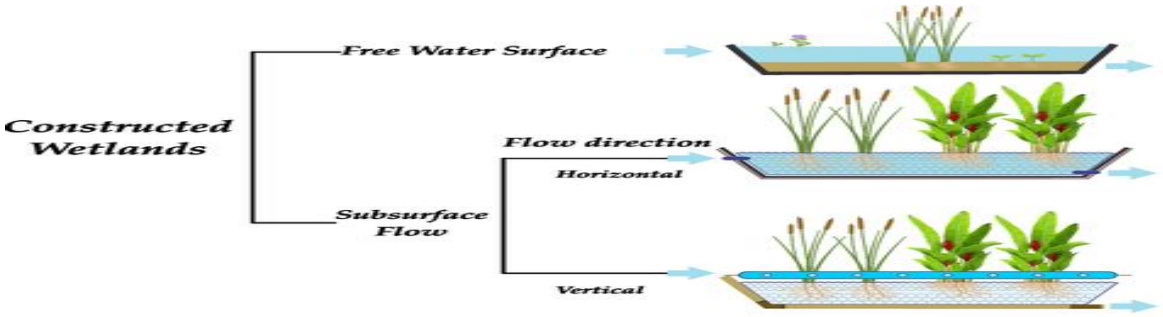

Figure 40 Scheme of types of constructed wetland

Table 23 Key features of treatment options for liquid effluents from dewatering units

	Key features	**Advantages**	**Disadvantages**
Waste Stabilization Ponds	Consists of bioreactors in series operating under anaerobic, facultative, and aerobic conditions	Low construction costs	Requires large land area
	BOD removal: 80-95%	Low O&M costs; main O&M requirement includes weeding (to prevent breeding of mosquitoes) and removal of scum	May promote the breeding of insects
	Residence time: 20-60	Low energy demand	The odor may be generated in

	days		some cases
		Appropriate for treating high-strength effluent	Well suited for tropical and subtropical countries
Wetlands	Organic loading rate: 30-110 g COD m^{-2} d^{-1} (Typical: 75g BOD_5 m^{-2} d^{-1})	Does not require chemicals, energy, or high-tech infrastructure	Requires large land area
	Hydraulic residence time: typically 3-6 days	Suited for combination with aquaculture or sustainable agriculture (irrigation)	Delayed operational status (vegetation establishment needed for peak removal efficiency might take 2-3 years)
		Good control of odor	Pretreatment of the effluent may be required to prevent clogging of the filter bed
		Low construction, O&M costs	Not very tolerant of cold climates
		High reduction in BOD, SS and pathogens possible	
		Attractive landscape features	

An anaerobic baffled reactor (ABR): An anaerobic baffled reactor (ABR) is an enhanced septic tank with a series of baffles that compel grey, black, or industrial effluent to flow under and over the baffles from the entrance to the output. The treatment is improved as a result of the longer contact time with the active biomass (sludge). Although ABRs are strong and can handle a variety of wastewater types, further treatment is still required before residual sludge and effluents may be adequately recycled or released.

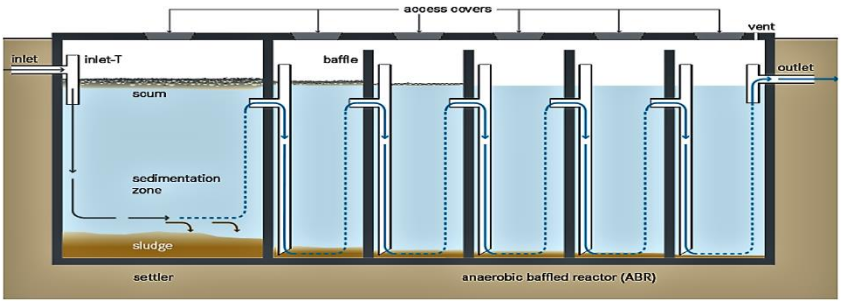

Figure 41 Schematic of the Anaerobic Baffled Reactor

Table 24 Comparative analysis of an anaerobic baffled reactor

Advantages	**Disadvantages**
Resistant to organic and hydraulic shock loads	Long start-up phase

No electrical energy is required	Requires expert design and construction
Low operating costs	Low reduction of pathogens and nutrients
Long service life	Effluent and sludge require further treatment and/or appropriate discharge
High reduction of BOD	Needs strategy for fecal sludge management (effluent quality rapidly deteriorates if sludge is not removed regularly)
Low sludge production; the sludge is stabilized	Needs water to flush
Moderate area requirement (can be built underground)	Clear design guidelines are not available yet
Simple to operate	

8.4 Feacl Sludge Treatment Process Technologies Adopted For AMT

Diverse combination methods were implemented worldwide for fecal sludge solid-liquid separation throughout the treatment process, and then wastewater underwent further treatment before being released into the environment. However the decentralized wastewater treatment system (DEWATS) was the most widely used technology in developing countries.

AMT lacks an infrastructure facility for the treatment of fecal sludge or wastewater. Currently, vacuum trucks are used to transfer fecal sludge to illegal dump sites near Nech Sar National Park. Given this, the various fecal sludge management options and feasibility studies have been examined by – Roikos and ZA Engineering S.A with a detailed design of CWIS for AMT. Based on the outcome of several technology selection criteria analysis, the proposed technology alternatives for Fecal sludge by the design consultant was in agreement with the ESIA consultant team. The prioritized technology alternative design for treating the produced fecal sludge in AMT comprises settling–thickening tanks, an unplanted sludge drying bed, and constructed wetlands with an anaerobic baffled reactor (ARB). The sequence of the proposed fecal sludge treatment process consisted of fecal sludge and septage receiving and screening unit- Settling – thickening tanks-Sludge drying beds-Flow equalization tank and pumping station-Anaerobic baffled reactor–Wetlands feeding pumping station- Constructed wetlands.

The ESIA consultancy team recognized and accepted the fecal sludge treatment design that has been selected for AMT by the design consultants and feasibility study Consultancy Roikos and ZA Engineering S.A. These technological possibilities offered the possibility of successfully treating fecal sludge to generate leachate effluent that could be safely disposed of without damaging the environment or providing health risks to people. Sludge and leachate that would fulfill the minimal or indicative wastewater quality standard values described in the UWSSP II, ESMF/WBG EHSG can also be treated using the suggested fecal sludge treatment approach.

9. Potential Sub-Project Impacts

Diverse environmental and social implications will possibly arise from the Sustainable City-Wide Inclusive Sanitation Management project. In this chapter, prediction, and analysis of possible positive and negative impacts of the construction and operation of the sanitation project are presented.

9.1 Assessment Methodology

The impact assessment was done through a standardized structured impact assessment process. The identification of impacts was done first by collecting a comprehensive list of key potential environmental impacts related to the project.

Impact identification: Prediction of possible impact determined in line with what could potentially happen to resources and receptors as a consequence of the project and its associated activities. The sections present the physical, biological, and socioeconomic environment.

Moreover, the potential impacts and receptors were identified by the pre-construction, construction, and operational phases. The possible impact receptors in the environment were listed and identified by surveying the existing environmental and socioeconomic conditions through baseline studies and consultation with concerned parties.

Impact Description: Impact description technically characterizes the causes and effects of impacts and their consequences on the local environment. Potential impacts of the proposed project, their characteristics, and the attributes of the receiving environment were predicted and presented for tenable mitigation measure development. Project impact characteristics include whether the impact is: adverse or beneficial; direct or indirect; short, medium, or long-term; and permanent; affecting a local, regional, or global scale; including transboundary; and cumulative or not. Each of these characteristics is addressed for every major impact identified during analyses.

Impact Evaluation: The significance of the predicted or identified impacts has been quantified and evaluated by considering the magnitude of the effect and the sensitivity, value, and importance of the affected resource or receptor. For the quantification and evaluation of impacts checklists and interaction matrices were applied. Each major impact is evaluated using the criteria assigned by experts' professional judgment based on the impact intensity, extent, duration, and sensitivity of the receiving biophysical and socio-cultural environment. After the evaluation of impacts, appropriate and justified mitigation measures for the negative impacts and enhancement measures for the positive impacts are forwarded.

Table 25 Classification of Impact Evaluation

Classification	Description
Extent	Evaluation of the area of occurrence or influence of the impact on the subprogram environment; whether the impact will occur **on-site**, in a limited area (**2km radius**); locally (**5km radius**); regionally (city-wide, nationally, or internationally).
Duration	Evaluation of the duration or persistence of impact on the subprogram environment, whether the impact was temporary (<1 year); short-term (1 – 5 years); medium-term (5 – 10 years); long-term (subprogram design period); or permanent (bound design period).
Sensitivity	Assessment of the impacts for sensitive receptors in terms of physical, ecological, social, and cultural settings, and major potential for stakeholder conflicts. The sensitivity classification is: **High sensitivity***:* Entire community Involuntary displacement, Property damage or Loss,

	biodiversity disturbance and species extinction, destruction of world heritage and important cultural sites, large-scale stakeholder conflict according to RPF, etc. **Medium sensitivity***:* Displacement of some households according to the RPF, moderate level of stakeholder concern, medium and reversible damage to the natural environment, etc **Low sensitivity***:* No displacements, no potential for stakeholder conflict, negligible impact on the natural environment, etc.
Severity (Overall Impact rating)	Using a combination of the above criteria, the overall severity of the impact was assigned a rating of Severe, Substantial, Moderate, Minor, and negligible. Note: These are just guidelines that will constitute professional judgment required in each case.

Impact severity: The impact severity was determined by professional experts by evaluating the intensity of the impact and the sensitivity of the environmental and social receptors, which is largely subjective. Impact severity assessment was done by assigning numerical descriptors (1-4) to the impact intensity, as well as the environmental and social receptors, for each potential impact. The numerical descriptors are 1, 2, 3, or 4; which are equivalent to very low, low, medium, or high. The impact severity is then calculated as the product of the two numerical descriptors, which is equivalent to negligible, minor, moderate, or major, as indicated in Table (31).

Impact Significance: Impact significance is determined from an impact severity matrix which compares the severity of the impact with the probability of its occurrence. Impact significance criteria are as follows:

- ***Major:*** These denote that the impact is unacceptable and further mitigation measures must be implemented to reduce the significance. It is shaded red Table (26).
- ***Moderate:*** Impacts in this region are considered tolerable but efforts must be made to reduce the impact to levels that are as low as reasonably practical. Shaded Yellow.
- ***Minor:*** Impacts in this region are considered acceptable. Shaded Gray.
- ***Negligible:*** Impacts in this region are almost not felt. Shaded Light green.

Table 26 Determination of impact severity matrix

			Sensitivity of receptor			
			Very low	Low	Medium	High
			1	2	3	4
Impact intensity	Very low	1	1Negligible	2Minor	3Minor	4Minor
	Low	2	2Minor	4Minor	6Moderate	8Moderate
	Medium	3	3Minor	6Moderate	9Moderate	12Major

	High	4	4Minor	8Moderate	12Major	16Major

The scale of intensity is defined based on social and ecological considerations and the expert's professional judgment Table (27).

Table 27 Intensity scale gradation for socio-environmental impacts

Intensity	**Criterion**
Very low	Environmental changes are within the existing limits of natural variations or carrying capacity
Low	Environmental changes exceed the existing limits of natural variations. The natural environment is completely self-recoverable or renewable.
Medium	Environmental changes exceed the existing limits of natural variations and result in damage to the separate environmental components. The natural environment remains self-renewable.
High	Environmental changes result in significant disturbance to particular environmental components and ecosystems. Certain environmental components lose their self-recovering ability.

Table 28 Overall Impact Rating and Description

Overall Impact Rating	Description of Impact	Significance
Major	✓ Non-compliance with national policy, environmental laws and regulations ✓ Highly noticeable, irreparable effect on the environment ✓ Significant, widespread, and permanent loss of resource ✓ Major defilement of water/air quality and noise guidelines ✓ Causing widespread nuisance both on and off-site ✓ Extensive property damage or loss	>12
Moderate	• Noticeable effects on the environment, reversible over the long term. • Localized degradation of resources restricting the potential for further usage • Increased traffic in sensitive environments • Widespread physical resettlement, affecting livelihoods	6 – 12
Minor	○ Noticeable effects on the environment, but returning naturally to the original	2 – 4

	state in the medium term ○ Slight local degradation of resources but does not jeopardize further usage ○ A small contribution to the global air problem through unavoidable releases ○ Infrequent localized nuisance ○ Population increase is not expected to stress existing infrastructure	
Negligible	➢ No noticeable, rapidly returning to the original state by the natural action ➢ Unlikely to affect resources to a noticeable degree ➢ No noticeable effects on regionally endangered species ➢ No significant contribution to the global air pollution problem ➢ Minor elevation in ambient water/air pollutant levels well below guidelines ➢ Temporary or intermittent changes to livelihoods or life quality aspects	< 2

Cumulative Impacts: Cumulative impact is the effect on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impact results from the aggregated effect of more than one project (or more than an action of the same project) occurring at the same time, or the aggregated effect of sequential projects. Cumulative effects manifest when socio-environmental conditions are already or will be affected by present, past, or rationally probable future developments or activities. The ESIA identifies the current and probable future impacts of the AMTCWIS on the receiving environment.

9.2 Positive Impacts of the project and their Enhancement

FSM is the collection, transport, treatment, and reuse or disposal of fecal sludge from pit latrines, septic tanks, or other onsite sanitation technologies. The implementation of the project will have a beneficial economic, environmental, or social result, such as additional economic activity or enhancement of the existing environmental and hygienic conditions.

The development and operation of the proposed project will have substantial direct or indirect positive environmental and social impacts on the local people, city, and region at large. Among others, some of the impacts include improved sanitation facilities, enhanced water quality, Improved public health, hygiene, and household health status, infrastructure improvement, Skill and technology transfer, and creation of employment opportunities during the construction and implementation phase of the project. Specifically, the following positive impacts are anticipated during the construction and operation phases of the project component:

9.2.1 Employment

The construction, operational, and decommissioning phases of the project will provide several Employment opportunities for various disciplines. In this employment opportunity, both skilled and unskilled will potentially participate. Mostly temporary jobs will be created during the construction phase and permanent jobs when the overall project is completed and starts

operating. This job opportunity will be available for residents, especially the PAHs, women, and youths, in the project area.

Project Phase	Construction	Operation	Decommissioning
when the impact will occur	✓	✓	✓

Enhancement measure: Unskilled and semi-skilled labor will be recruited preferentially from local communities, provided that they have the necessary experience, qualification, competence, and desired experience. Wherever feasible, local people should be considered for job opportunities commensurate with their level of skills. In this process special considerations and priority have to be given to vulnerable groups of society like women, the youth, and the disabled should be given priority.

Adequate occupational health and safety standards training program for artisans (builders, carpenters, plumbers) in the project area has to be facilitated by the project to ensure skills transfer and ensure the work environment is conducive. Information to create awareness about the proposed project activities will be provided to the PAPs targeting vulnerable (female-headed HH, people with disabilities, elderly, and others) and indigenous community groups.

9.2.2 Skill and Knowledge Transfer

The construction and operation of modern sanitation amenities is a new technology for our country and AMT. It is expected that for the implementation of the proposed project, some degree of capacity building will be given (organized and unorganized) through the transfer of new technologies and new skills to (unskilled) labor. Thus during construction and operation local skilled and unskilled workers will encounter and get experience from the FSTP installation, operation, maintenance, and management. This might be done through on-the-job training as well as through exposure to modern practices, management, and logistics procedures. Local sub-contractors and companies are also beneficiaries of the transfer of skills and will also build additional local capacity.

Project Phase	Construction	Operation
when the impact will occur	✓	✓

Enhancement measures: Where the required knowledge and skills are available locally, the local people should be given priority, particularly the vulnerable group, proportionate to their level of knowledge, skills, and interests. Programs and technical training courses as well as on-the-job training will be provided in specific skills areas for suitable candidates from local communities.

9.2.3 Income to material/ equipment suppliers and contractors

Some of the instruments and equipment may come from local or international areas. Some equipment and materials (such as gravel, bricks, plumber, steel reinforcement, and cement for

civil works) can be sourced locally within AMT and the neighboring regions. So local suppliers of construction materials and equipment in the project area will benefit financially. This is a positive but short-term and reversible impact.

Project Phase	Construction	Operation
when the impact will occur	✓	

Enhancement measures: Construction materials might be supplied from legal or illegal suppliers but it has to be a contractual obligation for contractors to procure construction materials from quarries/suppliers legitimately licensed /legal by the respective district authorities. Work on local sourcing of construction materials that will boost the livelihoods of residents

9.2.4 Boost to the Local Economy

During the construction phase of the project, a relatively large number of the workforce (unskilled and skilled) were employed. The workforce will require and get most of their food and other necessities from the surrounding area and this will provide a market for the local agricultural producers, craft producers, and other small businesses (local shops). This will in turn increase the incomes of pity traders in the locality. Wages will quickly raise household income and stimulate the local economy. Business opportunities especially for locals as most of them will be involved in small-time trades such as delivering food to site workers Thus the project will stimulate local economic activities by providing opportunities for the provision of basic and other services for the contractors and immediate community. Moreover, provision for direct employment and trade opportunities for the local community is expected.

Project Phase	Construction	Operation
when the impact will occur	✓	

Enhancement measures: Provide adequate awareness about the business opportunity that that project has to the local community. Encourage vulnerable groups of the local community (women, youth,) to participate in pity trade activities

9.2.5 Urban Service Infrastructure Improvement

The installation of fecal sludge treatment plants, public and communal toilets, or in general improved sanitation system of the city will increase the service delivery and contribute a lot to the development of the city, attracting investors and tourists. Modern waste management system infrastructure induces development, stimulates tourist attraction, and employment opportunities, and helps improve the sanitation and hygiene level of the society.

Project Phase	Construction	Operation
when the impact will occur		✓

Enhancement measure: The infrastructure development should be of a type that is desirable and sustainable. For this to happen, all future development plans must be undertaken within the framework of proactive government policy and strict planning and environmental enforcement. The sustainability of the project is assured if the public/society at large participates actively in all stages of project development. Urban sanitation consists of the collection, storage/treatment, transportation, re-use, or disposal of excreta, liquid, and solid waste in ways that improve or sustain human health and decrease negative impacts on the environment.

To ensure the sustainability of the infrastructure service, effective and efficient utilization of the developed infrastructure and maintenance for the malfunctioning systems have to be done timely with the required standard. Recurrent societal training is required on awareness of waste management sustainable use and ownership of the developed infrastructure.

9.2.6 Improved Health Status of Households and Communities

Fecal sludge (FS) is the mixture of excreta, flush water, and anal cleansing material that accumulates in the containment. Fecal sludge can range from solid (with waterless toilets) to more fluid (with septic tanks). FS is highly hazardous for human health and for the environment. The provision of adequate sanitation facilities in urban and rural areas has positive impacts on the health of users by greatly reducing the incidence of communicable enteric and infectious related diseases.

Thus safe disposal of human excreta is one of the key measures to break the chain of transmission diseases. AMT lacks adequate public and communal toilets and there are no sewage treatment facilities. The community denied such urban infrastructure. So the establishment of public toilets, and fecal sludge treatment plants in the short term will reduce and/or eliminate the indiscriminate disposal of human excreta and wastewater in the city. Enhanced sanitation facility in the city also contributes to livelihood improvement directly or indirectly. The project has huge rules to control and reduce waterborne, communicable diseases and outbreaks. Due to the correct management of fecal sludge, improvement in the health, and sanitation of the public in particular and the city environment in general is expected.

Project Phase	Construction	Operation
when the impact will occur		✓

Enhancement measures: Creating awareness for the general public on how to use and manage the wastewater treatment plant, proper use, regular cleaning, and effective maintenance of both the communal, household, and public toilet facilities. Educate users on the proper use, monitor the regular cleaning, and effective services of developed infrastructures. Ensure the required service and timely maintenance of communal, and public toilets and other related infrastructures.

9.2.7 Fertilizer and Biogas Production

Fecal sludge that has been properly handled and allowed to mature can be used as fertilizer. The use of composted sludge (decomposed sludge) as fertilizer has the potential to improve crop yield and enable a reduction in cost for nitrogen and phosphorus mineral fertilizers. Moreover, Sludge application helps to reduce soil erosion and improves the soil quality as a plant growth medium and can help conserve soil organic matter, and sludge stimulates biological activity in the soil (Stamatiadis et al. 1999). Recycling of sludge for fertilizer and biogas energy production and soil amendment is an appealing solution for the sustainable management of sludge.

Enhancement measures: Creating awareness for the general public about the potential of fecal sludge as an alternative fertilizer then chemical fertilizer. Encourage and participate people (vulnerable groups of the society) in compost preparation.

9.3 Negative Impacts and Their Mitigation Measures

The implementation of the CWIS project in AMT construction may harm adversely to the socioeconomic and environment at large. Potential adverse impacts are presented as follows

9.3.1 Pre-construction Phase

This phase included topographical surveys, plant site selection, geotechnical investigation, the finding of natural resources for construction materials, mobilization of construction machinery land acquisition, and resettlement issues. The planning and design processes were already completed. The main impact in this phase is related to project-affected people (PAPs).

9.3.1.1 Resettlement of Households

The FSTP requires a total of eight acres of land. Most of the required land (six acres) will be obtained from private land use right holders while the remaining two acres are government-owned. A screening report identified that the proposed site for the construction of the fecal sludge treatment plant is not free from encroachment hence loss of assets and livelihood will be triggered. Local people involuntarily give up their landhold rights, residential structures perennial crops, and trees for the benefit of the proposed project. The FSTP affects at least a total of 356 households and 1412 individuals residing within these households.

Impact Significance: The expansion of FSTP directly affects entire HHs around the treatment plant, leading to land acquisition, property damage, loss, and transfer. Among the project-affected community members, there are vulnerable community groups. The likelihood of the impact occurring is **high** and permanent. The extent of the impact will be on-site. The **intensity *of the impact and*** sensitivity of the receptor is **high** given the high potential to affect the poor local dwellers, children, elderly, and female-headed HHs. This results in **major** impact **significance**.

	Sensitivity of receptor			
	Very low(1)	Low (2)	Medium (3)	High (4)

Intensity of impacts					
	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation Measures

1. Conducting RAP before any civil work by the relevant UWSSP Implementing Agencies-Water and sanitation utilities, with the use of the screening tool as attached to the RPF and resettle the PAHs around the FSTP;
2. Use the RAP report as a guide to determining affected persons;
3. Compensate for land for land for PAHs;
4. Consider the cut-off date when census start date of RAP;
5. Tenable compensation paid both in cash & and kind to the PAHs;
6. Vulnerable community groups must get priority during compensation, land delivery, and post-livelihood rehabilitation works;
7. The resettlement site must have access to social amenities at least commensurate to their original village;
8. Conduct post-livelihood assessment study for resettles on an annual basis and work for livelihood improvement;
9. Resettle small and medium-scale enterprises to appropriate area that has adequate infrastructure (water, electricity, and road) and compensate them (in cash and Kind).

The planned and careful adoption of the aforementioned mitigation measures can reduce impact intensity to "**low"** resulting in a residual impact of **"minor significance**".

9.3.2 Construction Phase

9.3.2.1 Loss of vegetation cover

Within the FSTP project site, a few (7-12) tree species *Ximenia american* locally named "Inkoye" and *Terminalia browni Fresen* locally named "Weybeta" and *Balanites species are observed but c*ommon shrubs (*Solanum incanum, Lantana camara*) and grasses are dominant vegetation's in the project site. The proposed land is used for agricultural activity, home gardens, and residential houses. Land clearing and removal of the existing vegetation may result in the alteration of landscape integrity, grasses, perennial vegetation, and change in land use patterns in the project area.

Impact Significance: Thus whatever little vegetation may be affected by the proposed construction work, the **intensity *of the impact and*** the **sensitivity** of the receptor are **medium** given. This results in **moderate** impact **significance**.

	Sensitivity of receptor			
	Very low(1)	Low (2)	Medium (3)	High (4)

Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation strategies:

1. Once the work is completed re-vegetate the perimeters of the FSTP with 10 indigenous/endemic plant species per lost plant species during site clearance;
2. Store and reuse the topsoil removed from the site during site preparation properly;
3. Minimize the amount of destruction caused by machinery by promoting non-mechanized methods of vegetation removal;
4. All areas planned for clearing of vegetation must be demarcated before the commencement of the construction

9.3.2.2. Soil Degradation

Site preparation will involve clearing strips of vegetation to allow for excavations to begin. Land clearing and removal of the existing vegetation can be a cause for the alteration of landscape integrity. Topsoil stripping during leveling and grading of the right of way (ROW) and the excavation of subsoil during trenching will break up the soil structure. Also, construction equipment engaged in activities might cause light contaminations of soil due to leakage of fuels and lubricants from equipment. Excavated soil may be exposed to agents of erosion and prolonged storage of topsoil can lead to a loss in soil nutrients (leaching effect) viability of seed bank in the soil.

Impact significance: The, receptor sensitivity is assessed to be low and short-term. Chamo Lake is the nearest (8.5 km) aquatic environment to the proposed FST project site. Since the project will be done by a qualified contractor, medium impact intensity is expected. The duration of exposure of stockpiles is relatively short and assuming the rugged terrain around the proposed FST, the sensitivity of the impact occurrence is medium. Thus both the **intensity** of the impact and ***sensitivity*** of the receptor are rated as moderate, which results in moderate impact significance.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation strategies:

1. Develop an excavated soil management plan before the start of construction activities;
2. Protect the topsoil to retain the soil structure and minimize the risk of topsoil loss;

3. Topsoil and subsoil removed from the site during site preparation will be stored properly (away from runoff and possible contaminants) for reuse elsewhere or for backfilling and reinstatement;
4. Contour temporary and permanent access roads/laydown areas to minimize surface water runoff and erosion;
5. Avoid using old (not more than 10 years) and properly unmaintained machinery which can most likely lead to oil, grease, and fuel leakages;
6. Ensure that all equipment on duty is properly maintained and fully functioning to avoid oil and grease leakages;
7. Excess soil/ cart away must be removed from the site daily and deposited at an authorized approved site;
8. Protect adjacent areas of the construction site from disturbance and wherever possible construction work will take place during the dry season;
9. Prevent sheet and rill erosion of soil through the use of sandbags, diversion berms, culverts, or other physical means.

The adoption of the mitigation measures can reduce impact intensity to "**very low**" resulting in a residual impact of "**minor** significance".

9.3.2.3 Air Quality and Noise Pollution Dust Emissions

Dust emission: Project site clearing, earthworks like leveling, trenching, excavation of topsoil, vehicle movement over unpaved areas, and other activities will generate fugitive dust. Elevated levels of dust emissions resulted in temporary. So the air quality in the construction sites along transportation routes of project pollution of gases expected from the engines. Major dust sources will be vehicle movement over unpaved areas and transportation of raw materials and equipment within the work site.

Air quality: In regions being excavated for trenches, pits, or ponds, along transportation routes, and at the building site, dust and engine pollution gases may accumulate. During dry times, this is probably going to happen. Emissions of CO_2, CO, SO_2, NO_X PM_5 $PM_{2.5,}$ and other pollutants are produced by the continuous operation of trucks and equipment during the construction phase of the project. Moreover, some welding fumes such as metal oxides (Fe_2O_3, SiO_2, K_2O, CaO) and CO, NO_x can be produced during the construction phase but this work happens in a short time and the impact is localized and temporary.

Noise pollution: The use of heavy equipment including bulldozers, graders, and dump trucks during site preparation and transportation of materials will generate noise and vibrations. The levels of noise generated will depend on the type and condition of equipment employed by the contractor, and the number of employees at a particular time. With noise being perceived as one of the most undesirable consequences of construction activity, it might become a nuisance to the settlements within its environs. Since the noise levels in the area are low or within the acceptable limit, the activities will therefore temporarily increase such levels. Generally, construction phase noise level exceeding 75 dBA and 70 dBA during the day and night respectively has significant impacts on surrounding sensitive receptors within 50m of the construction site.

Impact significance: Particularly the FSTP site has ambient noise level with good air quality. The construction phase of the project might disturb the ambient conditions. The air quality impacts associated with dust generation and noise pollution to the receptor sensitivity is considered to be "low". The ***intensity*** of impact is assessed as ***low*** resulting in **minor** impact significance.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation Measures

1. Construction workers will be made aware of the permissible noise levels at the workplace and surrounding environment
2. Noise levels at construction sites should not exceed 75 dBA and 70 dBA during the day and night, respectively
3. During periods of off-work time, equipment will be switched off during off-work time whenever possible;
4. Utilize well-maintained and functional working equipment;
5. Avoid using old (> 10 years) or damaged equipment; every week check every day proper functioning of all the machines on duty;
6. Trucks will be covered during haulage of construction materials to reduce spillage of materials and Use spray water for dust suppression over dusty areas
7. Provide the necessary PPE (ear muffs, masks, etc.) to workers whenever needed and as found appropriate;
8. Adjust the travel speeds of construction vehicles to 30 Km/h along the road and should be controlled using traffic signals;
9. Avoid construction activities during the nighttime.

Adoption of these mitigation measures will reduce impact intensity to "**very low"** resulting in a residual impact of **low** significance.

9.3.2.4 Alteration of natural drainage pattern

The natural drainage pattern of a landscape refers to the way water flows through the land, typically from higher elevations to lower elevations. FSTP (Gizola) is located nearby of the natural drainage lines. During the rainy season relatively large amount of surface runoff passes through the existing drainage lines. The construction of the FSTP will have an impact on these drainage lines. Possible shifting of drainage lines is expected and this may have a devastating impact on the nearby community (FSTP). Stormwater (surface runoff) is the major urban flow of concern. Safe and efficient drainage of the management of stormwater is particularly important to maintain the environmental safety of the receiving water environment.

Moreover, the construction of the proposed project can result in changes in surface and sub-surface hydrology. Changing the natural soil characteristics of the project site from its present state to a more built state will lead to a change in the water regime at the project site. This is because the built areas will increase run-off while reducing the percolation of water into the ground thereby also changing the sub-surface hydrology.

Impact significance: The FSTP sites are located nearby of the natural drainage lines. The construction phase of the project might disturb these natural drainage lines and conditions. The impacts associated with the alteration of natural drainage line to the receptor sensitivity are considered to be "high". The ***intensity*** of impact is assessed as ***medium*** resulting in impact **major** impact significance.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation Measures

1. Plan and work on integrated water shade management (Soil and water conservation through physical, and biological) for the natural drainage lines;
2. Participate with stakeholders in stormwater drainage planning, design, and management activities;
3. Work on flood avoidance strategies as precautionary interventions that involve structural adaptations;
4. Flood mitigation strategies (flood responses before and during an event, emergency flood control works);
5. Construct drainage channels within the construction site to allow for the convenient and free flow of stormwater.
6. Construct drainage channels in all areas that generate or receive surface runoff water. The channels shall be designed concerning the maximum expected flood discharge;
7. Work in collaboration with stakeholders to prevent possible erosion, and flood and for the stabilization of gullies and drainage lines.

9.3.2.5 Slope Failure Due to Earthworks

Slope failure is a problem that can occur due to earthworks, which are any type of excavation or construction work that involves moving or disturbing soil or rock. Slope failure can be defined as the sudden or gradual collapse of a soil or rock slope, which can result in damage to property, infrastructure, and human life. Earthworks Altering the slope angle, vegetation cover, and drainage pattern during earthworks may result in failure

This impact is addressed due to the hilly nature of the FSTP area. The earthwork activity in hilly or steep areas might result in slope instability. Earthworks and river flow diversion in steep

areas could lead to slope instability accelerated erosion, and gully formation resulting in increased sediment transport to surface waters wetlands, or gardens. Slope failure would affect downhill community property, land, and aquatic environments. Risk of this potential impact occurring on the construction sites characterized by hilly terrain.

Impact significance: The likelihood of the impact occurring is high in the steep area (FSTP). Duration of the impact will be short-term and effects reversible hence the intensity of the impact is **low** and the sensitivity of the receptors **medium**. Impact significance is therefore moderate

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation strategies:

1. Protect very weak landform slopes by using engineered structures (slope stabilization measures, such as retaining walls, soil nails, or geotextiles);
2. Undertake all construction activities during the dry season which will minimize the risk;
3. Use the best available methods of construction technology to minimize the risk of blockages and constrictions;
4. Backfill and restore the eroded channels related to natural contours;
5. Protect the susceptible areas of the project by using temporary or permanent drainage works;
6. Perform Earthwork construction activity during the dry season by trained professionals who understand the risks and hazards associated with slope failure;
7. Monitoring the slope before and after the rainy season (two times) for signs of instability, such as cracks, bulges, or settling;
8. Implement effective erosion control measures (re-vegetation, erosion control blankets, or sediment control basins).

9.3.2.6 Traffic congestion /Accidents

Traffic congestion is anticipated from the construction phase of the project. Contractor Heavy-duty truck traffic can obstruct or damage roads and increase the likelihood of accidents. Vehicles and trucks transporting construction materials to the site may result in community risk of traffic-related accidents especially if proper signals, and safe speed limits are not put in place or not adhered to. Construction traffic accidents would have a significant social impact and are likely to affect children, women, the disabled, elderly people, and livestock. Accidental risks associated with the project will be due to trenches created for the construction of people in the area including children moving for different purposes, and domestic and wild animals.

Impact Significance: The duration of the risk will be short-term occurring during the construction and operation phases. The receptor sensitivity is **Low** given that the number of

people and animals along the roads and near the project area is minimal while the intensity is **Medium** given the temporary nature of the construction activities. However, some of the impacts like loss of life or severe physical damage may be irreversible. The impact significance is thus assessed to be **Moderate**.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation Measures

1. Develop a Traffic Management Plan (traffic flow, control measures, work zone management, emergency response) and incorporate proposed arrangements for traffic diversions with details of all necessary budgets and signals;
2. Provide temporary road signs or notices to indicate ongoing works;
3. The client and Contractor should choose traffic routes to reduce the impact in the neighborhood and any sensitive areas;
4. Ensure that vehicles for the construction work are operated only by qualified drivers;
5. Park all vehicles only at designated parking areas and use spaces for loading and unloading;
6. All of the drivers have to obey the speed limit of vehicles and know the speed limits, particularly in residential areas;
7. Travel speeds of construction vehicles along the road should be controlled by setting travel speeds and informing through signals;
8. No drivers or personnel under the influence of alcohol or any drug abuse will be allowed onsite;
9. Fencing or placing obstacles to trenches and ditches to avoid interference and accidents of wild and domestic animals and children.

Adoption of these mitigation measures will reduce impact intensity to “very low” resulting in a residual impact of **negligible** significance.

9.3.2.7 Water Pollution

Due to the rugged landscape of AMT, the construction of FSTP will aggravate soil erosion if the construction of projects is undergone during rainy seasons. The FSTP located nearby of seasonal natural drainage lines. Unless potential contaminants of the construction phase are properly managed, water pollution is inevitable. Contaminants introduced by construction could migrate into key receptors of the area (Chamo Lake). Groundwater sources and Lake Chamo are freshwater forms found nearby the project site which might be polluted due to the mismanagement of construction wastes. Potential contaminants associated with the construction activities include sediments, fuels, and lubricating oils; domestic wastes; welding wastes; wastes

from paints and solvents and corrosion inhibitors. For instance, Oils and grease lubricants that are used for construction machinery contain hydrocarbons and heavy metals such as lead, chromium, and cadmium, which are known water pollutants.

Impact Significance: The likelihood of the impact occurring is **high**. The duration of the impact will generally be long-term if the water body is polluted. The extent of the impact will be regional since the Lake and the river are valuable for the surrounding ecosystem, livelihood base for most, and source of water. The ***intensity*** of the impact is assessed as ***medium*** where intensive sedimentation/flooding during the rainy season around the river bank and Lake. The ***sensitivity*** of the receptor is **medium** given the proximity of the aquatic environment. This results in an impact significance of **moderate**.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation Measures

1. Maintain and keep all construction equipment in standardized operating condition that can minimize oil, grease, or fuel leakages to the environment;
2. Perform routine maintenance of construction machinery and vehicles at a designated workshop or maintenance area and keep maintenance wastes separately;
3. Locate stockpile areas for (sand, gravel, stone, and topsoil), away from water courses and will be surrounded by a perimeter with sediment and other pollutant traps located at drain exits;
4. Use trained personnel for fuel and oil handling at the project site. Control the amount of fuel and oil spill leaks minimum;
5. Segregate and store all hazardous wastes and empty containers of hazardous materials in a designated area on site and dispose of them per the national hazardous waste management regulation;
6. Perform construction in the dry season to avoid sediment transport to the river and Lake.

The adoption of the mentioned mitigation measures can reduce impact intensity to "**very low**" resulting in a residual impact of "**minor significance**".

9.3.2.8 Solid wastes

Different types of solid wastes will be generated during the construction phase. Some of the wastes are characterized as organic and others inorganic wastes. This solid waste comes from vegetation clearance, excavation of rock, and soil works. Moreover, the other activities that will generate related solid wastes include packaging waste, stones, wood, broken glasses, containers, wire cuttings, metal scrap, wooden planks, sharp objects (nails), etc. If solid waste is not properly managed, can lead to health and safety issues related to accidents, and harboring dangerous

animals. Therefore, this will have a major negative short-term impact on solid waste collection in the area. Construction activities wastes must be disposed of at authorized places in compliance with government rules.

Impact Significance: The likelihood of the impact occurring is **high**. The duration of the impact will generally be long-term if the water body is polluted. The extent of the impact will be regional since the Lake and the river are valuable for the surrounding ecosystem, livelihood base for most, and source of water. The ***intensity*** of the impact is assessed as ***low*** where intensive sedimentation/flooding during the rainy season around the river bank and Lake. The ***sensitivity*** of the receptor is **medium** given the proximity of the selected FSTP to the aquatic environment. This results in an impact significance of **moderate**.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation Measures

1. Prepare and apply a solid waste management system (waste reduction, collection, sorting reuse, recycling, and landfill) in the project site;
2. Reuse excavation of the ground and foundation works materials for Earthworks and landscaping;
3. Solid waste collection bins shall be placed at strategic locations within the site as collection centers to facilitate the separation and sorting of the various types of waste;
4. The Solid wastes shall be properly segregated and separated to encourage the recycling of some useful resources;
5. The contractor and proponent shall work hand in hand to facilitate the implementation of sound waste management.

9.3.2.9 Hazardous Wastes

Some of the wastes generated during the construction phase like paints, cement, adhesives, Spill clean-up, and contaminated materials and cleaning solvents will also be considered hazardous waste substances. Careless disposal of used containers for oil, lubricants, paint, and other toxic substances may pose a health hazard. Plastic containers are not biodegradable and can have long-term and cumulative effects on the environment. The storage and disposal of these waste streams have to be carefully performed to abide by the existing legal framework.

Hazardous waste poses risks or would have major and irreversible effects on both humans and the environment if it is not handled, stored, and disposed of according to engineering best practices. Hazard waste mishandling and uncontrolled disposal would have major health impacts

on on-site workers, inhabitants in the project's area of influence, and people who get in contact with waste during transportation and disposal.

Impact Significance: The probability of impact occurrence is medium. The ***sensitivity*** of receptors is assessed as **'**medium ' given that some project components particularly toilet sites are located in rural areas, close to green areas, and youth recreational and market centers. The impact intensity is assigned a ***low*** rating resulting in a ***moderate*** impact significance.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation Measures

1. Develop temporary adequate sanitary facilities in the construction site or the vicinity of the project area;
2. Segregate and classify Hazardous wastes from the non-hazardous and should be stored in suitable designated storage facilities at the project site;
3. Hazardous wastes such as paints, pipes, accessories, and adhesives should be properly sealed, labeled, secured, kept inside a locked fenced area to prevent access by unauthorized personnel, and covered to prevent water accumulation before transportation;
4. Prepare a hazardous waste management (waste identification and classification, waste minimization, storage and transportation, treatment and disposal) plan;
5. Solid waste storage bins and/or skips are provided at the contractor's campsite and the construction sites and ensure they are collected or emptied in time.

Adoption of the above mitigation measures will reduce impact intensity to "very low" resulting in a **residual** impact of **minor significance**.

9.3.2.10 Occupational Health and Safety (OHS) Risks

Workers' rights including occupational health and safety need to be considered to avoid accidents and injuries and to ensure fair treatment, remuneration, and working conditions. Construction sites are considered the most potentially hazardous and accident-prone parts of any working Environment. Grinding and cutting, as well as masonry works, construction workers will be exposed to risks of accidents and injuries. In addition to this, excavation machinery and trenches may pose an accident risk to workers either when equipment is operated by inexperienced workers or when the equipment is in poor mechanical condition.

OHS risks might be aggravated by insufficient medical capability, and neglect of safety equipment, precautions, and procedures on the construction site. So according to the safety and health standards, every employee shall have sound knowledge of their susceptibility to harm or injury in the workplace. In the construction phase some causes of risks related to OHincludes lack of safety signage at specific and required areas, improper storage/ handling and use of

dangerous substances/ chemicals, inadequate lighting and ventilation in workplaces, lifting of heavy and sharp objects, misuse of equipment and materials for functions they are not designed and others.

Impact Significance: Due to the high probability of occurrence and the high risk involved, accidents could cause considerable damage, financial loss, and harm to human life. While largely reversible, some impacts such as loss of human life and body injury are irreversible. The receptor *sensitivity* is considered a **medium given** that such impacts may be irreversible once they occur. The impact *intensity* is considered to be **medium** resulting in **moderate** impact significance.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation Measures

1. Prepare site-specific Health and safety management plan (work-related accidents, risk minimization, safe work practices, and guidelines training);
2. Assign a qualified health and occupational safety officer to oversee OHS matters daily;
3. Monitor construction workers on safe work practices and guidelines (OHS) and ensure that they adhere to them;
4. Provide training on OHS before commencing work on-site
5. Workers must follow safety standards and use protective equipment to minimize hazards
6. Standard Safety sign (OSHA) will be used to warn staff and/ or visitors about risk area
7. Provide first Aid kits and ensure availability of trained first aiders within the construction site;
8. Ensure that the campsite is fenced and hygienically kept with adequate provision of facilities (waste disposal receptacles, firefighting, and others);
9. Ensure the Code of Conduct is followed to regulate the performance and behavior of all workers.
10. Personnel will only undertake tasks for which they are trained or qualified;
11. Implement ergonomic interventions, such as job rotation or use of assistive devices, to reduce ergonomic hazards
12. Prohibit the use of alcohol, or “Chat”, in the work area;
13. Provide adequate OHS personnel protective gear (such as nose, ear mask, and clothing).
14. Adequate OHS personnel protective gear (such as nose, ear mask, and clothing) will be provided to the employees and good camp management shall be provided. Some PPE includes the following:
    - Face/Eye protection equipment like face shields, safety glasses, and goggles are vital in protecting the face from accidents.
    - Ear-protecting instruments from noise that exceeds 80 Decibels for 8 hours a day requires ear muffs and plugs.
    - For the hand use correct gloves for protecting the hand from chemicals and others.

- Foot protection boots are also important in the construction phase. Boots might be a toe, water, chemical, and non-slip type.

Adoption of these mitigation measures will reduce impact intensity to "very low" resulting in a residual impact of **negligible** significance.

9.3.2.11 Spread of communicable disease

Job seekers and other service providers, like food vendors would come from different places which might induce illicit contact and sexual relationships. The gatherings might result in the spread of communicable diseases like sexually transmitted diseases (STDs), HIV-AIDS, and COVID-19. The project will employ more young workers at lower skill levels. This category of workers is prone to engage in high-risk sexual activity. Negligence and inappropriate social distancing can aggravate the spread of COVID-19 and Irresponsible sexual relationships in project communities can break families and heighten the risk of contracting STDs. Illicit contact or sexual relationships can be short-term but have long-term and irreversible effects if COVID-19, HIV, or Hepatitis-B were contracted. If this impact occurred, the extent of disease spread would be local, national, or international depending on the origin and next destination of infected persons.

Impact significance: The duration of the impact of COVID-19 is short-term or long-term based on whether the contracted person recovers or passes away. In most cases, elderly and immune-compromised (people who have a chronic illness like hypertension, diabetes, TV, cancer, HIV/AIDS, etc.) individuals are contract COVID-19 is deadly. Regarding HIV/AIDS duration of the impact will be short-term or long-term depending on whether HIV/AIDS is contracted or not.

In both COVID-19 and HIV/AIDS cases the extent of the impact will be local or national depending on the origin and final destination of the construction worker. The likelihood of the impact occurring is medium if the contractor does not adequately sensitize workers about responsible and safe behavior, proper social distancing, use of masks and gloves. The ***intensity*** of the impact is also medium. ***The sensitivity*** of the receptor is rated ***medium given*** that both COVID-19 and HIV/AIDS, if contracted, have a long-term effect. Therefore impact significance is ***moderate.***

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation Measures

1. Develop a communicable disease management plan (incidence monitoring, prevention control measures, case investigation, treatment, and care, etc);
2. Prepare and enforce a Code of Ethical Conduct (CEC); in the camp to encourage respect for the local community and to maintain the cleanliness of the camp at all times;

3. The workers should periodically be sensitized on the Ethical code of conduct. Translate the code of ethical conduct local language;
4. Orient all construction workers and sensitize them about responsible sexual behavior in project communities;
5. A safety, health, and environment induction course shall be conducted for all workers two times per year, putting more emphasis on HIV/AIDS;
6. Prepare an awareness campaign plan to reduce the risks of spreading HIV/AIDS and other STDs as part of contractual obligation.

9.3.2.12 Social Misdemeanor

Many societies have social norms and expectations that guide behavior and promote social cohesion. While these norms can vary across cultures and communities, they generally promote respect for others, civility, and consideration for the common good. Adhering to these social norms can help maintain a harmonious and functional society while violating them can lead to social disorder and conflict.

Due to the sudden increase of labor to project sites, this social misdemeanor might be affected. An influx of labor can have both positive and negative impacts on the local community. The increased labor force may violate some social norms of the society and may result in incidences of Gender-Based Violence (GBV), Sexual harassment (SH), and Sexual exploitation (SE) on the job site or in the neighborhood.

Impact Significance: The probability of impact occurrence is medium. The ***sensitivity*** of receptors is assessed as **'**medium ' given that some project components particularly FSTP sites are located in rural areas. The impact intensity is assigned a ***low*** rating resulting in a ***moderate*** impact significance.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation Measures

1. Hire unskilled and skilled labor from the local population as far as possible to minimize on influx of labor into the community;
2. Effective communication and collaboration are key to addressing the challenges and opportunities presented by an influx of labor;
3. Local governments, businesses, and community organizations to work together to develop strategies for ensuring that workers are paid fair wages;

4. Any new employee should be required to sign a code of behavior;
5. All construction workers shall be orientated and sensitized about responsible social behavior through Workplace education and training in project communities;
6. Awareness has to be given to newcomers about the norms, and cultures of the project host community.

Adoption of the above mitigation measures will reduce impact intensity to "very low" resulting in a **residual** impact of **minor significance**.

9.3.2.13 Gender-based violence (GBV)

GBV refers to any form of violence or abuse that is directed at an individual based on their gender or sex. Construction sites are often male-dominated environments where women may face various forms of gender-based violence, discrimination, and harassment. During the construction phase, the number and type of GBV may exceed the normal circumstances. GBV in the construction phase can take various forms, including physical violence, sexual harassment, emotional, and psychological verbal abuse, intimidation, bullying, and unequal treatment based on gender. Many contributing factors like a predominantly male workforce, hierarchical power structures, long working hours, isolated and temporary worksites, poverty, lack of proper accommodation, inadequate security measures, and a lack of policies and procedures to address GBV.

Impact Significance: The probability of impact occurrence is medium. The ***sensitivity*** of receptors is assessed as **'**medium ' given that some project sites are located in urban areas. The impact intensity is assigned a ***low*** rating resulting in a ***moderate*** impact significance.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation Measures

1. Raising awareness and providing training to employees (quarterly) about GBV to reduce incidents of GBV in the workplace;
2. Ensure equal pay for women and men for equal jobs;

3. Providing support services, such as counseling, medical care, and legal aid, to employees who experience GBV;
4. Prepare and implement a code of conduct that among others strictly forbids sexual harassment /GBV and is to be signed by all workers;
5. Establish disciplinary procedures and sanctions for employees who engage in GBV;
6. Consider the safety and security needs of female employees.

9.3.2.14 Physical Cultural Resources: Historical or archaeological artifacts

Physical Cultural Resources (PCRs) can be movable or immovable objects, sites, structures, or groups of structures having archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. From the field visits / on-site survey and the stakeholder engagements held in the different project sites no graves, cultural or archaeological sites were not seen or reported.

There are no legally protected cultural heritage areas at the project site. Consequently, the impact on cultural heritage is insignificance from the proposed project. However, the Contractor should take precautionary measures during excavations just in case there are chances of finds. Chance Finds Procedures (CFP) are procedures that have to be followed when an event of buried PCRs being unexpectedly encountered or a "chance find" during the construction phase of the project and duly reported to respected bodies.

Mitigation Measures: In case of PCR discovery, during excavation for the construction phase of the project, the Contractor should take precautionary measures during excavations just in case there are chance finds. The contractor should report the case to the relevant Culture and Tourism Office found in AMT or Gamo Zone. Necessary measures have to be completed before the construction phase resumes.

9.4 Operation Phase Negative Impacts

9.4.1 Air Emissions, Dust, and Odor

During the operation phase dust has the potential to cause significant nuisance to people living close to the site and may pose a risk to the health of those working on the site, or visiting the site. Dust can be a problem, especially during the warm summer period, and during dry weather conditions. Given the scale and duration of the standby generators(emergency case only), and the comparatively small volumes of traffic (dust emission) that will be generated during the operation phase, the contribution of the proposed project to cumulative air quality impacts is considered to be of **Minor Significance**.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)

	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Dust and air emissions are inherent and cannot be eliminated. With few mitigation measures that can be applied at the locality will be enough. Like the regulation of speed to a suitable speed (20 km/h) for all vehicles entering the village's boundaries. Turn on generators only during power cut-off periods, implement preventive maintenance programs for vehicles and equipment, and promptly repair vehicles with visible exhaust fumes.

Fecal sludge treatment processes can generate foul odors and greenhouse gases, such as methane and carbon dioxide, which contribute to climate change and can also cause respiratory problems for nearby residents. Potential odor emissions from the sewerage plant would be the main concern during the operation phase. Odor can be at inlet works, grit chambers, and from sludge thickening and sludge storage areas of FSTP. Odors are the products of decomposition of organic matter. Within the FSTP, odors are expected to be generated near the inlet open channels and screens; oxidation ponds, and sludge storage areas.

Different types of odors (ammonia, organic) might be produced especially from the handling of the waste when it is unloaded from the waste trucks at the sorting area or when leachates are generated and accumulated in storage ponds. The main constituent of these odors is hydrogen sulfide (H_2S) due to its relatively high concentration in wastewater. This can be carried by wind to nearby settlements, thus unpleasant breathing environments. In general, the impact of odor nuisance, though localized, can be of immense magnitude, and will be permanent, and irreversible. Odor can be a significant problem for the people working in the waste treatment plant area and people living in the surroundings of the site.

Due to the location waste treatment site and wind direction the probability of the odor reaching the AMT is less but there are rural settlements near and around the selected waste treatment sites where the pungent odor may reach them.

Impact significance: The above impacts will affect the communities neighboring the FSTP, workers, and road users. Given the location of the project site's general wind direction, the likelihood of the impact is **low** and the extent is local. The intensity of impact is assessed as low given that intensive greenery can serve as a windbreak and sensitivity of the receptor becomes **medium**. The impact significance is therefore **moderate**.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation Measures

1. Plant indigenous trees at the perimeter of the FSTP project area with varying heights as a windbreaker;
2. AMTWSSE Project office must ensure proper operation to render unfriendly emissions during discharge of treated leachates due to overloading of the systems or negligence of the operators;
3. Odors generated by the facility can be controlled by the use of suppressants and regular cleaning of the receiving areas;
4. Control the volumetric BOD loading to be between 100-400 gm^3 to control odor release;
5. Exercise standardized operation working conditions for site management, operation, and proper functioning;
6. Apply Ferric chloride ($FeCl_3$) to control the possible generation of hydrogen sulfide (H_2S) odor in the sludge digestion process;
7. Regular maintenance (once per year) of FSTP stabilization ponds, removal of accumulated debris and other solids at the inlets and outlets,
8. Repair annually the embankment eroded by rainfall or damaged by rodents and livestock grazing;
9. Conducting effluent monitoring BOD (before and after the rainy season) and other key parameters, and adjusting the treatment process as necessary to ensure compliance with discharge limit standards of the country;
10. Quarterly exercise maintenance and monitoring to avoid accidental surface runoff intrusion from the manholes of the drainage network, which can overburden the facilities and cause foul odors.

Adoption of the above-mentioned mitigation measures will reduce impact intensity to "**very low**" resulting in a **residual** impact of **minor significance**.

9.4.2 Polluting nearby water sources

Improper treatment and disposal of fecal sludge can lead to the contamination of water sources, including groundwater and surface water. Inadequate operation could potentially damage aquatic life and the environment as a whole by hurting the local population and the surface and ground water quality. This can be a result of overloading the system, and breakdowns in operating machines, vehicles, and equipment causing deterioration of treatment efficiency.

All effluents discharged to inland waters have to follow the discharge limit standards. The discharge limit is regulated by the Environmental Standards for Industrial Pollution Control of Ethiopia. The regulation sets discharge limits to land waters, the discharge limit for BOD (80 mg/L), and COD (250 mg/L) while the discharge limit for total suspended solids (TSS) is set at 100 mg/L. The pH range of the effluent should be between 6 and 9.

Impact Significance: The likelihood of the impact occurring is medium and its duration will generally be long-term if the water body is once polluted. The *intensity* of the impact is assessed as ***medium*** given that the design and construction activity will be carefully done by the responsible bodies and the contractor. It is also believed that continuous monitoring mechanisms will be devised and in place to protect both ground and surface water from contamination. The extent of the impact is regional since the pollutants of surface and ground water may cover a

large area through ground water flow. The *sensitivity* of the receptor is ***medium*** given that once, it is contaminated treatment measures would be challenging resulting in **Moderate** impacts.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation Measures

1. Establishing water & and wastewater quality testing laboratories for the regular testing of the effluent;
2. AMTWSSA should ensure adequate operation and management of all the project components to avoid leakages and discharge of inadequately treated effluent;
3. The treated Fecal Sludge should not be discharged directly into the nearby water body, rather it can be utilized for agriculture, industry, energy production, Landscaping, and reclamation;
4. Quarterly laboratory quality tests for effluent and receiving water resources will be done to ensure that the quality of effluent meets the wastewater quality standards values set out within the UWSSPII ESMF, as well as the national discharge standards or requirements;
5. Leakages from treatment ponds & and sludge drying beds should be avoided or minimized by regular monitoring & and maintenance of the network;
6. A maintenance crew should be in place to monitor and repair the FSTP which is vital to maintain damage or leakage occurs and to avoid accidental surface runoff intrusion into water points;
7. The awareness campaign will be launched every half a year for all the beneficiaries about the proper operation and maintenance of sanitation facilities put in place;
8. Emergency telephone lines should be established to enable the public to immediately notify the AMYWSSE of any damages to the FSTP and other components of the network to ensure timely response and repair of such damages.
9. The treated fecal sludge should not be discharged directly into the nearby water body, rather the cake shall further it can be utilized in agriculture(compost), industry(briquettes), energy(biogas) production, Landscaping, and reclamation.

The adoption of the aforementioned mitigation measures can reduce impact intensity to “very low” resulting in a residual impact of “minor significance”.

9.4.3 Occupational Health and Safety Risks

FSTP can pose several occupational health risks to workers involved in the collection, transportation, and treatment of fecal sludge. Fecal sludge contains a variety of harmful pathogens, including bacteria, viruses, and parasites, which can cause serious infections and diseases. Untreated or improperly treated fecal sludge can lead to the spread of diseases and infections, such as diarrhea, hepatitis, and parasitic infections.

Workers who come into contact with fecal sludge, either directly or indirectly, may be at risk of exposure to these pathogens, Moreover, fecal sludge treatment can generate dust and fumes,

which can cause respiratory problems and other health issues for workers who inhale them during the operational phases. Fecal sludge treatment facilities can be wet, slippery, and uneven, which can increase the risk of slips, trips, and falls. Some fecal sludge treatment processes involve the use of chemicals, such as disinfectants or cleaning agents, which can be harmful if not handled properly.

Workers at the facilities might experience work-related adverse health impacts, particularly during the operational and maintenance phases of the project. This is particularly observed if they do not have access to proper PPE or if they do not follow appropriate hygiene practices. So it is important to identify and mitigate occupational health risks associated with fecal sludge treatment to protect the health and safety of workers.

Impact significance: Accidents could cause considerable damage, financial loss, and harm to human life. While largely reversible, some impacts such as loss of human life and bodily injury are irreversible. The receptor **sensitivity** is considered **medium** given that although such impacts may be irreversible once they occur, the workers will get adequate training, provided with safety protective equipment, and will have done similar work and have knowledge on how to avoid such incidences. The impact **intensity** is considered to be **medium** since the project office will hire qualified experts who are aware of OHS measures; this gives rise to an impact of **moderate** significance.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation Measures

1. Hire qualified and trained environmental health/OHS experts for regular monitoring and management of the fecal sludge treatment plant;
2. FSTP Workers have to use standardized PPE, protection gears (cut-resistant and high visibility protective clothing, gloves, safety boots, respiratory protection equipment, and face masks);
3. Develop and work on an Environmental Health and Safety Plan (Hazard identification, risk assessment, Emergency preparedness and response, Monitoring and evaluation, including health and safety measures to avoid accidents and injuries);
4. Routine maintenance including the removal of garbage, screenings, and grit, slashing around the embankments, and repair of the fence shall be done timely;
5. Providing appropriate training for workers at FSTP about ergonomic practices;
6. Provide accessible first Aid in the facility and immediate medical care in case of injuries and accidents;
7. Develop and maintain accident Log onsite to register all injuries/incidents and investigate their causes;

8. Vaccinate all labor working force (hepatitis) at the site and provide regular health examination access;
9. The FSTP should be fenced and signals put in place with security personnel to stop unauthorized people from accessing;
10. Exercise regular fumigation of the FSTP stores, administration rooms, and similar places to minimize, and kill disease vectors such as vermin, rodents, and mosquitoes;
11. Maintain important information on emergency resources (e.g., fire extinguishers, first aid kits, emergency contacts of a doctor, police men) in easily available places;
12. Strictly follow operation following the manufacturer's instructions and Material Safety Data Sheets (MSDS) procedures to store all chemicals utilized in FSTP and storage must conform to compatibility restrictions.

Overall, to mitigate occupational health risks associated with fecal sludge treatment to protect the health and safety of workers, the provision of appropriate PPE and adequate training, implementation of safety procedures, and creating of medical care access and support to the workers are equally important. The adoption of the aforementioned mitigation measures can reduce impact intensity to "very low" resulting in the residual impact of "minor significance".

9.4.4 Fecal Sludge reuse

Fecal Sludge management and reuse involves the proper handling, treatment, and beneficial utilization of sludge. Sludge reuse can have environmental and social benefits like recovery of valuable nutrients, utilization is soil fertility improvement, reduction of waste, energy generation, and others. However, reusing sludge may have adverse impacts. Fecal sludge may contain biological contaminants such as bacteria, viruses, and parasitic organisms; and chemical contaminants such as heavy metals, pharmaceuticals, and organic pollutants. Moreover, fecal sludge can result in odor and aesthetic Issues nuisance and discomfort to nearby communities if not properly managed. This can result in health risks for workers, nearby communities, and consumers if sludge is used in agricultural production.

Impact significance: The above impacts will affect the utilizers of fecal sludge, in communities neighboring the FSTP. Given the application of effective sludge management, appropriate treatment technologies, and regular monitoring and testing of sludge quality the potential risk intensity is **low** and the sensitivity of the receptor becomes **medium.** The impact significance is therefore **moderate**.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation Measures

1. Utilize effective sludge management through careful planning, appropriate technologies, and regulatory requirements

2. minimize potential risk and ensure suitability of sludge reuse, by applying regular monitoring and testing of sludge quality
3. Conduct public health education campaigns to raise awareness among farmers, communities, and consumers about the safe use and benefits of fecal sludge.
4. Apply adequate treatment of fecal sludge through anaerobic digestion, composting, and thermal treatment.
5. Minimize worker's direct exposure to pathogens and contaminants through appropriate PPE and good hygiene practices
6. Engage with local communities, farmers, and other stakeholders to raise awareness about the safe use of fecal sludge and address concerns.
7. Provide training and capacity-building programs for personnel involved in fecal sludge management.

9.4.5. Non-Pathogenic Health Risks

Chemical contamination is another potential health risk associated with fecal sludge. Contamination of soil and water can be easily possible by chemical constituents embodied in the fecal sludge, particularly heavy metals. Eventually, these chemicals accumulate in soils and water and directly or indirectly affect human health through various routes or the food chain. Further non-pathogen risks result from impurities of non-biodegradable origin such as Glass splinters or other sharp objects contained in the sludge. Such impurities can affect health by physically piercing or cutting those who could be involved in the manipulation of the waste. Also, health risks due to the attraction and proliferation of rodents and other disease-carrying vectors are common features of improperly managed sludge treatment and dumping sites. Due to the smell, several rodents, flies, some birds (vultures), hyenas, and dogs will be attracted to the area and increase the routes of contamination and disease transmission.

Mitigation Measures

1. Avoid use of percolated liquid from the sludge dry bed for irrigation or any use before adequately treating and disinfecting;
2. Create awareness among these people who are potentially exposed to the direct and indirect health impacts of the sludge;
3. Fence the area to prevent the entrance of dogs and other nocturnal animals; and
4. Keep the area neat and attractive so that flies and rodents cannot be attracted.

9.4.6 Impact on downstream and riverine flora:

During the operation phase aquatic plants, riverine trees and shrubs will get better water for their growth that is free from toxic substances. By using treated water, it will be possible to develop riverside green areas and botanical gardens. This impact is beneficiary impact and rated as very high. However, if the treatment plant releases for some unforeseen reason any untreated or practically treated waste effluent into downstream rivers, it would adversely affect the riverine and aquatic plants. This impact is less probable and rated to be low significance.

Mitigation measures

1. Monitor the proper functioning of the treatment plant,
2. Regularly check the effluent quality for its compliance with acceptable effluent discharge standards,
3. Whenever the quality of effluent fails to meet the standard, stop discharging the effluent into receiving streams and rivers,
4. As appropriate, promote integrated watershed management schemes around the WWTP and FSTP which enable to reduce of any potential spillover of liquid wastes into the natural environment.

9.4.7 Impacts on Fauna:

The overall impact of properly operating the treatment plant on fauna is highly positive. However, if improperly treated wastewater is released to the nearby water bodies, it may affect bird species resting near the rivers through contaminants production and reduce the necessary nutrients available for their growth and development due to eutrophication hence birds‟ variety and number will reduce. Bird species and some domestic animals living in the surroundings of the FSTPs, such as horses, cows, and oxen, may be affected by the discharge of improperly treated wastewater and sludge production from the FSTPs. This problem is improbable, of low significance, and long-term duration in the sense that the risk is always there, but reversible.

Mitigation measure

1. Ensure proper quality control of "treated" wastewater and sludge before releasing.
2. Control any accidental spill of untreated or partially treated wastewater into the environment.
3. Install a regular monitoring system on the quality of water discharged.

9.4.8 Landscape and Land Use Impacts

Land use, scenic, and visual quality: The construction of FSTP along the selected area will permanently change the surrounding landscape scenery into a walled-in enclosure. The location, design, and appearance of FSTP can impact the scenic quality of an area. During the operation phase, water stored in abandoned borrow pits in FSTP forms a breeding ground for vermin, mosquitoes, or other disease-causing and transmitting vectors, posing health risks to local communities and workers.

Impact significance: The duration of the impact will be long-term and the extent of the impact will be on-site. The intensity of the impact given to the proposed facilities the impact is **low**. The sensitivity of the receptor is rated **low** given that no such projects have ever been established so far in the project-affected areas. Therefore, the significance of the impact is rated as **minor**.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)

	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation measures

1. Incorporating vegetation (trees and shrubs) to improve the visual impact of the facility and provide shade, filter pollutants provide habitat for wildlife;
2. Using screening elements, such as fencing, walls, or vegetation, can help reduce the visual impact of the facility and provide privacy;
3. Regular staff training has to be emphasized. The staff has to know maintenance procedures, and customer service and properly trained staff can help maintain malfunctioned structures effectively and efficiently.
4. Regular maintenance is essential for preserving and enhancing landscape forms.

Adoption of the aforesaid mitigation measures will reduce impact intensity to "**very low**" resulting in a residual impact of **negligible significance**.

9.5 Decommissioning Phase Negative impacts

The decommissioning process has to be planned and implemented carefully and systematically. To minimize potential environmental and social risks, decommissioning FSTP requires careful planning, engagement with local stakeholders, and adherence to applicable regulations and best practices. Some of the project activities in the decommissioning phase include proper cleaning, decontamination of the project site, dismantling of equipment and metallic structures, demolishing of concrete structure, appropriate disposal of hazardous materials, and transportation of recyclable and reusable materials for site restoration into its original or pre-project condition.

9.5.1 Pollution of Soil and Water bodies

Decommissioning a fecal sludge treatment plant can result in the release of contaminants or pollutants into the surrounding environment, particularly if the plant has not been properly maintained or cleaned. This can result in soil and water contamination, as well as potential health risks to wildlife and humans. Spillage of contaminated water, sludge, chemicals, grease, or oil is the main cause of soil contamination.

Impact significance: The effect of the impact will be long-term and the extent of the impact will be on site. Since a standardized working procedure was followed, the intensity of the impact given for kind of the proposed facilities is **low** but the sensitivity of the receptor is rated highly given that the impact on the natural environment has a long-term effect areas. Therefore, the significance of the impact is rated as **moderate**.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation measure

1. Develop a decommissioning plan (regulatory requirements, hazard assessment, risk management, waste management, etc.) that outlines the steps and working procedures for decommissioning the FSTP, Toilets;
2. Engage local stakeholders, in the decommissioning process;
3. Conducting environmental quality assessment of the water body and the treated waste before the commencement of the decommissioning;
4. Transporting all the hazardous wastes (construction materials, chemical containers) to a predetermined site for treatment, deposal or storage;
5. Use the topsoil and subsoil removed form decommissioning will be stored properly and used for backfilling and reinstatement;
6. Compact the Back-filling materials to a level similar to the original surrounding soils;
7. Monitor through regular sampling of soil, water, and air to identify any potential contaminants or pollutants.

9.5.2 Occupational Health and Safety and Air pollution

Decommissioning a fecal sludge treatment plant can pose several occupational risks to workers involved in the decommissioning process. Workers involved in decommissioning may be exposed to hazardous materials through inhalation, ingestion, or contact with the skin or eyes that can pose a risk to their health. Workers may also be exposed to biological hazards, such as harmful pathogens or infectious diseases, which can be present in fecal sludge. Moreover, workers might be exposed to physical hazards (Accidents, falls, and crushing injuries) when they are working in confined spaces, with heavy equipment, or at heights. Certain tasks such as heavy lifting or awkward postures, can pose ergonomic hazards to workers, which can result in musculoskeletal disorders.

Impact significance: Accidents could cause considerable damage, financial loss, and harm to human life. While largely reversible, some impacts such as loss of human life and bodily injury are irreversible. The receptor **sensitivity** is considered **medium** given that although such impacts may be irreversible once they occur, the workers will get adequate training, provided with safety protective equipment, and will have done similar work and have knowledge on how to avoid such incidences. The impact **intensity** is considered to be **medium** since the project office will hire qualified experts who are aware of OHS measures; this gives rise to an impact of **moderate** significance.

		Sensitivity of receptor			
		Very low(1)	Low (2)	Medium (3)	High (4)
Intensity of impacts	Very low (1)	Negligible (1)	Minor (2)	Minor (3)	Minor (4)
	Low (2)	Minor (2)	Minor (4)	Moderate (6)	Moderate (8)
	Medium (3)	Minor (3)	Moderate (6)	Moderate (9)	Major (12)
	High (4)	Minor (4)	Moderate (6)	Major (12)	Major (16)

Mitigation measures

To minimize these occupational health and safety risks, it is important to implement appropriate measures and procedures to protect workers. This can include:

1. Recruiting a qualified health and occupational safety officer who will oversee OHS matters on-site;
2. Proper induction/training of the workers work-related accidents before decommissioning commencement;
3. Implement ergonomic interventions, such as job rotation or use of assistive devices, to reduce ergonomic hazards;
4. Provide appropriate, adequate PPE (gloves, masks, protective clothing, OHS personnel protective gear) to the employees;
5. Implementing engineering controls, such as ventilation systems and barriers, to reduce exposure to hazardous materials and physical hazards;
6. Trucks will be covered during the haulage of materials to reduce dust emissions.

9.5.3 Socio-economy impact

Decommissioning a fecal sludge treatment communal and public toilets will be stopped working and may have economic impacts on the surrounding community, particularly if the plant has been a source of employment or revenue. Decommissioning can result in job losses and reduced economic activity, which can have ripple effects on the local economy. Some unskilled workers will get temporary employment during the dismantling of the plants but the skilled workers that were hired to manage day to day operation of the FSTP are expected to lose their job during this phase.

Mitigation measure

1. Based on their skill, knowledge, experience, and interest, vulnerable community groups must be transferred to another secured job opportunity;
2. Provide financial assistance or grants to affected workers or businesses. This can involve providing loans, grants, or other forms of financial support to help workers or businesses transition to new opportunities;
3. Providing adequate provident fund or pension for those who want to retire;
4. Providing retraining programs in new industries or skills opportunities for workers who have been impacted by the process. Supporting workers to start their businesses;
5. Repurposing the site for other uses, such as a park or community center, can help to mitigate the economic impact of decommissioning.

10 Environmental and Social Management /Monitoring Plans(ESMP)

An Environmental and Social Management Plan (ESMP) is a formal document that outlines the measures and actions that will be taken to mitigate potential environmental and social impacts associated with a project or activity. The ESMP summarizes the identified potential impacts, mitigation measures for adverse impacts, expected out comes, indicators, monitoring, and evaluation. The ESMP report identifies parties responsible for management and monitoring actions, associated costs, indicators, and reporting.

10.1 Environmental and Social Management Plan (ESMP)

The ESMP is a critical component of ESIA because it takes the project-specific environmental and social safeguards as an integral part of the project for execution. The purpose of an ESMP is to ensure that potential environmental and social risks and impacts associated with a project or activity are identified, assessed, and effectively managed. The ESMP establishes a comprehensive framework that outlines the measures and actions that will be taken to minimize or eliminate negative impacts on the environment and local communities while promoting positive social and economic outcomes.

Table 29 Summary of Environmental and Social Management Plan

S/N	Eenvironmental and social Impacts	Mitigation measures	Responsibility		Execution Time	Cost in USD
			Implmenting bodies	Supervision		
1	Involuntary displacement, Land Acquisition & Property loss	• Conducting RAP with an independent consultant before any civil work and resettling the PAHs; • Use the RAP report as a guide to determining affected persons; • Consider the cut-off date when the census start date of RAP conducting consultant • Tenable compensation paid both in cash & and kind to the PAHs • Vulnerable community groups must get priority during compensation and post-livelihood rehabilitation works; • The resettlement site must have access to social amenities at least commensurate to their original village; • Conduct Post livelihood assessment study for re settles on an annual basis and work for livelihood improvement; • Resettle enterprises to appropriate area that has adequate infrastructure (water, electricity, and road) and compensate them (in cash and Kind).	AMTWSSE, PO, Municipality/ Mayor office & Land administration office	MoWE, WB, Grievance Handling Committee and Regional land administration	One-off	part of the government RAP cost
2	Vegetation clearance	• Re-vegetate (10 seedlings have to be planted as a replacement for the removal of a single tree) the perimeters of the FSTP with indigenous/endemic plant species lost during site clearance; • Store and reuse the topsoil removed from the site properly ; • Minimize the amount of destruction caused by machinery and promote non-mechanized methods of vegetation removal; • All areas planned for clearing of vegetation must be demarcated before the commencement of the construction.	Construction Contractor	Supervisory Consultant , EPA	During Construction	
3	Soil degradation	• Develop excavated soil management plan before the start of construction activities; • Protect the topsoil to retain the soil structure from topsoil loss; • Topsoil and subsoil removed from the site during site preparation will be stored properly for reuse elsewhere; • Contour temporary and permanent access roads/laydown areas to minimize surface water runoff and erosion; • Avoid using old (not more than 10 years) and properly unmaintained machinery; • Ensure that all equipment on duty is properly maintained and fully functional;	Construction Contractor	Supervisory Consultant, EPA Agriculture office	During Construction	253.9

		• Excess soil/ cart away must be removed on a daily basis and deposited at an authorized site ; • Protect adjacent areas of the construction site from disturbance; • Prevent sheet and rill erosion of soil through the use of sand bags, diversion berms, culverts, or other physical means.				
3	Air/ Noise pollution	• Construction workers will be made aware of the permissible noise levels at the workplace and surrounding environment; • Noise levels at construction sites should not exceed 75 dBA and 70 dBA during the day and night, respectively • Equipments will be switched off during off-work time whenever possible; • Utilize well-maintained and functional working equipment; • Avoid using of old (>10years) or damaged equipment's ones; • Trucks will be covered during haulage of construction materials to reduce spillage of materials and Use spray water for dust suppression over dusty areas • provide the necessary PPE (ear muffs, masks, etc.) to workers; • Adjust the travel speeds of construction vehicles 30 Km/h along the road and should be controlled using traffic signals; • Avoid construction activities during night time.	Construction Contractor	Supervisory Consultant EPA	During Construction	118.5
4	Occupational Health and Safety (OHS) Risks	• Prepare site-specific Health and Safety management Plan; • Assign a qualified health and occupational safety officer to oversee OHS matters; • Monitor construction workers on safe work practices and guidelines (OHS) and ensure that they adhere to them; • Provide training on OHS training before commencing work on site • Workers must follow safety standards and use protective equipment to minimize hazards • Standard Safety sign(OSHA) will be used to warn staff and/ or visitors about risk area • Provide first Aid kits and ensure availability of trained first aiders within the construction site; • Ensure that the campsite is fenced and hygienically kept with adequate provision of facilities; • Ensure the Code of Conduct is followed to regulate the performance and behavior of all workers. • Personnel will only undertake tasks for which they are trained or qualified; • Implement ergonomic interventions, such as job rotation or use of assistive devices, to reduce ergonomic hazards • Prohibit the use of alcohol, or "Chat", in the work area;	Construction Contractor	Supervisory Consultant EPA,Office of Labor and Social Affairs	During Construction	1,269.6

5	Water Pollution	• Maintain and keep all construction equipment in standardized operating condition; • Perform routine maintenance of construction machinery and vehicles at a designated workshop area and keep maintenance wastes separately; • Locate stockpile areas away from water courses and will be surrounded by a perimeter with sediment and other pollutant traps located at drain exits; • Use trained personnel for fuel and oil handling in the project site; • Segregate and store all hazardous wastes and empty containers of it in a designated area on site and dispose of them following the national hazardous waste management regulation; • Perform construction in the dry season.	Construction Contractor	Supervisory Consultant , EPA AMTWSSE	During Construction	507.8
6	Alteration of natural drainage pattern	• Plan and work on Integrated water shade management for the natural drainage lines; • Participate with stakeholders in storm water drainage planning, design, and management activities; • Work on flood avoidance strategies as precautionary interventions that involve structural adaptations; • Flood mitigation strategies (flood responses before and during an event, emergency flood control works); • Construct drainage channels in all areas that generate or receive surface runoff; • Work in collaboration with stakeholders to prevent possible erosion, and flood and for the stabilization of gullies and drainage lines.	Construction Contractor	Supervisory Consultant , EPA	During Construction	1,015.7
7	Slope Failure due to Earthworks	• Protect very weak landform slopes by using engineered structures (slope stabilization measures, such as retaining walls, soil nails, or geotextiles); • Use the best available methods of construction technology to minimize the risk of blockages and constrictions; • Backfill and restore the eroded channels related to natural contours; • Protect the susceptible areas of the project by using temporary or permanent drainage works; • Perform Earthwork construction activity during the dry season performed by trained professionals; • Monitoring the slope before and after the rainy season (two times) for signs of instability, such as cracks, bulges, or settling; • Implement effective erosion control measures (re-vegetation, erosion control blankets, or sediment control basins).	Construction Contractor	Supervisory Consultant, EPA	During Construction	947.9

8	Solid wastes	• Prepare and apply a solid waste management system ; • Reuse excavation of the ground and foundation works materials for Earthworks and landscaping; • Solid waste collection bins shall be placed at strategic locations within the site; • The contractor and proponent shall work hand in hand to facilitate the implementation of sound waste management.	Construction Contractor	Supervisory Consultant, EPA	During Construction	558.61
9	Hazardous Wastes	• Develop temporary adequate sanitary facilities in the construction site or in the vicinity of the project area; • Segregate and classify Hazardous wastes from the non-hazardous and should be stored in suitable designated storage facilities at the project site; • Hazardous wastes should be properly sealed, labeled, secured, and kept inside a locked fenced area to prevent access by unauthorized personnel; • prepare a hazardous waste management plan; • Solid waste storage bins and/or skips are provided at the contractor's camp site and at the construction sites and ensure they are collected or emptied in time.	Construction Contractor	Supervisory Consultant, EPA	During Construction	457.1
10	Traffic congestion /Accident	• Develop a Traffic Management Plan and incorporating proposed arrangements for traffic diversions; • Provide temporary road signs or notices to indicate ongoing works; • The client and Contractor should choose traffic routes; • Ensure that vehicles for the construction work are operated only by qualified drivers; • Park all vehicles only at designated parking areas and use spaces for loading and unloading; • All of the drivers have to know and obey the speed limit of vehicles; • Travel speeds of construction vehicles should be controlled by setting travel speeds and informing through signals; • No drivers or personnel under the influence of alcohol or any drug abuse will be allowed onsite; • Fencing or placing obstacles to trenches and ditches to avoid interference and accidents of wild and domestic animals and children.	Construction Contractor	Supervisory Consultant, EPA.Traffic management	During Construction	592.5
11	Spread of communicable disease	• Develop a communicable disease management plan; • Prepare and enforce a Code of Ethical Conduct (CEC)in the camp to encourage respect for the local community and to maintain the cleanliness of the camp ; • The workers should periodically be sensitized on the Ethical code of conduct. Translate the code of ethical conduct local	Construction Contractor	Supervisory Consultant , Health office, EPA	During Construction	406.3

		language; • Orient all construction workers and sensitize them about responsible sexual behavior in project communities; • A safety, health, and environment induction course shall be conducted to all workers two times per year, putting more emphasis on HIV/AIDS STDS;				
12	Social Misdemeanor Conflicts due to the influx of labor	• Hire unskilled and skilled labor from the local population as far as possible to minimize on influx of labor into the community; • Local governments, businesses, and community organizations to work together to develop strategies for ensuring that workers are paid fair wages; • Any new employee should be required to sign a code of behavior; • All construction workers shall be orientated and sensitized about responsible social behavior through Workplace education and training in project communities; • Awareness has to be given to new comers about the norms, and culturesof the project host community.	Construction Contractor	Supervisory Consultant, EPA,Office of Labor and Social Affairs	During Construction	321.6
13	GBV	• Raising awareness and providing training to employees (quarterly) about GBV; • Ensure equal pay for women and men for equal jobs; • Providing support services, such as counseling, medical care, and legal aid, to employees who experience GBV; • Prepare and implement a code of conduct that among others strictly forbids sexual harassment /GBV and to be signed by all workers; • Establish disciplinary procedures and sanctions for employees who engage in GBV; • Consider the safety and security needs of female employees.	Construction Contractor	Supervisory Consultant ,Women, Children and Youth Affairs office	During Construction	423.2
		Operation Phase				
14	Air Emissions, Dust and Odor	• Plant indigenous trees at the perimeter of the FSTP project area with varying heights as wind breakers; • AMTWSSE Project office must ensure proper operation to render unfriendly emissions during discharge of treated leachates due to overloading of the systems or negligence of the operators; • Odors generated by the facility can be controlled by the use of suppressants and regular cleaning of the receiving areas; • Control the volumetric BOD loading to be between 100-400 g/m^3 to control odor release; • Exercise standardized operation working conditions for site	AMTWSSE, PO and FSTP Manager	AMTWSSE, PO and Environmental protection office	During the operation	8,463.8

		management, operation, and proper functioning; • Apply $FeCl_3$to control the possible generation ofH_2Sodor in the sludge digestion process; • Regular maintenance of FSTP stabilization ponds, removal of accumulated debris and other solids at the inlets and outlets, • Repair annually the embankment eroded by rainfall or damaged by rodents and livestock grazing; • Conducting effluent monitoring BOD (before and after the rainy season) and other key parameters, and adjusting the treatment process as necessary to ensure compliance with discharge limit standards of the country; • Quarterly exercise maintenance and monitoring to avoid accidental surface runoff intrusion from the manholes of the drainage network, which can overburden the facilities and cause foul odors.				
15	Polluting Water Resources	• Establishing water & and wastewater quality testing laboratory ; • AMTWSSA should ensure adequate operation and management of all the project components to avoid leakages and discharge of inadequately treated effluent; • The treated Fecal Sludge should not be discharged directly into the nearby water body; • Quarterly laboratory quality tests for effluent and receiving water resources will be done to ensure that the quality of effluent meets the national discharge standards or requirements; • Leakages from treatment ponds & and sludge drying beds should be avoided; • A maintenance crew should be in place to monitor and repair the FSTP; • The awareness campaign will be launched every half a year for all the beneficiaries about the proper operation and maintenance of sanitation facilities put in place;	AMTWSSE, PO and FSTP Manager	AMTWSSE, PO and Environmental protection office	During the operation	9,310.2
16	Occupational Health and Safety Risks	• Hire qualified OHS expert for regular monitoring and management of FSTP; • FSTP Workers have to use standardized PPE, protection gear; • Develop and work on an Environmental Health and Safety Plan; • Routine maintenance including the removal of garbage, screenings, and repair of the fence shall be done timely; • Providing appropriate training for workers at FSTP about ergonomic practices ; • Provide accessible first Aid in the facility and immediate	AMTWSSE, PO and FSTP Manager	AMTWSSE, PO, Office of Labor and Social Affairs, Health office	During the operation	2,539.1

		medical care in case of injuries and accidents; • Develop and maintain accident Log onsite to register all injuries/incidents and investigate their causes; • Vaccinate all labor working force (hepatitis) at the site and provide regular health examinations access; • The FSTP should be fenced and signals put in place with security personnel to stop unauthorized people from accessing; • Exercise regular fumigation of the FSTP stores, and administration rooms ; • Maintain important information of emergency resources in easily available place ; • Strict follow operation following manufacturer's instructions and Material Safety Data Sheets (MSDS) procedures				
17	Landscape and Land Use Impacts	• Incorporating vegetation (trees and shrubs) to improve the visual impact of the facility and provide shade, filter pollutants provide habitat for wildlife; • Using screening elements, such as fencing, walls, or vegetation, can help reduce the visual impact of the facility and provide privacy; • Regular maintenance such as fixing leaks, repairing broken fixtures, and replacing damaged or worn-out parts of public toilets are important; • Regular Staff training has to be emphasized.	AMTWSSE, PO and FSTP Manager	AMTWSSE, PO . EPA office	During the Operation phase	1,269.6
18	Pollution of Soil and Water bodies	• Develop a decommissioning plan that outlines the steps and working procedures for decommissioning; • Engage local stakeholders, in the decommissioning process; • Conducting environmental quality assessment of the water body and the treated waste before the commencement of the decommissioning; • Transport all the hazardous wastes to a predetermined site for treatment, deposal or storage; • Use the topsoil and subsoil removed for backfilling and reinstatement; • Compact the Back-filling materials to a level similar to the original surrounding soils ; • Monitor through regular sampling of soil, water, and air to identify any potential contaminants or pollutants.	Contractor	AMTWSSE, PO ,EPA Office	Decomissioni ng phase	1,100.3

19	Occupational Health and Safety and Air pollution	• Recruiting a qualified OHS who will oversee OHS matters on site; • Proper induction/training of the workers work-related accidents; • Implement ergonomic interventions • Provide appropriate, adequate PPE to the employees; • Implementing engineering controls; • Trucks will be covered during the haulage of materials to reduce dust emissions.	Contractor	AMTWSSE, PO , EPA Office, Office of Labor and Social Affairs, Health office	Decomissioning phase	10,358.1
20	Socio-economy impact	• Based on their skill, knowledge, experience, and interest, vulnerable community groups must be transferred to another secured job opportunity; • Provide financial assistance or grants to affected workers or businesses; • Providing adequate provident fund or pension for those who want to retire; • Providing retraining programs in new industries or skills opportunities for workers who have been impacted by the process. Supporting workers to start their businesses; • Repurposing the site for other uses, such as a park or community center, can help to mitigate the economic impact of decommissioning.	Contractor	AMTWSSE, PO ,EPA Office, Office of Labor and Social Affairs,	Decomissioning phase	3,385.5
Total						**36,225.1**

10.2 Environmental and Social Monitoring Plan

Environmental monitoring and evaluation (EM&E) is a process used to measure and assess the impact of human activities on the environment. The goal of EM&E is to provide decision-makers with information that can be used to manage natural resources and protect ecosystems.EM&E is a critical component of environmental management, as it provides valuable information to decision-makers and stakeholders, allowing them to make informed decisions about how to manage natural resources and protect the environment.

The objective of environmental monitoring is to design a regular plan for the proper and timely execution of the mitigation measures and further help evaluate and design further remedial actions for unforeseen events. Monitoring involves the collection of data on environmental parameters such as air and water quality, soil characteristics, and biodiversity. This monitoring is important to assess the status of the environment during project operation, identify unexpected changes, and measure the effectiveness of the operational procedures, to confirm statutory and mandatory compliance. Hence, monitoring of identified mitigation measures is a key to sound environmental and social safeguard management, project sustainability, and community sense of ownership development.

Construction monitoring refers to the process of overseeing and supervising construction activities to ensure that they are carried out following the project plans, specifications, and applicable regulations. Construction monitoring is an important aspect of construction project management and is essential for ensuring that the project is completed on time, within budget, and to the required quality standards.TheAMTWSSE project office should establish both compliance and effects monitoring plans starting from the pre-construction phase. The following Table 35 examines the extent to which the adverse impacts identified can be controlled through the adoption of mitigation measures.

Table 30 Environmental monitoring plan for CWIS Project at AMT

Environmental and Impact	Mitigation measures	Monitoring indicator	Method of monitoring	Monitoring institutions	Monitoring frequency	Budget in USD
Pre-construction phase						
Involuntary displacement, Land Acquisition & Property damage	Conducting RAP with an independent consultant before any civil work and resettling the PAHs around the FSTP and public toilet sites	RAP document	Measurement	AMTWSSE,WB	One –Off	Part of the government RAP cost
	Use the RAP report as a guide to determining affected persons	RAP document, type, and number of HH gets Compensation	Observation & No of RAP document		One –Off	
	Compensate land for land for PAHs	The PAP's acceptance and approval of the RAP	Observation & document		One –Off	
	Consider the cut-off date when the census start date of RAP conducting consultant	Document records & Post PAP/PAHs audit opinions	Measurement		One –Off	
	Tenable compensation paid both in cash & and kind to the PAHs	Documented verification KII with the PAPs & and local community	Observation & document		Every quarter	
	Vulnerable community groups must get priority during compensation, land delivery, and post-livelihood rehabilitation works	A number of vulnerable groups benefited & satisfied	No of people received compensation	Town Youth Women affairs office	Twice per year	
	The resettlement site must have access to social amenities at least commensurate to their original village;	Site visit, documented verification of social amenities accessed by the PAPs	Observation & document	AMTWSSE, Municipality	Twice per year	
	Conduct Post livelihood assessment study for re-settlers on an annual basis and work for livelihood improvement	No of post livelihood assessments done	Document and observation	MoWE, AMTWSSE, municipality	Once per year	
Construction phase						
Water Resource Pollution	Maintain and keep all construction equipment in standardized operating condition;	Maintenance/status reports, Construction camp site observation	Observation & document	AMT/zone EPA		4,231.9
	Perform routine maintenance of construction machinery and vehicles at a designated workshop;	Machinery catalog and maintenance status report	Observation & document	AMT/zone EPA,	Every month	
	Locate stockpile areas away from water courses and;	Location of stockpile area and its management	observations	AMT /zone EPA, Health office	Every month	
	Use trained personnel for fuel and oil handling at the	The presence of trained personnel	Number of personnel	AMT/zone EPA	Every month	

	project site.	in charge of fuel	recruited			
	Segregate and store all hazardous wastes and empty containers of hazardous materials in a designated area;	HW management plan, storage areas, filed records of Hazardous waste transfer & and disposal	Observation & document	AMT/zone EPA	construction phase	
	Perform construction in the dry season.	Month of construction	Observation & document	AMT/zone EPA	construction period	
	Maintain and keep all construction equipment in standardized operating condition that can minimize oil, grease, or fuel leakages to the environment;	Number of malfunction equipment	Observation maintenance activity log	Town/zone EPA	Every quarter construction phase	
	Perform routine maintenance of construction machinery and vehicles at a designated workshop or maintenance area and keep maintenance wastes separately;	Maintenance records of machinery	Observation & document	AMT/zone EPA, PO	Construction phase	
Removal of Vegetation	re-vegetate 10 seedlings per removed plant at the perimeters of the FSTP with indigenous/endemic plant species;	No areas covered by vegetation trees, bushes, No seedlings planted	Area re- vegetated	AMT/zone EPA,	construction phase	2,115.9
	Store and reuse the topsoil removed from the site during site preparation properly ;	The amount of top soil stored; reused for backfilling, leveling & greening	Amount of soil Reused Observation	AMT/zone EPA		
	Minimize the amount of destruction caused by machinery by promoting non-mechanized methods of vegetation removal;	Applied/practiced nonmechanized methods of vegetation removal	Plants removed by human force	AMT/ Zone EPA, AMTWSSE		
	All areas planned for clearing of vegetation must be demarcated prior	Demarcated area for vegetation clearance	Observation, area demarcated	AMT Zone EPA, AMTWSSE		
Soil degradation	Develop excavated soil management plan	Excavated soil management plan documented	Observation & document	AMT/ Zone EPA, AMTWSSE	construction phase	5,078.3
	Protect the topsoil to retain the soil structure and minimize the risk of topsoil loss;	Top soil protection mechanism	Amount of top soil protected observation	AMT/ Zone EPA, AMTWSSE		
	Topsoil and subsoil removed from the site during site preparation will be stored properly;	Top soil protection mechanism	Amount of top soil protected observation	AMT/ Zone EPA, AMTWSSE		
	Contour temporary and permanent access roads/laydown areas;	Contour-based constructed Access road	Length of contour-based roads observation	AMT/ Zone EPA, AMTWSSE		
	Avoid using old (not more than 10 years) and properly unmaintained machinery;	Age of machineries documents Maintenance reports	Average age of working machineries	AMT, Zone EPA, AMTWSSE		
	Ensure that all equipment on duty is properly maintained and fully functioning	Maintenance reports	Average no of maintained machinery	AMT/ Zone EPA, AMTWSSE		

	Excess soil/ cart away must be removed from the site on a daily basis and deposited at an authorized approved site ;	Cart away soil management plan	Amount of cart away soil removed per day observation	AMT/ Zone EPA,AMTWSSE		
	Protect adjacent areas of the construction site from disturbance	Protected area from damage	Observation	AMT/Zone EPA, AMTWSSE		
	Prevent sheet and rill erosion of soil through the use of sand bags, diversion berms, and physical means.;	Application and bags, diversion berns	Observation	AMT/Zone EPA, AMTWSSE		
	Develop excavated soil management plan before the start of construction activities;	Cart away soil management plan	Observation /document	AMT/Zone EPA, AMTWSSE		
Air/ Noise pollution	Construction workers will be made aware of the permissible noise levels at the workplace and surrounding environment;	Type and number of trainings given to workers	Trained individuals and documents	AMT/Zone EPA, AMTWSSE		1,692.8
	Noise levels at construction sites should not exceed 75 dBA and 70 dBA during the day and night, respectively	Signal indicating the permissible noise level	Posted signals observation	AMT, Zone EPA, AMTWSSE		
	During periods of off work time, equipment will be switched off	Signal /notice indicating switching off machinery off work time	Observation signals availability	AMT/Zone EPA, AMTWSSE		
	Utilize well-maintained and functional working equipment;	The quality of working equipment	Observation document	AMT/Zone EPA, AMTWSSE		
	Avoid using of old (>10years) or damaged equipment's ones	Average age of equipment utilized	Observation document	AMT/Zone EPA, AMTWSSE		
	Trucks will be covered during haulage of construction materials to reduce spillage of materials and Use spray water for dust suppression over dusty areas	Type and nature of the truck cover Frequency of water usage for dust suppression	Observation	AMT/Zone EPA, AMTWSSE		
	provide the necessary to workers whenever needed and as found appropriate;	Available PPE and type	Observation documentation	AMT/Zone EPA, AMTWSSE		
	Adjust the travel speeds of construction vehicles 30 Km/h along the road	Traffic Signal (speed) posted in the required place	Observation documentation	AMT/Zone EPA, AMTWSSE		
	Avoid construction activities during night time	Working schedule	Work schedule observation	AMT/Zone EPA, AMTWSSE		
Occupational OHS Risks	Prepare site-specific Health and Safety management Plan	Presence of a health and safety plan	Observation documentation	AMT/ Zone EPA, Health office /AMTWSSE		8,463.8
	Assign a qualified OHS officer to oversee OHS matters daily;	Assignment-qualified OHS officer	Expert-recruited observation documentation	AMT/ Zone EPA, Health office /AMTWSSE		
	Monitor construction workers on safe work practices and guidelines (OHS);	Adherence of workers to safety procedures	Observation documentation	MoWE, AMT/ Zone EPA, AMTWSSE		
	Provide training on OHS before commencing work on-site	Type of OHS training given	Observation documentation	MoWE, AMT/ Zone EPA, Health office/AMTWSSW		

	Workers must follow safety standards and use protective equipment to minimize hazards	Utilization of PPE during work time	Observation documentation	AMT/ Zone EPA, Health office Social affairs/AMTWSSE		
	Standard Safety sign (OSHA) will be used to warn staff and/ or visitors about risk areas;	OSHA Safety Sign Posted for staff	Observation documentation	AMT/ Zone EPA, Health office Social affairs/AMTWSE		
	Provide first Aid kits and ensure availability of trained first aiders within the construction site;	Available first Aid Kit type and trained individual	Observation documentation	AMT/ Zone EPA, Health office Social affairs/AMTWSSE		
	Ensure that the campsite is fenced and hygienically kept with adequate provision of facilities	Availability of secured fences, sanitation facilities	Observation documentation	AMT/ Zone EPA, AMTWSSE		
	Ensure the Code of Conduct is followed to regulate the performance and behavior of all workers.	Available code of conduct	Observation documentation	AMT/ Zone EPA, AMTWSSE		
	Personnel will only undertake tasks for which they are trained or qualified	Available Work allocation procedure	Observation documentation	AMT/ Zone EPA, Social affairs/AMTWSSE		
	Implement ergonomic interventions, such as job rotation or use of assistive devices, to reduce ergonomic hazards	Type of job rotation practice	Observation documentation	AMT/ Zone EPA, Health office Social affairs/AMTWSSE		
	Prohibit the use of alcohol, or ”Chat”, in the work area;	Alcohol, chat Restricting Notice /signals in the work area	Observation documentation	AMT/ Zone EPA, Health office Social affairs/AMTWSSE		
	Provide adequate OHS personnel protective gear (such as nose, ear mask, and clothing	Available Personnel protective gear		AMT/ Zone EPA, Health office Social affairs/PO		
Alteration of natural drainage pattern	Plan and work on Integrated water shade management (Soil and water conservation through physical, and biological) for the natural drainage lines;	Available Integrated water shade management plan	Observation & document	AMT/ Zone EPA, AMTWSSE	construction phase	3,046.9
	Participate with stakeholders in storm water drainage planning, design, and management activities;	The number and type of stakeholder participation documented	Observation & document	AMT/ Zone EPA, AMTWSSE	construction phase	
	Work on flood avoidance strategies as precautionary interventions that involve structural adaptations;	Flood avoidance strategies practiced	Observation & document	AMT/ Zone EPA, AMTWSSE	construction phase	
	Flood mitigation strategies	Flood avoidance strategies practiced	Observation & document	AMT/ Zone EPA, AMTWSSE	End of the construction phase	
	Construct drainage channels within the construction site to allow for the convenient and free flow of storm water.	Length and size of drainage line constructed	Observation & document	AMT/ Zone EPA, AMTWSSE	construction phase	
	Construct drainage channels in all areas that generate or receive surface runoff water. The channels shall be designed about the maximum expected flood	Length and size of drainage line constructed	Observation documentation	AMT/ Zone EPA, AMTWSSE		

	discharge ;					
	Work in collaboration with stakeholders to prevent possible erosion, and flood and for the stabilization of gullies and drainage lines.	Number of type of Collaborative activities related to flooding	Observation documentation	AMT/ Zone EPA, AMTWSSE		
Slope Failure due to Earthworks	Protect very weak landform slopes by using engineered structures	Applied engineered structures for protecting slope	Observation & document	AMT/ Zone EPA, AMTWSSE	construction phase	3,724.1
	Undertake all construction activities during the dry season which will minimize the risk;	Season of construction period	Observation documentation	AMT/ Zone EPA, AMTWSSE	Pre-construction	
	Use the best available methods of construction technology to minimize the risk of blockages and constrictions;	Documented evidence applied methods	Observation & document	AMT/ Zone EPA, AMTWSSE	Entire construction phase	
	Backfill and restore the eroded channels related to natural contours;	Amount of soil/ material Backfilled eroded channels, contours	Observation & document	AMT/ Zone EPA, AMTWSSE	Entire construction phase	
	Protect the susceptible areas of the project by using temporary or permanent drainage works;	Protected drainage area	Observation & document	AMT/ Zone EPA, AMTWSSE	Pre-construction	
	Perform Earthwork construction activity during the dry season by trained professionals who understand the risks and hazards associated with slope failure;	Month/ Season of construction	Work schedule Observation documentation	AMT/ Zone EPA, AMTWSSE		
	Monitoring the slope before and after the rainy season (two times) for signs of instability, such as cracks, bulges, or settling;	Number of slope monitoring made per year	Observation documentation	AMT/ Zone EPA, AMTWSSE		
	Implement effective erosion control measures (re-vegetation, erosion control blankets, or sediment control basins).	Practice of erosion control measures	Observation documentation	AMT/ Zone EPA, AMTWSSE		
Solid wastes	Prepare and apply a solid waste management system on the project site;	Practice of SWMS and documentation of it	Observation documentation	AMT/ Zone EPA, AMTWSSE		1,591.2
	Reuse excavation of the ground and foundation works materials for Earthworks and landscaping;	Amount of soil reused for landscaping	Observation documentation	AMT/ Zone EPA, AMTWSSE		
	Solid waste collection bins shall be placed at strategic locations within the site as collection centers to facilitate the separation and sorting of the various types of waste;	Available solid waste bins	Observation documentation	AMT/ Zone EPA,AMTWSSE		
	The Solid wastes shall be properly segregated and separated to encourage the recycling of some useful resources;	Practice of Solid waste segregation	Observation documentation	AMT/ Zone EPA, AMTWSSE		
	The contractor and proponent shall work hand in hand to facilitate the implementation of sound waste management.	Practice of SWM	Observation documentation	AMT, Zone EPA, AMTWSSE		

Hazardous Wastes	Develop temporary adequate sanitary facilities in the construction site or the vicinity of the project area;	Developed/ available sanitary facilities	Observation documentation	AMT/ Zone EPA, AMTWSSE		3,013.1
	Segregate and classify Hazardous wastes from the non-hazardous and should be stored in suitable designated storage facilities at the project site;	Classified/segregates HW	Observation documentation	AMT/ Zone EPA, AMTWSSE		
	Hazardous wastes should be properly sealed, labeled, secured, kept inside a locked fenced area to prevent access by unauthorized personnel, and covered to prevent water accumulation before transportation;	Labeled secured HW storage area	Observation documentation	AMT/ Zone EPA, AMTWSSE		
	prepare a hazardous waste management plan;	Available HWMP	Observation documentation	AMT/ Zone EPA, AMTWSSE		
	Solid waste storage bins and/or skips are provided at the contractor's camp site and the construction sites and ensure they are collected or emptied in time.	Available SW bins storage area	Observation documentation	AMT/ Zone EPA, AMTWSSE		
Traffic congestion /Accident	Develop a Traffic Management Plan and incorporate proposed arrangements for traffic diversions with details of all necessary budgets and signals;	Developed TMP, Warning Signs, posters	Observation documentation	AMT/ Zone EPA, AMTWSSE/ transport office		2,539.1
	Provide temporary road signs or notices to indicate ongoing works;	Available road traffic signs	Observation documentation	AMT/ Zone EPA, AMTWSSE/ transport office		
	The client and Contractor should choose traffic routes to reduce the impact in the neighborhood and any sensitive areas;	Approved detour routs	Observation documentation	AMT/ Zone EPA, AMTWSSE/ transport office		
	Ensure that vehicles for the construction work are operated only by qualified drivers;	Available driving licenses of drivers	Observation documentation	AMT/ Zone EPA, AMTWSSE/ transport office		
	Park all vehicles only at designated parking areas and use spaces for loading and unloading;	Demarcated area for parking	Observation documentation	AMT/ Zone EPA, AMTWSSE/ transport office		

	All of the drivers have to obey the speed limit of vehicles and know the speed limits, particularly in residential areas;	Notice/ sign indicating the speed limit	Observation documentation	AMT/ Zone EPA, AMTWSSE/ transport office		
	Travel speeds of construction vehicles along the road should be controlled by setting travel speeds and informing through signals;	Available traffic signals on the roads	Observation documentation	AMT/ Zone EPA, AMTWSSE/ transport office		
	No drivers or personnel under the influence of alcohol or any drug abuse will be allowed onsite;	Code of conduct signed by the driver	Observation documentation	Town/ Zone EPA, AMTWSSE/ transport office		
	Fencing or placing obstacles to trenches and ditches to avoid interference and accidents of wild and domestic animals and children.	Work area Protecting structures	Observation documentation	AMT/ Zone EPA, AMTWSSE/ transport office		
Spread of communicable disease	Develop a communicable disease management plan	Developed CDMP	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Health office/social affairs		4,062.6
	prepare and enforce a Code of Ethical Conduct (CEC); in the camp to encourage respect for the local community and to maintain the cleanliness of the camp at all times;	Available code of conduct and signed by workers	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Health office/social affairs		
	The workers should periodically be sensitized on the Ethical code of conduct. Translate the code of ethical conduct local language;	Number of training given on CEC	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Health office/social affairs		
	Orient all construction workers and sensitize them about responsible sexual behavior in project communities;	Number of training given on sexual behavior	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Health office/social affairs		
	A safety, health, and environment induction course shall be conducted for all workers two times per year, putting more emphasis on HIV/AIDS;	Number of training given on STDS	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Health office/social affairs		
	Prepare an awareness campaign plan to reduce the risks of spreading HIV/AIDS and other STDs as part of contractual obligation.	No awareness given on HIV/AIDS	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Health office/social affairs		

Social Misdemeanor Conflicts due to the influx of labor	Hire unskilled and skilled labor from the local population as far as possible to minimize on influx of labor into the community;	Employment record of local people	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Social affairs/security		2,708.4
	Effective communication and collaboration are key to addressing the challenges and opportunities presented by an influx of labor;	Challenges resolved by Collaborative work	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Social affairs/security		
	Local governments, businesses, and community organizations to work together to develop strategies for ensuring that workers are paid fair wages;	Strategies developed to minimize the influx of labor	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Social affairs/security		
	Any new employee should be required to sign a code of behavior;	Signed code of behavior (COB)	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Social affairs/security		
	All construction workers shall be orientated and sensitized about responsible social behavior through Workplace education and training in project communities;	Number type of training given on social behavior	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Social affairs/security		
	Awareness has to be given to new comers about the norms, and cultures of the project host community.	Trainings given to new comers about cultural norms	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Social affairs/security		
GBV	Raising awareness and providing training to employees (quarterly) about GBV to reduce incidents of GBV in the workplace;	Trainings given on GBV	Observation documentation	Town/ Zone EPA, AMTWSSE/ Social affairs/security		1,692.8
	Ensure equal pay for women and men for equal jobs;	Payment rates for similar jobs	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Social affairs/security		
	Providing support services, such as counseling, medical care, and legal aid, to employees who experience GBV;	Number of support services given to employees	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Social affairs/security		

	Prepare and implement a code of behavior that among others strictly forbids sexual harassment /GBV and is to be signed by all workers;	Code of behavior (COB) signed by employees	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Social affairs/security		
	Establish disciplinary procedures and sanctions for employees who engage in GBV	Disciplinary procedure applied	Observation documentation	AMT/ Zone EPA, AMTWSSE/ Social affairs/security		
Operational phase						
Air Emissions, Dust and Odor	Plant indigenous trees at the perimeter of the FSTP project area with varying heights as wind breakers;	Number and type of trees planted at FSTP	Observation documentation	AMT/ Zone EPA,	operational phase	3,724.1
	AMTWSSE ensures proper operation to render unfriendly emissions during the discharge of treated leachates due to overloading of the systems or negligence	Available Standardized working procedures	Observation documentation	Town/ Zone EPA,	operational phase	
	Odors generated by the facility can be controlled by the use of suppressants and regular cleaning of the receiving areas;	Application of suppressants, cleaning activities	Observation documentation	AMT/ Zone EPA,	Entire operational phase	
	Control the volumetric BOD loading to be between 100-400 g/m^3 to control odor release;	Testing result of BOD loading	Laboratory reports Observation documentation	AMT/ Zone EPA, AMTWSSE	Entire operational phase	
	Exercise standardized operation working conditions for site management, operation, and proper functioning;	Applied working procedures	Observation documentation	AMT/ Zone EPA,	Entire operational phase	
	Apply ($FeCl_3$) to control the possible generation of H_2S odor in the sludge digestion process;	The application rate of $FeCl_2$ for an odor removing	Observation documentation	AMT/ Zone EPA,	Entire operational phase	
	Regular maintenance (once per year) of FSTP stabilization ponds, removal of accumulated debris and other solids at the inlets and outlets,	Maintained structures	Observation documentation	AMT/ Zone EPA, AMTWSSE	Entire operational phase	
	Repair annually the embankment eroded by rainfall or damaged by rodents and livestock grazing;	The number and type of maintenance done	Observation documentation	AMT/ Zone EPA, PO	Entire operational phase	

	Conducting effluent monitoring BOD (before and after the rainy season) and other key parameters, and adjusting the treatment process as necessary to ensure compliance with discharge limit standards of the country;	Effluent Test result of BOD	Observation documentation	AMT/ Zone EPA,	Entire operational phase	
	Quarterly exercise maintenance and monitoring to avoid accidental surface runoff intrusion from the manholes of the drainage network, which can overburden the facilities and cause foul odors.	Maintenance's performed at the required interval	Observation documentation	AMT/ Zone EPA,AMTWSSE	Entire operational phase	
Polluting Water Resources	Establishing water & and wastewater quality testing laboratory for the regular testing of the effluent;	Available standardize testing laboratory	Observation documentation	AMT Zone EPA,	Entire operational phase	3,385.5
	AMTWSSA should ensure adequate operation and management of all the project components to avoid leakages and discharge of inadequately treated effluent;	Operational manual and procedures	Observation documentation	AMT/ Zone EPA,	Entire operational phase	
	The treated FS can be utilized in Agricultural, industry, energy production, Landscaping, and reclamation;	Amount of Utilized FS for agriculture, biogas, soil amendment, etc	Observation documentation	AMT/ Zone EPA, Agriculture, AMTWSSE	Entire operational phase	
	A quarterly laboratory quality tests for effluent and receiving water resources	Available laboratory test results	Observation documentation	AMT/ Zone EPA,	Entire operational phase	
	Leakages from treatment ponds & and sludge drying beds should be avoided or minimized by regular monitoring & and maintenance of the network;	Reported monitoring and maintenance activities	Observation documentation	AMT/ Zone EPA, AMTWSSE, Enterprises office	Entire operational phase	
	A maintenance crew should be in place to monitor and repair the FSTP which is vital to maintain damage or leakage occurs and to avoid accidental surface runoff intrusion into water points;	Available crew members for monitoring and repair	Observation documentation	AMTWSSE,AMT/ Zone EPA,	Entire operational phase	
	An awareness campaign launched every half a year for all the beneficiaries about proper operation and maintenance of sanitation facilities put in place;	The number of Awareness given per year	Observation documentation	AMT/ Zone EPA,/AMTWSSE	Entire operational phase	

	Emergency telephone lines should be established to enable the public to immediately notify the PO of any damages to the FSTP	Available emergency call information	Observation documentation	AMT/ Zone EPA,/AMTWSSE	Entire operational phase	
Occupational Health and Safety Risks	Hire qualified and trained OHS experts for regular monitoring and management of the fecal sludge treatment plant;	Hired OHS and environmental expert	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	Entire operational phase	5,078.3
	FSTP Workers have to use standardized PPE, protection gears	Type and kind of PPE applied in FSTP	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	Entire operational phase	
	Develop and work on an Environmental Health and Safety Plan	Developed EHSP	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	Entire operational phase	
	Routine maintenance including the removal of garbage, screenings, and grit, slashing around the embankments, and repair of the fence shall be done timely;	Activity reports	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	Entire operational phase	
	Providing appropriate training for workers at FSTP about ergonomic practices ;	The number and type of training given	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	Entire operational phase	
	Provide accessible first Aid in the facility and immediate medical care in case of injuries and accidents;	Available first Aid kit	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	Entire operational phase	
	Develop and maintain accident Log onsite to register all injuries/incidents and investigate their causes;	Documented /Available accident log sheet	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	Entire operational phase	
	Vaccinate all labor working force (hepatitis) at the site and provide regular health examination access;	Type of vaccine and No of staff vaccinated	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	Entire operational phase	
	The FSTP should be fenced and signals put in place with security personnel to stop unauthorized people from accessing;	Signal posted, fenced structure	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	Entire operational phase	
	Exercise regular fumigation of the FSTP stores, administration rooms, and similar places to minimize, and kill disease vectors such as vermin, rodents, and mosquitoes;	Number of fumigations completed per year	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	Entire operational phase	

	Maintain emergency information in an easily available place ;	Information/sign posted/ indicated	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	Entire operational phase	
	Strict follow operation following manufacturer's instructions and Material Safety Data Sheets procedures to store all	MSDS available	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	Entire operational phase	
Landscape and Land Use Impacts	FSTP should have adequate ventilation.	Level of ventilated area	Observation documentation	AMT/ Zone EPA, Agriculture office /AMTWSSE	Entire operational phase	3,216.3
	Incorporating vegetation (trees and shrubs) to improve the visual impact of the facility and provide shade, filter pollutants provide habitat for wildlife;	Number and kind of trees planted	Observation documentation	AMT/ Zone EPA, Agriculture office /AMTWSSE	Entire operational phase	
	Using screening elements, such as fencing, walls, or vegetation, can help reduce the visual impact of the facility and provide privacy;	Fenced structure of toilets	Observation documentation	AMT/ Zone EPA, office / AMTWSSE	Entire operational phase	
	Regular maintenance such as fixing leaks, repairing broken fixtures, and replacing damaged or worn-out parts	Maintenance activity reports	Observation documentation	AMT/ Zone EPA, /AMTWSE	Entire operational phase	
	Regular Staff training about cleaning techniques, maintenance procedures, and customer service handling	Number of staff got training on cleaning	Observation documentation	AMT/ Zone EPA /AMTWSSE	Entire operational phase	
Decommissioning Phase						
Pollution of Soil and Water bodies	Develop a decommissioning plan that outlines the steps and working procedures for decommissioning of the FST	Available decommission plan	Observation documentation	AMT/ Zone EPA /AMTWSSE	Decommissioning phase	4,231.9
	Engage local stakeholders, in the decommissioning process;	Work engagement minutes	Observation documentation	AMT/ Zone EPA /AMTWSSE	Decommissioning phase	
	Conducting environmental quality assessment of the water body and the treated waste	Laboratory test results	Observation documentation	AMT/ Zone EPA /AMTWSSE	decommissioning phase	
	transporting all the hazardous wastes to a predetermined site for treatment, deposal or storage;	Amount of HW transported	Observation documentation	AMT/ Zone EPA /AMTWSSE	decommissioning phase	

	Use the topsoil and subsoil removed form decommissioning will be stored properly and used for backfilling and reinstatement;	Application of top soil for backfilling	Observation documentation	AMT/ Zone EPA /AMTWSSE	decommissioning phase	
	Compact the Back-filling materials to a level similar to the original surrounding soils ;	Rehabilitated area	Observation documentation	AMT/ Zone EPA /AMTWSSE	decommissioning phase	
	Monitor through regular sampling of soil, water, and air to identify any potential contaminants or pollutants.	Laboratory test results	Observation documentation	AMT/ Zone EPA /AMTWSSE	decommissioning phase	
Occupational Health and Safety and Air pollution	Recruiting a qualified health and occupational safety officer who will oversee OHS matters on-site;	Recruited personnel	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	decommissioning phase	2,539.1
	Proper induction/training of the workers related accidents before decommissioning commencement;	Number of training given	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	decommissioning phase	
	Implement ergonomic interventions, such as job rotation or use of assistive devices, to reduce ergonomic hazards;	Level and interval of job rotation	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	decommissioning phase	
	Provide appropriate, adequate PPE to the employees;	Utilized PPE	Observation documentation	AMT/ Zone EPA, work and social affairs, AMTWSSE	decommissioning phase	
	Implementing engineering controls, such as ventilation systems and barriers, to reduce exposure to hazardous materials and physical hazards;	Type of engineering controls applied	Observation documentation	AMT/ Zone EPA, Health office/AMTWSSE	decommissioning phase	
	Trucks will be covered during the haulage of materials to reduce dust emissions	Reduced emissions from trucks	Observation documentation	AMT/ Zone EPA, /AMTWSSE	decommissioning phase	
Socio-economy impact	Based on their skill, knowledge, experience, and interest, vulnerable community groups must be transferred to another secured job opportunity;	Number of Supported workers	Observation documentation	AMT/ Zone EPA, social affairs office/AMTWSSE	decommissioning phase	5416.8
	Provide financial assistance or grants to affected workers or businesses. This can involve providing loans, grants, or other forms of financial support to help workers or businesses transition to new opportunities;	Amount of financial assistance given	Observation documentation	AMT/ Zone EPA, social affairs office/AMTWSSE	decommissioning phase	

	Providing adequate provident fund or pension for those who want to retire;	Amount of Provident fund given	Observation documentation	AMT/ Zone EPA, social affairs office/AMTWSSE	decommissioning phase	
	Providing retraining programs in new industries or skills opportunities for workers who have been impacted by the process. Supporting workers to start their businesses;	Number of training given	Observation documentation	AMT/ Zone EPA, social affairs office/AMTWSSE	decommissioning phase	
Total cost						**66,474.80**

10.3 Implementation Arrangement

Implementation of the project will use the existing institutional arrangement and working team found at AMTWSSE. At AMTWSSE there is an established position for an Environmental Officer and positions for sociologists, which will provide oversight on the implementation of the environment (ESIA) and social(RAP) components of the program. The contractor and supervising consultant to comply with this ESMP and recruit OHS officers to implement and monitor to oversee day-to-day project construction activities and ESMP.

Both the project and site managers should familiarize themselves with the ESMP to execute required environmental, health, and safety supervision roles. The project manager shall have the ultimate responsibility for the implementation of ESMP and will therefore ensure that all of the resources are duly provided and ensure staff are adequately inducted and trained at the site regarding ESMP including emergency procedures. The Contractor's site supervisors and foremen will ensure that the provisions in this ESMP are implemented within the sites under their supervision and collect and transmit relevant information to the environmental and occupational safety and health Officers.

During the construction phase of the project, the responsibility for implementing ESMP will be of the contractor, AMTWSSE, AMT bureau of Health, AMT, and regional environmental authority. During the operation and maintenance of the FSTP works, the responsibility will be mainly under the AMTWSSE.

AMTWSSE has environmentalist and social safeguards but since the technology is new to the area, they do not have sufficient experience and capability for dealing either with the implementation of environmental mitigation measures or monitoring of various environmental quality parameters. Hence experts and operators will require training and expertise assistance to perform the ESMP environmental monitoring plan. The proposed training program for different staff with their field of training is given in Table 31 below in addition to on-the-job training by the environmental consultants.

Table 31 Training Programs for Capacity Building and associated costs

Target Group	Training title	Training content	Duration (Days)	Time	Trainer	Cost in USD
Top Management AMTWSSE/PMU monitoring Staff	Environmental management	Awareness of Environmental Management; Legal requirements; and National environmental standards	3	2X/year	AMTWSSE MoWE Environmental consultant	10,156.6
AMTWSSE Staff, regional water and energy bureau), Health officers, EPA, and other relevant stakeholders	Environmental supervision, monitoring, and reporting	Public health and safety of FSTP management; Community participation in environmental supervision monitoring; Risk assessment, response, and control; Awareness creation	3	2X/year	AMTWSSE MoWE Environmental consultant	5,924.7
On-site construction management staff; environmental and social safeguard staff; village /group authorities	Implementation of mitigation measures	Overview of environmental monitoring; Requirements of environmental monitoring; Role and responsibilities of contractors; monitoring forms and guide how to fill in the forms and risk report; Preparation and submission of reports; Grievance handling and reporting; GBV reporting	2-3	1x/year	AMTWSSE MoWE Environmental consultant	846.4
Representatives of community and/or worker leaders	Environmental sanitation and safety	Environmental and Social safeguards; Safety and health issues; Environmental Pollution risks and management; Mitigation measures at construction sites; Procedures to deal with emergency situations	2	2X/Year	AMTWSSE MoWE Environmental consultant	3,385.5
Core Process head, FS Emptying Customer Service Team Leader, Head of Finance	Customer service management	Marketing (promotion), customer handling; record keeping and reporting; financial management	3	2X/Year		5,078.3
Core Process head, FS Emptying Customer Service Team Leader, SludgeTruck Drivers Sludge Emptying Crew	Safety measures for proper FS emptying	Training on risks, safety measures, and good practices for FS sludge collection and conveyance	3	2X/Year	AMTWSSE MoWE Environmental consultant	5,078.3
Core Process FSTP Team Leader FSTP operators	Operation and maintenance Staff	Treatment plant operation principles; operation and maintenance procedures and treatment processes	3	2X/Year	AMTWSSE MoWE Environmental consultant	5,924.7
Utility Director, Core Process head, FS EmptyingCustomer Service, Team Leader FSTP Finance Team	Leadership and communication	Training on group coordination, team leading, and Communication	3	2X/year	AMTWSSE MoWE Environmental consultant	6,771.1
Total estimated cost						**50,782.9**

10.4 ESMP Implementation costs

The above ES Management and Monitoring Plan tables summarized the main possible negative impacts, nature of the receiving environment, possible mitigation measures, expected outcomes, monitoring indicators, monitoring plan, responsible institution for monitoring, time duration, and cost estimations in USD.

Even though it is very rough and subjective the overall ESMP cost estimated during construction, operation, and decommissioning phase is about **168,831.10 (One hundred sixty eight thousand eight hundred thirty one) USD.** This price estimation is not exhaustive due to the very wide nature of the study and market dynamics. Thus assuming the market dynamics and complexity of the study, the price estimation might have an error of **±30**% of the current value.

Table 32 Summary of Budget Estimate for ESMP

No.	Component	Project phase	Reference	Estimated cost in USD 1 USD = 118.15 Eth Birr
1	ESMP	Throughout all phases	Table 34	36,225.10
2	Environmental and Social Monitoring	Throughout all phases	Table 35	66,474.80
3	Training and capacity building	Throughout all phases	Table 36	50,782.90
	Subtotal 1+2+3			153,482.80
	Contingency 10%			15,348.30
	Total			**168,831.10**

10.5 Reporting

Reporting is an important aspect of any construction project, as it provides a means of communicating progress, issues, and other key information to stakeholders.

During construction, concise monthly monitoring reports should be compiled by the contractor. The report will highlight the different activities undertaken to manage environmental and social aspects of the project in line with contract specifications, laws, standards, policies, and plans of Ethiopia and WB safeguard policies.

The report will be discussed during the monthly progress meetings among the zone/town EPA, the project office, the contractor, and other stakeholders as necessary. The Environmentalist and Social Specialist for the supervising engineer will approve the contractor's monthly environmental and social monitoring report which will then be transmitted to the Environmental Protection Agency (EPA) and the project office for final approval. The EPA's Environmental Management and Social Specialist will also independently monitor the implementation of the ESMP and/or verify the accuracy and content of the contractor's monitoring report and may give further advise or instructions, including temporary/permanent suspension of the project, if in case there would be any non compliance issues. . The report will also be shared with the MoWE, WB, and other relevant stakeholders at least on quarterly bases. Approval of the environmental monitoring report will be the basis for the supervising engineer to approve payment of the respective environmental and social Bill of Quantity (BoQ) items.

During the operation phase monitoring mostly relies on the EPA and the project office for effective project execution. The role of the project office is both implementing and internal monitoring. Environmental safety officer at AMTWSSE is responsible for controlling the overall implementation and monitoring of the project. The System already started and a new E&S expert has been recruited in line with the UWSSPII proposal to undergo such activities. The EPA monitoring reports should be shared with the project office, regional EPA, and MoWE for further remedial actions. Besides EPA has a mandate, or order the project office to hire consultants, conduct audit studies, and disclose the findings to interested public bodies as a regulatory requirement (National EIAproclamation 299/.2000).

10.6 Environmental Audit

Environmental audits can provide a valuable tool for organizations to evaluate their environmental performance, identify opportunities for improvement, and demonstrate their commitment to sustainable development. Audits will be necessary both during construction and project operation. While construction audits will aim to verify compliance to impact mitigation requirements, post-construction audits are a regulatory requirement to ensure effects and compliance monitoring and the implementation of the mitigation measures within 12 months and not more than 24 months after the start of the operation of the FSTP. Both construction and post-construction audits can be conducted internally by the project office or by a Consultant hired by the project office with technical support from FSTP.

10.7 Grievance handling procedure

A grievance handling procedure is a process used by organizations to address and resolve complaints or grievances raised by employees or other stakeholders. The procedure typically outlines the steps that should be followed when a grievance is raised, including who should be involved in the process, how the grievance will be investigated, and the expected timeline for resolution.

This section describes the avenue for affected persons to lodge a complaint or express a grievance against the project, its staff, or contractors during project implementation. It also describes the procedures, roles, and responsibilities for addressing grievances and resolving disputes. Every aggrieved person shall be able to trigger this mechanism to quickly resolve their complaints.

The objectives of the grievance handling are to:

- Ensure that appropriate and mutually acceptable corrective actions are identified and implemented to address complaints;
- Verify that complaints are satisfied with outcomes of corrective actions;
- Avoid the need to resort to judicial proceedings.

The grievance mechanism at each project facility will be fed from four main sources:

- Project-affected persons(PAPs) or project affected Households (PAHs)
- Local community residents and the respective local leaders;
- Supervising engineer, clerk of works, or contractor; and

- Monitoring team who will forward issues/concerns identified in the field.

According to the RPF (2016), the grievance resolution committee is indicated in Table 33 .

Table 33 Grievance Resolution Committee

No	Institution/ individual representation	Role
1	Municipality representative	Chairperson
2	Community representative	Member
3	Representative of PAPs	Member
4	Women affairs	Member
5	Two respectable citizens from society including one from the underserved community, one of them should be women	Members
6	Representative of implementing agency	Secretory and member

Steps of the grievance process

Step One: ***Receipt of complaint***

A verbal or written complaint from a complainant will be received by the Clerk of Works or Grievance Redness Committee and recorded in a complaints log S (he) keeps on-site. The log will indicate grievances, the date lodged, action taken to address the complaint or reasons the grievance was not acted on; information provided to the complainant, and the date the grievance was closed. Grievances should be lodged at any time, either directly to the Clerk of Works, Grievance Redness Committee (project office), or through the local council chairperson. The process for complaining is:

- Clerk of works on site or project office receives a complaint(s) from the complainant and records it in a log (in Amharic);
- The Clerk of Works or Grievance Redness Committee reads the recorded grievance for the complainant to confirm correct detail of the complaint has been documented;
- Both the complainant and clerk of work or Grievance Redness Committee sign the log to confirm grievance was accurately recorded.

Step Two: Determination of corrective action: If in his/her view, a grievance can be solved at this stage, the Clerk of Works or Grievance Redness Committee will determine a corrective action in consultation with the aggrieved person. Remedial action(s) and the frame within which they must be accomplished have been described and the person responsible for implementing them will be recorded in the complaint log. Grievances will be resolved and status reported back to complainants within 5 days. If more time is required this will be communicated clearly and in advance to the aggrieved person. For cases that are not resolved within the stipulated time,

detailed investigations will be undertaken and results discussed not more than 15 from lodging a grievance.

Step Three: Meeting with the complainant: The proposed remedial action and the timeframe in which it is to be implemented will be discussed with the complainant within 5 days of receipt of the grievance. Consent to proceed with the corrective action will be sought from the complainant and witnessed by a local government chairperson.

Step Four: Execution of Corrective Actions: Mutually agreed corrective action will be commenced by the project office or its contractor within the agreed time frame. The date of the completed action will be recorded in the log against the complainant's grievance.

Step Five: Verification of the Remedial Actions: To verify satisfaction, the aggrieved group or person will be asked to return if not satisfied or bring the case to court with the corrective action.

Step SIX: Action by the project office and/or the contractor: If the project office or contractor cannot solve the grievance within 15 days, S (He) will refer it to court through the social safeguard and or occupational safety and health professional. It is believed that most of the possible grievances can be solved at this level.

11. Conclusion and Recommendations

11.1 Conclusion

Fecal sludge management (FSM) is a complex challenge in many parts of Africa. In developing countries access to safe and sustainable sanitation services is limited and its management requires a comprehensive and multi-faceted approach. In line with this, AMT planned to construct FSTP in collaboration with FDRE MOWE (technical support) and WB (financial support). The project plan to rehabilitate the existing fecal sludge treatment plant construct a new FST.The findings of the environmental impact assessment of the proposed project results in both positive and negative impacts. FSTP can contribute to sustainable development by improving public health, protecting the environment, reducing open defecation, recovering valuable resources, creating job opportunities, and improving access to sanitation services in town and the nation at large. The long-term environmental and social benefits include reduced morbidity and increased productivity of households; increased enrolment of children in educational institutions and improved tourist destination and economic development.

The ESIA study identified major negative impacts during the construction and operation phases as follows; involuntary displacement, land expropriation, property damage, biodiversity disturbance, landscape and integrity change, water, air, and noise pollution, social misdemeanor, and related others. These impacts can be minimized by applying the indicated mitigation measures outlined in the ESMP of this report. The AMTWSSE project office, municipality, and the contractor have to work hand in hand for the implementation of proposed mitigation measures. The regulatory work, monitoring, and evaluation mostly rely on the Zone/ town EPA, WB in addition to the project office itself. For the PAHs, the local community (youth Women, vulnerable group's kebele leaders) should properly involved in the compensation procedure, study, and decision-making to minimize grievance and ensure tenable benefits from the project development.

In conclusion, if the FSTP operates in conformity with the legal requirements provided in the ESMP, the benefits of the project to the nation will be by far outweighing its potential negative effects.

11.2 Recommendations

The implementation of the project in AMT will bring positive outcomes for the socioeconomic and environment. And hence the project is duly suggested to proceed following the application of mitigation measures described in the environmentaland social Management/monitoring plan (ESMP). For the effectiveness and timely implementation of mitigation measures, the EMP shall be included in the bid document of civil works and need to become part of the civil works contracts. Strict observation of environmental and social management and monitoring plans are required

- As a living document, the monitoring activities that have been outlined in the ESIA report have to be exercised and respond to the regular environmental monitoring results, collection, and analysis of detailed bio-physical and environmental data.

- Ensure that worker's occupational health and safety standards are maintained through capacity building, proper training, and providing protective clothing;
- The project proponent is to provide reports, and transparent and accessible information on environmental performance to stakeholders and regulatory authorities.
- Annual environmental audits should be carried out on the project to ensure compliance of the project with the mitigation measures outlined in the Environmental and Social Management Plan (ESMP);
- Involvement of all relevant stakeholders is proposed throughout the process to ensure project acceptability;

References

ESMF (2017), Environmental and Social Management Framework Final, Urban Water Supply and Sanitation Project Phase II. Ministry of Water, Irrigation and Electricity, Federal Democratic Republic of Ethiopia, Addis Ababa, Ethiopia. Unpublished report

Krueger, R. A., & Casey, M. A. (2002). Designing and conducting focus group interviews.

MoWIE(2017). Ethiopia Second Urban Water Supply and Sanitation Project (UWSSP II) Ministry of Water, Irrigation and Electricity, the World Bank Group; Addis Ababa

Muellmann, S., Brand, T., Jürgens, D., Gansefort, D., & Zeeb, H. (2021). How many key informants are enough? Analyzing the validity of the community readiness assessment. BMC research notes, 14(1), 1-6.

Oliver Jones (2015), Monitoring sanitation and hygiene in rural Ethiopia: A diagnostic analysis of systems, tools, and capacity. Water and sanitation program: Technical paper, water and sanitation program, the World Bank Group. www.wsp.org.

RPF (2016), Resettlement Policy Framework, Revised Draft, Urban Water Supply and Sanitation Project-II Federal Democratic Republic of Ethiopia Ministry of Water, Irrigation and Electricity; Addis Ababa, Ethiopia, Unpublished report

Stamatiadis, S., Werner, M. and Buchanan, M., 1999. Field assessment of soil quality as affected by compost and fertilizer application in a broccoli field (San Benito County, California). Applied Soil Ecology, 12(3), pp.217-225.

TOR (2019), Terms of Reference for Environmental and Social Impact Assessment Consultancy. Urban Water Supply and Sanitation Project Phase II Five Secondary Cities. Addis Ababa, Ethiopia, Unpublished report

National Discharge Limit (2003); Guideline Ambient Environment Standards for Ethiopia, the Environmental Protection Authority and the United Nations Industrial Development Organization, August 2003, Addis Ababa

Appendix

Appendixes	Appendix title	Attached document
1	List of study Team in charge of the ESIA	Appendix 1 Team in charge of the ESIA AMT.zip
2	Public consultation meetings and engagement participants	Appendix 2 Community consultation minutes and participants AMT.zip Anex 2 Consultation minute AMT New.zip
3	Chance Find Procedure	Appendix 3 Chance Find Procedure AMT.zip
4	List of consulted stakeholders	Appendix 4 List of Consulted people at AMC ESIA.zip
5	Environmental Guidelines for Construction Contractors	Appendix 5 Environmental Guidelines for Construction Contractors AMT.zip
6	TOR	Appendix 6 TOR MOWE 2ND UWSSP.zip
7	Data collection tool	Appendix 7 Data collection tools.zip
8	List of Tripartite participants	Appendix 8 List of Tripartiate discusion attendants.zip