ውሃና ኢነርጂ ሚኒስቴር

MINISTRY OF WATER AND ENERGY

የኢትዮጵያ ፌዴራላዊ ዴሞክራሲያዊ ሪፐብሊክ | Federal Democratic Republic of Ethiopia

Second Urban Water Supply and Sanitation Project

Environmental and Social Impact Assessment

(Fecal Sludge Management Project, Degahbur Town)

[Final Report]

Motion Consultancy &Training PLC

Telephone: *+251-118691799*,

Email: mctethio@gmail.com

Financed By

WORLD BANK

November 2023

Addis Ababa

ውሃና ኢነርጂ ሚኒስቴር
MINISTRY OF WATER AND ENERGY
የኢትዮጵያ ፌደራላዊ ዲሞክራሲያዊ ሪፐብሊክ | Federal Democratic Republic of Ethiopia

Environmental and Social Impact Assessment

(Fecal Sludge Management Project for Degahbur Town)

[Final Draft Report]

Second Urban Water Supply and Sanitation Project

Financed By

WORLD BANK

November 2023
Addis Ababa

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

ABR	Anaerobic Baffled Reactor
DWSSA	Degahbur Water Supply & Sewerage Agency
BOD	Biological Oxygen Demand
BP	Bank Procedures
SRS EPA	Somali Regional State Environmental Protection Authority
CBOs	Community Based Organizations
CITES	Convention on International Trade in the Endangered Species of Fauna and Flora
CR-WSP	Climate Change Resilience Water Safety Plan
CSE	Conservation Strategy of Ethiopia
EA	Environmental Assessment
EEPO	Establishment of Environmental Protection Organs
EPA	Environmental Protection Authority
EPC	Environmental Pollution Control
EIA	Environmental Impact Assessment
EPE	Environmental Policy of Ethiopia
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EHS	Environmental Health and Safety
FDRE	Federal Democratic Republic of Ethiopia
FSM	Fecal Sludge Management
FSTP	Fecal Sludge Treatment Plant
GoE	Government of Ethiopia
GHG	Greenhouse Gas
GTP	Growth and Transformation Plan
GBV	Gender Based Violence
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
HASP	Health and Safety Plan
HNAP	Health National Adaptation Plan to climate change
HSDP	Health Sector Development Program
IEC	Information Education & Communication
IFC	International Finance Corporation
ITCZ	Inter Tropical Convergence Zone
MoH	Ministry of Health
MoWE	Ministry of Water and Energy
MoWIE	Ministry of Water, Irrigation & Energy
NGO	Non-Government Organization
OP	Operational Policy
PAP	Project Affected People
PCT	Public and Communal Toilet
PPE	Proper care of Protective Clothing and Equipment
POPs	Persistent Organic Pollutants
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SA	Sexual Abuse
SEA	Sexual Exploitation and Assault
SEP	Stakeholder Engagement Plan
STD	Sexually Transmitted Disease
ToR	Terms of Reference
TMP	Traffic Management Plan
UWSSP-II	2nd Urban Water Supply and Sanitation Program
UWWM	Urban Waste Water Management
WASH	Water, Sanitation and Hygiene
WB	World Bank
WB's (EHS)	World Bank Environment, Health & Safety
WHO	World Health Organization
WIF	WASH Implementation Framework

EXECUTIVE SUMMARY

INTRODUCTION

This report presents an Environmental and Social Impact Assessment (ESIA) for the upcoming Fecal Sludge Treatment plant (FSTP) project in Degahbur town, Ethiopia. It also discusses alternative options for the proposed technologies (FSTP technologies). Degahbur City is the administrative center of Fafan Zone of the Somali Regional Sate. The town has a projected total population of 48,672 (Males 25,888, Females 22,784) as of July 2023[1]. The population increased by 70% between 2007 and 2022, which puts pressure on available sanitation infrastructures and services. Due to the lack of improved waste treatment system, waste management entirely relies upon on-site practices with the majority of the population utilizing different types of pit latrines with or without a soak-away system. Only One publicly owned sludge emptying truck is functional for liquid waste/sludge collection-emptying and transportation in Degahbur town.

The town Water Supply and Sewerage Authority (DWSSA) is currently implementing the 2nd Urban Water Supply and Sanitation Project (UWSSP-II), which the World Bank supports. The primary objectives of the project under the UWSSP-II are to construct 11 (eleven) new type II communal toilets and 2 type II public toilets, provide 2 (two) additional emptying trucks with a capacity of 8 cubic meters, and construction of new FSTP in the short-term in the Degahbur town to improve the sanitation problems for the town.

The infrastructure development may bring adverse environmental and social impacts that need efforts to minimize the negative impacts and set mitigation measures to make the project environmentally safe and socially acceptable. Without proper planning and management, the project may have severe economic, social, and environmental impacts. Hence, this assignment aims to provide an insight into the possible environmental and social impact analysis which can occur due to the design, construction, and operation of the proposed FSTP. In connection with this, the Ministry of Water and Energy (MoWE) signed a consultancy service contract with Motion Consultancy and Training PLC. to undertake the ESIA study for the FSTP Construction project in Degahbur town.

The overall objective of the ESIA is to identify, predict, and evaluate the potential impacts of the proposed project on the biophysical, social, and economic environment in terms of magnitude, spatial extent, duration, and significance. The study also aims to provide recommendations for enhancing the beneficial impacts and mitigation measures for the adverse impacts as well as the environment and social management and monitoring plans that would help implement the recommended enhancement and mitigation measures.

METHODOLOGY

The ESIA study followed the environmental and social management framework (ESMF) for UWSSP-II[2], the Government of Ethiopia (GoE) environmental and social impact assessment proclamation, ESIA guideline and the World Bank's safeguards policies. As such, a scoping exercise was carried out as an initial step of the ESIA study. The scoping exercise aimed to determine the scope of work to be undertaken in assessing the proposed project's likely environmental and social impacts. The scoping exercise involved field reconnaissance visits, a literature review, and comprehensive consultations with relevant stakeholders. The scoping exercise leads to a detail assessment and analysis of potential environmental and social impacts. Based on these findings and expert judgment, the consultant has compiled the projected social and environmental impacts (positive and negative) likely to emanate from proposed project activities and the

Environmental and Social Management (ESMP) and Monitoring Plans, which details how adverse impacts and risks will be reduced or eliminated and by whom.

DESCRIPTION OF THE PROPOSED PROJECT

The project area for the proposed fecal treatment plant is found in the south of the city located at GPS coordinates 8°11'02.95"N and 43°34'42.66"E. The project site has a gentle slope and is favorable for construction. The project requires a total of 3.2 ha of land for Fecal Sludge Treatment site, including a buffer zone. The land ownership of the project site is communal or public and will be acquired easily without compensation.

To select the site multi-criteria analysis was used and sites was evaluated against certain criteria, taking into consideration the nature of the work and the socio-environmental condition of the sites. The criteria include proximity to social and cultural amenities, proximity to natural resources, accessibility & distance from the town, exposure to risk of flooding and land use and cover.

- No settlement, sensitive environment such as schools, mosque, churches, or other infrastructure to the proximity of FSTP site. Settlement is more than three km far from the site.
- There is no also any sensitive conservation areas and water bodies within 1 km radius from the FSTP. The Jerer River is more than 1 km far from the site.

The design assumed to serve the projected population of the town in the next five years and will have a capacity of 12.3m³/day or 3154m^3/year. The FSTP need subsequent upgrading to serve the increasing population number in the next 20 years.

The treatment process comprises course screening solid, liquid separation, solid line treatment, and liquid line treatment, tertiary treatment for liquid effluent, and Bio solids treatment and management. In the first unit, the liquid and solid parts of the fecal sludge will be separated. The solid part goes to solid treatment lines (unplanned drying bed). Collected leach-ate (liquid part) goes to the liquid treatment units called waste stabilization ponds and will be treated in a series of ponds, which include anaerobic ponds, facultative pond, and maturation ponds. Where the main function of these structures is the destruction of pathogens, they also carry out polishing of the wastewater to achieve the stands for Biological Oxygen Demand (BOD) and suspended solids. The dried sludge will be stored for an extended time for further dewatering and treatment. The final liquid will enter the constructed wetland for further treatment to ensure safe reuse or discharge to the nearby River.

The project component includes ***Inlet, Screening, and Grit Removal Channels*** *(two* coarse bar Screen channels and two in number grit Removal Channels); ***Thickening tanks and settling tanks (***Two thickening tanks and a settling tank each with a volume of 180 m^3); 3 in number reinforced concrete ***sludge drying beds; WSP*** (two Anaerobic pond, two facultative pond, and two Maturation pond); constructed wetland; ***Connection and Pipelines (***680 meters in length); and ***Final Effluent Chamber, Discharge Outfall (*** approximately 550 meters long). A warehouse of 200 m² will be constructed on the FSTP site for dried sludge storage.

The ancillary works include an office, guard house, internal paves and internal access roads, laboratory, warehouse and fencing & gate, drainage appropriate drainage for the whole site to avoid flooding conditions, water tanks and water and electrical connections. It also has landscaping of the treatment works site, and open areas shall be covered with trees, attractive plants, and bushes.

Project Cost:
Project capital cost is estimated to be USD 2,285,587.00. However, this is an estimate which may be subject to changes during the course of construction works and operation. The construction work is estimated to take about 22 months.

POLICIES, LEGISLATIONS AND INSTITUTIONAL FRAMEWORK

Relevant National Policies and Strategies

The Constitution of the Federal Democratic Republic of Ethiopia (1995) establishes the fundamental principles and legal provisions for all legislative frameworks within the country. Within this Constitution, the concepts of sustainable development and the people's environmental rights are specifically outlined in Articles 43 and 44. These Articles, along with others, guarantee the right to development, the right to reside in a clean and healthy environment, and the right to receive compensation, including assistance from the state, for individuals displaced or negatively impacted by government programs. Additionally, Article 35 serves as a basis for recognizing and protecting women's rights, ensuring equal rights between men and women.

The Environmental Policy of Ethiopia (1997) aims to enhance all Ethiopians' overall health and quality of life. Other relevant policies issued by the Government of Ethiopia (GOE) including Water Resources, Wildlife, Population, Health, HIV/AIDS, and Women Policies, etc., have been reviewed. Applicable strategies and programs include the Climate Resilient Green Economy Strategy, Urban Wastewater Management Strategy, Health National Adaptation Plan to Climate Change (HNAP); the Second Urban Water Supply and Sanitation Program (2017 to 2022); Integrated Urban Sanitation and Hygiene Strategy; National Hygiene and Sanitation Strategy; Water, Sanitation, and Hygiene (WASH) Implementation Framework and Climate Change Resilience Water Safety Plan (CR-WSP) Strategic framework, Environmental and social framework for USWSSP-II, etc., have been reviewed. In addition, Proclamation on Environmental Pollution Control, Proclamation on Ethiopian Water Resources Management, Proclamation on Hazardous Waste Management, Proclamation on Forest Development, Conservation and Utilization, Proclamation on Research and Conservation of Cultural Heritage, Wildlife Protection Proclamation, Land Laws-Expropriation and Payment of Compensation and other relevant laws have been reviewed.

The World Bank's Environmental Assessment (EA) policy (OP/BP 4.01) and the Physical Cultural Resources (OP 4.11) shall at least be applicable as part of the construction and operational phases of the proposed subproject.

DESCRIPTION OF BASELINE CONDITIONS

Physical Environment

The town has an average elevation of 1,044 meters above sea level. It is found approximately 795km southeast of Addis Ababa and 160km southeast of Jigjiga along the highway that connects Jigjiga and Kebridehar.

The city is characterized by a hot climate, ; the maximum monthly average temperatures in Degahbur range between 28.0 °C and 34.1 °C, while the minimum monthly average temperatures range from 11.4 °C to 20.2 °C. The mean annual rainfall in Degahbur is 321 mm.

Biological Environment

An observation-based biodiversity assessment was made at the proposed project site. The proposed FSTP site has been identified as an area of neither significantly sensitive natural vegetation cover nor an important cultural amenity. There are no sensitive natural habitats and wildlife or any other forms of protected areas at or in the vicinity of the project sites. The selected FSTP site is barren and with scattered bushes and shrubs.

Socio economic Environment

The total population of the study area is estimated to be 48,672 (Males 25,888, Females 22,784) as of July 2023. Degahbur town is divided into 9 kebeles (lowest administration level).

There are different institutions and infrastructures in the town. These include schools, pharmacies, residential houses, clinics, market areas, road networks, hospitals, universities & colleges, manufacturing industries, farms, and other institutions and facilities. None of the observed institutions and infrastructures is expected to be directly affected by the construction of FSTP.

PROJECT ALTERNATIVES

This ESIA study was conducted in joint meetings and discussions with the parties involved in the feasibility study and design consultants. During the feasibility and ESIA studies, alternative sites and alternative technologies were assessed, analyzed, compared, and recommended.

Different alternative FSTP technologies were reviewed and compared to select the best solids and effluent treatment as well as dry sludge treatment technologies used to process and dispose of sludge. These include unplanted Drying Bed, Planted Drying Bed, Geotextile de - watering Bag and Mechanical methods for solid treatment; waste stabilization pond, thickening filter, aerated lagoon, and oxidation ditch for effluent treatment; and storage for an extended period, solar drying with composting; and black soldier fly for bio-solids treatment**.** These alternative technologies were evaluated and ranked based on technical feasibility (easy operational and maintenance), cost, technical feasibility, and environmental impacts. The ESIA team also evaluated the alternative technologies, emphasizing the Environmental and social factors.

Accordingly, a combination of unplanted drying beds (solid treatment) + waste stabilization ponds (for liquid part treatment) + constructed wetland (tertiary treatment), and storage for extended periods for dry sludge treatment were selected. The selected technologies' capital and operation and maintenance costs and skills requirements are comparable. In addition, its electrical energy requirement is low or not needed, and it uses local and natural materials for the construction of the facility, which again has a low cost.

In the alternative ‘without project’ analysis, it was found that the ‘without project’ option is not acceptable, and it is recommended that the envisaged project be implemented to address the shortage of sanitation facilities in the town.

PUBLIC AND STAKEHOLDER CONSULTATION

Consultation meetings were conducted with key stakeholders and project proponents to present the proposed project and get feedback from the stakeholders and local community on the project contents and its possible impacts. Accordingly, consultations were made with DWSSA, Environment protection, the mayor's office, the office of Agriculture, women's affairs, the health office, land Administration, and youth representatives at the town and regional levels. Consultation was done with the project community around the project area.

The findings of the consultations conducted with the above-mentioned actors reveal that all the stakeholders have interest in the implementation of the project. The main issues/concerns raised by the stakeholders and recommendations provided include the following

a) Odor and Aesthetic effect,
b) Dust pollution during construction, and
c) Management of liquid waste (effluent treatment) and its impacts to the natural environment,

POTENTIAL IMPACTS AND MITIGATION MEASURES

FSTP construction project is proposed mainly to improve the quality of the social and natural environment of Degahbur. The existing sanitation situation in the town is very poor and below the standard. Though construction and operation of the proposed FSTP is a well-recognized solution to overcome the existing environmental pollution and associated health impacts, some impacts are expected to occur during the construction, operation and decommissioning phases of the project. Adverse impacts are characterized by type, magnitude, nature, spatial extent, and impact duration, and assessed for significance.

Impacts during Construction Phases

The main positive impact during the construction phases is job creation for skilled and unskilled workers, particularly for the jobless youth in the project area and for national contractors and consultants. Proposed enhancement measures include prioritizing the local communities, women, and job training and capacity building for potential workers.

There are several potential adverse impacts associated with the proposed project. These include Clearance of vegetation, air pollution due to vehicle movement and site preparation, noise pollution caused by vehicles, soil compaction and soil erosion, spillage of pollutants and wastes that can lead to water bodies pollution, traffic accident risks, occupational health and safety risks, landscape alteration, public health risks (spread of SDTIs including HIV/AIDS), Gender Based Violence (GBV)/ Sexual Exploitation Abuse (SEA), and potential conflict between migrant workers and locals over employment opportunities.

The identified impacts are predicted to be moderate to high, short-term, reversible, and direct adverse impacts. However, appropriate mitigation measures can be taken to minimize these impacts to acceptable levels. Such measures will include regular inspections and maintenance of equipment and vehicles, water spraying on all sources of dust, implementing reasonable speed limits, and adhering to WHO and Ethiopian maximum allowable noise level standards around the camps. Additionally, proper storage and handling of hazardous substances, provision of personal protective equipment (PPEs), awareness creation on health, safety, and traffic accidents, posting visible signs and using barricades at appropriate locations, road rehabilitation, planting trees, providing job opportunities to locals, and raising awareness on HIV/AIDS and other infectious diseases.

Impacts during Operation Phase

Most of the beneficial impacts of the project significant impact will be the improved quality of health resulting from the proper management of fecal matter. Instead of being indiscriminately dumped and eventually draining into rivers, where others may come into contact with it, the FSTP project will ensure that fecal matter is managed in a more systematic and hygienic manner. Furthermore, the availability of manure, which is a byproduct of the FSTP project, will contribute to increased agricultural productivity in the area. This will prove beneficial for local farmers and potentially lead to a boost in agricultural output. Overall, the

operational phase of the FSTP project holds immense potential for positive change in Degahbur town and its residents.

The operation phase of the treatment plant may have negative impacts such as unpleasant odors caused by H_2S, contamination of groundwater and surface water due to leakage or overflow, soil pollution by hazardous substances like heavy metals at the temporary sludge storage site, public health and safety hazards due to spillages or discharge of sewage and uncontrolled sludge spreading, as well as exposure to H_2S. Spread of malaria is also one of the adverse impacts.

During the operation phase, certain negative impacts can occur, which are identifiable, reversible, and have moderate to high significance, with long-term effects. These impacts can be minimized by adhering to national legal frameworks, creating adequate buffer zones from 400 to 500m around the treatment plant, planting trees to reduce nuisance odors and improve the aesthetic view, taking steps to prevent vandalism, and ensuring that the treatment process sites are inaccessible to the public by installing fences. Other steps include: applying aeration, proper chemical dosing, oxidation or pH adjustment to reduce offensive odor; covering tanks or installing exhaust hoods; operating at the minimum design conditions; applying efficient housekeeping procedures; and conducting regular facility maintenance and monitoring.

Impacts during decommission phase

At the end of the design life of the FSTP, DWSSA could upgrade or decommission the treatment plants. During this phase, it is important to consider the potential adverse impacts that may arise assuming that the waste treatment plant will be decommissioned at the end of its design lifetime. These impacts include the release of dust and other pollutants during the dismantling and demolishing process, soil and water pollution if contaminated soil is dumped outside the designated area or a properly designed sanitary landfill is not used, loss of job opportunities, and adverse effects on workers' health and safety due to dismantling concrete structures and reinstating the areas. The identified adverse impacts of the decommissioning phase are possible, reversible, of low to moderate significance, and temporary.

Mitigating the negative impacts of demolishing structures can be done through systematic demolition that considers the reuse of materials for other purposes. Wetting materials before demolishing them, avoiding burning any material, and avoiding all contaminated soil from treatment plant sites are also important. Disposing of contaminated soil at designated waste disposal sites or sanitary landfills, creating job opportunities in related projects, and securing pension benefits for eligible workers are essential. Planning decommissioning ahead of time to avoid sudden stops of the treatment plant before completely treating the influent is also crucial. Providing appropriate personal protective equipment (PPE) for workers, reinstating the treatment plant sites after they stop functioning, and removing and disposing of all unwanted structures at designated waste disposal landfills are also important. Most importantly, organizing, training, and promoting workers to establish their own small-scale enterprises through loan or financial support facilitation is necessary. Creating links with appropriate government agencies and financial sources can also help.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The Environmental and Social Management Plan (ESMP) for the proposed project Ethiopia includes measures to mitigate and address adverse environmental and social impacts. The plan guides preventing, controlling, and reducing negative impacts throughout the project's phases. It outlines the roles and responsibilities of stakeholders involved in implementing and monitoring project operations. The ESMP contains binding commitments for the project proponent, establishes environmental and social performance

standards for contractors and suppliers, and can be used to develop a management system for the project's operational phase. The ESMP ensures effective environmental and social management throughout the project life cycle.

ENVIRONMENTAL AND SOCIAL MONITORING PLAN

This plan encompasses methodologies and indicators that are appropriate for the project. It covers air and water quality, noise levels, biodiversity, waste management, community health, and social well-being. The plan clearly outlines the frequency and duration of monitoring activities and identifies the parties responsible for conducting and reporting the results. To ensure transparency and accountability, the monitoring program should involve internal and external stakeholders, including government agencies, local communities, and non-governmental organizations. Public participation and feedback should be encouraged to enhance the monitoring process.

Regular communication of monitoring results is essential to keep all relevant stakeholders informed. This includes the project proponent, regulatory authorities, affected communities, and the general public. By sharing these results, informed decision-making can occur, and timely corrective actions can be implemented if necessary.

IMPLEMENTATION ARRANGEMENTS AND CAPACITY BUILDING

DWSSA has an established and functional position for an Environmental Officer and positions for social safeguard expert, which will provide oversight on the implementation of the environmental (ESIA) components of the program. It is further planned that oversight on environmental issues will be supplemented through the recruitment of additional environmental and social safety experts by the supervising consultant and the contractor once the project commences. In the interim, this staffing arrangement is deemed adequate. Similarly, the Somali Region Water, Energy and irrigation Bureau, and the Ministry of Water and Energy also have the required Environmental and Social safeguard officers to support the project.

The responsibility for implementing the ESMP of the supplemental ESIA during construction will be of the contractor and DWSSA. During the operation and maintenance of the FSTP works, the responsibility will be mainly under the DWSSA. Similarly, Somali Regional State EPA and Degahbur Town environmental agency are responsible for monitoring and regulating the overall social and environmental performance of the project activities.

The environmental sustainability of the FSTP project depends on institutions' capacity at all levels (i.e. staffing, training, and other necessary support services) to carry out the associated ESMP implementation work. Thus, DWSSA must allocate sufficient resources for training and capacity building.

Budget Estimation

The estimated total budget for the ESMP, mainly for environmental monitoring programs and training required to implement the ESMP, is about **7,958,192.00 Eth**. Birr.

CONCLUSION AND RECOMMENDATIONS

The proposed project aims to address the poor sanitation-related environmental pollution in Degahbur town and downstream areas. Implementing this project, it is expected to have a significant positive impact on the social dynamics and overall environment.

1. INTRODUCTION

Safe sanitation is indispensable for human health through preventing infectious diseases promoting and sustaining physical, mental as well as social well-being. It is also an essential component in ensuring environmental well-being. Sanitation is also a building block of development[3]. Currently, wastewater management and fecal sludge management (FSM) is a global concern, including improved sanitary facilities (for example, toilets), particularly in low-income countries that predominantly rely on on-site sanitation technologies. That's why, in poor and growing urban areas of those low-income countries like Ethiopia, poor FSM represents a growing challenge, generating significant adverse public health and environmental risks.

Waste management is a big challenge in Ethiopia, especially in urban areas. For example, fecal sludge generated from Degahbur town is disposed of illegally in open spaces without proper sanitation facilities installed. In the growing complexity of problems, precautionary measures such as environmental and social impact assessment (ESIA) of projects to ensure adequate waste management can be more effective. To effectively manage the above social and environmental challenges, the Government of Ethiopia (GoE), with the World Bank's support implements citywide fecal sludge management and the construction of public and communal toilets.

1.1. Background and Rationale

Ethiopia faces various sanitation problems related to a low level of priority for sanitation, poverty, unavailability of equipped skilled human resources, unclear institutional framework, and responsibilities. As a result, only 4% of rural and 16% of urban households use improved toilet accommodations. About 56% of rural households rely on unimproved toilet facilities, and more than 35% of toilet accommodations are shared in urban households, whereas only 2% of rural households share their toilet facilities with other households [4]. One in three Ethiopian households has no toilet facility; defecate to bush/fields (39% in rural areas and 7% in urban areas) [4]. Furthermore, according to the WHO estimates, diarrhea contributes to more than one in every ten child deaths in Ethiopia [5]. Ethiopia's total population growth rate is also 2.5% a year, with urban centers growing at a rate of 5.1% [6]. This situation triggers the need for the construction of PCT, fecal sludge management facilities, wastewater treatment plants, sewer lines, and the purchase of vacuum trucks in five selected towns of Ethiopia in three horizons (phases, 2021-2041). Poor sanitation has long been regarded as a constraint to the regional socioeconomic growth in the city of Degahbur, like in many parts of the nation or any community.

Fecal sludge management (FSM) encompasses the entire "value chain" or "service chain" involved in handling fecal sludge. This includes storage, collection, transportation, treatment, and the safe disposal or beneficial reuse of fecal sludge. The objective of fecal sludge treatment is to reduce the presence of pathogens to a safe level or to convert fecal sludge into a valuable product that offers economic and environmental advantages.

At the household level, managing liquid waste and fecal sludge is severely inadequate. Approximately one-third of the global population is estimated to rely on onsite sanitation systems, and in low-income countries, less than 10% of urban areas have access to sewer systems[7]. In these low-income countries, a significant proportion of fecal sludge is discharged into the urban environment without any treatment. This occurs in public spaces such as streets, drainage lines, and nearby open areas, substantially burdening public health and the environment. Hence, FSM plays a crucial role in ensuring the safe management of sanitation and safeguarding public health.

In Degahbur, there are no private operators who can empty septic tanks and latrines. Moreover, while the municipality is providing the service, there is no appropriate and properly managed site for disposal of the fecal sludge waste. Hence, the construction and operation of the proposed fecal sludge management system development will improve the town's sanitary facility problems, including its FSM, reducing the spread of communicable diseases and pollution of ground and surface waters. It also improves hygienic conditions, bringing social and economic advantages to the town and its surrounding environment. Furthermore, implementing the FSTP will improve the town's social, economic, and environmental conditions.

1.2. Project Benefits

The lack of a fecal sludge treatment plant is a major challenge for Degahbur town in effectively managing fecal sludge wastes. The fecal sludge is currently being dumped in open areas without proper management and treatment, which poses a significant threat to environmental pollution. This issue requires immediate attention and collaboration from all relevant stakeholders. To address the sanitation problem in the town, a feasibility study was conducted to develop a comprehensive plan for constructing a fecal sludge treatment plant in the short, medium, and long terms.

Once implemented, the project will greatly improve the fecal sludge management in Degahbur. It will also create employment opportunities for local workers and benefit the community during the construction and operation phases.

1.3. Objectives of the ESIA

The general objective of the ESIA study is to describe the existing bio-physical and socio-cultural features of the proposed Degahbur town sanitation project, assess the potential positive and negative impacts, and recommend appropriate enhancement and mitigating measures that will enhance the positive impacts and avoid or minimize any undesirable impacts expected to result from the construction and operation activities of the proposed project. The specific objectives of the ESIA are to:

- Identify key environmental and social issues related to the proposed project, their impacts, and mitigation for negative impacts.
- Generate baseline information of the project area's biophysical, socio-economic, and cultural attributes.
- Prepare an ESMP comprising environmental and social management measures as well as mechanisms for their implementation and compliance monitoring to minimize the project's negative impacts and enhance the positive aspects.
- Anticipate and avoid, minimize, or offset the developmental proposal's adverse significant biophysical, social, and relevant effects.
- Enable information exchange, notification, and consultations between stakeholders.
- Propose a practical Grievance Redress Mechanism (GRM) considering the nature of the project.

1.4. Scope of the ESIA

This ESIA was conducted for Degahbur town of Ethiopia on the FSTP project activities. It has to be noted that site specific environmental and social assessment shall be carried out for each of the toilet schemes in conformance with the UWSSP II ESMF requirements, which, in fact will be on the case by case bases. The assessment referred to the rules and standards stipulated by the government of Ethiopia's ESIA (EIA) guidelines, directives, legislation, and World Bank's safeguards policies and legislation. In accordance with

the ToR (provided by MoWE), ESIA consulting team conducted a series of reviewing of relevant policies, legislation, and relevant documents, including a feasibility study on the proposed project activities and its technologies, collecting, verifying, and constituting environmental and social safeguards and compliance, grievance redress approaches and protocols in line with the ESIA. A conventional and contemporary collection, coding, and analysis of all generated data were employed during the analysis and evaluation of the ESIA.

The scope of this report is limited to outlining the overall activities in terms of how, what, when, and who of the ESIA study should be conducted of the assessment in the selected project activities and sites throughout phase I, given the continuation of the proposed project activities. During the ESIA assessment, analysis, and presentation, the following major aspects of the intended project were carefully examined:

- Outline the national policies, legislation, and administrative framework within which the environmental and social management of the proposed works will be carried out.
- Describe and evaluate the present baseline data and the relevant environmental and social characteristics of the area proposed for the development of the work.
- Identify, analyze, and assess potential environmental and social impacts resulting from the proposed works based on the proposed design.
- Stakeholder analysis, responsibility description, and assignment.
- Propose cost-effective mitigation measures for minimizing or eliminating adverse social and environmental impacts of the proposed works, including recommendations on design/technology changes if deemed necessary.
- Propose modalities and arrangements for collecting stakeholders' views ensuring participation of key public and community representatives.
- Prepare an environmental and social management plan for implementing the mitigation measures and recommend institutional administrative and management frameworks.
- Estimation of cost for proposed mitigation measures formulated.

1.5. Team in charge of the ESIA

More than eight senior professionals with diverse backgrounds and extensive relevant experience were involved in the process of the ESIA. The qualifications, experiences, and positions of the assigned staff is attached in annexes (Annex 13).

2. METHODOLOGY OF THE ESIA STUDY

2.1. Approach

The overall approach used to carry out the ESIA study is based on the Ethiopian ESIA and World Bank Guidelines. Relevant studies, policies and guidelines were reviewed. Primary data was collected through field observation and beneficiary consultation. A field survey of the project sites of FSTP was conducted, and potential environmental impacts of the expected project activities were identified, assessed, and documented. Consultations were also conducted with key stakeholders and local community representatives pertaining to social, economic, and environmental matters. Obtaining experts' opinions and learning from previous experiences were also among other study approaches used.

2.2. Methodology

This ESIA study is based on reviewing relevant previous studies, primary data collected through a comprehensive field visit in the project area, and consultations with project beneficiaries, city, local administration, key stakeholders, and relevant experts. Secondary data was gathered from various offices at regional, town levels, internet as well as feasibility and design study reports. The detailed methodologies followed are explained briefly herein.

2.2.1. Review of Relevant Studies, Policies, and Legal Documents

Policies, legislation, and guidelines pertinent to social safeguard and environmental protection were gathered and reviewed for assessing the relevant environmental and social safeguard policies, laws, and regulations related to social and environmental protection matters in general and the expected social and environmental impacts of the proposed development in particular. In addition, available documents on the previous studies of the proposed project, baseline of the social and environmental conditions of the project influence area, and other relevant data were collated and reviewed to obtain important data/ information for the project description. The feasibility study and design of the proposed project activities were reviewed to understand the method of delivering the project. The list of the documents reviewed is provided in the list of references.

2.2.2. Scoping

The environmental scoping process was conducted to determine the important environmental aspects of the project, understand the areas that will be most affected by the project, and assess the positive and negative impacts. This involved studying the project design, visiting the site, consulting with the design team, and reviewing relevant literature. Through this process, the valued environmental components for the FSTP project were identified and defined.

During the scoping exercise, relevant stakeholders were identified. The environmental and social impacts likely to be significant were determined in the Scoping process, and these were analyzed in detail in Section 8. The Scoping exercise also identified the data required to describe the baseline E&S baseline conditions that would be the basis for the impact analysis. Moreover, it showed the availability of the required baseline data and additional surveys that need to be carried out to fill data gaps.

The selected site for FSTP is a communal land and does not affect individual properties. In addition, the scoping exercise revealed no environmentally sensitive/ fragile ecosystems like dense forests, parks, and wildlife habitats, historical and cultural sites, or sensitive landscapes. There are no social service centers

(schools, churches, health institutions, etc.) at the proposed FSTP site that can be negatively affected by the construction and operation of the project.

2.2.3. Baseline Surveys and Data Collection

Following an extensive review of existing documents related to the proposed projects, field investigation and collection of detailed data on the social and natural environment were carried out at the project area. The survey aimed to collect social and environmental baseline data for the project influence area and to identify sensitive environmental components that are likely to have a significant effect due to the implementation and operation of the envisaged sanitation projects. Data collection was carried out using a checklist.

Figure 1 site visit at Degahbur FSTP site

2.2.4. Public and Stakeholders Consultations

The main purpose of public and stakeholders' consultation was to disseminate information about the project to the public and affected parties and to obtain their views and concerns. Individuals and groups of the local communities in the project area who are likely to be affected directly or indirectly by the implementation of the proposed project were consulted. Concerned government officials, and professionals (social and environmental experts) at the Regional State, municipal, and project office were consulted during the ESIA fieldwork.

Information related to the existing waste management system, existing environmental and social features of the project influence area, potential environmental issues/impacts related to the proposed project components and activities, as well as the attitudes of the officials, local communities, and experts towards the planned scheme were assessed. This information and opinions have been considered in this socio-environmental impact analysis. Formal and informal consultations were also conducted with the design consultant's staff, Client's officials, and experts. The outcomes of the consultations are summarized in section- 7

As an initial step towards preparing a Stakeholder Engagement Plan (SEP), the consultants have analyzed the relevant stakeholders to the project, who are considered to be affected or affect the project activities. The SEP shall be implemented during the construction and operation phases of the project, where the Contractor and Operator are responsible for ensuring its proper implementation. Moreover, a Grievance Redress Mechanism (GRM) shall be put in place to allow the below-mentioned stakeholders in communicating their concerns regarding any project activity.

Table 1 List of Concerned Stakeholders

Stakeholders	Stakeholders	Level of involvement
Local Residents	✓ Residents located near proximity to the FSTP facility to be constructed	Directly affected
Property-owner and landowners	✓ Individuals, legal entities, local administration holding land title documents (no land or property affected and not applicable) ✓ Tenants or occupiers without formal rights (not exist) (no tenants and not applicable)	Directly affected
Public facility	✓ Educational facilities (none-existence) ✓ Religious entities (mosques/churches) (none existing around the FSTP site ✓ Medical facilities (hospitals, clinics, medical centers)-not in close proximity to the proposed project ✓ Utilities (electricity, water supply, road, telecommunication facility and others)-none existence	Directly affected
Business and Service Providers	✓ Shops, markets, supermarkets (not at a close distance) ✓ Petrol stations, car wash & service, others (not at a close distance) ✓ Restaurants (not at a close distance) ✓ Financial services (banks) (are not at a close distance)	Indirectly affected
Administrative Bodies and Authorities	✓ National and Regional Authorities ✓ Ministry of Water and Energy and regional bureaus ✓ Environmental Protection Authority and regional authority/bureau ✓ Degahbur Water Supply and Sewerage Authority ✓ Regional authorities/bureaus ✓ Local authorities (town and Kebele administration) ✓ Degahbur town municipality	Indirectly affected, but may have influence over the implementation of the project
International donors	✓ World Bank	Indirectly affected, but may have influence over the implementation of the project
Bodies involved in project implementation	✓ Construction contractor(s) (management, staff) ✓ Sub-contractor(s) ✓ Supervision contractor (the Engineer) ✓ Suppliers	Directly affected, but may have influence over the implementation of the project
Non-governmental Organizations (NGOs) and Community Based Organizations (CBOs)	✓ Specialized environmental & social organizations, NGOs - engaged in WASH activities ✓ Experts on a national and international level	Indirectly affecting/affected
Community-based Organization engaged in waste management/ emptying/ handling transporting CBOs	✓ Specialized in waste management at the local level (not exist) ✓ Community based organization involved waste collection (not exist)	Indirectly affected and/or has impacts on project success

2.2.5. Use of Relevant Data Generated by other Disciplines

Data collected by the project design team (engineering team) were reviewed, and other studies were used to supplement the environmental and social data and to understand the proposed technical features of the project so that to render the impact assessment as comprehensive as possible.

2.2.6. Identification and Analysis of Impact

The impact assessment was based primarily on the selected valued environmental and social components. Impacts and their depth and significance were outlined with reference to environmental and social settings on a temporal and spatial basis. The following stepwise approach was followed:

- ***Identification***- This includes description of the existing environment, determination of the project components and definition of the environment that will be modified by the project.
- ***Prediction***- Forecasting the quality and/or spatial dimensions of the changes and estimating the probability that the impact will occur.
- ***Evaluation***- Determination of the incidence or magnitude and significance of the impact before mitigation.

Key, potentially beneficial as well as adverse impacts on the physical, biological, and socioeconomic environment associated with the project operation were identified with the help of checklist and matrices method.

The impacts of the proposed project have been analyzed along the following parameters: Probability of occurrence

- Extension in space
- Duration in time
- Magnitude
- Significance

The predicted environmental and social impacts are characterized as follows:

- Nature of Impact: Direct, indirect or cumulative;
- Type of impact: Positive, negative or both
- Duration of impact: Short term, medium term or long term;
- Spatial scale of impact Local, regional, National, International
- Significance of impact: Low, Medium, High or Very High

A combination of these parameters were summarized in an all-encompassing measures of significance which is the basis for identifying and prioritizing major significant impacts and recommending mitigating measures. Finally, the magnitude and significance level of the identified impacts were evaluated as minor, medium, or major significance impacts.

2.2.7. Data Gaps and Assumptions

Data gaps and assumptions have been assessed based on:

a) Identifying knowledge gaps, assumptions, and unavailable information;
b) Reasons for the incomplete nature and/or assumptions of information;

c) Implications of those identified knowledge gap and assumptions for decision making and
d) Proposals and/or suggestions to avoid the identified constraints and limitations

Since this ESIA report was prepared by multidiscipline expertise, significant gap in knowledge was not observed. Also, the ESIA team didn't face any major difficulty in getting relevant information as the ESIA report was developed after the project feasibility study was completed and in parallel with the detail design

3. DESCRIPTION OF THE PROPOSED PROJECT

3.1. Overview of UWSSP-II Program

The Urban Water Supply and Sanitation Program (UWSSP) is an extension of the World Bank's long-term involvement in Ethiopia's urban water supply and sanitation sector. It aims to support the government's efforts in improving sanitation services in urban areas. Key principles of the program include implementing an integrated city-wide approach to sanitation improvement that offers diverse service options to accommodate different settlement types.

The program emphasizes the development of a comprehensive suite of services for the collection, transportation, treatment, and disposal/reuse of liquid waste. It recognizes the importance of public awareness and social engagement in promoting proper waste management practices and encourages the involvement of the private sector to provide services, goods, and construction work, as well as improving the efficiency of utilities in resource utilization and management.

The government has secured finance from the World Bank under the Second Ethiopia Urban Water Supply and Sanitation Project (UWSSP-II) to increase access to improved sanitation facilities and improve efficiency in water supply services in Addis Ababa and 22 secondary cities [**]. The project will support these cities to achieve the targets set under the Growth and Transformation Plan II (GTP II) and the Sustainable Development Goals (SDGs).

Degahbur town is among these selected cities for implementing the UWSSP-II project for the immediate, intermediate, and long-term sanitation intervention project. The main goal of the project is to enhance and expand the availability of proper sanitation facilities and establish a long-lasting waste management system.

The proposed development interventions in Degahbur town for the short term are:

- The construction of a fecal sludge treatment plant with necessary facilities.
- Construction of 11 new Type II communal toilets, primarily in residential areas where existing access to services is low.
- Construction of 2 new Type II public toilets in public areas with high level of public footfall.
- Replace existing fleet of vacuum trucks and provide additional vehicles to meet the total required number of 2 vehicles, each with a capacity of $8m^3$.
- Monitor sludge collection services and set up and maintain a comprehensive database to enable future service upgrades to be calibrated to meet the actual demand.

This report focus on Environmental and Social Impact Assessment of the envisaged FSTP subproject

3.2. Project Location

Degahbur town, situated in the Jerer zone of the Somali Regional State, serves as the capital of the Degahbur Woreda. It is found approximately 795km southeast of Addis Ababa and 160km southeast of Jigjiga along the highway that connects Jigjiga, Kebridehar, and Gode. Its geographical coordinates are approximately 8° 13’ North and 43° 34’ East, with an average elevation of 1,044 meters above sea level.

[**] Dire Dawa, Mekelle, Adama, Bahiredare, Hawassa, Jimma, Gonder, Sodo, Adigrate, Harer, Jigjiga, Degahbur, Gambella, Assosa, Semera Bishoftu, Dessie, Shashemene, Nekemte, Asela, Arbaminch, and Debre berhan

Degahbur is situated in the plain of Ogaden. The topography is characterized by a relatively flat landscape that gently slopes towards the south and southeast, following the course of the Jerer River. The average slope of Degahbur ranges from 1.3% in the northern part to 2% in the southern part[9].

The FSTP site is located outside the town boundaries, around 4.85 km southeast of the town center on the western side of the Jerer River. Geographically, the FSTP is located at8°11'02.95"N and 43°34'42.66"E with an average elevation of 1040m asl. The slope of the FSTP site is gentile with 2.5 -3.5% gradient. The geographic location of the FSTP site is shown in figure 2 below.

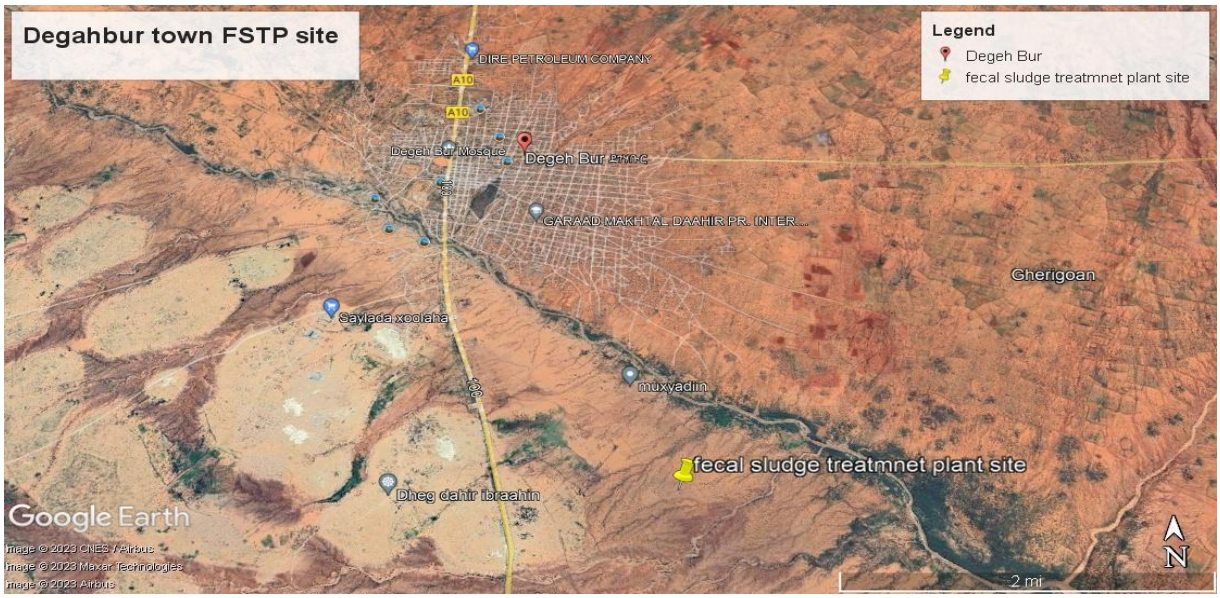

Figure 2 Degahbur town project Intervention Area
Source: Google earth

It is observed that

- The site is at least 3 km away from settlement areas
- The ground profile is sloping towards the Jerer River. The site is more than one km from Jere River.
- There is a tributary on the southern boundary
- The site has no access to electricity and piped water supply system and the utilities are to be provided.
- Has no access road to the site from the main Degahbur - Kebridehar main route. The area is covered with shrubs and bushes and will not significant social and environmental impacts or issues for the construction of access road.
- The soil is sandy and Unproductive, land is covered by scattered shrubs and bushes.

3.3. Land Ownership

About 3.3ha of Land area is required for the fecal Sludge Treatment site, including the buffer zone. There is no settlement and/or commercial area near the site within 3km radius. The land required for the construction of the fecal sludge treatment plant is communal land that belongs to the community and local government and has no compensation issues for the land acquisition. In the community and stakeholder meeting conducted during the ESIA report preparation all the parties are willing to use the designated land for the project.

3.4. Project Components

3.4.1. Fecal Sludge Treatment Process

The process of treating fecal sludge involves several steps:

1. The initial step involves transporting the fecal sludge to the treatment facility, where it undergoes preliminary treatment.
2. Following the preliminary treatment, the fecal sludge is divided into two streams: liquid and sludge.
3. The sludge is then further processed to eliminate excess liquid, resulting in a cake with a high dry solids content.
4. Before being reused or disposed of, the cake may undergo additional treatment (storage for extended time of more than 18 months) to decrease the concentration of pathogens.
5. The liquids from the fecal sludge and sludge cake undergo a series of treatments before they can be discharged into the environment or reused. The treated liquid will undergo further pathogen removal before being discharged or collected for reuse using a constructed wetland.

3.4.2. Fecal Sludge Treatment Unit

The fecal sludge treatment plant will include the improvement of storage, collection, transport, and disposal of fecal sludge wastes, the establishment of a disposal facility, and treatment for fecal wastes (sludge). The FSTP will have an average capacity of 12.3m³/day or 3154m^3/year in the Short-Terms.

FSTP components includes

- **Preliminary Treatment:** Screens & Grit Removal Unit;
- **Solid, liquid separation:** Sludge Thickening Tanks
- **Solids treatment line:** non - planted Drying Beds
- **liquid treatment line:** Wastewater stabilization ponds(anaerobic ponds, facultative and maturation ponds) for the;
- **Bio solid/** dried sludge **treatment**: Storage of dried sludge for an Extended Period and
- **Tertiary treatment**: Constructed wetland
- Treated Effluent Tank
- Discharge pipe line

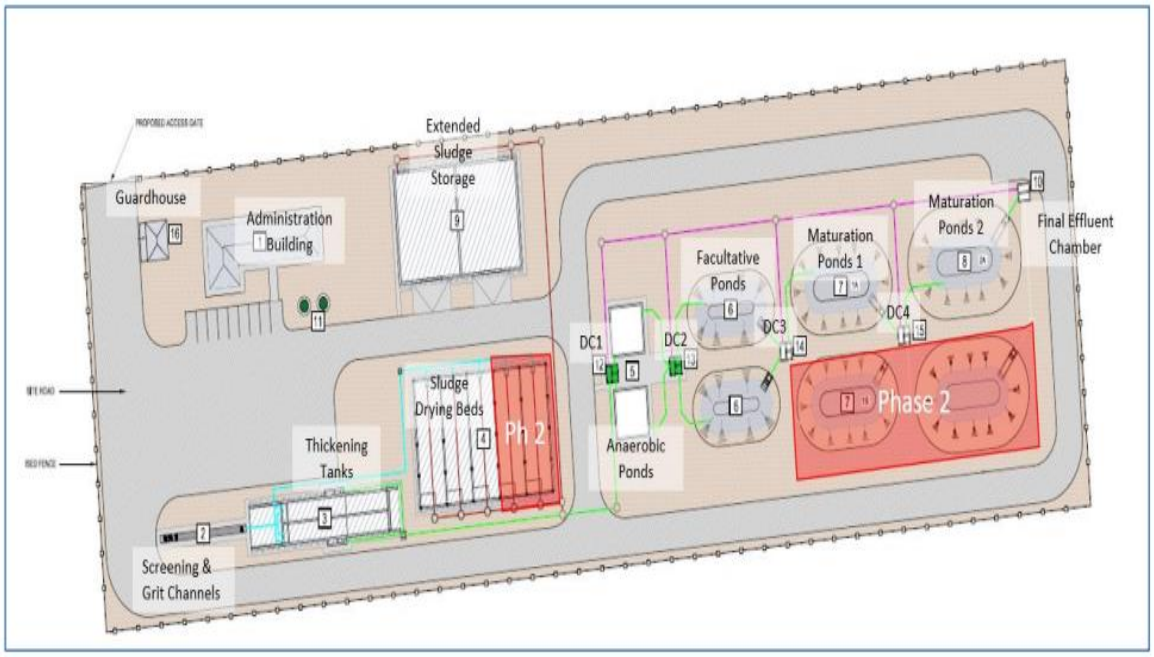

Figure 3 Layout of the FSTP and Facilities
Source: [9]

3.4.2.1. Receiving and Screening Units

The FSTP Receiving and Screening units comprise a coarse screen. The vacuum trucks will discharge directly in coarse screens incorporated into each drying bed. The coarse screens are recommended to remove potential hard items, such as those used for anal cleansing. The screenings will be dried and disposed of through burial in excavated trenches within the treatment plant.

Table 2 Size and number of Screening Units

	Description	unit	Value
1	**Screening unit/FS Manually Cleaned Coarse Screens**		
	Number of screen channels	number	2
	Selected water depth downstream screens	m	0.13
	Channel width	m	0.3
2	**Grit Removal unit/ FS Horizontal-Flow Grit Chambers**		
	Number of channels		2
	Selected grit chamber depth	m	0.13
	selected grit chamber width	m	0.3
	selected grit chamber length	m	25

3.4.2.2. Fecal Sludge Thickening /solid liquid separation

Solid-liquid separation will be carried out in rectangular thickening tanks. Fecal sludge enters the tank at one end and flows out over a weir at the other end. Solids settle along the length of the tank, as in a conventional rectangular sedimentation tank. The thickening tanks operate in batch mode, with each tank loaded for several days and then allowed to rest before sludge is removed. Two thickening tanks of 180 m3 each with dimensions of 4 m Width X 18 m Length will be provided for the solid-liquid separation.

3.4.2.3. Unplanted Drying Beds

Sludge drying beds are the longest established and simplest option for sludge dewatering. It is a simple, permeable bed that, when loaded with sludge, collects percolated leach-ate and allows the sludge to dry by percolation and evaporation. Approximately 50% to 80% of the sludge volume drains off as liquid or evaporates [11].

Unplanted drying beds are preferable and suitable for developing countries due to their low capital and operating costs, simplicity of operation, and good dewatering efficiency, especially in dry and hot climates[11]. Moreover, dried sludge can be used for composting, an important input in agricultural production. However, this treatment technology requires large land areas; it is labor intensive, especially for the dried sludge removal; and it has limitations in stabilization, pathogen, odors, and flies reduction. The FSTP will have 3 non - planted drying beds with a dimension of 20m length, 6m width, and 1m depth.

3.4.2.4. Liquid Treatment Units

Waste stabilization ponds or lagoons are proposed for the effluent treatment in this project. Waste stabilization ponds are large shallow basins enclosed by earthen embankments in which raw sewage is treated by natural processes involving algae and bacteria. The WSP includes anaerobic ponds, facultative ponds, and maturation ponds. These treatment ponds can be used to treat the liquids separated from the fecal sludge and the sludge cake in the solids.

Anaerobic and facultative ponds are mainly designed for BOD removal, while maturation ponds are used for pathogens removal. These facilities are used to further treat the drained liquid from the drying beds to fit into an admissible range for safe discharge in the environment.

The three ponds are linked together for effective effluent treatment, as indicated in figure 3 above. Depending on the effluent volume to be treated each day, 2 (two) anaerobic ponds, 2 (two) facultative ponds and 2 (two) maturation ponds will be needed in parallel.

Table 3 Sizing of WSPs Ponds

Parameter	Quantity in number	Length in m	Width in m	Depth in m
Anaerobic pond	2	8	8	3
Facultative	2	16.8	8	2
Maturation ponds	2	17.2	8	1

Source: [9]

Treatment Principles

Anaerobic pond: The pond is designed to reduce the organic load and serves as a primary pre-treatment of the effluent. Without solids/liquid separation or other types of pre-treatment techniques, the entire depth of the fairly deep pond is anaerobic due to solids sedimentation. This significantly reduces the solid and BOD loads by the anaerobic bacteria. The depth of the pond ranges from 2 to 4 m, with a retention time varying between 1 and 7 days.

Facultative ponds: Facultative ponds are the simplest form of secondary treatment. Its main purpose is to remove organic material and solids, but they can also remove ammonia that is incorporated into biomass [12]. The upper layers of facultative ponds are aerobic, with oxygen introduced through atmospheric oxygen diffusion and algal photosynthesis. Anaerobic conditions prevail near the bottom of ponds, while

intermediate levels may be intermittently aerobic and anaerobic, depending on the time of day and whether or not photosynthesis is occurring. The oxygen in the upper layers is mainly produced by photosynthesis due to natural algae growth together with incident light energy, in addition to oxygen from the atmosphere. The oxygen is then used by pond bacteria for organic waste oxidation and result in CO_2 production, necessary for the algae growth and vis-versa.

Maturation pond: Maturation ponds normally follow facultative ponds (second stage) and are designed for pathogen removal. Their shallow depth, typically 2-4 m, allows sunlight to penetrate to the bottom of the pond and inactivate pathogens. The sunlight also encourages photosynthesis, and aerobic bacterial and algal growth. Fecal coliform concentrations are normally used as a proxy for the presence of specific pathogens as they are relatively easy to measure. Since their main purpose is to remove pathogens rather than reduce the organic and suspended solids loads, maturation ponds must follow processes that have already removed BOD and TSS. Ponds should have a length-to-width ratio of at least 2:1 up to 3:1. Ponds can be constructed with vertical concrete walls, but the more normal practice is to provide sloping sides, as already described for facultative ponds.

3.4.2.5. Effluent Treatment/ Tertiary Treatment

FSTP is designed in such way that the effluents released from it need to assure the safe discharge to the environment particularly into the water bodies. As described in the design report of the project, the proposed effluent quality fulfills the standard requirement specified within the USWSSP-II ESMF. Constructed wetlands will be provided downstream of the stabilization ponds for final tertiary treatment before reuse or disposal.

Table 4 Expected Effluent Quality Standards

Parameter	Maximum Value	Unit
PH	6 – 9	
BOD	30	mg/l
COD	125	mg/l
Oil and Grease	10	mg/l
TSS	50	mg/l
Ammonium	10	mg/l
Phosphorus	2	mg/l
Sulphate	1	mg/l
Coliforms	400	per/100ml
Helminthes egg	< 1	helminthes egg/L
Temperature increase	^{o}c	3

3.4.2.6. Dried Sludge Management

A warehouse of 200 m² will be constructed on the FSTP site to receive the dried sludge from the drying beds and to store it for 18 months to achieve Class B biosolids reuse standards. This temporary storage contributes to further dehydration of the product and the die-off of pathogens before the end use is discussed and agreed upon. The sludge can be sufficiently stabilized or digested if the proposed design is well implemented and maintained. Hence it can be reused for energy sources such as biogas and composting. The dried sludge with the proposed design procedure is also suitable for agricultural uses except for fruit and vegetable growing. Moreover, it may be applied in forage development, but animals should be restricted from grazing for three weeks after the application of sludge on the grazing land.

To increase the awareness on the use of the sludge for fertilizer and other uses such as biogas, there should be training and communication campaigns for the local community.

Biosolids which are not reused will be disposed of in an appropriately designed and licensed solid waste disposal site landfill.

3.4.2.7. Infrastructures and Auxiliary Facilities

In addition to the main unit process operations project components of fecal sludge treatment plant include The following ancillary facilities

- Sampling and monitoring equipment;
- Interconnecting pipework between process treatment units;
- Bypass/diversion arrangements;
- Internal site roads and services required to ensure access to all areas of the plant for operation and maintenance purposes;
- Utilities and services, including power and water supply;
- Internal drainage for surface water run-off;
- Access gates and permanent security fencing;
- Flood protection measures;
- Landscaping of the treatment works site

Administrative building

An administration building containing an operational staff office, store, and a laboratory, toilet and similar facilities will be provided at the FS treatment facility. In addition, it will have fencing and a security guard house.

Laboratory Facilities

To ensure an accurate evaluation of the fecal sludge treatment plant's performance, it is necessary to have a laboratory facility on site. This facility will be responsible for routine monitoring of various parameters related to the treatment processes and operations. These parameters include pH levels, total solids (TS), total suspended solids (TSS), chemical oxygen demand (COD), biochemical oxygen demand (BOD5), and nutrients such as total nitrogen and total phosphorus in the fecal sludge. Furthermore, assessing the quality of the dried fecal sludge will require analysis of additional parameters such as pH, moisture content, nutrients (nitrogen and phosphorus), calorific value, presence of Ascaris eggs (for safety considerations), and heavy metal concentrations (such as cadmium, lead, and chromium). Operators working at the fecal sludge treatment plant and within the laboratory should always wear appropriate personal protective equipment, focusing on hygiene and safety measures.

Interconnecting pipework between process treatment units and Bypass

The connection between the different ponds in the fecal sludge treatment plant will be made using DN 200 pipes equipped with valves.

Effluent discharge pipeline will be an approximately 680 meter long 600 mm diameter HOPE-lined concrete sewer which discharges into a stormwater head wall, surrounded by Reno-mattress (rock mattress) on the banks of the river to protect it from erosion under periods of high velocity flows.

Water Supply, Electrical Installations and Sanitary Facilities

The treatment plant will have a water tank to allow regular water access at the plant with appropriate connection and sanitary facilities. Electrical installations will be provided for the operation building, roads, lanes, and corners of the ponds to ensure proper illumination.

Other facilities

Other facilities include internal roads, walkways, and parking areas. It has appropriate drainage for the whole site to avoid flooding conditions. Landscaping of the treatment works site will be worked and open areas shall be covered with trees, attractive plants, and bushes.

3.5. Project Activities

Construction and operation of the works follow normal routines whereby there are activities before construction, construction activities, and finally, operations and maintenance activities.

3.5.1. Mobilization, Construction, Demobilization Contractors

This stage involves the mobilization of the construction teams, transport and storage of equipment and plant and construction materials. The contractor may hire additional labour and set up temporary facilities for offices and storage. This stage also generates waste, including solid, liquid, and gaseous waste, from storage yards and temporary worker camps. Garbage such as packaging, papers, cardboard boxes, plastic, wood crates, bottles, glass, and metal cans will be generated and must be segregated for proper disposal and/or incineration. Additionally, materials such as aggregates, sand, cement, wood, and reinforcing steel will be purchased and stockpiled.

Construction of the FSTP and associated axillary facilities will start following the mobilization. Internal access roads and protective fences or barricades should all be in place before construction begins.

Among the activities that would affect the soil resources include site clearing, stripping of topsoil, excavation in soil, reproofing of the ground to suit the proposed ground profile, and loading of spoils and hauling of the same to disposal sites; these activities would involve operation of heavy-duty equipment and dump trucks. These undertakings have the potential impact on the environment. During the demobilization phase, all site activities will be cleared, and site facilities will be tidied up. Construction equipment will be demobilized, and any remaining unwanted material will be disposed of properly. The same waste management methods used in previous phases will be employed.

Damaged areas will be upgraded before the project is commissioned. Wastewater generated from work camps will also be addressed. Once the contractor's obligations are completed, the structures will be handed over to the Project Proponent, DWSSA, for the operation phase.

3.5.2. Operation

Upon the completion of the construction of the sludge treatment plant, the actual purpose of the plant for collection, treatment, and disposal of sludge will start. Trucks will be employed for the collection of sludge from latrines from households or institution’s septic tanks and offloaded at the treatment plant. Dried sludge will be used as manure.

During the operation phase, DWSSA will be responsible for the maintenance and management of the structures. This includes regular inspections, repairs, and ensuring that the facilities are functioning properly. Any issues or malfunctions that arise during this phase will be addressed and resolved by DWSSA. In addition to the maintenance and management of the structures, DWSSA will also be responsible for monitoring and ensuring the quality of the effluents discharged. This includes regular testing of the discharges for contaminants and ensuring that they meet all regulatory standards.

Overall, the operation phase is focused on ensuring that the FSTP system is running smoothly. DWSSA will play a crucial role in maintaining and managing the infrastructure to ensure its long-term sustainability.

3.5.3. Project Decommissioning

The capacity of FSTP is designed to accommodate the population projection of the town up to 2032. However, to accommodate the increasing population of the town the project will be upgraded for medium and long term use by construction of additional structures and it will be expected to be used for 20 years. Accordingly, the decommissioning of the project and the social, economic, and environmental impact will depend on additional further construction and activities.

3.6. Construction and Civil Works to FSTP

The short-term implementation schedule is in place until 2026 under the five-year development plan. The construction has been proposed to be undertaken in the short term and the completion time of for the construction of the project is estimated to be within 22 months.

Table 5 Project schedule

Project Activity	Month																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Mobilization																						
Civil works																						
Structural works																						
M& E installation																						
Testing and commissioning																						
Handover																						

The estimated total cost by the engineering consultant for the construction of FSTP and associated facilities is ETB USD 2,285,587.00. The estimated capital costs for the construction of the fecal sludge treatment plant are summarized in Table below).

Table 6 Estimated capital Cost of the Proposed Fecal Sludge Treatment Facilities

Inlet Screening	**72,029**
Settling/ Thickening Tanks	114,791
Sludge Drying Beds	183,946
Anaerobic Ponds Works	67,602
Facultative Ponds Works	21,385
Maturation Pond Works	16,355
Dried Sludge Storage Area	131,045
Administrative Building	180,597

Inlet Screening	**72,029**
Ancillary Site Works	349,175
Sludge Pumping	17,912
Electrical Installations	81,008
Pipeline Costs	81,544
Internal Access Road	361,080
Constructed Wetlands	150,000
SUBTOTAL	**1,828,470**
General Items (15%)	274,270
Contingency (10%)	182,847
TOTAL	**2,285,587**

Source: Detailed Design Report Degahbur Town

4. POLICIES, LEGAL AND ADMINISTRATIVE FRAMEWORK

The implementation of the FSTP project has the potential to cause environmental and/or social impacts that shall be addressed in accordance with relevant Ethiopian legislation as well as the requirements of the World Bank Environmental and Social safeguards policies. This section provides a highlighted review of the policy and legislative framework for the ESIA associated with the proposed project.

4.1. Relevant National Policies and Strategies

This section addresses the legislative and institutional framework relating to ESIA, specifically relevant to the proposed the FSTP project. For this project, the EIA (here ESIA Assessment Report) has been prepared under specific consideration of the national legal frameworks and safeguard policies.

Table 7 National Legal Framework

Category	Summary
Constitution of FDRE **[13]**	According to Article 44 of the FDRE constitution, every citizen has the right to a healthy and satisfying environment, and it is the duty of every individual to protect and preserve the environment. In order to address environmental concerns and maintain a clean environment, Article 92 of the Ethiopian constitution mandates the proper collection, treatment, and management of waste, including household and industrial waste, to prevent any degradation of the environment and minimize adverse effects on human health, natural resources, flora, and fauna. The Ethiopian Constitution also acknowledges the right to private property and ownership (Article 40), individuals affected by development projects should be fairly compensated for any damage or loss to their property. Additionally, the Ethiopian legal system recognizes various treaties ratified by the Government of Ethiopia as integral components.
Policies	**Environmental Policy of Ethiopia (EPE)** [14] emphasizes the importance of integrating environmental considerations into all sectors and levels of decision-making. It promotes the conservation and sustainable use of natural resources, the prevention and control of pollution, and the promotion of environmental education and awareness. Overall, the EPE serves as a comprehensive framework for addressing environmental concerns in Ethiopia. It provides guidelines and principles for sustainable development, resource management, pollution control, community participation, and impact assessments.
	Ethiopian Water Resources Management Policy [15]**:** The main objective of the policy is to ensure sustainable and efficient use of water resources in Ethiopia for socioeconomic development. The policy addresses sectoral and cross-sectoral environmental issues, conducting an Environmental and Social Impact Assessment study to identify and mitigate potential negative impacts during project phases. An Environmental and Social Management Plan need to be developed based on this assessment. Overall, the policy guides activities to prevent harm to ecosystems, promote coordination in environmental management and help achieve sustainable development goals.
	National Health Policy [16]**:** was issued in 1993, with the aim of giving special attention to women and children, to neglected regions and segments of the population, and to victims of manmade disasters. The policy places give emphasis on the control of communicable diseases, diseases that are related to malnutrition and poor living conditions, the promotion of occupational health and safety, and the development of environmental health.
	National Policy on Women [17]**:** The primary objective of the policy is to ensure gender equality and equal access to resources and decision-making processes for both men and women in Ethiopia without discrimination. It highlights the importance of women's participation in economic and social programs, emphasizing that they should benefit equally from all activities carried out by government institutions. In line with this policy, the proposed project in Degahbur town will prioritize equal economic opportunities for both men and women. This includes ensuring equal access to job opportunities and a fair land acquisition process during various project phases.

Category	Summary
	National Policy on HIV/AIDS [18]**:** The 1998 Policy on HIV/AIDS of the Federal Democratic Republic of Ethiopia urges communities at large, including government ministries, local governments, and the civil society, to feel responsibilities 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 that it is expected that sufficient awareness exists within the community. In addition, all the workers and contractors working in the proposed project shall be treated fairly in accordance with the policy.
Strategies and Programs	**Climate Resilient Green Economy Strategy /2011** [19]: The strategy's objective of the strategy is to protecting the country from the adverse effects of climate change and promoting a green economy. By implementing different initiatives, Ethiopia aims to limit its greenhouse gas emissions by 2030 to the levels of 2010. The strategy emphasizes the importance of sustainable and clean waste management practices to reduce greenhouse gas emissions in the waste sector.
	Urban Wastewater Management Strategy/2017 [20]**:** The Ministry of Water, Irrigation, and Energy (MoWIE) issued a strategy in 2017 to provide a common understanding and guide with the aim of providing a common understanding and guiding vision for effective wastewater management. The strategy focuses on prioritized interventions, targeted programs, and the sustainable use of resources. Its objectives include developing robust wastewater management institutions, preparing master plans, implementing methods for wastewater collection, treatment, and reuse of treated effluent and sludge, and ensuring the protection of the environment from wastewater discharge.
	National Hygiene and Sanitation Strategy [21]**:** This National Strategy for Improved Hygiene and Sanitation has been developed to complement the existing health policy developed by the MoH and the national water sector strategy [9] in placing greater emphasis on 'on-site' hygiene and sanitation. The primary focus is on blocking faces from entering the living environment through the safe management of faces, hand washing at critical times, and the safe water chain from source to mouth. Thus the ESIA consultant believes that the current project will contribute to the national hygiene and sanitation strategies.
	Ministry of Water Irrigation and Electricity, Environmental and Social Management Framework (2017) [2]**:** According to this framework Piped sewerage systems and wastewater/ fecal sludge management treatment facilities are under schedule 2 that requires partial or limited ESIA study withy preparation of ESMP. Accordingly, the project is clearly schedule 2 with limited ESIA study.
Proclamations and Regulations	**Proclamation on Establishment of Environmental Protection Organs** [22]**:** The objective of this Proclamation (No. 295/2002) is to assign responsibilities to separate one organization for environmental development and management activities on one hand, and environmental protection, regulations, and monitoring on the other, in order to ensure sustainable use of environmental resources, thereby avoiding possible conflicts of interest and duplication of effort. It also intends to establish a system that fosters coordinated but differentiated responsibilities among environmental protection agencies at federal and regional levels. This Proclamation re-established the EPA as an autonomous public institution of the Federal Government of Ethiopia. Furthermore, the Proclamation states that each regional state should establish an independent regional environmental agency or designate an existing agency that shall be responsible for environmental monitoring, protection, and regulation in their respective regional states.
	Guideline for reviewing environmental impact study reports [23]**:** gives general guidance regarding ESIA preparation. It shows the ESIA processes and project categorization into schedule 1, 2, and 3 depending on their impact level. The contents of the ESIA start from the project description, components of the baseline (biophysical environment), the impact analysis, and mitigation measures, among other things.

Category	Summary
	Environmental Impact Assessment Proclamation: General EIA Guidelines 299/2002 [24]**:** The Environmental Impact Assessment (ESIA) Proclamation makes ESIA a mandatory requirement for the implementation of major development projects, programs, and plans in Ethiopia. The proclamation is a tool for harmonizing and integrating environmental, cultural, and social considerations into decision making processes in a manner that promotes sustainable development. The Proclamation states that ESIA studies need to include measures to eliminate, minimize, or mitigate negative impacts, a contingency in cases of incidents, and procedures of self-auditing and monitoring during the implementation. EIA guideline determining the modalities of protection, conservation, and promotion of the environment in Ethiopia regulates the conduct of Environmental Impact Assessments (EIAs). In its article, it states that, every project shall be subjected to EIA before obtaining authorization for its implementation. This applies to programs and policies that may affect the environment and with which ESIA has complied. The Vision further requires that an Environmental and Social Impact Assessment (ESIA) be carried out for development and infrastructure infrastructures activities likely to negatively impact the environment. Hence, this project is assessed based on the legal requirements indicated in the proclamation and associated guidelines.
	Proclamation on Environmental Pollution Control [25]**:** The main objective of Proclamation No. 300/2002 is to protect the environment and ensure the well-being of citizens in Ethiopia. It establishes environmental standards and makes violating the violation of these standards a punishable offense. The "polluter pays" principle is applied to all individuals, and the Environmental Protection Agency (EPA) is responsible for enforcing these standards by appointing Environmental Inspectors. This proclamation also helps ensure occupational health and safety for customers and workers involved in the project.
	Public Health Proclamation, Proclamation No. 200/2000 [26]**:** The proclamation emphasizes the need for occupational health and safety, the development of environmental health, and the provision of safe and adequate water for both urban and rural populations. It also encourages the safe disposal of waste and measures to improve the quality of housing and work premises for better health.
	Solid Waste Management- Proclamation No. 513/2007 [27]**:** The objective of the solid waste management proclamation is to prevent adverse impacts and create beneficial assets from solid waste. It emphasizes community participation and the management of various types of solid waste. The Proclamation addresses existing waste management problems and aims to prevent environmental pollution. The EPA and regional environmental agencies have responsibilities in implementing the Proclamation. Community participation is promoted, and urban administrations must prepare solid waste management plans. Project proponents must adhere to regulation requirements and allocate necessary resources for waste management.
	Proclamation on Ethiopian Water Resources Management [28]**:** The Proclamation (Proc. No. 197/2000) issued in March 2000 regulates water resources management, protection, and utilization in Ethiopia. Its aim is to ensure the proper conservation, utilization, and prevention of harmful effects related to water resources. The Supervising Body, either the Ministry or a delegated organ, is responsible for planning, managing, and protecting water resources. Certain activities, such as constructing water works, supplying water, transferring water, and releasing waste into water resources, require a permit from the supervising body.
	Proclamation on Hazardous Waste Management[29]**:** The purpose of this proclamation (Proclamation No.1090/2018) is t to prevent and control problems of environmental pollution caused by the mismanagement and disposal of hazardous waste. It deals with creating a system to control the generation, storage, treatment, recycling and reuse, transportation, disposal, and movement of hazardous wastes is of paramount importance to prevent harm to human and animal health as well as the environment due to the mismanagement of hazardous waste. The project contractor and proponent must establish clear procedures for handling hazardous wastes such as fuels, chemicals, and others based on the requirements in this proclamation. Subsequent implementation of the procedures must be inspected by an environmental expert involved in the project.

Category	Summary
	Proclamation on the Development, Conservation, and Utilization of Wildlife [30]**:** The Proclamation (Proc. No. 541/2007) issued in August 2007 serves three main objectives: conserving, managing, and utilizing wildlife resources in Ethiopia; fulfilling government obligations under wildlife conservation treaties; and promoting wildlife-based tourism and private investment. The proclamation establishes designated wildlife conservation areas administered by the Federal Government, regions, private investors, and local communities. It addresses hunting permits, scientific collection of wildlife, and economic activities related to wildlife resources, such as tourism and trading. The proclamation includes provisions for penalties.
	Proclamation on Forest Development, Conservation, and Utilization/ Proclamation No.1065/2018[31]**:** The proclamation prohibits cutting endangered indigenous naturally grown trees from state forests or those naturally grown in the community forest. So, in this regard, the relevant stakeholder shall be involved in the site selection for FSTP in Degahbur town that does not cause any permanent damage to the forest/natural resources in the surrounding environmental settings.
	Proclamation on Research and Conservation of Cultural Heritage/ Proclamation No. 209/2000 [32]**:** The Proclamation provides a legal framework for the management, exploration, discovery, and study of Cultural Heritage in Ethiopia. Article 41 specifically addresses the fortuitous discovery of Cultural Heritage during various activities such as mining explorations, building works, road construction, or other similar activities. It states that any person who discovers Cultural Heritage in these circumstances must report it to the Authority and protect it until the Authority delivers it. The Authority is responsible for examining, delivering, and registering the discovered Cultural Heritage. Additionally, the Proclamation states that if Cultural Heritage is discovered during construction activities in a reserved area, the construction must be stopped, and the discovery must be reported to the Authority.
	Ethiopian Wildlife Protection Proclamation [33]**:** The Wildlife Proclamation No.541/2007, enacted in August 2007, approves the development, conservation, and utilization of wildlife in Ethiopia. This legal enactment aims to enhance the contribution of the wildlife sector toward poverty reduction and maximize the economic and social benefits derived from wildlife resources. The proclamation emphasizes the importance of protecting and conserving wildlife species and establishing mechanisms for their conservation and protection. Wildlife conservation and protected areas are categorized into four categories from the highest protection ranking, 'National Park', followed by 'Game Reserve' and 'Sanctuary' to 'Controlled Hunting Area'. Thus, protection and conservation aspects of wildlife species, established mechanisms for conservation and protection of wildlife, etc., shall be assessed to ensure/enhance wildlife management shall be formulated as part of ESMP. However, the designated FSTP site for Degahbur town is not under the category of any of the above wildlife conservation areas and does not impact the wildlife and their habitats.
	Land Laws-Expropriation and Payment of Compensation (Proclamation 1161/2019 and Regulation No. 472/2020)[35][36]**:** This proclamation is the main legislation in Ethiopia regarding land expropriation. It provides guidelines for the expropriation process, compensation, and the purposes for which expropriation can be carried out. The power to expropriate land for public purposes lies with Woredas or urban administrations, and compensation must be paid in advance. Concerning compensation, the government has developed a regulation (Regulation 472/2020) that defines in detail how compensation for the expropriated property should be calculated. According to the law, people who are displaced due to expropriation in rural lands (lands used for production) have the right to be compensated for the loss of income from the land if they do not receive replacement land. The compensation is defined as 10 times the yearly income from the land, based on the average income from the last 5 year (article 8(1)).

Category	Summary
	Labour Law/Proclamation 1156/2019[37]**:** The Labor Proclamation in Ethiopia, revised in 2019, governs labor conditions based on the political, economic, and social policies of the federal government and international conventions and treaties. It includes provisions on occupational safety, health, working environment, prevention measures, and employer obligations. The proclamation requires employers to take necessary measures to safeguard workers' health and safety. The Occupational Health and Safety Directive limits occupational exposure to working conditions. According to the proclamation, employers must be obligated to pay workers their entire wages, which should be done at the end of a month or based on an agreement.

4.2. World Bank Environmental and Social Safeguard Policies

4.2.1. The World Bank Operational Policy 4.01

In addition to the requirements of the Federal Government of Ethiopia, donor organizations such as the World Bank have requirements for environmental assessment (EA). The WB E&S safeguards policies are applicable as part of the UWSSP II implementation. Five of the ten WB safeguards Policies are triggered as part of 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) [38] and Projects on International Waterways OP/BP 7.50) [39]. Besides, the World Bank Group (WBG) Environment, Health and Safety Guideline (EHSG) shall be applicable as deemed necessary. The World Bank Operational Policy 4.01 requires EA of projects proposed for Bank financing to ensure that they are environmentally sound and sustainable, and thus to improve decision-making. The Bank favors preventive measures over mitigatory or compensatory measures, whenever feasible.

EA considers the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources); and trans-boundary and global environmental aspects. It also takes into account the variations in project and country conditions; the country's overall policy framework, national legislation and obligations of the country, pertaining to project activities, under relevant international environmental treaties and agreements. The Bank does not finance project activities that would contravene such country obligations.

Based on the World Bank's OP 4.01, projects can be categorized as A, B, C or Fl. The selection of the category is based upon the expected environmental impacts.

- Category A: A full EA is required. I.e., a proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented.
- Category B: Although a full EA is not required, environmental analysis is required. A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas-including wetlands, forests, grasslands, and other natural habitats are less adverse than those of Category A project. These impacts are site-specific; few if any of them are irreversible; and in most cases, mitigation measures can be designed more readily than for Category A projects.
- Category C: No EA or environmental analysis is required. A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.
- A proposed project is classified as Category Fl if it involves an investment of Bank funds through a financial intermediary, in project that may result in adverse environmental impacts.

The FSTP have been rated Environmental Risk Assessment Category B and trigger five environmental and social safeguard policies. However, the following safeguards policies are more relevant and applicable as part of implementation of the proposed FSTP project activities; Environmental Assessment (OP/BP 4.01); Involuntary Resettlement (OP/BP 4.12); and Physical Cultural Resources (OP/BP 4.11) [40].

OP/BP 4.01 requires environmental and social impact assessment (ESIA) of projects/to ensure that they are environmentally sound and sustainable. The ESIA process will lead in the preparation of an ESMP for proposed project activities in the town. The ESMP sets out mitigation, monitoring, and institutional measures to be taken during operations of these activities to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels.

4.2.2. Physical Cultural Resources (OP/BP 4.11)

The objective of this policy is to assist countries in avoiding or mitigating adverse impacts of development projects on physical, cultural resources. 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.

4.2.3. Involuntary Resettlement (OP/BP 4.12)

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. However, in Ethiopia, there are no explicit requirements for an RPF or RAP. As regards compensation, Ethiopia requires only the rightful land or property owner (statutory or customary rights of occupancy) should be compensated, while the WB OP 4.12 requires that any person (whether is the rightful owner or not) who loses or is denied or restricted access to economic resources including tenants, squatters should either be compensated for the use of the land or assisted to moving. 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. However, the FSTP project in Degahbur is not expected to cause physical displacement and involuntary settlement.

4.2.4. General Environmental Health and Safety (EHS) Guidelines

The General EHS Guidelines [41], developed by the International Finance Corporation (IFC), cover a wide range of technical references that can be applied to general and industry-specific actions that resonate with Good international Industry Practices. These Guidelines can apply to this program, along with the mentioned legislation outlined in this section. Specifically, the following EHS guidelines can be considered:

- General EHS Guideline (1): Environmental
- General EHS Guideline (2): Occupational Health and Safety
- General EHS Guideline (3): Community Health and Safety
- General EHS Guidelines (4): Construction and Decommissioning
- Donor Safeguard Requirements and Applicable Standards
- General Environmental Health and Safety Guidelines

4.3. Comparison between Ethiopian and World Bank Safeguards Policies

Project Categorization in World Bank and Ethiopian legislation are more or less similar. In both policies environmental screening is the requirement to identify whether the project is subject to environmental impact assessment or not. However, the categorizations that result from the screening processes are slightly different in their definition but still are roughly equivalent.

In general, "Schedule 1" and "Category A" are roughly equivalent as they both include projects with potentially significant adverse impacts that demand a full-fledged ESIA. Though, there is a slight difference that, in some cases, schedule 1 projects, as per Ethiopian policy, could fall under category B of the World Bank.

Schedule 2 and Category B projects are more or less similar in their definitions; both categories refer to projects with fewer impacts than those of Category A or Schedule 1 projects. Under OP 4.01, category B projects require environmental work at the appropriate level, be it an ESMP, an ESIA, or implementing mitigation measures in the context of an environmental and social screening process.

However, the Ethiopian guidelines do not make provisions for the screening of project of a smaller scale than those listed in Schedules 1 and 2, which may have negative localized impacts that will require mitigation.

There are some gaps between Ethiopian laws and regulations and the requirements for resettlement as laid out in OP 4.12. In some cases, the Ethiopian laws and regulations are incompatible with the Bank's OP 4.12 provisions. Table 3 below compares Ethiopian Law on land acquisition and the World Bank's operational policy and recommended measures to address the gaps:

Table 8 Comparison of Ethiopian Legislation and World Bank's Operational Policy

Theme	World Bank's Safeguard Policies Applicable	Ethiopian Legislation	Measures to Address the Gaps
Eligibility for Compensation	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 right or claim to the land	Proclamation No1161/2019, Article 8(1) allows' landholders' to be eligible for compensation, No.1161/2019 Article 8, 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 is decided to be expropriated to the urban or rural land administration office on the time schedule of the office. These give entitlement only to those who have formal legal rights over their land holdings (properties).	Eligibility criteria for compensation and assistance shall be in line with the WB eligibility to benefits.
Public consultation and disclosure procedures	Consult project-affected persons, host communities and local NGOs, as appropriate. Provide them opportunities to participate in the planning, implementation, and monitoring of the resettlement program, especially in the process of developing and	There is specific Guideline entitled with" Guideline on Public Consultations in Environmental and Social Impact Assessments Process" which has entered into force in December 2018 by the FDRE EPA.	Provide project-affected persons and local NGOs/CSOs, local leaders, vulnerable groups, media and women as appropriate the

Theme	World Bank's Safeguard Policies Applicable	Ethiopian Legislation	Measures to Address the Gaps
	implementing the procedures for determining eligibility for compensation benefits and development assistance (as documented in a resettlement plan), and for establishing appropriate and accessible grievance mechanisms.		opportunities to participate in the planning, implementation, and monitoring of the resettlement program.
Measures for livelihood restoration and assistance to vulnerable groups	Livelihoods and living standards are to be restored in real terms to before displacement levels or better. OP 4.12 further requires attention to be given to the needs of vulnerable groups such as those who are below the poverty line, landless, elderly, women and children, indigenous groups, ethnic minorities and other disadvantaged persons.	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.	Additional support may be needed for vulnerable groups. Vulnerable groups in the project area will be identified and the support need specified in RAP or LRP.

4.4. Multilateral Environmental Agreements

There are quite a number of multilateral agreements in the environment sector to which Ethiopia has become a signatory. These agreements form part of the body of laws of the country as per Article 9 of the Ethiopian Constitution and are, hence important to consider when checking for the compliance of economic activities with laws in force in Ethiopia. Some of the main Multilateral Environmental Agreements (such as UNFCCC, UNCCD, and UNCBD) are briefly stated below.

4.4.1. United Nations Convention on Biological Diversity (UNCBD)

Ethiopia ratified this Convention by Proclamation No. 98/94, on May 31, 1994. The Convention has three goals: (i) the conservation of biodiversity, (ii) the sustainable use of the components of biodiversity, and (iii) the fair and equitable sharing of the benefits arising from the use of genetic resources. Under this convention, any sanitation facility development shall not interfere with the biodiversity of the proposed sites.

4.4.2. United Nations Convention to Combat Desertification (UNCCD)

This Convention was ratified by Ethiopia in 1997 through Proclamation No. 80/1997. The objective of the Convention is to combat desertification and mitigate the effects of droughts in countries experiencing serious drought and/or desertification, particularly in Africa. Thus, any activities should not lead to or aggravate desertification and should not reduce efforts in combating the deforestation process.

4.4.3. United Nations Framework Convention on Climate Change (UNFCCC)

Ethiopia has ratified the Convention through Proclamation No. 97/1994 on May 2/1994. This Convention takes into account the fact that climate change has trans-boundary impacts. Its basic objective is to provide for agreed limits regarding the release of greenhouse gases into the atmosphere and to prevent the occurrence or minimize the impact of climate change. Any activities related to sanitation facility development shall not contribute to global warming through greenhouse gas emissions.

4.4.4. Convention on the Protection of World Cultural and Natural Heritage

Each state that is party to this convention recognizes the duty of ensuring the identification, protection, conservation, preservation, and transmission to future generations of the culture and natural heritage situated on its territory, belongs primarily to the state. Ethiopia has ratified this convention in 1997.

4.4.5. The Vienna Convention on the Protection of the Ozone Layer

Ethiopia ratified and became a party to the Vienna Convention and the Montreal Protocol in January 1996. The National Meteorological Services Agency has been mandated to coordinate and supervise the implementation of this convention.

The basic objective of the Convention is to combat the negative impact on the environment and human beings resulting from ozone-depleting substances by reducing the amounts released and eventually banning their commercial use through internationally agreed measures.

4.5. Administrative and Institutional Framework

The most lined administrative and institutional framework of the project are briefly described below.

4.5.1. Ministry of Water and Energy

MoWE is responsible for the overall coordination, monitoring, and evaluation of the project, facilitation of capacity building, and policy formulation. As it is the responsible organization for the implementation of SUWSSP for secondary cities, the feasibility detail design and this ESIA studies were conducted under the supervision of the Ministry. The construction of the project is also contracted out and managed by the Ministry.

4.5.2. Federal Environmental Authority

The then Environment, Forest and Climate Change Commission (EFCCC) and Environmental Protection Authority (EPA) was re-established under Proclamation No.1097/2018 issued for "Definition of Powers and Duties of the Executive Organs of the Federal Democratic Republic of Ethiopia". It is an autonomous public institution of the Federal Government of Ethiopia entrusted with the protection and conservation of natural resources in the country.

The environmental legislation gives the EPA power to fulfill its role, support all federal institutions in establishing environmental units, and develop skills in strategic environmental analysis of policies and public instruments. The EPA is involved in the development of environmental policy and legislation, setting environmental quality standards for air, water, and soils, monitoring pollution, establishing ESIA procedures and an environmental information system, and undertaking capacity development in relevant agencies to ensure the integration of environmental management in policy development and decision-making.

The responsibilities of EPA with respect to ESIA process are establishment of a system for environmental assessment of public and private sector projects, as well as social and economic development policies, strategies, laws, and programs of federal level functions; review, decision-making and follow-up implementation of environmental impact study reports for projects, as well as social and economic development programs or plans where they are subject to federal licensing, execution or supervision; also proposed activities subject to execution by a federal agency, likely to entail inter- or trans-regional and

international impacts; notification of its decision to the concerned licensing agency at or before the time specified in the appropriate law or directives; ensure that the proponent complies with requirements of the ESIA process; auditing and regulation of implementation of the conditions attached to the decision; provision of advice and technical support to the regional environmental agencies, sect-oral institutions and proponents; making its decisions and the ESIA report available to the public; resolution of complaints and grievances in good faith and at the appropriate time; development of incentives or disincentive structures required for compliance with Regional State Environmental Protection Authorities requirements.

4.5.3. Somali Regional State Water and Energy Bureau

As it is specified in SUWSSP-II ESMF, the Regional Water Bureaus are responsible for overall project planning, management, coordination, and capacity building at the regional level. The Regional Water Bureaus play an important role in arranging technical assistance for towns and cities. Thus, the Somali Regional State Water and Energy Bureau is responsible for the overall coordination of the project study, design, and implementation in collaboration with MoWE. Environmental and social personnel assigned for the ongoing UWSSP at Regional level will assist the water utility of the project area in monitoring and following up on the implementation of the proposed mitigation measures for each project found in their respective regions.

4.5.4. Somali Regional State Environmental Protection Authority

In accordance with the principles of government decentralization and the Proclamation no. 295/2002, in which The Environmental Protection Organs Established, each regional state shall establish an independent Regional Environmental Agency or designate an existing agency that shall be 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 conservation strategies; and
- Environmental monitoring, protection, and regulation.

Regional Environmental Protection Authority shall ensure the implementation of federal environmental standards or, as may be appropriate, issue and implement their own no less stringent standards. The regional EPAs shall prepare reports on the respective state of the environment and sustainable development of their respective states and submit them to EPA. For the Somali Regional State where the Degahbur town sanitation project is located, the Somali Environment Protection Authority is responsible for environmental protection matters in the Region. The Bureau is responsible for the review and approval of ESIA development proposals under the mandate of the Regional Government. It follows up on the implementation of ESIA recommendations of such proposals. Therefore, to implement the ESIA, the project proponent, the Ministry of Water and Energy and Degahbur town Municipality should closely work with the Regional State EPA.

4.5.5. Degahbur Town Water and Sewerage Authority

As specified in the ESMF of the project, the utility is required to allocate an appropriate budget, assign/recruit safeguards experts to implement and monitor the ESMP and RAP study documents. Besides, utilities will be responsible for the preparation of the periodical safeguards implementation status report and submit it to the MoWE. These reports will provide summaries of (i) environmental screening, (ii) ESIAs

carried out in the course of the budget year, Environmental and Social Management Framework - Second Phase of UWSSP 16, (iii) overall implementation status of the ESMPs, and (iv) summary of the environmental monitoring carried out on systems at both construction and operation phases. The EPA and the MoWE will review annual reports, and copies will be sent to the World Bank.

5. DESCRIPTION OF BASELINE CONDITIONS

This Section describes the physical, social, economic, and biological baseline of the proposed project sites, based on the findings of the data collection, field investigations, and review of the relevant documents (including feasibility study and detailed design).

5.1. Physical Environment

5.1.1. Climate

Degahbur falls within an arid and semi-arid climatic zone, experiencing low rainfall and high temperatures throughout the year. According to regional meteorological data, the maximum monthly average temperatures in Degahbur range between 28.0 °C and 34.1 °C, while the minimum monthly average temperatures range from 11.4 °C to 20.2 °C. Generally, the hottest months in the town are from September to April, while the coldest months are from May to August. Degahbur has two main rainy seasons: the first rainy season extends from mid-April to the end of June, and the second rainy season extends from October to the end of December. The mean annual rainfall in Degahbur is 321 mm. Different Reports indicates that Degahbur has repeatedly been impacted by flood events.

5.1.2. Wind Speed and direction

The average hourly wind speed in Degahbur is characterized by a significant seasonal variation over the year. The major average hourly wind direction also varies throughout the year. Southwesterly winds are the most prevailing wind in the town[42].

5.1.3. Geology and Soils

The geology around Degahbur area is characterized by Mesozoic sedimentary rock. The landscape surrounding the town displays rocky outcrops, suggesting the presence of shallow bedrock. The soils in the town's vicinity consist mainly of white and reddish sandy soils, which are highly porous, as well as alluvial soils deposited from the upper course of the Jerer River. According to the FAO-ISRIC Soil Database2, the soils in and around the town are primarily dystric nitisols[9]. In the project area, the soil types range from Petric Calcisols to Calcaric Regosols in the Jerer River valley and neighboring watersheds. Additionally, a significant portion of the southwest part of the project area is covered by Vertic Cambisols. These well-drained soils are typically sandy loams, loams, and sandy soils characterized by a lack of accumulated clay and humus.

5.1.4. Water Resource

The project area does not have any permanent rivers, although there are two notable seasonal streams, the Fafan and Jerer, which drain the region and its surrounding areas. Degahbur town falls under the broad Shebelle River Basin. Rivers and streams in this area (Jerer) drain and flow to the Wabi Shebelle River. The FSTP project site is more than 1 km from Jerer River.

5.1.5. Noise

Most of the town areas experience ‘typical’ noise and vibration levels which are generated from normal human activities and vehicles (e. g. ‘Bajaj’). Road traffic noise levels are considered below 55 Decibels during the day and 45 Decibels during the night, and the range of densely traveled roads established by WHO is representative of urban city areas [43]. However, the project site is out of settlement area and no nose pollution is around the FSTP site.

5.1.6. Air Quality

Exhaust emissions are highest in urban centers and along major highways and vary according to peak traffic flow periods. However, the FSTP site is located in the outskirts of the town and the air quality is not expected to be affected.

5.2. Biological Environment

The land proposed for the FSTP a barren land covered by small shrubs and no species of fauna or flora that can be significantly affected by the project.

5.2.1. Local Flora and Fauna

The FSTP site has few shrub and woody species with potential clearing for the FSTP construction. The observed vegetation species in the project influence zone are Acacia tortilis, Acacia nilotica, Aloe vera, Prosopis juliflora, Calotropis julitropha, etc. The habitat for wildlife has been significantly modified because of human activities of agriculture, deforestation and urbanization. Hence the vicinity is poorly endowed with wildlife resources of conservation interest. Hyena, different birds are among the wildlife found in the vicinity of the FSTP.

The project does not pose any significant risk in terms of potential impacts during construction and operational phases to surface water resources and wetland ecosystems. There are no sensitive bird species that would occur in the vicinity of the FSTP site. Hence, the area proposed for the FSTP site has not been identified as an area of significant sensitivity. No threatened, near threatened, or any rare and declining species as identified to occur on the study site. (e. g. by IUCN categories)[44].

5.2.2. Land Use

The land use in the town can be classified as residential (buildings), commercial recreation, service, etc. The land use category under service includes governmental and non-governmental institutions, service institutions such as education institutions (KG up-to-University level), health institutions (including health post health centers and hospitals); civic and cultural service giving places (ceremonial places, youth centers, public library) and worship places & cemetery places; as well as industrial areas. The details of the land use of the town are indicated in the table below.

Table 9 Existing Land Use Distributions and Area Share for Degahbur

	Major Land Use Category	Area (%)
1	Administration	0.4
2	Commerce, Business	4.6
3	MSC's, Industrial	1.5
4	Residential, Mixed	70.2
5	Real Estate	12.4
6	Recreation, Green	5.0
7	Services	5.7
8	Transport	0.2

Source: [9]

As per the site survey and observations made on the proposed FSTP site, the location is covered by small and scattered shrubs.

5.2.3. Conservation Areas

The specific project areas (FSTP) have no forest reserves, no National Parks, or any form of conservation area as defined in the National Wildlife Policy. Similarly, there are no culturally, historically, and archaeologically sensitive areas close to the FSTP site.

5.3. The Human Environment (socio economic Settings)

5.3.1. Population and Settlements Areas:

Degahbur is one of the towns among those rapidly expanding urban centers in Somali regional state in terms of population, economic growth, and physical size. The Town has a project area of approximately 21km^2 that is divided into 9 Kebeles. According to the CSA projection, the town has a population of 48,672 (Males 25,888, Females 22,784) as of July 2023[1]. The town is a first-grade town that has its own town administration headed by a mayor.

The population of Degahbur was registered to be 28,708 of whom 14,976 were male and 13,732 female. According to this census the majority of the inhabitants are Muslim and ethnic Somali. Between 2007 and 2022 the population increase by 70% as a result during the phase of the project, this increase in population is expected continue producing larger quantities of excreta [45].

5.3.2. Economic Conditions

The income-generating activities of a bigger part of the urban population are mainly through businesses, government/private employment, and livestock production. In the town, the major economic activities are mainly related to retail trade of electronics, and consumable goods including.

Other important economic activities include government services, and private sector services such as hotel, restaurants, cafeteria, and transportation service. The majority of the town's population is driving their livelihoods by undertaking small and medium trades. There are a number of kiosks/small shops, small hotels and cafeterias, DWSSA and open markets, several government and non-governmental institutions in the town in the own. The surrounding community is pastoral which engaged in livestock production as source.

5.3.3. Health

The major health institutions in the town include hospital, health centers, health post and and clinic owned by both public and private. Based on data from Degahbur town health office respiratory and gastrointestinal diseases such as Diarrhea are among the top ten prevalent diseases occur in the town. Eye illness, skin disease & itching, malaria, Diarrhea and malaria are among top five diseases in and around Degahbur.

Table 10 summary of the health institutes

No	Health Institute	Total
1	General Hospital	1
2	Health Centers	1
3	Health Posts	3
4	Clinics	8
	Total	13

5.3.4. Education

There are government and privately owned educational facilities in the town. Such facilities include nursery schools, several primary and secondary schools in the town. Accordingly, 13 private and governmental schools operated in the Town in 2022/23.

Table 11 Education Facilities and Number of Schools and Students

	School	Total
1	Grade 0-10th grade	1
2	Preparatory School (9th - 12th)	1
3	Grade 5th - 10th	1
4	Primary & Junior School (0 Class - 8th)	3
5	Primary School (0 Class - 4 th)	5
	KG - 12th	2
	Total	**13**

Source: [9]

5.3.5. Utilities and Services

Major transportation facilities comprise roads connecting different parts of the Fafan Zone, neighboring zones of the Somali regional state. The road which connects Addis Ababa to the eastern parts of the country provides good economic opportunities to the town but also contributes to the generation of waste.

Regarding electricity supply, the town is being serviced on a 24-hour basis with power supply (hydro-power source) from the national grid. Although there is occasional power supply interruption, the town has almost 100% coverage. However, as the FSTP requires high power supply, new transformer will be required for additional power supply for the treatment plant.

In the town, there are also communication facilities (for mobile phones, line phones, internet, fax, and postal services). With regards to access, the FSTP site has no access roads.

5.3.6. Water Supply

In Degahbur, households receive their water supply from a variety of sources. These include the town's piped water supply system, traditional water sources such as wells, and water vendors who offer their services through private water vendors, water trucks, and animal-driven water barrels.

There are 550 connections to customers and 11 public taps in Degahbur. The report states that one-third of households in the town rely on the piped water system, which includes house connections, yard connections (both private and shared), and public taps. Additionally, 8% of households rely on traditional sources like wells. Private water vendors play a significant role in Degahbur, distributing 54% of the total water supply[9].

However, the existing water supply in Degahbur has been found to be insufficient in terms of both quantity and quality. To address this issue, the Somali Regional Water Bureau has commissioned the Somali Design and Supervision Works Enterprise to carry out works at the Tewlene Wellfield. The plan involves testing and drilling six new boreholes to solve the water supply problem.

5.4. Existing Solid Waste Management Practice

5.4.1. Solid Management

The major sources of solid waste in Degahbur town could be categorized into domestic, commercial, institutional. The predominant quantities of waste generated in the town are from domestic and commercial followed by others. The other major solid waste contribution comes from the streets and open markets of the town, where different inorganic and organic materials like vegetables, fruits, chat (khat), etc., are generated daily in huge quantities.

The current solid waste management services in Degahbur were found to be inadequate in all aspects of collection and disposal. Poor management of solid waste storage was particularly evident outside of the central business district, where waste was visible along streets and in drainage channels within residential areas. There is no intermediate storage or segregation of waste at any level in the town, with household waste being stored in backyards until collection.

The collection of solid waste is carried out using two dump trucks with a capacity of $12m^3$ each and one garbage pressing truck with a capacity of $10m^3$. The private sector is not involved in any aspect of the collection, transfer, or disposal of solid waste. The municipality collects waste door-to-door. The collected solid waste is transferred to a newly established dumping site. However, this site lacks appropriate containment measures, posing environmental and public health risks. During the site visit, practices such as burning of solid waste were observed.

5.4.2. Wastewater and Fecal Sludge Management

The current wastewater infrastructure in Degahbur is extremely limited, with most households relying on pit latrines for containment of wastewater and fecal sludge. The lack of a proper fecal sludge treatment system in Degahbur is a major concern for the town's sanitation.

There are no public or communal latrines available in the town, although there are plans to bring newly constructed facilities into operation. Only around 20% of people have access to basic sanitation facilities, while 67% have access to unimproved and limited sanitation facilities. Open defecation practices are still common, particularly along watercourses and storm ditches, with an observed open defecation rate of 8.8% among respondents[9].

Currently, there are no private operators in the town, and the DWSSA is the only body that provides liquid waste/sludge collection, emptying, and transportation services in town. The Fecal sludge is transported to a disposal site located 4.5km away from the town. This site consists of an open excavated pit and does not have any measures to treat or safely dispose of the sludge if the pit becomes full. This poses a significant risk of overflow and potentially contaminating surrounding areas, groundwater, storm water, and land. Additionally, there is currently no reuse of waste in the town. To address the inadequate fecal sludge management in Degahbur, it is essential to establish a properly designed and constructed fecal sludge treatment system. This will help ensure the safe and effective disposal of fecal sludge, reducing health and environmental risks in the town.

6. PROJECT ALTERNATIVE ANALYSIS

The purpose of the alternatives analysis is to identify other options, including not implementing the project, to achieve the project objectives and compare their impacts with the original proposal. The analysis systematically compares feasible, less adverse, alternative technologies, designs, operations, and sites – including the "no project" option – to the proposed project in terms of

- Their effectiveness of achieving the project objectives as well as potential trade-offs;
- Their potential environmental and social impacts;
- The feasibility of mitigating identified impacts;
- Operational requirements and their suitability under local conditions;
- Their institutional, training, and monitoring requirements;
- Their estimated cost-effectiveness;

6.1. FSTP Location Alternatives

The selection process includes an environmental and social impact assessment to quantify the impacts based on the natural characteristics of potential sites. Selection criteria are used to compare proposed sites to an ideal one. The more a site matches the ideal and fulfills the criteria requirements, the more suitable it is as a FSTP site.

Repeated field visit and study was conducted by the feasibility study and design consultant team, ESIA team, DWSSA, and other stakeholders to select the most environmentally, geographically, technically, and economically viable sites for the FSTP development. The site evaluation for FSTP gave stresses to the following points.

- From the point of view of selecting the most degraded area under no/little economic activity (whether the site is economically active or not);
- From the perspective of optimizing site selection with the rehabilitation of degraded area with the development of FSTP site
- From the point of view of enhancing the opportunity for minimizing land ownership and compensation and resettlement issues;
- To minimize the impact on vegetation and water bodies
- From the point of view of minimizing air pollution and impact to the surrounding community
- Distance from the city center
- To the point of view minimizing susceptibility of flood and soil pollution/slop of the area

Accordingly, three (3) sites were proposed for preliminary site assessment. These sites are shown in Figure 4 and described below.

Option site 1

- The site is geographically located outside the proposed town boundaries or outside the zones of the master plan around 5.80 km south-east of the town center on the eastern side of the Jerer River. This may cause difficulty in acquiring the land.
- The site has the relatively shortest average of all three sites.
- It may have more impact on Jerer River in case of operational failure specifically compared to Site 3

- It is not located near any significant settlement or commercial area, but there are a small number of settlements in the neighborhood of the site.
- Has no access road from the main road to the site
- The average slope of the site is approximately 2%, which is suitable for the construction of an FSTP. And the area is also susceptible to flood and soil and water pollution
- Some vegetation observed in the site
- Around settlement area and has some economic potential
- Has large area for expansion in the long-term

Option site 2

- **Location**: the site is geographically located outside the proposed town boundaries around 4.85 km south-east of the town center on the western side of the Jerer river.
- Has no access road from the main to the site and requires up to 3km of access road. But the site from the main road to FSTP is covered by bushes and shrubs and will not have that much environmental impact.
- No settlement or commercial area in the neighborhood
- The average slope of the site is approximately 1%, which is favorable for the construction of an FSTP. And the area is also susceptible to flood,
- Covered by scattered bushes and Shrubs
- land is sandy and infertile for crop production
- the site is in more than one km far from Jerer River and another tributary
- has sufficient area for further expansion in the long term

Option site 3

- The site is geographically located outside the proposed town boundaries around 5.75 km south of the town center. This site has a longer distance than Site 2
- no any significant settlement or commercial area
- has no access road but is a relatively short distance from the main highway
- The average slope of the site is approximately 2%, which is steeper than Site 2 but good for FSTP construction.
- Potential agricultural area
- Far from Jerer River, close to other 2 (two) tributaries
- Covered by scattered vegetation bushes and shrubs
- Site with limited land availability for future expansion

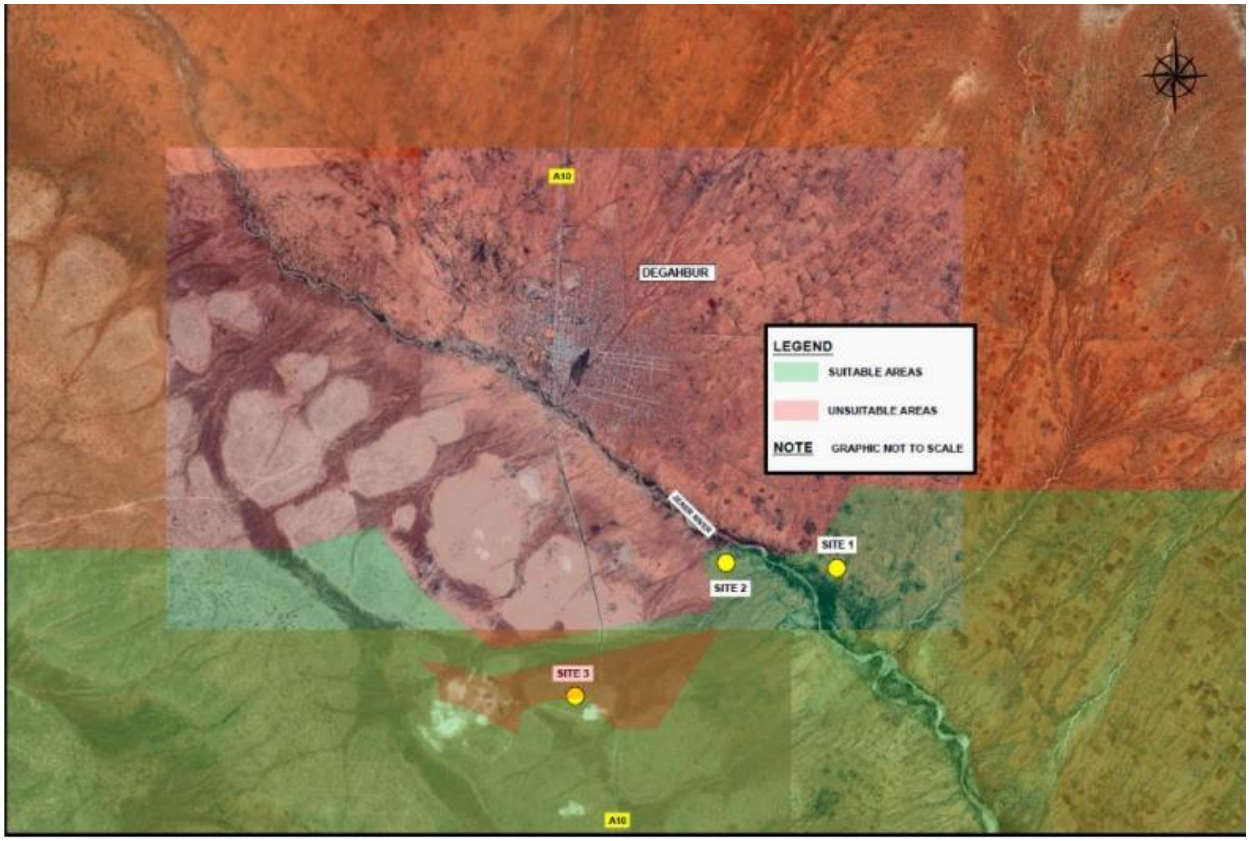

Figure 4 Identified Sites for FSTP
Source: [9]

Each of the sites was evaluated against certain criteria putting into consideration the nature of the work and social and environmental condition of the sites. The criteria include proximity to social and cultural amenities (settlement, archaeological, religious, and other cultural and historical sites), proximity to natural resources (forest, conservation area, surface water, and ground sources, wildlife sanctuaries, etc.), accessibility & distance from the town, slope, land use and cover etc.

Giving emphasis to Social-economic and Environmental criteria, the ESIA consultant evaluates the alternative sites using multi-criteria analysis; based on this method, each of the selected criteria was scored on a negative scoring basis, with a score of between 0 and 4 assigned per the following approach:

- 0 – Excellent
- 1 – Very Good
- 2– Good
- 3– Poor
- 4 – Very Poor

A weighting factor in percentage was assigned to each criterion as per Table 12 below. The site with the lowest total weighted score was deemed the most favorable site for the construction of FSTP. Accordingly, site 2 at coordinate point of 8°11'02.95"N and 43°34'42.66"E (see figure 4) which was also proposed by the design consultant is also found suitable by the ESIA consultant for the construction of FSTP compared to other sites based on the above characteristics.

The fact that the selected site is located on land that did not require resettlement, and the fact its socioeconomic and environmental impact, as well as capital expenditure and operation costs, are minimal, and its topological suitability for construction indicates that few other options would offer a better choice than the site 2.

Conclusion: the site selection looks appropriate in terms of social and environmental feasibility and acceptance by the local community.

Table 12 FSTP Site Evaluation

Evaluation Criteria	Criteria Weight	site 1 score	site 2 score	site 3 score
Socio-economic impact				
Resettlement or Land acquisition and displacement	20%	20%	0%	0%
Threat to population/nuisance and pollution /near to residential areas	20%	13%	7%	0%
Economic importance of land /fertility	10%	5%	0%	5%
Sub Total	**50%**	**38%**	**7%**	**5%**
Impact on Environmental and sustainability				
Impact on vegetation	10%	10.00%	0.00%	0.00%
Impact on watercourses	20%	4%	8%	8%
Suitability for future expansion	10%	0%	5%	5%
Susceptibility to flooding and soil pollution	10%	5%	0%	5%
Sub total	50%	19%	13%	18%
Grand Total		57%	20%	23%
Cost[9]		high	low	very high

6.2. 'No Project' Option

One of the many choices provided and examined in the comprehensive ESIA in order to meet the program objectives is the "no action" option. Technical, economic, environmental, social, and climate risk comparisons were made among the alternatives, considering the different issues. Doing nothing will jeopardize or delay the long-term city development plan since a good sanitation system is essential for maximizing the effects of other development measures and elevating the city's status.

Under the Do-Nothing Alternative, FSTP will not be built and operated, and the unsanitary conditions associated with the dispersal fecal sludge to the environment surrounding the town will continue. The do-nothing alternative would mean that land and water and ultimately the surrounding environment will continue to be polluted and loaded with untreated fecal matter and potential disease vectors. The existing system released the untreated micro-nutrients (mainly nitrogen and phosphorus) into the natural environment.

The FSTP project in Degahbur town is expected to: improve sanitation and public health in the urban setting. The municipal population is growing fast amid the absence of adequate and quality sanitation services and facilities. From the economic perspective as well as health and social considerations, the following benefits will be realized: i) improved sanitation, ii) enhanced modern FSM; and iii) low incidence of pollution, diseases, and accidents. For this project, the alternative of "no-project" will increase the risks of poor public health and environmental degradation. Hence, the 'no project' option is not a viable alternative.

6.3. Technology Alternatives for FSTP

This involves looking at various possible technology alternatives, project designs, and layouts based on design study, literature, and document reviews. The main technological aspect considered by the design consultant as well as the ESIA team was the gradient factor; the objective was to ensure that it was cost-effective (low maintenance and operation costs), easy to manage, and have less social and environmental impacts.

Fecal sludge can be treated in a variety of ways, and there is no single best option considering the widely varying conditions of urban areas. Primary sludge treatment technologies that are best suited for developing countries were identified through a literature review and document analysis.

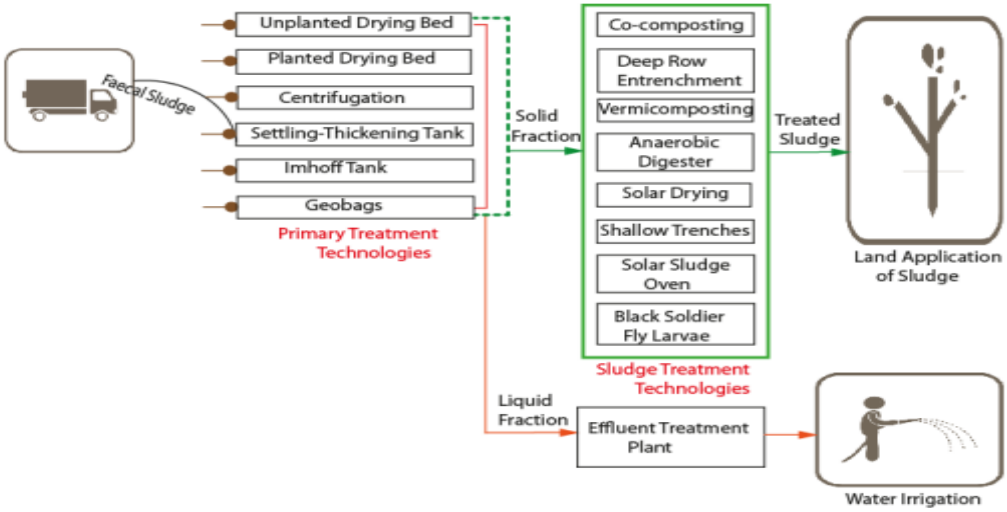

Figure 5 Overview of Technology Options for Fecal Sludge Treatment
Source: [46]

Subsequent treatment processes may include solid-liquid separation, liquid treatment, solid treatment, and pathogen removal in liquid stream. As indicated in Table 14 below, different alternative treatment process were screened for each of the Solid line, liquid part treatment, and bio-solid treatments. However, considering the physical environment, local operation and maintenance capabilities, and local socio-economic conditions, the combination of primary treatment technologies with non - planted drying bed with waste stabilization ponds and constructed wetland emerged to be the most viable alternative for FS treatment in the town. The table below presents Screened Fecal sludge Treatment options for the town.

Table 13 Screened Fecal Sludge Treatment Options for the Town

Solid Line	Liquid treatment	Dry sludge Treatment	Tertiary treatment
• unplanted Drying Beds; • Planted Drying Beds; • Geo bags(Geotextile de - watering Bags • Screw presses; • Belt filter presses, and • Centrifuges.	• Waste stabilization bonds • Anaerobic ponds; • Facultative ponds; • Maturation Ponds	• Storage for an extended period • Solar drying; • Composting; • Black soldier fly treatment	Constructed wetland

Source: [9]

6.3.1. Solid Line Technology Review

Different Treatment Options for Solid Line Treatment has been considered. The solid fraction separated from the fecal sludge needs to undergo further treatment to remove excess water from the sludge, thereby reducing its volume and allowing it to be handled as a solid e.g. using spades or mechanical equipment such as front-end loaders. Depending upon the end use of the DE-watered sludge (disposal or safe reuse), further solids treatment may be required after de - watering. Several advanced mechanical dewatering technologies can potentially be used to DE-water the sludge to higher solids content and significantly reduce its volume. Such potential treatment technologies include:

- Screw presses;
- Belt filter presses, and
- Centrifuges.

However, these mechanical dewatering technologies were excluded from this assessment as they were not considered to be feasible for the short or medium-term development horizons for the same financial and operational reasons.

Table 14 Screened Solid Line Fecal Sludge Technology Treatment Options

Criteria	unplanted Drying Bed	Planted Drying Bed	Geo bag	Mechanical(Centrifugation, Screw presses, Belt filter presses)
Land requirements	High	Medium	low	low
Energy Required for daily operation	none	none	yes	yes
CAPEX including construction complexity	Very Low	Low	Medium	high
OPEX	Very Low	Low	Medium	High
Skill Requirement	Very Low	Low	Medium	High
Reuse opportunity (reuse of the treated waste)	Medium	High	Medium	High
Removal Efficiency	Medium	High	Medium	High
Desludging	High	Low	Medium	Medium

Considering the exclusion Mechanical treatment methods (Centrifugal, Screw presses, Belt filter presses) for the reasons of high construction and operation costs, skill and energy requirement non - planted Drying Beds; Planted Drying Beds; and Geo-bags were considered suitable for the short- and medium-term fecal sludge treatment plants for developing countries having warm and/or dry climates. Therefore, these three technologies were further evaluated to select the best treatment process.

Unplanted Drying Beds

Unplanted drying beds consist of a gravel sand filter equipped with a drainage system. Fecal sludge is loaded on the bed where the water is separated mainly by percolation through the filter and partiality by evaporation. Once the sludge reaches the right dry solids content, it is removed using spades or other suitable equipment. The water separated from the beds is transferred to the liquid line of the process for further treatment. A schematic representation of this process is presented in Figure 6 below.

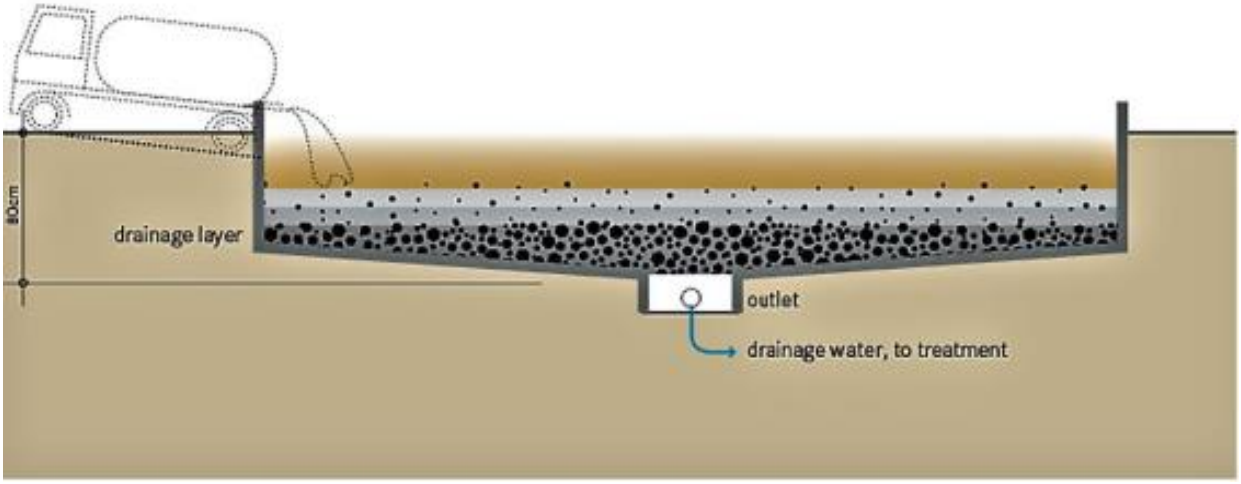

Figure 6 Schematic of a un planted drying bed.
Source: [11]

Advantage

- Has good removal Efficiency, achieves more than 20% Dry solids concentration
- Has potential for Environmental pollution in terms of sludge handling and disposal due to higher sludge production volumes than Planted Drying beds
- It does not provide stabilization of the fecal sludge and it is prone to odor pollution
- Has low operation and maintenance complexity compared to other options
- Has the best technical Feasibility- the design construction and operation do not require specialized skill, expertise or materials
- Low cost compared to other alternatives

Disadvantage

- Required large area of land
- Has negative visual impact due to large number of drying beds
- Require more labor for desludging compared to other alternatives as volume of dry sludge is high and need removal frequently compared to other alternatives
- The DE-watered sludge requires further treatment to ensure that solids are suitable and safe for reuse.

Planted Drying Beds

Planted drying beds are similar in construction to unplanted beds but are planted with emergent Macrophytes. Water loss from planted drying beds takes place through a combination of evaporation, evapotranspiration from plants, and percolation through the bed. Like un-planted drying beds, the water separated from the beds is transferred to the liquid line of the process for further treatment. Dried sludge is removed at intervals of years. This is possible because the plant roots create drainage paths in the sludge, facilitating both evaporation and percolation.

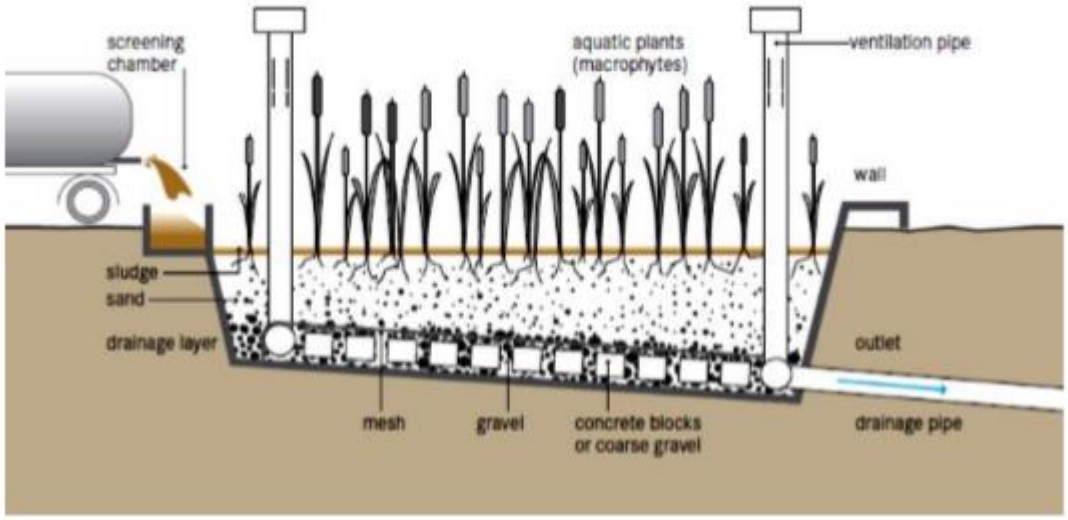

Figure 7 Schematic of planted drying bed
Source: [9]

Advantage

- Has Excellent removal Efficient- more than 20% dry solids (DS) concentration is achievable
- Provide effective sludge minerals as they undergo stabilization and dewatering over an extended period in the beds. Besides removing moisture, this process yields a final product that can be used for land application, directly or after further composting.
- Compared to Geobags and unplanted Drying Beds, Drying Beds have the advantage of reducing sludge production volumes, which ultimately leads to a lower environmental risk in terms of sludge handling and disposal.
- Has less visual impact
- Land requirement is relatively smaller than non - planted Drying Beds but is higher than Geo bags
- Sludge removal takes place at intervals of years, which reduce labor cost compared to unplanted drying beds
- Very little/no mechanical and electrical components are needed for this solution
- Low cost compared to Geo bags

Disadvantage

- The process does not provide stabilization of the fecal sludge so it is susceptible to odor issues.
- Operation and maintenance is relatively complex compared to non - planted drying bed. eg. replanting
- Design and Construction complexity compared to unplanted drying bed, this process is relatively complex as it requires a specialist supplier for the selection and provision of the plants. Construction may need a supervisor with experience on planted drying bed treatment.

Geo-textile De-watering Bags (Geo bags)

Geo bags are constructed using a durable, permeable fabric that has a fine pore structure. This fabric is specifically designed to retain particles above a certain size. When fecal sludge is pumped into the bags under pressure, the liquid is able to seep through the pores, leading to a reduction in the volume of the material being contained. The strength of the seams in a Geo textile dewatering bag is crucial for its long-

lasting performance and ability to withstand the stresses that occur during repeated expansion and contraction until it reaches its maximum capacity. The structure of Geotextile dewatering bag is depicted in the figure below.

Figure 8 Schematic of Geo-textile dewatering Bags
Source: [9]

Advantage

- Has good removal Efficiency, achieves more than 20% Dry solids concentration
- Requires relatively small area of land
- The lower footprint reduces the visual impact of the overall facility.

Disadvantage

- De-watered sludge requires further treatment to ensure that solids are suitable and safe for reuse.
- Has lower efficiency of reducing sludge production volumes compared to planted drying beds, ultimately leading to a higher environmental risk in terms of sludge handling and disposal.
- The Geo bags are not biodegradable, and are contaminated and not reusable; hence, the disposal of the used Geo bags is the biggest environmental has high environmental impact.
- Higher sludge production volumes than Planted Drying beds leading to increased potential impacts if not properly disposed of
- Does not provide stabilization of the fecal sludge, so it is susceptible to odor issues.
- Require mechanical and electrical components,
- Required expertise for design and installation, and operation of mechanical and electrical components is also needed for the sludge feeding pumps and polymer dosing system.
- Higher cost compared to above technologies need spare parts and replacement of Geo bags.

Giving emphasis to Social, economic, and Environmental criteria, the ESIA consultant evaluates the alternatives treatment technologies using multi-criteria analysis; based on this method each of the selected criteria was scored on a negative scoring basis, with a score of between 0 and 4 assigned per the following approach:

- ✓ 0 – Excellent
- ✓ 1 – Very Good

- ✓ 2– Good
- ✓ 3– Poor
- ✓ 4 – Very Poor

A weighting factor in percentage was assigned to each criterion as per Table 15 below. The technology with the lowest total weighted score was deemed the most favorable solid line treatment technology for Degahbur town.

Table 15 Summary of l Weighted Score for Solids Line Technology Selection

Evaluation criteria	Weighting Factor	Geo bags	non - planted drying beds	Planted drying beds
	Score	Score	Score	Score
Cost	25%	12.50%	8.30%	4.20%
O&M Complexity	15%	7.50%	0.00%	7.50%
Treatment Performance	10%	4%	4%	2%
Environmental	40%	15.00%	15.00%	10.00%
Technical Feasibility	10%	6.00%	0.00%	4.00%
Final Weighted Score	100%	45%	27%	28%

It can be concluded from Table above that, following the MCA, non - planted drying beds has emerged as the option with the lowest total score and therefore deemed the most advantageous process to be adopted for the treatment of the sludge produced from the WSPs for the short and medium-term horizon in Degahbur.

6.3.2. Liquid Line Technology Options

The liquid portion of the fecal sludge and the floating from the sludge dewatering process require additional treatment to ensure that the resulting effluent can be safely reused or released into the environment. Advanced wastewater treatment methods have the potential to achieve a higher standard of effluent quality. However, as indicated the table 16 below, these advanced technologies were not deemed feasible for implementation within the short or medium-term development plans because of:

- High Capex and Opex;
- Need for a large and reliable electrical power supply;
- Skilled personnel for the construction, operation and maintenance;
- Higher degree of operational complexity in terms of automated equipment and monitoring systems to ensure the plant performance;
- Skilled plant operators required to monitor and interpret operational data and adjust the plants performance to maintain effective operation;
- Higher need for specific spare parts and reliance on technical support from equipment suppliers

Table 16 comparison of technologies for liquid treatment organics removal

Technology	Design and Construction					Operation			
	Capacity range	Treatment process	Construction	Equipment need	Energy need	Labor	Consumable /spare parts	Desludging	Operator skill
WSP	Medium	Anaerobic /aerobic	Simple	None	no	High	no	Yes	Low
ABR*	Medium	anaerobic	Medium	none	no	low	no	yes	low

Trickling filter *	Medium –high	Anaerobic /aerobic	Medium	yes	yes	low	Media replacement		Medium
Aerated Logon	Medium –high	aerobic/mechanical	Complex	yes	yes	low	Spare parts	no	Medium
Oxidation Ditches*	High	aerobic/ mechanical	Complex	yes	yes	low	Spare parts		High

*Needs to combine with other options to achieve treatment goal

Due to the existing limitations in organizational structure and the lack of skilled personnel to operate complex treatment systems, it is currently not feasible to implement such a solution in the short or medium-term. Accordingly, among various treatment technologies, Waste Stabilization Ponds (WSP) treatment, which includes anaerobic, facultative, and maturation ponds, is considered the most practical option for Degahbur in the short and medium term. Waste Stabilization Ponds (WSP) WSPs are a relatively simple technology for wastewater treatment in developing countries where sufficient land is available and temperature is favorable for the technology.

WSPs are large basins enclosed by earth embankments, in which raw wastewater is treated entirely by natural processes. These treatment ponds can be used to treat the liquids separated from the fecal sludge and from the sludge cake in the solids line. Long hydraulic retention times are used because the rate of oxidation is slow due to the usage of natural processes; these times typically range from 30 to 50.

Anaerobic and facultative ponds are mainly designed for BOD removal, while maturation ponds are used for pathogens removal. Some level of Nitrogen and Phosphorus removal also occurs during throughout the treatment in the anaerobic, facultative, and maturation ponds.

Supernatant from the unplanted drying bed will resemble very high-strength wastewater. The BOD and TSS in the liquid stream are expected to be reduced to a high degree; this is almost an order of magnitude higher than domestic sewage. The higher strength of seepage/fecal sludge creates a need for more than one treatment stage; if an acceptable effluent standard is to be achieved accordingly, it will be treated in seriously connected waste stabilization ponds. A brief description and treatment principle is indicated in section 3.4.2.4 in chapter three.

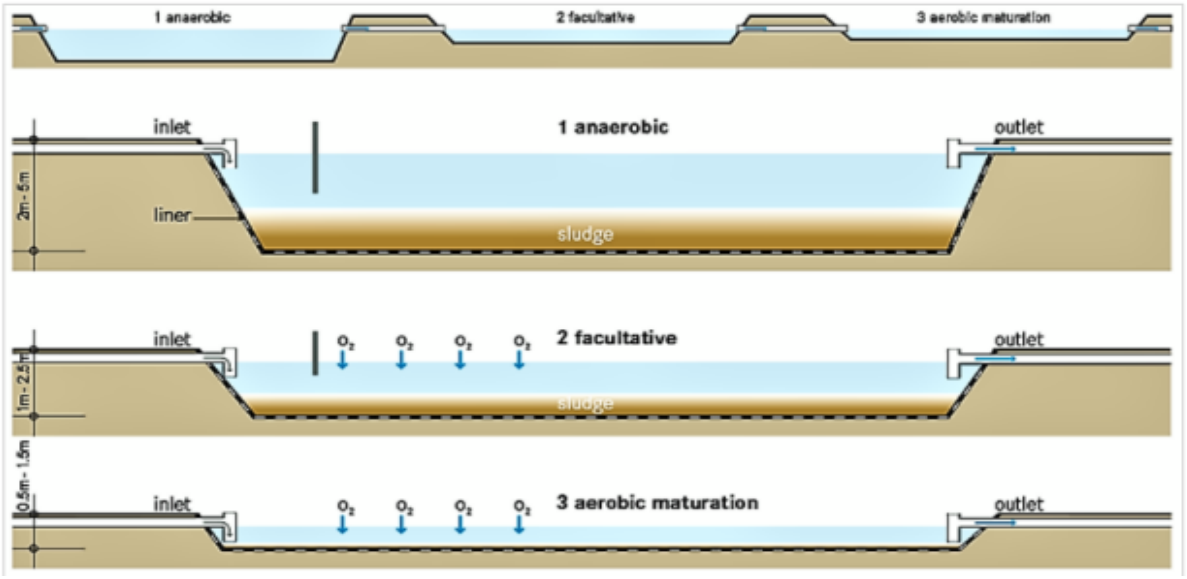

Figure 9 typical features of anaerobic, facultative, and maturation ponds
Source: [9]

6.3.3. Alternative analysis of Bio solids Disposal & Reuse Options

Solids' treatment technologies are primarily used for dewatering and drying of sludge and for stabilization and pathogen reduction. The seepage entering the treatment plant is typically 1% to 3% dry solids content (by mass). The solids liquid separation step thickens the solids in the seepage to a dry solids content typically between 6% - 30%, depending on the process used, and even up to 50-60% for sludge drying beds (SDBs). Selection of solids treatment technologies should consider the end use of the final sludge product.
The table below categorizes solids' treatment technologies by various treatment goals and summarizes their requirement for design, construction, and operation considerations.

Storage for an Extended Period:
Storing De-watered sludge for an extended period is a simple way to reduce pathogen concentrations. This approach is suitable in dry climates and areas with enough space to store the sludge. However, there are challenges with this option. Due to the uncertainties and the level of pathogen reduction achieved, it cannot be guaranteed that extended storage will meet the standards for Class A biosolids reuse. Instead, it is assumed to only meet the requirements for Class B biosolid reuse.

Advantage

- Requires very little/no mechanical or electrical components, which reduces the operating costs
- Lower maintenance cost as it uses very little/no mechanical and electrical components and Operators with basic training can undertake all the O&M tasks required for this process.
- Has better efficiency/produces Class B biosolids

Disadvantage

- Required relatively larger area for storage of longer period
- Requires relatively higher cost for construction of shelter
- Manual labor is still needed for the process.
- Potential to cause surface water pollution (if not poorly managed).

- The Class B biosolids may pose a risk to animal/human due to their higher pathogen concentration as it uses large area that is not easily concealed from public view/impact on aesthetics.

Solar Drying

Solar drying is very simple and effective for obtaining high dry solids content but requires a lot of available land, reasonably long drying times, relies upon environmental conditions and ventilation for performance, and requires significant manual labor for turning.

Advantage

- Requires no automation, but it involves some mechanical and electrical components and has low operation and Maintenance costs
- Removal efficiency is good, similar to storage for extended periods and compositing Class B biosolids

Disadvantage

- Require relatively higher area to construct the drying beds /almost similar to storage for extended time
- Relatively high cost due to cost of the solar drying beds and mixing equipment
- Require some mechanical and electrical components, and this may also increase operating costs.
- Manual labor is required to feed, mix, and empty the beds.
- Similar to storage for extended periods, it is not easily concealed from public view
- Requires relatively experienced expertise for electro-mechanical design and installation.

Solar drying is used not only to reduce pathogen concentrations but also to increase the dry solids content. It consists of:

- Beds housed within greenhouse-type structures, which are typically formed from translucent polyethylene mounted on a metal frame;
- Relies entirely on evaporation to remove moisture;
- Sludge must be regularly turned. Turning brings wet sludge to the surface, thereby increasing the potential for evaporation.
- Ventilation is required to remove moist air from above the beds and replace it with dryer air, so maximizing the evaporation that can be achieved.

The pathogen removal achievable with this technology can also be inconsistent. Therefore, biosolids treated via by solar drying should at best be considered as Class B biosolids and reused accordingly. Therefore, it is not recommended for Degahbur Town.

Solar Drying followed by Composting

Composting is a beneficial process that utilizes microorganisms to break down biosolids in the presence of oxygen and heat. This results in the production of compost, a stable and versatile substance that can be used for various purposes. Compost is an excellent fertilizer, soil conditioner, and natural pesticide when applied to land. The composting process also effectively eliminates pathogens in the biosolids if the temperature remains within the thermo-philic range (40–70°C) for a sufficient duration. The selection of the appropriate composting time and temperature depends on the desired quality target for the biosolids (Class A or B).

However, before biosolids can undergo composting, it is necessary to increase their dry solids content to 40–45%. This can be achieved through a solar drying step prior to composting.

Advantage

- Storage time is significantly lower (usually less than 2 months) than storage for an extended period. Shelters are also required to protect the compost from the rain.
- Composting requires very little mechanical or electrical components, which do not affect operating costs.
- However, manual labor is intensive due to the continuous mixing and monitoring required for drying
- Revenue, which can be generated from the sales of the compost
- Has the Highest reduction efficiency /produce Class A biosolid.
- Has the lowest risk for environment and human and animal
- Requires no specialist input for the design; construction is simple.

Disadvantage

- Require relatively higher area to construct the drying beds
- Relatively high cost due to the cost of the solar drying beds and mixing equipment
- Require some mechanical and electrical components, and this may also increase operating costs.
- Require intensive and trained labor due to the continuous mixing and monitoring (monitor its characteristics (temperature, humidity, dry solids content, etc.), and ensure its effective ventilation.)
- Similar to storage for extended period it is not easily concealed from public view
- Require relatively experienced expertise for electromechanical design and installation

Black Soldier Fly

The black soldier fly (Hermetia illucens) is a type of fly that belongs to the Stratiomyidae family. In nature, the larvae of this fly able to break down organic material and returning nutrients to the soil. This natural activity is harnessed to convert various organic materials such as food wastes, agricultural wastes, manures, and human feces into usable by-products.

In these facilities, the larvae of the black soldier fly feed on decomposing organic material. Within a span of 14-16 days, they can grow from a few millimeters to around 2.5 cm in size while reducing the wet weight of the waste by up to 80%. To separate the larvae from the organic wastes, a mechanical agitator is used to harvest them before they enter the perpetual stage. The harvested larvae are rich in protein (approximately 35%) and fats (around 30%), making them suitable as animal feed, similar to fish meal. The leftover residue can also be used as a soil conditioner, but it requires additional treatment before it can be reused.***Advantage***

- This technology has the smallest footprint and require small area of land
- Can be generated from the sales of the animal feed is a potential benefit of this solution.
- Doesn’t require sophisticated instrumentation
- Lower risks to the environment/ humans/animals compared to the other technologies.
- Has the lowest footprint among the other technologies, and it can be hidden from public view.

Disadvantage

- Higher cost requirement for the nursery and the equipment required for the larvae growth.
- The process has a high operational and control complexity (The breeding colonies can be difficult to establish and black soldier fly reproduction)

- Require Trained and skilled operators
- Required experienced experts to design hatcheries so compared to others above, there would be a limited number of contractors with sufficient capabilities to implement this solution.

Table 17 Summary and Multi-criteria analysis comparison of technologies for solid treatment

Criteria	Category Weight	Storage for extended period	Solar drying	Solar drying followed by composting	Black soldier fly treatment
		score	score	score	score
Cost	25%	2.3%	4.5%	9.1%	9.1%
Operation & maintenance complexity	15%	0.0%	1.9%	5.6%	7.5%
Treatment Performance	10%	4.0%	4.0%	0.0%	2.0%
Impact on Environment	40%	16.0%	16.0%	8.0%	0%
Technical Feasibility	10%	0.0%	1.7%	1.7%	6.7%
Total score	**100%**	**22.3%**	**28.1%**	**24.4%**	**25.3%**

Biosolids Treatment Technology Selection Four feasible biosolids treatment technologies were identified above for Degahbur. A Multi criteria Analysis was prepared to assess these four technologies. It can be concluded from Table above that following the MCA, Storage for an Extended Period has emerged as the option with the lowest total score and, therefore, deemed the preferred biosolids treatment technology for FSTP in Degahbur.

In general, a combination of unplanted drying beds for solid treatment); WSB with a combination of constructed wetland for Liquid treatment and Storage for extended periods for Biosolid treatment is found suitable for the FST in Degahbur.

The main advantages of the recommended treatment technologies are the low cost in terms of construction, operation, and maintenance, simplicity of operation and maintenance, good treatment efficiency, no energy requirement, and the fact that they can be built and repaired with locally available materials. Moreover, the land required for the treatment scheme is available in the city and the warm climate of the town favor for use of WSP and sludge drying beds than other technologies in Degahbur.

7. CONSULTATION PROCESS

During the preparation of the ESIAs, extensive consultations were conducted at various levels. The public consultation process in Degahbur was conducted in accordance with the Ethiopian Environmental Impact Assessment Regulation of 299/2002 to provide clear and accurate information about the proposed project to communities living in the project area and promote understanding through the active engagement of individuals groups, stakeholders, and organizations who have a stake in the project and its outcomes.

Information related to the existing waste management system focusing on constraints, existing environmental and social features of the project influence area, potential environmental issues/impacts related to the proposed project component and activities, as well as the attitudes of the officials, local communities, design consultant's staff, Client's officials and experts towards the planned scheme were assessed. This information and opinions have been considered in this social and environmental impact analysis.

The project ESIA process also involved the development of a separate Stakeholder Engagement Plan (SEP) report, which provides guidance for the engagement and disclosure activities for the future project stages, starting from the project preparation to the actual operation of the wastewater project.

7.1. Consultation with the Community at Project Intervention Site

The people in the project impact areas of influence were consulted. A total of 46 people (11 male and 35 female) participated in the meeting (Appendix-1 Community consultation minutes). The communities were given detailed information about the project through presentations by the consultant team. The presentations highlighted the project background, objectives, expected upcoming activities, and potential socio-economic and environmental impacts of the proposed project interventions. After the presentations, the floor was opened to the community for discussion and to forward their views, comments, and queries. Questions were answered (that needed an immediate response by the ESIA consultant and DWSSA staff), clarifications were offered, and their recommendations were received for further deliberation.

All members of the consultation meetings were very interested to participate in the discussions, and they shared their views and opinions on the discussion points. The main issue of concern raised in the discussion was the health impact which occurs as a result of improper disposal of wastes, including fecal sludge.

The community is happy to hear about the project and expresses their well and commitment to support the project. All the participants do not have any opposition to the implementation of the project but their concern is the project may pollute the downstream Jerer River if it is not properly operated and managed.

In general, the meeting participants raised the issue of safe disposal of fecal sludge and proper treatment in order to ensure the health of the local community and the environment. Finally, they concluded that they would support the project and participate in its implementation with full heart if they are sure that they will get the anticipated benefit from the project.

Figure 10 Community Consultation Meeting at Kebele/site Level

7.2. Consultation with Governmental Stakeholders at Degahbur Town

Meeting was held with different stakeholders, which consists of the mayor's office, environmental protection, land administration, Agriculture, Women and children affairs, youth representatives and Health, office representatives. The objective of the consultation is to discuss the issues of the project and to identify the possible solutions and mitigation measures for the problems that would be caused due to the project intervention in the town.

All the consulted offices were very cooperative in sharing their concern and information about the project. We had a fruitful discussion about the project, project importance, stakeholder and their roles, impacts of the proposed project, and mitigation measures. During the discussion, key recommendations were forwarded by the participants.

Figure 11 Consultative/Stakeholder Meeting at Degahbur

The outcomes of the discussions during the consultative meeting are briefly presented below:

- The project is critical and needs to urgently start the construction and operation in such a way as to ensure the health and wealth of the public. The implementation of this project is critical to bringing about sustainable development and ensuring equitable share considering the interests of all stakeholders to address the increasing population sanitary demand.
- The FSM are long-standing problem of Degahbur, that needs to engage all stakeholders in the design, implementation, and operation;
- Proper design and implementation of the project are necessary not to pollute the nearby Jere River and the downstream tributaries.

- Moreover, they also recommend proper mitigation methods to control bad odor, buffering and landscaping of the site as well as reusing of FSTP effluent and sludge for fertilizer.

Mitigation:

- Conduct regular monitoring for effluent quality and needs to fulfill the national and international standards before it is released to nearby water bodies;
- The constructed facilities need to be managed with properly trained workers;
- Implement the FSTP as indicated in the design and technologies so that reduce/avoid bad smells from the treatment plan; and effluents not to pollute soil and water bodies.

7.3. Summary of Consultation Findings

The following table presents a summary of the findings of consultation at various levels.

***Table 18** Issues and Concerns raised During Stakeholder Meeting*

Stakeholder	Project impacts/concern raised	Mitigation suggested
Institutional /Town stakeholders	Project delay, prior awareness and Knowledge in FSTP management Lack of coordination,	Improve project communication and capacity of the client and its stakeholder's coordination system
	Impacts on the existing land use, and response to the challenges	Promote appropriate rehabilitation for degraded lands due to the project Continuous awareness raising activities at all level
Community	nuisance odor, aesthetic value deterioration	Fencing and proper operation of the facility Promote importance of the project through awareness raising activities, proper monitoring of discharges engage the local community in any relevant site works at various level
Management issues /DWSSA	Issue of water for the FSM in general and for the operation constructed FSTP in particular	Improve water supply system in the town and provide water supply to the proposed FSTP

7.4. Public Disclosure

Start of the project study has been disclosed to relevant stakeholders through a series of consultations made at the town administration levels. Through these consultations, project information (including purpose, project type, and project location) and the ESIA requirements were disseminated to the stakeholders and PAPs. This ESIA report has been prepared to take into account all the feedback from stakeholder and PAPs consultations. In accordance with the World Bank policy on access to information, disclosure of relevant project information needs to be posted on MoWE website (executive summary translated in Amharic and full ESIA document) and the World Bank external website to receive the opinions and suggestions of civil societies, academics, and other professionals as well.

8. IMPACT IDENTIFICATION, ANALYSIS AND POSSIBLE MITIGATION MEASURES

8.1. General Considerations

This part of the report addresses potential impacts associated with the proposed projects and measures for avoiding, reducing, or restoring the negative impacts, and enhancing the positive effects of the project. The following issues were considered for the assessment of the social and environmental impacts of the proposed project:

- Impacts of all phases of the project cycle, including construction, operation, and decommissioning is assessed;
- All elements of the project infrastructure and activities associated with the project, including actions by third parties on which the project depends, whether they are funded as part of the project or by other parties;
- The potential impacts of the project on the physical and natural environment, social, economic and cultural environment including impacts on the health and safety of the local communities and project workers;
- The positive impacts, as well as adverse effects and proposed measures to enhance the beneficiary, impacts and mitigation measures for the adverse impacts.

Proposed Topics to be Scoped Out: With reference to the analysis of the legal and institutional framework and collected information in the baseline, there are certain topics considered not relevant or with less importance to the project and, therefore, proposed to be scoped out. Topics of less importance and therefore proposed to be scoped are

- Biodiversity conversion and sustainable management of living natural resources. It is not relevant, given that there are no threatened, rare, or endangered species of fauna or flora registered or known to exist around the site.
- Climate change assessment (climate check) since the project intervention is very local and does not have significance on climate change adaptation and mitigation efforts.

8.2. Impact Identification

In this section, the expected possible impacts under each stage of the project activities were identified and analyzed for the proposed project in relation to the various stages of its implementation.

For this assessment, the impacts identified were those which are considered to be ‘significant impacts. This is not to say that minor impacts were disregarded, but that their impact, whilst detectable, is not considered significant. The overall level of predicted impacts (positive and negative) is evaluated. Realistic assumptions have been made and qualified. The impacts may be positive as well as negative and may be short or long-term, temporary, and reversible or permanent. The impact assessment for the proposed project works has considered the level of the potential impacts, this being based on both the value of the environment and the nature and magnitude of the potential impact.

Identifying the project boundaries within which the ESIA was undertaken is an important component of the study. The identification process focused and delineated the FSTP within an area where impacts both

positive and negative will be felt on the environment, economy, and local community. The types of boundaries considered were institutional, temporal, and spatial.

8.2.1. Institutional Boundaries

The institutional boundaries are composed of institutions and sectors relevant to the project development. These can be determined from the political boundaries, regulations, institutional mandates, and structures. The proposed project is likely to affect directly or indirectly the interests of the surrounding institutions. Therefore, these institutions have been adequately consulted during the ESIA process.

The institutional framework for environmental management and handling ESIA requirements in the town/region exists at the regional, sector, Municipality/ DWSSA/ local government, and Kebeles (Village). The relevant institutions for handling ESIA requirements for the construction sector include the following: National and Regional Environmental Protection Authority, Somali Regional State Urban Development and Construction, Health Bureau, education, culture and tourism, women and Children Affairs, and Municipal Environment Management units, village Committees, and DWSSA.

8.2.2. Temporal Boundaries

Temporal boundaries refer to project life span and the reversibility of impacts. For example, the impact of construction works on natural vegetation may be short-lived if measures are taken to restore vegetation and the land after material extraction. However, the resettlement of the community to give way for proposed works, if applicable, may have a long-lasting impact, stretching far into the future in terms of loss of income, land, and disruption in cultural life and livelihood of the people. However, the proposed sanitation project will not permanently impact the local community in terms of resettlement and loss of land and properties at FSTP sites.

***Table 19** Estimated Temporal Boundaries of the Project*

Project phase	Duration
Construction	Up to 22 months
Operation	20 years subject to upgrade in the subsequent medium and long term intervention
Decommissioning	After 20 years depending on the conditions

8.2.3. Spatial Boundaries

Spatial boundaries refer to the area affected by the project. The area of direct impact for the proposed FSTP will be within the project's legal framework where most of the activities will take place. The immediate impact area of the proposed projects is adjacent to the site where some of the impacts, such as traffic accidents, the spread of communicable diseases such as HIV/AIDS public health, and dust and sound pollution, will be felt directly. The influential impact area is defined as the one comprising areas where decisions are made. This project's decisions are made mainly at the regional, Municipality, and kebele administration levels. In addition, environmental protection and DWSSA, together with town administration, may all have input regarding land ownership and construction permits and issues.

8.3. Impact Characterization and Significance

When identifying the potential impacts of a new project on the existing environment, it is necessary that it should be measured against the existing baseline conditions. The significance of each identified impact was determined by experts who relied on their previous experience, field observations, consultations with stakeholders, and consideration of relevant legal frameworks, regulations, and standards related to the

project. Each expert involved in the impact assessment was assigned a significance rating (low, medium, and high) for each impact individually. Finally, these ratings were combined to create an overall significance rating for each impact.

The overall significance of the possible impacts has been determined by combining the perceived 'Likelihood of Occurrence' of the source of the impact in combination with the corresponding impact 'Consequence' describing the severity of the impact, 'Significance' describing the level of required mitigation measures, the 'Spatial Influence', describes the proximity of the impact, 'Temporal Influence' describes the duration of the impact, and finally, 'Reversibility' describes the ability to return to original conditions after implementing mitigation measures. The detailed classification of impacts is provided in Table 20 below, and the Matrix of Potential impacts against classification and significance for each project.

Table 20 Detailed Impacts Classification Approach

Impact Criterion	Effect on Environment	Classification of Effect	
		Expression	Impact description
Likelihood of occurrence	What certainty of occurrence is associated with impact?	Unlikely Likely Certain	Probably will not occur May occur Will occur
Consequence	How severe will the impact be?	Marginal Critical Severe	Little impact Moderate impact High impact
Significance	How important is impact in Project design?	Low Medium High	Impact of little importance, needs limited mitigation Impact has influence and requires mitigation Impact of great importance, mitigation is a must
Spatial influence	How the impact shall be extended spatially?	Local Regional	Within the surrounding area of the project Extends beyond the surrounding area
Temporal influence	How shall the impact extend over time?	Short term Medium term Long Term	The impact shall last short period of time The impact shall last medium period The impact shall be permanent
Reversibility	Can the influence be removed once the impact ends, or will the influence remain?	Reversible Irreversible	The influence of the impact can be reversed The influence of the impact cannot be reversed and shall be permanent

Table 21 Prediction and Significance of Potential Impacts of FSTP project Activities

No	Identified Potential Impacts	Type of Impact		Likelihood of occurrence			Consequence			Spatial influence		Temporal influence			Reversibility		Significance without Mitigation/Enhancement Measures			
		Positive	Negative	Unlikely	Likely	Certain	Marginal	Critical	Severe	Local	Regional	Short	Medium	Long	Reversible	Irreversible	None	Low	Medium	High
	CONSTRUCTION PHASE																			
1.	Land use change		X			X	X			X				X		X		X		
2.	Clearing of vegetation		X			X	X			X				X	X				X	
3.	Soil compaction and erosion		X		X		X			X		X			X				X	
4.	Pollution of surface water		X		X		X			X		X			X				X	
5.	Noise dust and vibration		X			X		X		X		x							X	
6.	Occupational Health and Safety of Workers		X		X			X				x			x	x				X
7.	Health impact (HIV AIDS/ STDs)		X		X			X		X			X						X	
8.	Labor influx and conflict with local community		x		x		x			x		x			x				x	
9.	GBV/SEA		X		X			X				X			X				X	
10.	Loss of land/Impact on livelihood		X	x			X			X				X		X				X
11.	Impact on archaeological & cultural heritage sites		X	X				X		X		X			X				X	
12.	Traffic congestion and accident		X		X		X			X		X			X				X	
13.	Job creation	X				X				X		X								
14.	Skill transfer to local workers	X				X				X		X								
15.	Indirect job opportunities for coffee and tea vendors	X			X					X		X								
	OPERATION PHASE																			
1.	Impact on water bodies		X		X		X			X			X		X					X
2.	Gas emission and Air pollution		X			X	X			X				X	X				X	
3.	Noise pollution		X		X		X			X								X		
4.	Odor (Foul smell) at the site and surrounding environments		X			X		X		X				X	X				X	
5.	Impact on public health/use and contact from sludge		X		X			X		X			X			X			X	
6.	Occupational safety		X		X			X		X						X			X	
7.	GBV/SA		X		X			X					x	X	X	X			X	

8.	Job creation	X								X				X					
9.	Compost generation from sludge	X								X				X					
	DECOMMISSIONING PHASE																		
1.	Air and Noise pollution		X			X	X			X		X			X			X	
2.	Impact on water bodies		X		X		X			X		X			X			X	
3.	Spoil disposal		X		X					X								X	
4.	Soil compaction and erosion		X		X		X			X							X		
5.	Health impact		X		X					X								X	
6.	GBV/SA		X		X		X			X				X		X		X	
7.	Loss of Job opportunity		X		X														

8.4. Positive Impacts and Enhancement Measures

The most significant benefit derived from this project will be the well-developed institutional capability for sanitation and hygiene service delivery and, eventually, a cleaner natural and living environment and significantly improved health standards in the town of Degahbur.

The project will result in many socio-economic and environmental benefits for Degahbur town and for those in their peri-urban areas (avoiding open dumping sites). It is expected that the projects will result in better access to safe sanitation and hygiene facilities and treatment units leading to an improved standard of living in terms of reduction of diseases (such as pathogenic) and creating temporary/permanent employment during construction and operation.

The impact analysis presented in section 8.3 above identified positive impacts of the proposed project activities. The identified impacts and their enhancement measures are briefly described below.

8.4.1. Job creation

The construction, operation, and decommissioning of the project activities will create both short- and long-term employment opportunities. Most of it will be during the construction phase, where there is a possibility of engaging skilled and unskilled labor from the communities around the project. Indirect job opportunities like coffee and tea selling around the construction site, mainly by women, are another benefit of the project, particularly during the construction phase. Skill transfer from experienced and skilled workers to others will also be one of the beneficial impacts of the project.

Enhancement measures: Benefits from job opportunities can be enhanced by providing job training and capacity building; it is possible to enhance job opportunities for the local community, specifically for women and youth.

8.4.2. Health

The implementation of the proposed project will prevent any health-related problems, particularly outbreaks of waste-related diseases (such as cholera dysentery disease caused by poor sanitation). The proposed project will positively contribute towards improving the environmental sanitation and community health in Degahbur.

Enhancement measures: Health advantage from FSTP would be enhanced by creating awareness of fecal sludge management in the community. Integrating hygiene promotion and awareness creation activities will enhance the positive impacts or results of the proposed project. In this regard, a national one WaSH approach can be followed.

8.4.3. Air Quality in the Catchment

Though the localized odor at treatment sites and their boundaries is expected to be adverse, the overall air quality of the catchment will be improved. This is because fecal sludge, which is being discharged to a wider environment without treatment, will be collected at treatment plants and treated to remove harmful components. The project itself is designed to mitigate environmental pollution. Hence, the impact on air quality will be highly positive.

Enhancement measures: To improve the air quality in the FSTP project site in particular and the city in general, promoting the implementation of appropriate management strategies such as regular monitoring.

8.4.4. Improvement of Water Quality

Concerning surface water, including the bottom sediment, the major positive impact of the operation of the FSTPs is the improved water quality within the project area and downstream. Therefore, properly managing FS will play a key positive role in protecting water pollution.

Enhancement measures: To enhance the positive impacts on downstream water quality, it would be important to regularly monitor the quality of the effluent released to downstream rivers and check whether the effluent quality complies with the Ethiopian effluent discharge standards.

8.4.5. Production of Compost/Fertilizers

One of the advantages of a non-plant drying bed is that the sludge can be used to prepare compost. Dewatering sludge (Biodegradable materials) removed from the FSTP process can be utilized for fertilization and conditioning of the soils. This could be an additional benefit for the local community. In addition, the Degahbur town water and energy office can mobilize resources to take advantage of FS wastes to generate biogas for households and institutions. In this regard, the related office will collaborate with institutions in Degahbur to convert the waste into biogas.

Enhancement measures: Creating a demonstration field and training of farmers on how to use the compost on their farm plots and biogas to fuel their houses would enhance the benefit. Producing marketable compost will enhance the benefit and generate income for the DWSSA. This needs to closely work with the regional/zone bureau of agriculture to ensure the quality of compost prepared.

8.4.6. Supplementary Measures

The following proposed measures would scale up the expected benefits obtained due to the implementation of the project activities. These include:

- Capacity Building: The other broad area of intervention required to enhance the identified positive impacts is conducting capacity-building programs within DWSSA, municipality, and other relevant stakeholders, including environmental protection, health, and agriculture. Implementing training and capacity-building programs would serve the project's sustainability.
- Strengthening the legal framework: Another recommended enhancement measure is to work on and strengthen the legal aspect. Laws relevant to solid and liquid waste management (including the disposal methods) should be reinforced and their application must be monitored to minimize the ongoing gap.

Table 22: ESMP for Enhancing Beneficial Impacts

Socio-Environmental Component	Proposed Enhancement measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
		Implementation	Supervision		
Job opportunities	Benefits from job opportunity can be enhanced by providing priority for local community (youth and women). Recruit local labor in consultation with project administration office	Construction Contractor	DWSSA/ Supervisory Consultant	constructio n phase	Not required
	Give priority of skilled and unskilled jobs for local community. Provide on job training to build the capacity of workers.	DWSSA/FSTPs Management	Labor and social affair office	Operation phase	550,000
Improvements on public health	Creating awareness to the community using health extension workers Promoting residents to organize environmental health committee and follow up their environmental sanitation status. Promote proper solid waste collection, treatment and disposal system to supplement the benefit obtained from treatment.	Degahbur Town Health Office	Community Health Promotion Office	Operation phase	part of the Government budget.
Production of compost/fertilizers from the Sludge	Creating a demonstration field and training farmers on how to use the compost on their farm plots would enhance the benefit. Producing marketable compost will enhance the benefit and generate income to DWSSA.	DWSSA/FSTPs Management in cooperation with Agriculture Offices	SREPA, Agriculture and natural resource department		Part of the FSTPs operation budget

8.5. Negative Impacts and Recommended Mitigation Measures

An impact evaluation matrix has been used for the identification and assessment of potential negative impacts of the proposed project activities in terms of spatial extent, duration, level of significance, probability of occurrence, and reversibility of the issue for the stages of construction, operation, and decommissioning.

The assessment is made against each issue or medium of impact on physical elements that include water bodies (surface and ground), soils, ambient air, and flora as well as the human or socioeconomic elements that include the socio-economy, health, and safety, noise and vibration, traffic accidents referring to the impacts on the overall wellbeing. These impact areas of concern for the implementation of the project and their proposed mitigation measures are presented below:

8.5.1. Impacts during Construction Phase

Land Use change and Impacts on Fauna and Flora: The proposed project activities would lead to the land-use change. The FSTP is planned to be implemented in an area covered by bushes and shrubs hence the construction activities will remove vegetation covers, changing the land use of the site. The new land-use type will be semi-built. This change is permanent. There are limited types of shrubs (Acacia tortilis, Acacia nilotica, Aloe vera, and Prosopis juliflora species) that would be affected by the project development. In addition as the site is near (about 1 km) the Jerer River and there may be some movement of wild animals from the riverine and the construction activities may restrict the movement or cause accidents to the wild life. The impacts on Fauna and Flora are predicted to be moderate, localized but permanent without applying mitigation measures.

Mitigation measures

- Plant trees in and around the project site to replace the removed trees (10 seedlings per removal of a single tree), the selection of appropriate tree species and locations of planting shall only be done in consultation with the concerned Environmental Protection Office.
- Limit land clearing works only to what is absolutely necessary
- Demarcation and fencing off the construction areas.
- Prohibit poaching and killing of wildlife by the workers.
- Backfilling of trenches and other excavated areas and grading to the natural topography.

Soil Compaction Erosion and Pollution: The construction activities will cause soil compaction and damage soil structure and expose the soil to runoff water erosion. This will increase the risk of soil erosion and silt transport to the nearby Jerer Rivers. Moreover, Soil pollution could also occur due to hazardous substances such fuel, lubricants, oil and cement sludge resulting from poor handling of the substances, especially during maintenance of machinery and vehicles and construction.

.

These impacts on soils are predicted to be moderate, localized, and temporary and reversible without applying any mitigation measures.

Mitigation measures

- Limit excavation works only to what is absolutely necessary and carry out the works in the dry season only to reduce soil exposure to runoff water erosion.
- Careful removal and proper stockpiling of the topsoil removed from the sites and re-using it for site restoration when construction works are finished.

- Reduce the time exposed surfaces or excavated soils remain bare following completion of works and implement restoration measures such as re-vegetating exposed areas as quickly as possible.
- Use only existing roads to the extent possible, and do not drive through unpaved soil.
- Provide well-designed and constructed culverts and side ditches for the access roads to minimize potential erosion.
- Install drip pans and fuel funnels at dispensing points of fuels and lubricants.
- Oil exchange and Washing of vehicles should occur only in the already prepared workshop area and never in rivers and open soils.
- Properly manage and dispose of construction waste in designated waste disposal areas, including packaging materials, concrete debris, and other non-hazardous waste.

Pollution of Water Bodies: Release of solid and liquid wastes and spillages of hazardous substances such as fuel and oils from workshops and from workers camp can potentially affect the surface/nearby Jerer River and groundwater quality.

The impact on surface water bodies before mitigation measures is anticipated to be moderate, while the impact on groundwater is rated low.

Mitigation Measures

- Perform excavation works and earth-moving activities during the dry season, thereby minimizing erosion or transport of excavated materials by runoff water to water bodies.
- Prevent environmental pollution by hazardous substances such as oil, fuel, cement sludge, and detergents through proper storage and handling of these substances.
- Providing suitable facilities for workers, and disposing of waste according to approved waste management plan (avoiding open waste disposal practices).

Impacts on Ambient Air Quality: The emission sources in the construction phase are:

- Site clearance;
- Excavation and earth-moving activities;
- Dust emissions from handling and transportation of excavated materials, construction inputs, and auxiliary materials;
- Vehicular traffic movements on unpaved roads and earth moving activities;
- Gaseous emissions from vehicles and construction equipment; and

The impact on air quality is rated as moderate, localized, short-term, and reversible without applying any mitigation measures.

Mitigation measures

- Regular spraying of water on unpaved access roads, exposed earth, and any stockpiles on site, and where feasible, covering stockpiles on site with plastic materials.
- Minimize excavation and earth moving to only what is required for the specific nature and type of construction.
- Limit stockpiling of excavated topsoil to a maximum of 2m height.
- Use paved roads as much as possible. and

- Limit the speed of vehicles to 30km/hour on unpaved access roads, especially in the vicinity of sensitive areas (residential and business areas, social services, religious places).

Noise Impact: Similar to air pollution, noise pollution is one of the adverse impacts of construction activities involving vehicles and heavy equipment operation. Especially high noise levels above WHO and Ethiopian noise standards can cause health impacts on recipients. The Ethiopian noise standard for daytime in residential areas is 55 dB, and for night times, it is 45 dB. The long-term exposure to noise above this standard in residential areas is expected to cause health impacts. Activities expected to generate significant noise include

- Operation of the traffic that will deliver construction materials to and from the laydown areas and to the site.
- Excavation works to construct the proposed FSTP.
- Excavation and materials moving activities.
- The activities involved in the production of concrete

Considering the nature and extent of construction works and machinery involved, the noise impact of the project is rated as moderate, localized, short-term, and reversible.

Mitigation Measures

- Carry out noisy construction activities during normal working hours only;
- Keep noise levels near camps below the WHO and Ethiopian maximum allowable noise level standards;
- Provide ear protection equipment (earplugs) for workers operating heavy machinery and workers in vicinity of noise emissions;

Traffic Accident Risks: During construction, there will be increased traffic volume on the roads along the construction of FSTPs and commensurately this may result in increased traffic accident risks to the workers. In general, the factors that could contribute to traffic accidents include

- Low awareness of many drivers about traffic safety and traffic regulations and signs as well as lack of discipline.
- Lack of awareness of pedestrians about traffic safety and regulations and signs.
- Presence of barriers that impair the visibility of the road.
- Use of alcohol and substances such as chat/khat.

Traffic accident risks during construction are anticipated to have moderate, short-term, and direct adverse impacts.

Mitigation measures

- Develop and strictly implement and follow up a well-designed work program and traffic management plan (TMP) that would consider local conditions like normal traffic and socio-economic conditions.
- Provide necessary information such as speed limits, hazard locations, and sensitive sites (e.g., schools, religious areas, health centers, etc.) by putting appropriate signs and hazard markings.

- Provide awareness training on traffic safety measures for operators of equipment and construction vehicles in traffic safety measures.
- Establish speed limits and controls for construction vehicles and discipline for the drivers.
- Provide awareness education for the nearby residents in traffic safety measures at public meetings, social gatherings, schools, mosques churches, etc.
- Ban use of substances such alcohol and khat while at work.

Occupational Health and Safety Impact: Large-scale construction work is a hazardous job. Safety risks could be related to the storage and use of hazardous substances, accidents of various natures, dust and exhaust emissions. The impact on the health and safety of project workers during the construction is anticipated to be moderate to high, short-term to long-term, and direct adverse impact.

Mitigation measures

- The contractor will provide a health and Safety Plan prior to the commencement of work to be approved by the resident engineer.
- There should be a safety policy clearly displayed on the site.
- Create awareness for workers on safety issues.
- Provision of protective clothing (gloves, gum boots, overalls, and helmets).
- Provide first aid kits at construction worksites and inside vehicles.
- Appropriate signs must be erected to warn workers and visitors.
- Ensuring that the drivers and machine operators hired on the site are qualified.
- Hung-up fire extinguisher bearing detailed information about its status at appropriate places.
- All personnel, vehicles, and machinery should be covered under an appropriate Insurance System.
- Regularly spray water in dusty roads and work areas.

Labor influx and conflict with local community

- The project is expected to stimulate many labor issues in the project area. The majority of the project's activities are labor-intensive. This is a call for labor from other areas in the project area to take the available jobs. And cause conflict with local peoples. In addition, Influx of people in the area may introduce behavioral changes. The impact is predicted medium and short term

Mitigation

- There is a need for continuous awareness creation activities by the project to inform the local people on the various dimensions of the project and enable them to accept workers from other areas when necessary.
- Create awareness to migrant workers on the culture and norms of the local society

Exposure to HIV/AIDS and Other Sexually Transmitted Infections (ST Is)

Large-scale construction project workers are considered to have a high potential for the spread of HIV/AIDS and other sexually transmitted infections partly because construction workers are mostly young, sexually active groups of the population and mobile because they are forced to live in hotel rooms or in construction camps.

In addition, the presence of a large number of workforces at construction sites may attract sex workers to the area and also entice young girls from the locality to go into the business. Hence, this makes the project area highly vulnerable and easily exposed to the spread of STIs and HIV/AIDS transmitting diseases.

Mitigation Measures

- Contractors should assign experienced HIV/AIDS sub-consultants to handle the issues related to HIV/AIDS awareness and prevention.
- Launch awareness and education campaigns about HIV/AIDS and STIs among the construction workers and community to make them informed. This has to be done on the one hand by the contractor's sub consultant and on the other hand by the local health institutes in the project area, targeting especially women and sex workers.
- Condoms shall be provided at a subsidized rate or for free to construction workers, and health facilities must be supported with a supply of condoms.
- Town administrations and health offices, must work jointly to with DWSSA and contractor to create a positive impact and bring major attitudinal and behavioral changes.

Gender and Gender Based Violence/SH Risks: Experiences from different infrastructure projects show that there is a lack of knowledge and understanding of Gender issues and GBV/SH and Sexual Exploitation and Assault (SEA) by Contractors, consultants, and construction workers. Due to this, female construction workers could face difficulties in their workplaces, such as GBV and sexual harassment. Hence, there is a potential that gender abuse might occur during the construction of the proposed fecal sludge treatment plant through unequal distribution of work, sexual harassment, discrimination against women, and unequal pay for women, among others. This impact is rated to be low for the reason that contractors are expected to include gender specialists among the workforce to create awareness to prevent GBV/SH and SEA.

Mitigation measures

- Prepare and implement a code of conduct that sufficiently addresses gender and sexual harassment issues;
- Create awareness among workers on gender and sexual harassment issues.
- Provision of gender dis-aggregated bathing, cloth changing areas & sanitation facilities.
- Provide women workers with appropriate types of safety equipment and protective materials.
- The Contractor should ensure women are paid equal pay for equal work with their male counterparts.

Impact on Cultural, religious, and Archaeological Sites: According to site observations, the proposed project site is not located in any historical or cultural and archaeological sites and is unlikely to be affected. However, the Project Contractor must take appropriate measures not to affect any chance of finding or discovering cultural or archaeological assets during the project construction and immediately report to the relevant Culture and Tourism Office.

8.5.2. Operation Phase

Odor (Foul smell): The frequent dumping of truckloads or fecal sludge may cause bad smells in and around the FSTP. However, as the FSTP is located outside the town, an obnoxious smell from the treatment plant area is expected to be of minor significance.

Mitigation measures

- Proper facility maintenance, including avoiding pools of dirty stagnant waters and spills.
- Covering swampy parts of the settlement and drying beds with a layer of earth or sand.

- Aerate and adjust chemical dosing and oxidation or pH to reduce odor from plant influents.
- Cover tanks or installation of exhaust hoods.
- Operate equipment at optimum/design conditions.
- Adopt effective and efficient housekeeping procedures (regular cleaning of the grit and screenings).
- Regular facility maintenance and monitoring operational practices
- Operate especially the secondary treatment processes at optimum condition.
- Plant layers of shrubs and trees along the periphery and provide adequate stack height to exhaust emissions.
- Provide adequate buffer zone, particularly along the major windward and limit any future settlement with in the established buffer zone (400m from the facility).

Impact on ambient air quality: multiple contaminants gases (CH_4, CO_2, and H_2S) will be generated from fecal sludge treatment plants, and release of these gases into the atmosphere, impact the environment through the generation of bad odors. The impact is adverse, possible, reversible, of moderate significance, and long-term.

Mitigation Measures:

- Regular monitoring of the ambient air, including measuring H_2S presence in the air,
- Control an aerobic digester parameter (pH, Temperature, oxygen level, etc.) for H_2S-producing bacteria/microorganisms (suppress or creating unfavorable environment),
- Changing redox potential, which helps in reducing or oxidizing capacity of anaerobic digestion system?

Impact on water and soil bodies

The waste is treated inside properly designed units. Neither the sludge nor the drained water will be allowed to leave the FSTPs without proper treatment. However, if there is leakage or overflow, the contamination risk will be high. The heavy metals in the treated wastewater may have potential human and environmental health impacts. The impacts associated with heavy metals in sludge are adverse, irreversible, of high significance, and long-term.

Mitigation Measures

- Close monitoring of the facility to ensure it functions as planned; this involves monitoring ground and surface waters in the surroundings of the FSTP.
- Ensuring that the facility's effluent complies with the national effluent standards.
- Seal the foundation of treatment plants and influence areas with concrete lining to avoid leakage of Wastewater through permeable soils and weathered and fractured rocks into the groundwater system.
- All pipework and fittings should be up to standard.
- Dispose of the sludge with dangerous substances in a designated landfill.

Impact on downstream and riverine flora: If the treatment plant releases any untreated or partially treated waste effluent into downstream rivers for some unforeseen reasons, it would adversely affect the riverine and aquatic plants. This impact is less probable and rated to be moderate significance and is reversible

Mitigation measures

- Monitor the proper functioning of the treatment plant
- Regularly check the effluent quality for its compliance with acceptable effluent discharge standard

- Whenever the quality of effluent fails to meet the standard, stop discharging the effluent into receiving rivers.
- As appropriate, promote integrated watershed management schemes around the FSTP, which reduce any potential spillover of liquid wastes into the natural environment.

Impacts on Fauna: if improperly treated wastewater is released into rivers, 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 the FSTPs, such as camels, cows, shoats, and oxen, may be affected by the discharge of improperly treated wastewater and sludge production from the FSTPs. This problem is improbable, of moderate significance, and long-term duration because the risk is always there but reversible.

Mitigation measure

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

Occupational health & Safety:

Workers may be affected from handling of partially treated dry sludge, and the gas emission or Hydrogen sulfide from the treatment plant which is a toxic gas.

Other potential health and safety impacts include accidents and plant malfunctions. The probability and impact of the following events were categorized: spills, Process Upset, natural hazards, Power Failures, fires, and Injury/death. The impact is adverse, possible, reversible, of moderate significance, and long-term.

Mitigation measures

- Provision of adequate and appropriate Personal Protective Equipment (PPE) to workers.
- Regulate the exposure to hydrogen sulfate, (the OSHA permissible exposure limits for hydrogen sulfide are 10 ppm (time-weighted average) and 15 ppm (short-term exposure limit).
- Regularly check the adequacy of the facility, particularly when beds are (nearly) full and during the rainy season.
- Timely heightening the bund surrounding the facility and/or increasing the bed capacity.
- Strict prohibition of the operation of equipment by unauthorized personnel.
- Operators shall be provided with regular medical check-ups and safety training at least on every six months,
- Appropriate warning signs shall be placed in areas where accidents are expected to occur.

Health impact and risks

- Partially dried sludge adversely impacts human health and the environment. Partially dewatered or dried sludge is rich in pathogenic organisms such as bacteria, viruses, eggs, and cysts of nematodes, cystoids, giardiasis, and amoeba. Hence, negligently handled sludge cake could impose adverse health impacts on nearby residents and workers involved in the day-to-day operation of the system.
- Using untreated fecal sludge in agriculture as fertilizer may infect farmers in contact with this inadequately treated dried sludge

- Bacteria and worm eggs may also attach to the plants and infect consumers if the crops are eaten raw and are not thoroughly washed.
- Inadequately treated sludge can also affect the quality of grazing lands as well as the health of cattle grazing around.
- 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
- Further non-pathogen risks result from impurities of non-biodegradable origin such as Glass splinters or other sharp objects contained in the sludge
- Health risks due to the attraction and proliferation of rodents and other disease-carrying vectors are also common features of improperly managed sludge treatment and dumping sites. Due to the smell, several rodents, flies, some birds (vultures), monkeys, hyena, and dogs will be attracted to the area increase contamination and disease transmission routes.

Mitigation measures

- Provide awareness training to the facility operators on the handling and managing the system and potential dangers. Equip the operators with the necessary precautionary measures (including a reporting system) for any pathogenic incidents during the operation of FSTP.
- Use of protective clothes such as gloves and masks and good hygiene (washing hands after work, etc.).
- The department of DWSSA dealing with sludge should introduce rules for using protection by their staff, and care should be taken to enforce those rules.
- Create appropriate awareness of preparation and utilization of composts from such sources.
- Fecal sludge should always be treated prior to its use in agriculture.
- Storage of sludge over a period long enough to allow natural pathogens to die off (minimum 6 months) is another possibility to disinfect sludge without using expensive technologies.
- Avoid Use of untreated sludge for growing food crops: Particularly, abstain from irrigating edible vegetables & crops with untreated sludge water or percolated water from the drying bed
- Avoid Use of untreated sludge for growing cattle feed: Cattle grazing on pasture irrigated or contaminated fields with raw sludge could be heavily infected with the larval stage of the tapeworm Taenia saginata (*Cysticercus bovis*).
- Hygienic Education and Treatment: Good personal hygiene breaks the direct contact routes by which pathogens are transmitted, and the full impact of the measures described above will only be achieved if they are accompanied by efforts to improve hygiene.
- Create awareness among these people who are potentially exposed to the direct and indirect health impacts of the sludge.
- Fence the area to prevent the entrance of dogs and other nocturnal animals. and
- Keep the area neat and attractive so flies and rodents cannot be attracted.

Public health impacts /Mosquito breeding and disease transmission

As indicated socio-economic baseline, malaria is among the major diseases in Degahbur area. If the project is not properly managed, the waste stabilization pond may be a favorable environment for Mosquito breeding and disease transmission, which may aggravate the already infested area. However, with proper mitigation measures the impact is localized and moderate but long-term.

Mitigation measure

- Put in place various control measures to ensure that environmentally sound measures are taken to ensure that the plant produces no adverse effect on transmission rates of mosquito-transmitted diseases such as malaria.
- The ponds to be properly maintained to ensure that the ponds do not become mosquito breeding sites

Impact on aesthetic value: During the operation, the FSTP there will be impact on Aesthetic values /visuals from the waste stabilization ponds.

Mitigation measures

- New housing developments should be limited in the safety area zone around the FSTP.
- Safety zone of at least 200m should be assigned and maintained based on the availability of land
- Plant trees around the treatment plant and buffer zone.
- Keep the buffer zone and open areas within the treatment plant neat all the time.

Gender Based Violence (GBV)/Sexual Exploitation Abuse (SEA) Risks: During the Operation phase, there might be a risk of Gender Based Violence (GBV)/ Sexual Exploitation Abuse (SEA) due to lack of knowledge. There is also a potential that gender inequality might occur during the operation of the FSTP through unequal distribution of work, sexual harassment, discrimination against women, and unequal pay for women, among others.

Mitigation measures

- Prepare and implement a code of conduct that, among others, strictly forbids sexual harassment /GBV and is to be signed by all workers
- Provide and avail a separate sanitation facility for women and men at the treatment plants.
- Provide women-friendly safety equipment and materials.
- Assign women to works that do not affect their biological condition.

Impacts of flooding risks: The site is prone to flooding and needs proper flood protection works.

Mitigation measures:

- While the design of FSTP includes drainage and flood protection within the compound of the treatment plant, Watershed management works need to be undertaken upstream of the FSTP site, and an additional flood protection dike needs to be constructed and proper operation and maintenance should be respected.

8.5.3. Decommissioning Phase

DWSSA could upgrade or decommission the treatment plants. Most probably upgrading the system will be expected. Suppose the decision is made to decommission the treatment plants at the end of their design life. In that case, there will be impacts related to the disposal of contaminated soils from the treatment plant sites and the generation of solid waste from demolishing the treatment plant structures. These impacts are expected to occur, assuming the waste treatment plants will be decommissioned.

Air pollution: During the decommissioning, structures installed to aid the treatment plants will be dismantled and demolished, which will cause the release of dust and other pollutants embedded in the demolished structures. This impact is temporary, local, and of low significance.

Mitigation measures

- Systematically demolish structures considering reuse of materials for other uses.
- Wet the materials before demolishing to suppress the release of dust.
- Avoid burning any material.

Impacts on Soil and Water Bodies: During the decommissioning phase, there will be a large amount of spoil from demolishing structures and scraping contaminated soil that will pollute the soil and water resources, including groundwater.

The effect is of medium significance. However, decommissioning the sites without a better substitute for the treatment of ever-increasing wastewater would adversely affect the soil and water resources of the area and its downstream.

Mitigation measures

- Properly collect all the debris generated while demolishing the structures and transport to the designated disposal site
- Remove all the contaminated soil from the treatment plant site and dispose of it at a designated waste disposal site or a sanitary landfill.
- Level the ground so that it will be used for other purposes.
- Reclaim polluted soil with appropriate technologies such as phytoremediation.
- Avail advanced FSTP that technology of the time offers before decommissioning the one at hand.
- Properly reinstate the abandoned fecal sludge treatment plant site.
- After reinstatement, DWSSA could use the area for other purposes.
- Develop the areas for recreational parks or plant trees to increase the aesthetic value of the area or hand over to the nearby community in consultation with their respective Kebele administrations so that they can develop what they think is important for the community.

Health Impact: the health impacts associated with dismantling concrete structures and reinstatement of the area from the removal process of contaminated sludge and soil could adversely affect the workers involved in demolishing works.

Mitigation measures

- Create appropriate awareness before operating to the local community and local administration, including (agriculture, water and energy, and health offices).
- Plan the decommissioning work ahead of time to avoid a sudden stop of the treatment plant before completely treating the influent reached the treatment plant.
- Provide appropriate PPE for the workers to be involved in decommissioning works.

Loss of Job Opportunity: During the decommissioning of the treatment plants, previous jobs which skilled and unskilled workers enjoyed during the operation phase will not be continued. This loss of jobs would adversely affect workers and their families, who depended on it for their livelihood.

Mitigation measures

- Give job priority to other related projects.
- Secure pension benefit if the age of the job loser is in the set range of pension.

- Organize, train and promote the establishment of their own small-scale enterprises through the facilitation of loans or financial support. Create links with appropriate government agencies and financial sources.

Gender-Based Violence/SH Risks: Gender and gender-based violation and sexual harassment is expected to be low to moderate during the decommissioning phase of the project. This is because there will be few workers expected to be involved in the decommissioning phase activities.

Mitigation measures

- Provide and avail a separate sanitation facility for women and men.
- Provide women-friendly occupational health and safety equipment and materials.
- Assign women to works that do not affect their biological condition.
- Incorporate measures to be taken against those workers who commit GBV and sexual harassment.
- Prepare and implement a code of conduct that, among others, strictly forbids sexual harassment /GBV and is to be signed by all employees.
- Ensure equal pay for women and men for equal jobs.

9. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The ESMP aims to describe in detail the necessary actions to be taken to ensure that serious impacts will be mitigated. The ESMP for the proposed project consists of a set of mitigation and institutional measures to be taken during the implementation and operation phases to eliminate the adverse environmental and social impacts identified and predicted in the previous stages, offset them, or reduce them to acceptable levels. The plan will also include the actions needed to implement these measures. The mitigation plan covers all aspects of the implementation of the project in its various phases related to environment and social health.

The objective of this ESMP is to ensure the integration of environmental and social requirements and proposed mitigation and monitoring measures into the construction contractor's obligations. The ESMP shall be fully integrated into the construction activities, hereby addressing the responsibilities of the construction contractor (the contractor), the Engineer, and the Employer. Furthermore, an ESMP has been developed for impacts resulting from the operational phase, which shall be fully integrated into operational activities. Responding adequately to the nature of the envisaged FSTP construction, the ESMP refers to the following issues:

- Environmental and Social Mitigation Measures during Construction and operation.
- Environmental and Social Quality Monitoring during Construction and operation and
- Obligations, roles, and responsibilities among concerned parties.

A comprehensive decommissioning plan will guide the decommissioning process developed through the decommissioning audit process. However, the following features must be decommissioned upon completion of the works.

i. Contractor's camp and installations that will need to be removed without compromising the safety and general welfare of the immediate residents. Special care should be given to associated wastes and dust emitted.
ii. Materials stores that will comprise fresh materials and used items. Each category will be moved safely out of the site, ensuring minimal or no impacts on the related environment and social setting.
iii. Wastes and debris holding sites will be cleared with maximum re-use of the debris either on surfacing the passageways or other grounds.
iv. Under normal circumstances, the project will be maintained and sometimes rehabilitated. During rehabilitation, a new ESIA can be instituted, or an environmental management plan can be prepared depending on the degree of rehabilitation.

Table 23 presents identified impact mitigation measures proposed in the ESIA for the implementation arrangements, including responsibilities for implementation, the time frame, and the budgetary implications.

Table 23 Environmental and Social Management Plan for Proposed project

Sr. No	Issue/ Main Impacts	Proposed Mitigation Measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
			Implementation	Supervision		
	CONSTRUCTION PHASE					
1.	Impact on Fauna &Flora	● Plant appropriate trees in and around the project site to replace the removed trees ● Restricting land clearing to what is absolutely necessary. ● Demarcation and fencing off the construction areas. ● Prohibit poaching and killing of wildlife by the workers. ● Backfilling of trenches and other excavated areas and grading to the natural topography.	Construction Contractor	DWSSA Supervisory Consultant	Throughout the Construction Phase & until the size of the seedlings reaches 1.5 meters height	Part of the construction and Supervision cost to be covered by the contractor and consultant.
2.	Impacts on soils (soil erosion, compaction, and contamination by hazardous substances)	● Limit excavation works only to what is absolutely necessary. Execution of earthworks during the dry season and refilling the excavated soil soon. ● Refilling the trenches and other excavated/exposed places soon, covering with topsoil, leveling the surrounding landscape, and replanting with appropriate grass, shrub and/or tree species as soon as possible. ● Provision of well-designed and constructed culverts and side ditches for the access roads ● Use only existing roads to the extent possible, and do not drive through unpaved soil. ● Oil exchange and Washing of vehicles and oil changes should take place only in the already prepared workshop ● Properly manage and dispose of construction waste, including packaging materials, concrete debris, and other non-hazardous waste, in designated waste disposal areas.	Construction Contractor	DWSSA Supervisory Consultant SC	Throughout Construction phase	Part of the construction and supervision cost to be covered by the contractor and consultant
3.	Impact on Water Bodies	● Minimize soil erosion by refilling the trenches and other excavated/exposed places soon and establishing protective cover such as appropriate grasses and other vegetation ● Proper storage and handling and disposal of hazardous substances such as oil, fuel, cement sludge, and detergents away from watercourses. ● Minimizing erosion or transport of excavated materials by runoff water to water bodies.	Construction Contractor	DWSSA Supervisory Consultant	Throughout construction phase	Part of Contractor's Contract
4.	Air	● Regular spraying of water on unpaved access roads, exposed	Construction	DWSSA	Throughout	Included in

Sr. No	Issue/ Main Impacts	Proposed Mitigation Measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
			Implementation	Supervision		
	pollution due to dust, exhaust emissions, and noise generated by the construction activities	earth, and any stockpiles on site, Construction workers should wear dust masks for dust protection when operating plants or heavy machinery. ● Minimize excavation and earth moving to only what is required for the specific nature and type of construction. ● Limit stockpiling of excavated topsoil to a maximum of 2m height. ● Use paved roads as much as possible and limit the speed of vehicles to 30km/hour on unpaved access roads, especially in the vicinity of sensitive areas (residential and business areas, social services, and religious places).	Contractor	Supervisory Consultant (SC),	Construction phase	the contract for the Contractor & SC
5.	Impact of Noise and Vibration	● Carryout noisy construction activities during normal working hours only; ● Provide ear protection equipment (earplugs) for workers operating plant or heavy machinery and for workers in vicinity of noise the emissions;	Construction Contractor	DWSSA/ Town EPA	Though out construction phase	Part of the construction and supervision cost to be covered by the contractor and consultant
6.	Traffic accident risks	● Develop and strictly implement and follow up on a well-designed work program. ● Provide awareness training on traffic safety measures for operators of equipment and construction vehicles. ● Establish speed limits and controls for construction vehicles and discipline for the drivers. ● Provide awareness education for the nearby residents in traffic safety measures ● Prohibit use of alcohol and Khat at work	Construction Contractor	DWSSA/Supervisory Consultant, traffic management office of the town	During construction	Part of the construction and supervision cost to be covered by the contractor and consultant
7.	Occupational Health and Safety	● provide a Health and Safety Plan prior to the commencement of works ● There should be health and safety policy clearly displayed on the site. ● Create awareness for workers on safety issues. ● Provision of protective clothing (gloves, gum boots, overalls, and helmets). ● Provide first aid kits at construction worksites and inside	Construction Contractor	● Supervisory Consultant ● DWSSA ● Health office	During construction	Part of the construction and supervision cost to be covered by the contractor and consultant

Sr. No	Issue/ Main Impacts	Proposed Mitigation Measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
			Implementation	Supervision		
		vehicles. ● Appropriate signs must be erected to warn workers and visitors. ● Ensuring that the drivers and machine operators hired on the site are qualified. ● Hung-up fire extinguisher bearing detailed information about its status at appropriate places. ● All personnel, vehicles, and machinery should be covered under an appropriate Insurance System. ● Carefully record and keep all incidences of injuries and accidents including date, time, and place of occurrence, level of injuries, resources damage, people injured/dead, major causes for the accident, measure taken, etc. ● Regularly spray water in dusty roads and work areas.				
8.	**Labor influx and conflict with local community**	• Continuous awareness creation activities to local community to enable them to accept workers from other areas when necessary. ● Create awareness to workers from other area on culture and social norms of the local community	Construction Contractor	● DWSSA	During construction	Part of the construction and supervision cost to be covered by the contractor and consultant
9.	Exposure to HIV/AIDS and Other Sexually Transmitted Infections (STIs)	● Contractors should assign experienced expert to handle the issues related to HIV/AIDS awareness and prevention. ● Awareness raising and education programs about HIV/AIDS and other STIs to the construction workers and community to make them informed ● Condoms shall be provided at a subsidized rate or for free to construction workers, and health facilities must be supported with a supply of condoms.	Construction Contractor	Supervisory Consultant DWSSA & Health office	Prior to start & during construction	Part of the construction and supervision cost to be covered by the contractor and consultant and Birr 30,000.00 for HIV awareness
10.	Gender Equity, GBV/SEA and Sexual Harassment	● Prepare and implement a code of conduct that sufficiently addresses gender and sexual harassment issues; ● Create awareness among workers on gender and sexual harassment issues. ● Provision of gender dis-aggregated bathing, cloth changing areas & sanitation facilities.	Contractor	● Supervisory Consultant ● DWSSA and Office of Women,	Prior to start & during construction	Part of the construction and supervision cost to be covered by the contractor and consultant Birr 30,000.00

Sr. No	Issue/ Main Impacts	Proposed Mitigation Measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
			Implementation	Supervision		
		● Provide women workers with appropriate types of safety equipment and protective materials. ● Ensure women are paid equal pay for equal work with their male counterparts.		children and youth affairs		for GVB /SEA awareness training
11.	Impact on archaeological & cultural heritage sites	● No known archaeological sites are expected on-site; however, if encountered, the Contractor/ Supervising Consultant is to inform the local authority for further action. ● Apply the chance finds procedure.	Construction Contractor	Supervisory Consultant DWSSA	During construction	-Part of the construction and supervision cost to be covered by the contractor and consultant
	Operation phase					
1.	Ambient air quality (Odor/obnoxious smell from the TP	● Regular monitoring of the ambient air including measuring H_2S presence in the air, ● Control an aerobic digester parameter (pH, Temperature, oxygen level, etc.) for H_2S producing bacteria/microorganism (creating unfavorable environment), ● Changing redox potential, which helps in reducing or oxidizing capacity of anaerobic digestion system; ● Avoidance of pools of dirty stagnant waters and spills. ● Covering swampy parts of the settlement and drying beds with a layer of earth or sand. ● Aerate and adjust chemical dosing and oxidation or pH to reduce odor from plant influents. ● Cover tanks or installation of exhaust hoods. ● Operate equipment at optimum/design conditions. ● regular cleaning of the grit and screenings ● Regular facility maintenance and monitoring operational practices including process control and chemical treatment, continuous process of the operation ● Operate especially the secondary treatment processes at optimum condition. ● Plant layers of shrubs and trees along the periphery and provide adequate stack height to exhaust emissions. ● Provide adequate buffer zone (400m from the facility), particularly along the major windward	● Facility manager	● DWSSA ● Environmental protection office /EPA	Throughout the operation phase	Part of the FSTP operation budget

Sr. No	Issue/ Main Impacts	Proposed Mitigation Measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
			Implementation	Supervision		
2.	Impact on Soil	● Ensuring that the dry sludge to be dispose or used for agriculture complies with the national effluent standards ● Dispose of sludge with dangerous substances only in a designated sanitary landfill	DWSSA Facility manager	DWSSA, Town EPA	Throughout the entire operation phase	Part of the FSTP operation budget
3.	Impact on Water Bodies	● All pipework and fittings should be a class A rating more than the maximum pressure attained in service, including any surge pressure. ● Dispose of the sludge with dangerous substances in a designated landfill. ● Close monitoring of the facility to ensure it functions as planned, this involves monitoring of ground and surface waters in the surroundings of the TP, and ensuring that the facility's effluent complies with the national effluent standards.	DWSSA Facility manager	DWSSA	During design, construction and operation of TPs	Part of the FSTP operation budget
4.	Impact on flora and Fauna	● Monitor the proper functioning of the treatment plant, ● Regularly check the effluent quality for its compliance with acceptable effluent discharge standard, ● Whenever the quality of effluent fails to meet the standard, stop discharging the effluent into receiving rivers. ● As appropriate, promote integrated watershed management schemes around the FSTP which enable to reduce any potential spillover of the liquid wastes into the natural environment. ● Proper quality control of 'treated' sludge before releasing it to the natural environment. ● Ensure proper quality control of "treated" wastewater and sludge before releasing. ● Control any accidental spill of untreated or partially treated wastewater into the environment. ● Install a regular monitoring system on the quality of water discharged.	● FSTP Quality Control	DWSSA,	Throughout the operation phase	Part of the FSTP operation budget
5.	Occupational health & Safety	● Strict prohibition of operation of equipment by unauthorized personnel. ● Operators shall be provided with regular medical check-ups and safety training at least every six months, ● Provision of adequate and appropriate Personal Protective Equipment (PPE) to workers.	● DWSSA Facility manager	● DWSSA ● Labor and social affair office	Throughout the entire operation phase	Part of the FSTP operation budget

Sr. No	Issue/ Main Impacts	Proposed Mitigation Measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
			Implementation	Supervision		
		● Appropriate warning signs shall be placed in areas where accidents are expected to occur. ● Regularly check the adequacy of the facility, particularly when beds are (nearly) full and during the rainy season. ● Timely heightening the bund surrounding the facility and / or increasing the bed capacity.				
6.	Health impact from use of untreated fecal sludge in agriculture Health Impact on people handling the sludge	● Provide awareness training to the facility operators, who has in contact with and community who use it. ● Use of protection clothes such as gloves and masks and good hygiene (washing hands after work etc. ● The department of DWSSA dealing with sludge should introduce rules for use of protection by their staff and care should be taken to enforce those rules. ● Create appropriate awareness on preparation and utilization composts from such sources. ● Fecal sludge should always be treated prior to its use in agriculture ● Storage of sludge over a period long enough to allow natural pathogens to die off (minimum 6 months) is the other possibility to disinfect sludge without using expensive technologies. ● Avoid Use of untreated sludge for growing food crops: Particularly, abstain from irrigating edible vegetables & crops with untreated sludge water or percolated water from the drying bed ● Avoid Use of untreated sludge for growing cattle feed: Cattle grazing on pasture irrigated or contaminated fields with raw sludge could be heavily infected with the larval stage of the tapeworm Taenia saginata (*Cysticercus bovis*). ● Hygienic Education and Treatment ● Create awareness among these people who are potentially exposed to the direct and indirect health impact of the sludge. ● Fence the area to prevent the entrance of dogs and other nocturnal animals. and ● Keep the area neat and attractive so that flies and rodents could not be attracted.	● DWSSA Facility manager	● DWSSA ● Health office	Throughout the entire operation phase	Part of the FSTP operation budget

Sr. No	Issue/ Main Impacts	Proposed Mitigation Measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
			Implementation	Supervision		
7.	Public health impacts /Mosquito breeding and disease transmission	● Ensure that the plant produces no adverse effect on transmission rates of mosquito- transmitted diseases such as malaria. ● The ponds to be properly maintained to ensure that the ponds do not become mosquitoes breeding site				
8.	Impact on Aesthetic value	● New developments of housing should be limited in the safety area zone around the FSTP. ● Safety zone of at least 400m should be assigned and maintained based on the availability of land ● Plant trees around the treatment plant and buffer zone. ● Keep the buffer zone and open areas within the treatment plant neat all the time	DWSSA Facility manager	● DWSSA	Throughout the entire operation phase	Part of the FSTP operation budget
9.	Gender and Gender Based Violence/SH/SEA Risks	● Prepare and implement code of conduct that among others strictly forbid sexual harassment /GBV and to be signed by all workers ● Provide and avail a separate sanitation facility for women and men at the treatment plants. ● Provide women friendly safety equipment and materials. ● Assign women in works that do not affect their biological condition.	DWSSA Facility manager	● DWSSA ● Women and children affairs, office	Throughout the entire operation phase	Part of the FSTP operation budget
10.	Impacts of flooding risks	● Watershed management works need to be undertaken in the upstream of the FSTP site and ● Additional flood protection dike need to be constructed and proper operation and maintenance should be respected.	DWSSA	Town EPA	Operation	Part of the management
	Decommissioning phase					
1.	Air pollution	● Systematically demolish structures considering reuse of materials for other use. ● Wet the materials before demolishing to suppress release of dust. ● Avoid burning of any material.	DWSSA	● Town EPA	Decommissioning	Part of the Municipality/DWSSA operation budget
2.	Impacts on Soil and Water Bodies	● Remove all the contaminated soil from the treatment plant site and dispose it at a designated waste disposal site or at sanitary landfill. ● Level the ground in such a way that it will be used for other	DWSSA	● Town EPA	Decommissioning	DWSSA operation budget

Sr. No	Issue/ Main Impacts	Proposed Mitigation Measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
			Implementation	Supervision		
		purposes. ● Reclaim polluted soil with appropriate technologies such as phytoremediation. ● Avail alternative FSTP before decommissioning the one at hand. ● Properly reinstate the abandoned fecal sludge treatment plant site. ● After reinstatement, DWSSA could use the area for other purposes.				
	Health Impact	● Create appropriate awareness before operating to the local community and administration, including (agriculture, water and energy, and health offices). ● Plan the decommissioning work ahead of time to avoid a sudden stop of the treatment plant before completely treating the influent reached the treatment plant. ● Provide appropriate PPE for the workers to be involved in decommissioning works.	DWSSA	● Town EPA	Decommissioning	Municipality/ DWSSA operation budget
6.	Loss of Job Opportunity	● Give job priority to other related projects. ● Secure pension benefit if the age of the job looser is within the set pension range. ● Organize, train, and promote the establishment of their own small-scale enterprises through the facilitation of loans or financial support. Create link with appropriate government agency and financial sources	DWSSA	● Degahbur town Labor and Labor Affair bureau	Decommissioning	Municipality/ DWSSA operation budget
8.	Gender and Gender-Based Violence/SH Risks	● Provide and make available a separate sanitation facility for women and men. ● Provide women friendly occupational health and safety equipment and materials. ● Assign women in works that do not affect their biological condition. ● Ensure equal pay for women and men for equal jobs.	DWSSA	● Town women and social affair	Decommissioning	Municipality/ DWSSA operation budget

10. ENVIRONMENTAL AND SOCIAL MONITORING PLAN

The environmental and social impact assessment requires the developer to prepare and undertake a monitoring plan and regular auditing. The objectives of environmental monitoring upon executing activities are to:

- Monitor the effective implementation during the construction and operation phases of proposed mitigation measures.
- Confirm compliance with environmental, public health, and safety legislation/regulations during construction.
- Control the risks and ecological/social impacts.
- Ensure best practices management as a commitment to continuous environmental performance improvement.
- Provide environmental information to the community/stakeholders.
- Provide early warning signals on potential environmental degradation for appropriate actions to prevent or minimize environmental consequences. The projects impact to climate change risks and opportunities should also be monitored and evaluated.

Table 24 below provides the monitoring estimated costs, indicators and monitoring activities at various phases.

Table 24 Environmental and Social Monitoring Plan

S/N	Issue/ project main Impacts	Monitoring Indicators	Monitoring Party	Monitoring Frequency	Method of Measurement/monitoring	Budget Estimate (in Birr) for monitoring
	CONSTRUCTION PHASE					
1.	Impacts on soils and landscape quality	● Evolution of erosion signs (sheet erosion, gully formation, silt accumulation in nearby watercourses or drains). ● Length/ area of trenches and other exposed surfaces properly refilled, leveled to the surrounding landscape, and replanted with appropriate plant species following completion of works to minimize soil erosion, slope failures or improve the affected landscape's quality. ● Area of land affected due to exploitation of quarries and borrows sites and area reinstated after exploitation has ceased. ● Incidence of soil pollution by spillage of hazardous substances	DWSSA	Minimum twice per month during the construction contract period	Visual observation, area measurement, Collaborative field visit and reporting the result	50,000.00
2.	Impacts on water quality; sedimentation, pollution by hazardous substances and wastes generated by the project	● Location/distance of the contractor's site facilities (camps, storage site, workshop/garage) from water bodies (min. of 1km is recommended). ● Provision of a secondary containment system for fuel storage facilities. ● Proper handling of hazardous substances (oil, fuel) and disposal system used oils. ● Incidence of water pollution by spillage of hazardous substances. ● Sediment load/turbidity of nearby streams & rivers.	DWSSA,	As required	Visual observations, water quality analysis in laboratory or using field kits Collaborative field visit and reporting the result	50,00.00
3.	Impacts on air and noise quality	● Dust levels or incidence of dust pollution in the construction areas & rate of application of dust suppressants (spraying water) on dusty areas. ● Use dust collectors or water spray systems in stone crushing or batch plant operations. ● Noise and exhaust emission levels generated by	DWSSA	As required	Visual observations & Recording of case	39,360

S/N	Issue/ project main Impacts	Monitoring Indicators	Monitoring Party	Monitoring Frequency	Method of Measurement/monitoring	Budget Estimate (in Birr) for monitoring
		construction vehicles and equipment. ● No. of complaints due to nuisance noise or dust pollution.				
4.	Impacts on flora and fauna	● Area of vegetation cleared for the project within the boundary of the project site ● Number of trees/land area replanted a survived to replace the trees removed and the plantation affected. ● Number of wild animals killed during the construction works.	DWSSA/ Town EPA	As required during the contract period	Visual observations, surface area measurement and recording of trees affected & Animal fatalities Collaborative field visit and reporting the result	39,360
5.	Impacts on traffic mobility and safety issues	● Number of construction sites provided with appropriate signals to minimize obstruction to traffic mobility & safety hazards. ● Number of risky construction sites prohibited for people and animals or fenced to minimize safety risks. ● Timely collection and disposal of excess spoil materials availability of an adequate number of protective kits and whether workers are using protective kits	DWSSA and Municipality (traffic management office of Degahbur town)	Once per day or as required construction works are ongoing at road crossings or pedestrian access	Visual Observations Collaborative field visit and reporting the result	50,000.00
6.	Impacts on public health	Number of awareness raises and education campaigns about HIV/AIDS given for project workers and vulnerable local populations.	DWSSA	As required	Communication with the implementer & Interviewing the vulnerable groups Collaborative field visit and reporting the result	80,000
	OPERATION PHASE					
1.	Odor	Intensity of odor and spatial coverage around the treatment plant and nearby surrounding areas	DWSSA, Town EPA	Whenever there is a complaint from the affected	Visual observations & Recording of cases Collaborative field visit and reporting the result	Part of the regular budget of regulatory body

S/N	Issue/ project main Impacts	Monitoring Indicators	Monitoring Party	Monitoring Frequency	Method of Measurement/monitoring	Budget Estimate (in Birr) for monitoring
				people		
2.	Sludge water treatment & disposal of the cake	● Proper functioning of the installed drying lagoons as thickeners for sludge water. ● Proper disposal & control of the dewatered sludge at the properly located dumping/landfill site	Town EPA	As required	Visual Observation Collaborative field visit and reporting the result	Part of DWSSA operation cost & cost of a regulatory body and monitoring cost 250,000
3.	Water quality monitoring	● Physical-chemical indicators such as PH, turbidity, total dissolved solids, electrical conductivity, nutrients (nitrate, phosphate), residual chlorine, etc. ● Bacteriological indicators such as Escherichia coli (E. coli) – an indicator of fecal contamination	DWSSA and Town EPA	Twice/year for nearby source water intake), once per month for treated water at WTP	Sampling & testing in laboratory or using field kits with portable incubators for microbiological testing	Part of DWSSA operation cost and cost of regulatory body and monitoring cost 300,000
4.	Public health & Environmental sanitation issues	Number or availability of adequate drainage facilities for wastewater disposal.	Town Health office Representatives of the community	As required	Visual observations, review of drainage plans & documents	Part of the budget of regulatory Body & monitoring cost 250,000
5.	Operation and Maintenance of the TP System	● Adequacy of implementation of preventive and all unscheduled/ emergency maintenance work ● Periodic housekeeping of the system ● Allocation of human and financial resources for the preventive and unscheduled maintenance	DWSSA	Monthly	Performance reports Collaborative field visit and reporting the result	Part of DWSSA regular maintenance cost and monitoring cost 250,000
	Total monitoring costs for the planned activities					**1,358,720.00**

11. INSTITUTIONAL ARRANGEMENTS AND CAPACITY BUILDING

The program will use the existing institutional arrangements and a dedicated Project Implementation Team, who are employees of the executing agency, Degahbur Water Supply and Sewerage Authority, DWSSA has an established and functional position for an Environmental and social safeguard experts which will provide oversight on the implementation of the environment (ESIA) components of the program.

The responsibility for implementing the ESMP during construction will be of the contractor and DWSSA. During the operation and maintenance of the FSTP works, the responsibility will be mainly under the DWSSA. It is further planned that oversight on environmental issues will be supplemented through the recruitment of additional environmental and social safety expertise by the supervising consultant and contractor once the project commences. Moreover, the Regional Water and Energy Bureau and The Ministry of Water and Energy have appropriate staffs. In the interim, this staffing arrangement is deemed adequate. The regional environmental authority is also mandated for the follow-up and compliance monitoring of the E & S-related aspects.

The environmental sustainability of the FSTP project depends on the capacity of institutions at all levels (i.e., staffing, training, and other necessary support services) to carry out the associated ESMP implementation work. Thus, it is vital that DWSSA allocate sufficient resources for training and capacity building. These efforts will benefit the authorities and build local capacity to undertake other development initiatives.

The institutional capacity to implement, enforce and monitor the project environment and health was assessed based on the technical, financial, and physical capability of the Community leaders and DWSSA. The findings indicated that these different groups have different capacity-building and training needs in terms of raised awareness, sensitization to the issues, and detailed technical training. The DWSSA is found to have a limited institutional capacity to implement the provisions of the ESMP, especially regarding the FSTP project.

Therefore, it is recommended that capacity-building interventions, including training, should take place at all levels, i.e., community-based organizations relevant to waste management, relevant government officials (E&S, environmental protection, health, women and labor), community leaders, and DWSSA management team. The DWSSA environmental and social experts should be exposed to short-term training in environmental and social issues management. The training program for various role-players will include an orientation program on the ESMP, Environmental Assessment Processes, Participatory Methodologies, and Project Management and Monitoring. The training on ESMP may be integrated with the social framework and another related training program for cost-effectiveness.

Table 25 Institutions Responsible for the Implementation of ESMP

Stakeholders	Roles and Responsibilities
Degahbur town Administration	Allocate Budget to the Client project office and monitor its utilization; Monitor the implementation and operation of the proposed project; Coordinate the activities of the town Administrations for the successful implementation of the project. Make sure that GRM established and functioning properly.
DWSSA	Responsible for the implementation of the proposed project as proponent; Coordinate the efforts of the other organizations responsible for the management and monitoring plan; Follow-up the rehabilitation of the affected part. Coordination of stakeholders during monitoring of project activities at various phases**.**
Town Environmental Protection office	Provide technical advice about environmental protection during the project implementation; Audit the project from an environmental protection point of view; monitor the implementation of environmental and social mitigation actions.
Degahbur town health office	Provides technical advice about social health issues such as HIV/AIDS, COVID-19, STD, and others.
Degahbur town Women and Children's Office	Provides technical advice about the social issues of GBV, child labor, etc., and monitoring at various phases.
Somali Regional state water & energy bureau	Provides technical advice (2nd UWSSP) and capacity building and monitoring. The bureau will participate in monitoring during water quality measurement.
MoWE	Technical advice and capacity building (2nd UWSSP).
The World Bank	Finance the project as per the agreement. Monitor& evaluate the work's progress and check the allocated fund's correct use. Demand work progress reports on the implementation of the project.
Contractor	The Contractor has to prepare the Construction's ESMP and implement it. To this end, the contractor should mobilize environmentalist, sociologist, health and safety expert and gender specialist at construction site.
Supervision Consultant	The Consultant's EHS team, in cooperation with DWSSA environmental and social impact assessment & monitoring and evaluation sub process will conduct regular monitoring of the project activities and give advice and instruction to the Contractor to perform environmental, social, and health and safety issues as per the ESIA, ESMP, and finance providers of environmental, social and health safeguard guidelines.
Local community	Engaged in the monitoring of the E&S through their representative

11.1. Training Programs

Training programs are developed and shall be delivered to the project developer to implement environmental safeguards of the proposed project. Following training needs assessment, specific and tailored training will be developed and agreed upon by the developer and key stakeholders for implementing safeguards during project implementation.

- Target groups for the training: DWSSA Civil and Sanitary Engineers, Environmental and social safeguard officers, Contractors, and Community Representatives in the project area.
- Training schedule: at least 1 month before construction starts.
- In-service and refresher Training: The training programs proposed below will take place every six months on a yearly basis, and their content will be updated and adapted to implementation issues. Training frequency and the content will be reviewed in the course of the project's operation lifespan depending on needs or technical requirements.

Table 26 Training Programs for Capacity Building and Associated Costs

Target Group	DWSSA Staff, MoWE (regional water and energy bureau), Health officers, Regional EPA, and other relevant stakeholders	Description
Training title	Environmental supervision, monitoring and reporting	
Participants	Environmental staff and social workers of DWSSA and other stakeholders who are going to engage in the management and monitoring (total 15 participants)	15participants* 3 days*2times a year*5 years*3000/day 1,350,000.00
Training frequency	Soon after project effectiveness but at least 2 weeks -1 month before the start of project work. In-service /refresher training during operation.	
Time	Training is twice a year, and then it is to be repeated on a yearly basis until year three of implementation.	
Training content	· Public health and safety of FSTP management. · Social mitigation for environmental projects · Community participation in environmental supervision monitoring · Supervision of contractors, Subcontractors, and community representatives in the implementation of environmental supervision · Risk assessment, response, and control · Awareness creation · Public and communal toilet management approaches	
Responsibilities	DWSSA with the facilitation from the MoWE environmental and social safeguard specialists	
Training title	Implementation of mitigation measures	
Participants	On-site construction management staff; environmental and social safeguard staffs; village/group authorities.	Contractors /10 persons /2 years /2timea/year = 360,000 supervisor and client /4 person /2 years,(2timea /year = 96,000
Duration	After bidding, and determining based on needs	
Time	3 days of training for contractors and 2 days of training for others, to be repeated twice a year on an annual basis depending on needs (contract supervisors, foreman and ES expert	
Training Content	· Overview of environmental monitoring · Requirements of environmental monitoring · Role and responsibilities of contractors · Scope and methods of environmental monitoring · Response and risk control · Propagate monitoring forms and guide how to fill in the forms and risk report · Preparation and submission of reports · Other areas to be determined · Grievance handling and reporting · GBV reporting	
Responsibilities	DWSSA with facilitation from the MoWE	
Target groups	Local communities/ stakeholders, DWSSA, Health Officers and, municipality, urban infrastructure technicians/ Engineers/EPA	
Training title	Environmental sanitation and safety	30 persons/for 2 days 2 times/year for 2 year 30*2*2*2*3000 =720,000
Participants	Representatives of community and/or worker leaders (as appropriate) (up to 30 participants)	
Training frequency	Bi-yearly or every 6 months for the first two years	
Time	One-day presentation and one-day on-the job training twice a year, to be repeated on as needed basis	
Training content	· Environmental and Social safeguards · Safety and health issues · Environmental Pollution risks and management · Management of environmental safety and sanitation on work sites · Mitigation measures at construction sites · Procedures to deal with emergency situations · Other areas to be determined	
Responsibilities	DWSSA and another relevant stakeholder	

Target Group	DWSSA Staff, MoWE (regional water and energy bureau), Health officers, Regional EPA, and other relevant stakeholders	Description
	Subtotal 1	**2,526,000**
Training title	Customer service management:	
Course content	Marketing (promotion), customer handling, record keeping and reporting, financial management	(25*3000*2*2*5)
Target group	Head of Core Process, Fecal Sludge (FS) Emptying Customer Service Team Leader, Head of Finance Accountant (up to 20 participants)	1,500,000
Responsibilities	DWSSA and another relevant stakeholder/every 6 month for 5 years	
Training title	Safety measures for proper FS emptying up to 8 persons	
Course content	Training on risks, safety measures and good practices for FS sludge collection and conveyance	12*2*5*3000 360,000.00
Target group	Head of Core Process, FS Emptying Customer Service Team Leader Sludge Truck Drivers Sludge Emptying Crew	
Responsibilities	DWSSA and another relevant stakeholder	
Training title	Operation and maintenance of treatment plant 3 days every year for 5 years	8*5*5000*2
Course content	Treatment plant operation principles, operation and maintenance procedures, and treatment processes	20,000.00
Target group	Head of Core Process FSTP Team Leader FSTP operators	
Responsibilities	DWSSA and another relevant stakeholder	
Training title	Leadership and communication	
Course content	Training on group coordination, team leading and communication	
Target group	Utility Director General Head of Core Process, FS Emptying Customer Service Team Leader FSTP Team Leader Finance Team Leader	=8*2*5*3000 240,000.00
Responsibilities	DWSSA and another relevant stakeholder	
	Subtotal 2	**2,340,000.00**
	Total estimated cost	**4,866,000.00**
	Contingency 10%	**486,000.00**
	Total	**5,352,600.0**

11.2. ESMP Implementation Costs

The maintenance of specified impacts within permissible levels, early mitigation of unanticipated consequences (before they become a problem), and realization of projected project benefits depend on environmental and social management and monitoring. So, the goal of an ESMP is to aid in the systematic and quick identification of issues as well as the successful implementation of corrective measures, leading to the achievement of good environmental performance.

To support this, the ESIAs have provided a budget estimate for ESMP implementation, which will be included in the overall project implementation budget. Thus, the overall cost, i.e., including mitigation, monitoring and capacity building as detailed in Table 27 becomes about **ETB 7,958,192.00.**

Table 27 Summary of Budget Estimate for ESMP

No.	Component	Project phase	Unit/ Reference	Estimated cost in ETB
1.	**ESMP**			
	Implementation of replanting program to compensate for trees or buffer zone plantation	construction and implementation	Lump sum	350,000.00
	HIV/AIDS & GBV awareness and prevention	construction	Table 23	60,000.00
	ESMP enhancing beneficial impacts	All phases	Lump sum	600,000.00
	Subtotal 1			**1,010,000.00**
2.	**Environmental and Social Monitoring Costs**			
	Impacts on soils and landscape quality monitoring	Construction	Table 24	**50,000.00**
	water quality monitoring	All phases	Table 24	**350,000.00**

	Air and Noise quality monitoring	Construction	Table 24	**39,360.00**
	Monitoring of flora and fauna	Construction	Table 24	**39,360.00**
	Traffic mobility and safety issues monitoring	Construction	Table 24	50,000.00
	Public health and Environmental sanitation monitoring	All phases	Table 24	330,000.00
	Sludge water treatment & disposal of the cake monitoring	Operation	Table 24	250,000.00
	Operation and Maintenance of the TP System monitoring		Table 24	250,000.00
	Subtotal 2			**1,358,720.00**
3.	Training cost including skill development	All phases	Table 26	**4,866,000.00**
	Subtotal 3			**4,866,000.00**
	Subtotal 1+2+3			**7,234,720.00**
	Contingency 10%			**723,472**
	TOTAL			**7,958,192.00**

11.3. Grievance Redressing Mechanisms

To ensure that PAPs have access to channels for resolving complaints related to environmental and social impacts, construction management negligence, and other project-related matters, procedures for the redress of grievances should be established for the project. According to OP 4.12 of the WB, the GRM should be accessible and appropriate to address complaints effectively. Without these essential components, complaint procedures will not yield the desired results in terms of resolving complaints.

In the case of complaints by Project Affected Persons (PAPs) regarding project-related activities, it is preferable to settle them through amicable means to save time and resources rather than resorting to formal courts. For the current project, it is necessary to establish a grievance redress committee consisting of members from the project administration office, PAPs, elders/religious leaders, and local NGOs. Capacity building and awareness creation interventions should be conducted to enhance the performance of the local level Grievance Redress Committee (GRC). The project owner/client is responsible for facilitating such training to ensure the project's overall success. The following steps will be followed to achieve consensus for any grievance related to any aspect of the project.

Procedure

- Complainants can log/file their complaint(s) in written form, verbally, through a telephone call, text message, or any means or channel convenient to them.
- The filed complaint(s) need to be itemized, clear, and concise with remedial suggestions
- Present the form for the relevant designated officer (first contact point, in this case, secretary of the Grievance Redress Committee - GRC)
- All types of complaints presented by the above means should be registered in a standard format prepared for the same purpose by the secretary of GRC. (Address of the PAP or PAPs (Telephone number, Kebele, etc.)

Obligation of the GRC

- Check the complaint is project-induced
- Registering all complaints and organize them properly (Secretary of the GRC)
- The stakeholder (the complainant) who raised the feedback or grievance shall be contacted within 24 hours to verbally acknowledge that it has been received and to inform the stakeholder of the likely timeframe in which a follow-up action can be expected.
- Forwarding the case to the committee

- Grievances will be screened and assessed within one week of receipt by the GRC and the complainant will be notified of the outcome.
- If resolution is required, the approach selected will be completed within one calendar month, 30 days and the stakeholder informed of the outcome.
- If accepted the resolution will be signed off and recorded as such. If not resolved, the stakeholder/ complainant will be informed of alternative approach such as informing/forwarding to the project owner/client to be completed within a further 30 days.
- If resolved, the grievance will be signed off and recorded. If still unresolved the grievance will be forwarded for third party consideration and resolution.Feedback /or GRC committees‟ decisions should be communicated to the PAP(s) at a maximum of one weeks.
- If the GRC does not settled by the GRC, inform/forward the same to the project owner/client
- Feedback from the project owner to be communicated to the PAP
- As it has been repeatedly mentioned, the GRM should be based on the core principles of fairness, objectiveness, simplicity (localized and contextual), accessibility to PAPs, responsiveness and efficiency. In addition, GRM should not only deal with compensation issues; rather all other project–induced complaints partly listed above.

11.4. Code of Conduct

The project implementing Agency is responsible for establishing and implementing a Code of Conduct to address environmental and social risks associated with construction. This code aims to promote a safe and respectful environment where harmful, offensive, abusive, or aggressive behavior is not tolerated. It ensures that everyone is free to express concerns without fear of punishment or retaliation.

The Code of Conduct applies to all individuals working at the construction site, including staff, laborers, and other employees. It also extends to personnel employed by contractors, subcontractors, consultants, and any other individuals involved in executing the construction activities.

The Code of Conduct should include the following core requirements applicable to the project workers. Every person involved in the project activities should:

- Carry out his/her duties competently and diligently;
- Comply with this Code of Conduct and all applicable laws, regulations, and other requirements, including requirements to protect the environment, health, safety, and well-being of other contractor’s personnel and any other person;
- Maintain a safe working environment including by
  - ensuring that workplaces, machinery, equipment, and processes under each person’s control is safe and without health risk; wearing required personal protective equipment;
  - using appropriate measures relating to chemical, physical and biological substances, and agents;
  - Following applicable emergency operating procedures.
- Report work situations that he/she believes are not safe or healthy and remove himself/herself from a work situation that he/she reasonably believes presents an imminent and serious danger to his/her life or health;
- Treat other people with respect, and not discriminate against specific groups such as women,
- people with disabilities or migrant workers;

- Not engage in any form of sexual harassment including unwelcome sexual advances, requests for sexual favors, and other unwanted verbal or physical conduct of a sexual nature with other Contractor's or Employer's Personnel;
- Not engage in Sexual Exploitation, which means any actual or attempted abuse of position of vulnerability, differential power or trust for sexual purposes, including but not limited to profiting monetarily, socially or politically from the sexual exploitation of another.
- Not engage in Sexual Assault, which means sexual activity with another person who does not consent.
- Not engage in any form of sexual activity with individuals under the age of 18, except in case of a pre-existing marriage.
- Complete relevant training courses that shall be provided related to the environmental and social aspects of the Contract, including health and safety matters and Sexual Exploitation and Assault (SEA).
- Report violations of this Code of Conduct. Any violation of this Code of Conduct by contractor personnel may result in serious consequences, including termination and possible referral to legal authorities.
- The contractor shall require all employees and the employees of the sub-Contractor to sign the Code of Conduct individually, and shall proactively address any breach to the Code of Conduct.
- A copy of the Code of Conduct in the local language shall be displayed in a location easily accessible to workers.

12. CONCLUSION AND RECOMMENDATIONS

12.1. Conclusions

Lack of sanitation is a serious health problem affecting billions of people worldwide, specifically in developing countries. When human beings do not have access to sanitation facilities, they suffer in the overall socio-economic and environmental existence. This is true for Degahbur town; lack of sufficient sanitation facilities such as PCT and FSTP in Degahbur town are among the bottlenecks for the development of the town. This poor sanitary situation is affecting the socio-economic and environmental health of the town. Hence, efforts to increase access to improved sanitation will greatly contribute to the town's overall sanitation. Considering the town's condition, the need for an improved fecal sludge management system (fecal sludge treatment plants and collection system) is indisputable.

Accordingly, the new treatment plant will be installed on the outskirts of the town. To maintain current treatment as well as future goals, non-planted Drying Bed with waste stabilization ponds and constructed wetland are recommended for the proposed fecal sludge treatment plant (FSTP). The selected technology for the fecal sludge treatment plants allows proper waste management and creates new capacity and opportunity for the municipality. The selection of the treatment technology was carried out based on capital and operation cost, space requirement, ease of operation, treatment efficiency, etc. The appropriateness of the sanitation facilities and technologies has been critically evaluated against available alternatives. Accordingly, the selected treatment technology is appropriate to the local context.

The ESIA study results show some limited negative environmental implications of the project activities; the proposed works will have high socio-economic benefits to the residents of Degahbur town. The associated negative impacts will be significantly reduced or eliminated through careful engineering design, best construction practices, and effective implementation of mitigation measures. Specific mitigation measures have been suggested in this report to offset some of the inherent adverse impacts, especially those linked to the natural, human, and social environment. Effects in the construction phase include impact on ambient air quality due to dust, soil erosion, poor solid waste disposal, and vegetation clearance. In addition, traffic accidents, occupational health, and the spread of social diseases, e.g., HIV/AIDS risk, may result from project activities.

Many adverse environmental and socio-economic impacts on the FSTP site are minor and can be easily mitigated. The identified ‘major impacts’ are all subjective and may happen under rare conditions, such as in the case of negligence, accident, etc. These also have appropriate mitigation measures and are indicated in the ESMP.

It is, therefore, concluded that effective implementation of the proposed project will mitigate the predicted impacts to non-harmful or near non-harmful levels. Their implementation should be adequate and timely. Overall, the anticipated positive impacts will outweigh the negative ones by far.

Predicted impacts shall be managed through the proposed mitigation measures and implementation regime laid down in this ESIA. Degahbur Water Supply and Sewerage Authority is committed to implementing all the proposed recommendations and further carrying out environmental auditing and monitoring schedules as well as enhancing the anticipated positive impacts, specially creating a healthy environment (social and natural environment).

The summary of recommended mitigation and management measures to minimize the potential impacts are:

- Proper design to accommodate measures for stormwater effects, soil erosion, and slope destabilization during construction.
- Measures to safeguard job opportunities and gender balance during both the construction and operation of project.
- Mitigation measures against workplace health and safety.
- Measures against noise and dust effects.
- Management of traffic accidents.
- Measures against the possible increase of social disease prevalence.
- Monitor compliance with environmental, health, and safety measures.

In general, the ESIA study indicates that the implementation of the project is expected to have enormous significance. Implementing the project will improve the health and livelihood of the town residents and downstream users of polluted river waters as it reduces the prevalence of waterborne diseases and other diseases born due to poor sanitation. The project will also create short and long-term employment opportunities potentially enable the reuse of the treated fecal sludge waste for agriculture and allow the production of biogas for energy and organic fertilizer (compost) from the by-products of the fecal sludge treatment process in the future.

The project will certainly play an important role in bringing about a more ecologically, sociocultural and economically sustainable and equitable environment in the project intervention sites.

12.2. Recommendations

It is recommended to implement the project with strict observation of the environmental and social management and monitoring plans. However, the project supervision consultant, once mobilized, should prepare a ‘Construction Supervision Plan’ before the beginning of construction works, and this plan should be part of the contract. In addition, the environmental management plans should be part of the contractor's contract documents so that ESMP compliance is ensured. The ESMP recommends environmental monitoring at the different phases of the project. The monitoring should be conducted to check the efficacy of mitigation measures. The Environment and Safety Division should develop an environmental checklist for the daily environmental audit of the project activities. The environmental expert of the contractor should fill this up and it should be verified by the City environmental protection office.

REFERENCES

1. CSA. Population Size of Towns by Sex, Region, Zone and Weredas [Internet]. 2023. Available: http://www.statsethiopia.gov.et/
2. MoWIE. Environmental and Social Management Framework (ESMF). 2017.
3. WHO. Sanitation [Internet]. 2017. Available: http://www.who.int/topics/sanitation/en/
4. CSAEthiopia & ICF. Ethiopia Demographic and Health Survey 2016. Int Food Res J. 2017;
5. WHO. Methods and Data Sources for Child Causes of Death 2000–2012. 2014.
6. Haddis A, de Geyter A, Smets I, Van der Bruggen B. Wastewater management in Ethiopian higher learning institutions: functionality, sustainability and policy context. J Environ Plan Manag. 2013;57: 369–383. doi:10.1080/09640568.2012.745396
7. World Bank. Global Water Security and Sanitation Partnership (GWSP) Annual Report 2022 (English) [Internet]. Washington D.C; 2022. Available: http://documents.worldbank.org/curated/en/099102211102224772/IDU0a8831b08028b604d070aa0104893aa4ceda2
8. World Bank. Stakeholder Consultations in Investment Operations - Guidance Note. 2011;
9. Nicholas O'Dwyer Ltd in association with Blue Matrix Consultancy. Development of Integrated City-Wide Sanitation Plans and Waste Water Management Systems Feasibility Study Report for Degahbur. 2023.
11. Tilley E, Ulrich L, Lüthi C, Reymond P, Zurbrügg C. Compendium of Sanitation Systems and Technologies. 2nd Revised Edition [Internet]. 2014. p. 180. Available: www.sandec.ch/compendium
12. Mara, Duncan , Lane, Jon, Scott Beth TD. PLOS Medicine Sanitation and Health. 2010; Available: http://www.plosmedicine.org/article/info:doi/10.1371/journal.pmed.1000367#pmed-1000367-g005
13. FDRE. Proclamation of the Constitution of the Federal Democratic Republic of Ethiopia [Internet]. Federal Negarit Gazeta. 1995. pp. 1–38. Available: http://www.ethiopianembassy.be//pdf/Constitution_of_the_FDRE.pdf
14. FDRE EPA. ethiopian environmental policy. 1997; Available: https://www.google.com.sa/search?q=ethiopian+environmental+policy+pdf&oq=E&aqs=chrome.0.69i59l3j69i57j69i60l2.2020j0j7&sourceid=chrome&espv=210&es_sm=93&ie=UTF-8
15. FDRE M of WR. Water Resources Management Policy and Strategies. 2001.
16. FDRE. Ethiopia's National Health Policy. Ethiopia; 1993.
17. FDRE. National Policy on Women. Ethiopia; 1993.
18. FDRE. National Policy on HIV/AIDS. 1998.
19. FDRE. Climate Resilient Green Economy Strategy . Ethiopia; 2011.
20. MoWIE. Urban Wastewater Management Strategy . 2017.
21. MoH. Federal Democratic Republic of Ethiopia Ministry of Health National Hygiene and Sanitation Strategy. 2005.
22. FDRE-HPR. Environmental Protection organs Establishment proclamation No. 295/2002. Federal negarit gazeta. 2002.
23. FDRE EPA. Guideline for reviewing environmental impact study reports, final drafts. 2003.
24. EPA. Environmental Impact Assessment Proclamation: General EIA Guidelines 299/2002. 2002.
25. FDRE. Environmental Pollution Control Proclamation No. 300/2002. Federal Negarit Gazeta. 2002.
26. FDRE. Public Health Proclamation. Negarit Gazeta. 2000.
27. FDRE. Solid waste management. 2007.
28. FDRE. Ethiopian Water Resources Management Proclamation No: 197/2000. Federal Negarit Gazeta. 2000. pp. 1250–1260.
29. FDRE. Proclamation on Hazardous Waste Management. Proclamation No.1090/2018 Ethiopia; 2018.
30. FDRE WL conservation A. Development, Conservation and Utilization of Wildlife Proclamation. 2007.
31. FDRE. Proclamation on Forest Development, Conservation, and Utilization. 2018.
32. Ethiopia TFDR of. Research and Conservation of Cultural Heritage . 2000 p. pp.1345-1356.
33. FDRE. Ethiopian Wildlife Protection Proclamation. Proclamation No.541/2007 Ethiopia; 2007.
34. FDRE. Ethiopian building code. Proclamation 624/2009 Ethiopia; 2009.
35. FDRE. Proclamation on Expropriation and Payment of Compensation. Proclamation 1161/2019

Ethiopia; 2019.
36. FDRE. Regulation No Expropriation and Payment of Compensation. Regulation No. 472/2020 2020.
37. FDRE. Labor Proclamation. Federal Negarit Gazeta. 2019.
38. World Bank. Involuntary Resettlement Policy (OP/BP 4.12). 2016.
39. World Bank. OP 7.50 - Projects on International Waterways. 2012; 3 pp.
40. World Bank. Physical Cultural Resources OP. 4.11 [Internet]. Op. 411 2006. Available: http://go.worldbank.org/IHM9G1FOO0
41. IFC. Environmental, Health, and Safety General Guidelines. International Finance Corporation-World Bank Group. 2007. pp. 1–15.
42. Weatherspark.com. Weatherspark.com [Internet]. 2023 [cited 7 Jun 2023]. Available: https://weatherspark.com/y/101155/Average-Weather-in-Debre-Birhan-Ethiopia-Year-Round
43. WHO. The world health report 1997 - Conquering suffering, enriching humanity. World Health Forum. 1997. doi:10.1590/s1020-49891997001200018
44. IUCN Redlist [Internet]. [cited 28 Oct 2023] p. https://www.iucnredlist.org/. Available: https://www.iucnredlist.org/
45. CSA. Summary and Statistical Report of the 2007 Population and Housing Census, Population size by Age and Sex, Addis Ababa, Ethiopia, United Nations Population Fund. 2008.
46. Singhe. Overview of Technology Options for Fecal Sludge Treatment. 2016;

DEFINITION OF TERMS

Anaerobic digestion: A process that uses bacteria to break down organic and biological waste in the absence of oxygen.

Containment/storage: Ways of collecting and storing (and in some cases treating in-situ) fecal sludge generated from a latrine.

Compensation: Payment in cash or in kind of the replacement cost of the acquired assets.

Drying beds: Method of treating fecal sludge off-site whereby sludge is spread out over a contained space to dry

Direct Impacts: Those impacts that are caused by the action and which generally occur at the same time and place as the action.

Environment: The physical factors of the surroundings of human beings, including land, water, atmosphere, climate, sound, odor, taste, the biological factors of animals and plants, and the social factor of aesthetics, including both the natural and built environment.

Environment and Social Impact Assessment (ESIA): A systematic examination conducted to determine whether or not a project will have any adverse environmental impacts.

Environmental Impact Study: means the study conducted to determine the possible environmental impacts of a proposed policy, project, or activity and measures to mitigate such impacts.

Environmental Monitoring: the continuous determination of any activity or phenomenon's actual and potential effects, whether short-term or long-term.

Fecal sludge: Contents of an on-site sanitation facility (such as a latrine pit) typically comprising of excreta, flush water, and anal cleansing materials.

Fecal sludge management (FSM): Methods and processes to manage fecal sludge.

Latrine: A sanitation system that captures fecal sludge and contains it. Through this containment, a barrier is established to prevent contact between humans and potentially disease-causing microbes in fecal sludge. Numerous types of latrine systems, technologies, and configurations exist.

Indirect Impacts: Those impacts that induce changes in the natural environment, population, economic growth, and land use as a result of actions not directly linked to the project in question.

Impact: is the effect of any action that affects one or more elements of the natural, social or economic environment, either adversely or beneficially.

Physical Displacement: Relocation, loss of residential land, or shelter as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas.

Pollution: any direct and indirect alteration of the physical, thermal, chemical, biological, or radioactive properties of any part of the environment by discharging, emitting, or depositing wastes to affect any beneficial use adversely, to cause a condition that is hazardous or potentially hazardous to public health, safety or welfare, or to animals, plants or aquatic life, or to cause a contravention of any condition, limitation or restriction to a healthy environment.

Project: a set of planned activities to achieve objectives within a given area and time frame.

Mitigation measures: Actions that reduce, avoid, or offset the potential adverse environmental consequences of a project and include engineering works, technological improvements, management measures, and ways and means of ameliorating effects to the environment and losses suffered by individuals and/or communities, including compensation and resettlement.

Scoping: is the early transparent process that identifies concerns, evaluates them, and organizes them by eliminating insignificant impacts and focusing on significant impacts for further assessment so that attention and therefore resources can be effectively and efficiently utilized.

Significance: an expert evaluation/judgment of the magnitude of impact or the degree to which a proposed activity or project may (potentially) impact the environment if implemented.

Significant effect: substantial/ potentially substantial, adverse changes in any of the physical factors of the surroundings of human beings, including land, water, atmosphere, climate, sound, odor, taste, biological factors of animals and plants, and social factor of aesthetics and includes both natural and built environment.

Significant Impact: Impact experienced by 200 people or more, involving (i) physical displacement from housing or (ii) loss of 10% or more of their productive assets or income-generating activities.

Stakeholders are those affected by the outcome of a project or can affect the outcome of a proposed project either negatively or positively.

Squatters: People who unlawfully occupy land or a structure. Suppose the occupation is well established before the dissemination of project details and the cut-off date, the occupying people are found vulnerable. In that case, they are eligible for compensation for the loss of any structure, trees, crops, and other assets they will lose access to because of project implementation.

Treatment: A process that changes the physical, chemical, and biological characteristics of fecal sludge so that it is converted into a safer product for end-use or disposal.

Vulnerable Groups: Households below the poverty line, women, children, elderly, and people without legal title to assets (including land).

Waste: is a by-product of day-to-day activities or anything which is no longer useful to someone and is disposed of. It is an unwanted or undesired material or substance that is thrown away.

APPENDICES

Appendixes	Appendix title	Appendix Attachment
1	Minutes of community consultation	 list of commuinty consulted -Degehabu
2	Lists of stakeholder consultation participants	
3	Primary data collection checklist	 Checklist.docx
4	Secondary data collection Checklists	 Secondary data collection Checklists
5	Checklist and Formats	 Other checklist and Formats.docx
6	Ambient Factors	 Environment.docx
7	GRM form	 GRM Form.docx
8	GAP	 Gender Action Plan.docx
9	Environmental Guidelines for Construction Contractors	 Annex 15 Environmental Guideli
10	Chance find procedure	 Chance Find Procedure.docx
11	Brief summary of Scoping report	 Degahbur scoping.docx
12	Response to Comments	 Response to Commnets.docx
13	Team involved in ESIA Study	 Team involved in the ESIA Study.docx

ውሃና ኢነርጂ ሚኒስቴር

MINISTRY OF WATER AND ENERGY

የኢትዮጵያ ፌደራላዊ ዲሞክራሲያዊ ሪፐብሊክ | Federal Democratic Republic of Ethiopia

Prepared By: **Motion Consultancy and Training PLC**

ሞሽን ኮንሰልታንሲ ኤንድ ትሬኒንግ ኃላ. የተ. የግ. ማ

Bole sub-City, Woreda 04, Ghana Street, St. Urael Church, Sheger Building, 2nd floor, office # 201/202

+251-118691799, +251-968-96-9696, Email: motionethio@gmail.com

www.motionethio.com

MOTION