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Second Urban Water Supply and Sanitation Project

Environmental and Social Impact Assessment

(Fecal Sludge Management Project for Jigjiga City)

[Final Report]

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Financed By WORLD BANK

November 2023
Addis Ababa

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ACRONYMS

ABR	Anaerobic Baffled Reactor
AF	Anaerobic filter
ARCCH	Authority for Research and Conservation of Cultural Heritage
ARAP	Abbreviated Resettlement Action Plan
BAU	Business as Usual
BH	Borehole
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
JWSSA	JigJiga Water Supply and Sewerage Service
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 & 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 and 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
PT	Public Toilets
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 & 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
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

INTRODUCTION

This report presents an Environmental and Social Impact Assessment (ESIA) for the upcoming Fecal Sludge Treatment plant (FSTP) project in Jigjiga City, Ethiopia. Jigjiga city is the administrative center of Somali regional state located in the eastern part of Ethiopia.

The city has a projected total population of 204,249 (Males 105,485, females 98,763) as of July 2023 (CSA, 2023). Due to the lack of improved waste treatment system, the 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. The municipality and four private service providers operate in the city's waste/sludge collection-emptying and transportation.

The city Water Supply and Sewerage Authority (JWSSA) is currently implementing the 2nd Urban Water Supply and Sanitation Project (UWSSP-II), which the World Bank supports. The primary objectives of the UWSSP-II are to construct 19 new type II communal toilets and 18 type II public toilets, provide 3 additional emptying trucks with a capacity of 8 cubic meters, and construct new FSTP in the short-term in the Jigjiga city to improve the sanitation problems for the town.

The infrastructure development may bring adverse impacts on the environment and social aspects that need efforts to minimize the negative impacts and set mitigation measures to make the project environmentally safe and socially acceptable. 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 Jigjiga city.

The overall objective of the ESIA is to identify, predict, and evaluate the potential impacts of the proposed project on the biophysical and socio-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. The ESIA emphasizes the potential impacts on the quality of life of people living close to the proposed projects, the health, and safety of those involved in the construction and operation of the FSTP, the surrounding natural and human environment. It looks for options that would help to avoid or reduce potential E&S risks and impacts and for residual impacts.

METHODOLOGY

The ESIA study process followed the proposed guidelines set out within the Environmental and Social Management Framework (ESMF) for UWSSP-II, 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 detailed 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 the proposed project activities, and has prepared the Environmental and Social Management (ESMP) and Monitoring Plans, which detail how adverse impacts and risks will be reduced or eliminated and by whom.

DESCRIPTION OF THE PROPOSED PROJECT

Location

Jigjiga, the capital city of the Somali National Regional State, is in the Jigjiga Woreda within the Fafan Zone of Ethiopia. It is located in the eastern part of the country, approximately 640 km from the capital city, Addis Ababa. The geographical coordinates of Jigjiga are approximately between 9º 16' to 9º 24' North latitude and 42º 44’ to 42º 51’ East longitudes. The town has an average elevation of approximately 1680 meters above sea level with flat Jigjiga plains along the Jerer River.

The project area for the proposed fecal treatment plant is found 8.5 km south of the city center located at GPS coordinates 9° 16' 24"N and 42° 48' 19"E. The site is far from settlements (more than one kilometer).The project site has a gentle slope and low risk of flooding which is favorable for construction.

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 one 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 and ground water fields are also far from the site by more than 2.5 km.

The project requires a total of 4.25 ha of land for Fecal Sludge Treatment site including buffer zone. The land ownership of the project site is privately owned by about 15 farmers. Hence, ARAP by independent consultant and appropriate compensation is necessary to acquire the land.

Design Capacity

The design assumed the base year to be 2027 for the population projection and accommodate the population projection until year 2031 with a capacity of 48.64 m^3/day or 12,646 m^3/year.

Treatment Process

The treatment process comprises course screening solid, liquid separation, solid line treatment, liquid line treatment, and tertiary treatment for liquid effluent. In the first unit, the liquid and solid parts of the fecal

sludge will be separated and the solid part goes to solid treatment lines (unplanned drying bed).The collected leachate (liquid part) goes to the liquid treatment units called waste stabilization ponds and will be treated in a series of ponds, including anaerobic pond, facultative bond, and a maturation pond. Where the main function of these structures is the destruction of pathogens, they also carry out polishing of the wastewater to achieve the standards for Biological Oxygen Demand (BOD) and suspended solids. The dried sludge will be stored on open ground. And the final liquid will enter the constructed wetland for further treatment to ensure safe reuse or discharge to the nearby River.

Project Components:

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 421 m^3); 16 in number reinforced concrete ***sludge drying beds; WSP*** (two Anaerobic pond, two facultative pond, and two Maturation pond); constructed wetland; ***Connection and Pipelines (***1083 meters in length); and ***Final Effluent Chamber, Discharge Outfall (*** approximately 550 meters long). A warehouse of 1850 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 26 months.

POLICIES, LEGISLATIONS AND INSTITUTIONAL FRAMEWORK

The Constitution of the Federal Democratic Republic of Ethiopia (FDRE 1995), provides the overriding principles and legal provisions for all legislative frameworks in the country. The Constitution addresses the concept of sustainable development and emphasizes the environmental rights of the people. These key principles are articulated in Articles 43 and 44 of the Constitution. Articles 43 and 44 highlight several important rights, including the right to development, the right to reside in a clean and healthy environment, and the right to receive monetary or alternative forms of compensation.

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

Climate

Jigjiga city has an average elevation of 1680m.a.s.l above sea level. The geographical location of Jigjiga lies between 9º 16' to 9º 24' North and 42º 44’ to 42º 51’ East. The city is characterized by subtropical highland with a monthly average temperature of 20.0°C and a mean annual rainfall is 600mm. The area's rainfall is characterized by bio-modal rainfall seasons, main rainfall and short rainfall seasons (locally known as meher and Belg, respectively).

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 JigJiga city is about 204,249 (Males 105,485, females 98, 763) as of July 2023 (CSA, 2023). Administratively, the town is divided into 20 kebeles ((lower level of administration) and has its town administration (Municipality) led by a mayor.

The town's economic activity mainly depends on small and medium businesses and employment. There are not that many industrial activities in the town. The town has different governmental and non-governmental institutions such as schools, pharmacies, residential houses, clinics, market areas, roads, hospitals, universities & colleges, manufacturing industries, electric and Ethio telecom infrastructures, and other institutions and facilities. None of the observed institutions and infrastructures is expected to be affected by the construction of the proposed projects.

PROJECT ALTERNATIVES

During the ESIA studies, alternative sites and alternative technologies were assessed, analyzed, compared, and recommended. 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.

Different alternative FSTP technologies were reviewed and compared to select the best solids treatment, effluent treatment, and dry sludge treatment technologies used to process and dispose of sludge. These include Unplanted Drying Bed, Planted Drying Bed, Geotextile Dewatering Bag and Mechanical methods for solid treatment; waste stabilization pond, thickening filter, aerated lagoon, and oxidation ditch for effluent treatment; and storage for extended periods, solar drying with composting; and black soldier fly for bio-solids treatment**.** These alternative technologies were evaluated and ranked based on technical feasibility (easy operation 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 has been 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 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, local community the main objective of presenting the proposed project, getting feedback and draw on the required measures and actions. Accordingly, consultations were made with Mayor Office and its subsequent sector offices such as Agriculture, health, environmental protection, Water and Energy, women and child affair at town level and SNRS EPA, Bureau of water and energy at regional level. Grass-roots consultation was done with local community and Project affected persons around the FSTP site.

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

- Fecal Sludge management is one of the persistent problems of the city, in which all concerned stakeholders need to play its role in the planning, design, implementation, and operational activities of the project;
- The project is critical and its construction and operation need to be started urgently in such a way to improve the health and wealth of the public;
- The Municipality has discussed with the PAPs and will pay appropriate compensation for possible loss of land based on study.
- Many of the stakeholders lack awareness and prior knowledge about similar projects and capacity building training is necessary.

- Reusing of FSTP effluent for irrigation and its sludge fertilizer were also one interest areas discussed and agreed; but it need proper awareness creation and training to the local community to utilize this positive impact.
- For controlling of bad odor, buffering and landscaping of the site are also among the issues and recommendations forwarded by the stakeholders.
- The PAPs has no opposition on the project but their concern is loss of farm land and impact on their livelihood and they expect sufficient & appropriate compensation, they also expect access to water from the project.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The implementation of FSTP is proposed mainly to improve the quality of the social and natural environment of Jigjiga City. The existing sanitation situation in the town is very poor that the absence of well-organized sanitation facilities has caused the deterioration of the social and natural environment with adverse consequences on human health, which is directly, or indirectly associated with water, air, and soil pollution resulting from improper fecal waste disposal. In this ESIA both positive and adverse environmental and social impacts were identified .Adverse impacts are characterized by type, magnitude, nature, spatial extent, and duration and assessed for significance.

Potential impacts of 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 and international contractors and consultants. Proposed enhancement measures include prioritizing the local communities, providing business opportunities, job training, and capacity building for potential workers.

There are several potential adverse impacts associated with the proposed project. The major negative impact is loss of land and livelihood (about 15 farmer), other negative impacts include landscape alteration, air pollution due to vehicle movement and site preparation, noise pollution caused by vehicles, soil compaction and soil erosion, inadequate handling and spillage of pollutants and wastes that can lead to water bodies pollution, traffic accident risks, occupation health and safety risks, , labor influx and potential conflict between migrant workers and locals over employment opportunities; gender based violence/GBV public health & safety such as HIV/AIDS.

Based on the assessment, it is expected that there will be direct adverse impacts, which can range from low to moderate in severity, and be of short-term duration. However, these impacts can be minimized to acceptable levels by implementing appropriate mitigation measures. These measures will include appropriate compensation of PAPs, 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 in sensitive areas. Additionally, it is essential to ensure proper storage and handling of hazardous substances, provide personal protective equipment (PPEs), raise awareness on health, safety, and traffic accidents, post visible signs and use barricades at appropriate locations, rehabilitate roads, plant trees, provide job opportunities to locals, and raise awareness on infectious diseases, such as HIV/AIDS.

Impacts during Operation Phase

Most of the beneficial impacts during the operation phase of the project is improving the quality of health from proper management of fecal matter that would otherwise be dumped haphazardly and drain into rivers where others may come in contact and affected, reducing cases of waterborne diseases such as cholera, typhoid, amoeba, and diarrhea through the provision of sanitation facilities due to improved hygiene; moreover, agricultural production and productivity may increase using treated water and bio solids/compost from the FSTP.

The potential negative impacts during the operation phase include unpleasant odors caused by frequent dumping of truckloads of fecal sludge & 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 handling, use and untreated dry sludge, spillages or discharge of sewage and uncontrolled sludge spreading and malaria; occupational health and safety due to handling of sludge, accidents as well as exposure to H_2S.

The negative impacts are, 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 around the treatment plant (at least 400m from settlements), planting trees around the FSTP perimeter/boundary line to reduce nuisance odors and improve the aesthetic view; provision of PPEs for the relevant staffs; 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; avoiding logging of water discharges around the treatment plan

Impacts during decommission phase

At the end of the design life of the FSTP, JWSSA could upgrade or decommission the treatment plants. The following Potential adverse impacts are predicted assuming that the waste treatment plants will be decommissioned at the end of their design lifetime.

- 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.
- Impacts on Soil and Water Bodies: If the contaminated soil is dumped outside the designated area or outside the properly designed and constructed sanitary landfill, it would pollute the soil and water resources including groundwater. Moreover, decommissioning the sites without availing a better substitute for the treatments of ever-increasing wastewater would also adversely affect the soil and water resources of the areas and their downstream.
- Loss of Job Opportunity: decommissioning of the treatment plants means number of skilled and unskilled workers will lose jobs which would adversely affect workers and their dependents. Health Impact: health impacts (occupational and safety) associated with dismantling of concrete structures and from the removal process of contaminated sludge and soil.

The identified adverse impacts of the decommissioning phase are possible, reversible, of low to moderate significance, and temporary. They can be mitigated through:

Mitigation measures

- Systematically demolish structures considering reuse of materials for other use;
- Wet the materials before demolishing to suppress the release of dust; and
- Avoid burning any material.
- Remove all the contaminated soil from the treatment plants sites and dispose of it at a designated waste disposal sites or at sanitary landfills;
- Give job priority in other related projects;
- Secure pension benefit if the age of the job loser is in the set range of pension; and
- Organize, train and promote to establish their own small-scale enterprises through the facilitation of loan or financial support. Create links with appropriate government agencies and financial sources.
- Plan the decommissioning work ahead of time to avoid sudden stop of the treatment plant before completely treating the influent reached to the treatment plant, and
- Provide appropriate PPE for the workers to be involved in decommissioning works
- The treatment plant sites should be reinstated after the plants stop their functions
- All the unwanted structures should be removed and disposed of at a designated waste disposal landfill

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The Environmental and Social Management Plan (ESMP) for the proposed project 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 lifecycle.

ENVIRONMENTAL AND SOCIAL MONITORING PLAN

An effective environmental and social monitoring plan ensures compliance with regulations, identifies potential issues or risks, and implements appropriate mitigation measures.

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 responsible parties 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.

IMPLEMENTATION ARRANGEMENTS AND CAPACITY BUILDING

The Ministry of Water and Energy (MoWE) and Somali Regional State Water and Energy Bureau are the 'Promoters'. Execution at the local level rests with the Jigjiga City Water Supply and Sanitation Authority (JWSSA). JWSSA effectively acts as the implementing agency on the ground, charged with the responsibility of delivering upon the commitments within the local jurisdictions. The MoWE and Somali Water and Energy Bureau are charged with the oversight of execution and the provision of enhanced technical assistance, as well as the responsibility to supervise execution of the projects.

JWSSA has an established and functional position for an Environmental and social safeguard experts, which will provide oversight on the implementation of the ESIA. 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. In the interim, this staffing arrangement is deemed adequate. Similarly, the Somali 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 ESIA during construction will be of the contractor and JWSSA. During the operation and maintenance of the FSTP works, the responsibility will be mainly under the JWSSA. Similarly, Somali Regional State EPA and Jigjiga City environmental agency have the sole responsibility for monitoring and regulating the overall social and environmental performance of the project activities.

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, JWSSA 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 **8,252,860.00** Birr.

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 important component in ensuring environmental well-being. Sanitation is also a building block of development [1]. Nowadays, 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 negative public health and environmental risks.

Waste management is a big challenge in Ethiopia, especially in urban areas. For example, fecal sludge waste generated from Jigjiga City is disposed of illegally in open spaces without proper sanitation facilities installed. Industrial effluent and diffuse release from agricultural activities are other forms of environmental pollution. 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 financial support, plans to implement 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. In contrast, only 2% of rural households share their toilet facilities with other households [2]. One in three Ethiopian households has no toilet facility; defecate in bush/fields (39% in rural areas and 7% in urban areas) [2]. Furthermore, according to the WHO's estimates, diarrhea contributes to more than one in every ten child deaths in Ethiopia [3]. Ethiopia's total population growth rate is also 2.5% a year, with urban centers growing at a rate of 5.1% [4]. This situation triggers the need for the construction of PCT, fecal sludge management facilities, wastewater treatment plant, 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 Jigjiga, 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[5]. In these low-income countries, a significant proportion of fecal sludge is discharged without any treatment into the urban environment. 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 Jigjiga, no private operators can empty septic tanks and latrines. Moreover, while the municipality is providing the service, there is no appropriate and properly managed site to dispose 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, and reduce the spread of infectious diseases and pollution of ground and surface waters. It also increases hygienic conditions, bringing social and economic advantages to the town and its surrounding environment. Furthermore, implementing the FSTP will improve the town's socio-economic and environmental conditions.

1.2. Objectives of the ESIA study

1.2.1. General Objective

The general objective of the ESIA study is to describe the existing bio-physical and socio-cultural features of the proposed Jigjiga City 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.

1.2.2. Specific Objective

The specific objectives of the ESIA are to:

- To review the Ethiopia's environmental and sectorial policies, legislation, regulatory and administrative framework in conjunction with the World Bank's safeguards policies;
- To identify and describe the baseline Physical, biological and socio-economic environmental condition in the project implementation area and highlight the major constraints that needs to be taken in to account in the course of project implementation;
- In light of the available information, to develop an environmental and social screening and scoping process for the project;
- To identify, predict and evaluate the potential positive and negative impacts of the proposed project on the physical, biological and socio-economic environment in terms of magnitude, extent, and duration;
- To develop a stakeholder consultation process that ensure all stakeholders, including potentially affected persons, are aware of the objectives and potential environment and social impacts of the project, and that their views are incorporated in to the project's design as appropriate;
- To prepare an Environmental and Social Management and Monitoring Plan including monitoring indicators during the mobilization, construction, operation and decommissioning phases of the FSTP and

- To evaluate alternatives to the proposed project.

1.3. Scope of the ESIA

This ESIA was conducted in Jigjiga City of Somali Regional State on the FSTP component. The scopes of service of the ESIA were as follows:

- Provide a comprehensive description of the project units, size, nature, and characteristics, land and other resource requirement, waste generated, project implementation period and the like;
- Review existing project documents mainly Situation Assessment, Feasibility study final design reports of the project, and other related reports;
- Identify and analyse the national and the World Bank environmental safeguard policies and regulations that the project activities will trigger;
- Review the ESMF for Urban Water Supply and Sanitation Project Phase II (2017) and ensure that the requirements specified in the ESMF are considered properly in the ESIA study.
- Review the Resettlement Policy Framework issued in 2016 and make sure that the guidelines provided in the document are considered sufficiently in the ESIA process.
- Conduct baseline surveys to identify and analyze the existing condition and carry out all the required survey data collection and investigations. The baseline assessment addresses:
  - Physical and bio-physical environment (climate, topography at the project site(s), surface water, soils, erosion sensitivity, flora, fauna, including the identification of any protected or endangered species);
  - Land use at the project site and in its vicinity;
  - Human environment: description of the town communities (population size, population structure, and demography, socio-political organization, livelihoods, access to public services);
- Identify biophysical, socio-economic and cultural components likely to be impacted by the project;
- Make an analysis of alternatives of the proposed project;
- Assess, predict and evaluate potential impacts of the proposed project and its potential alternatives at different stages of the project;
- Conduct public consultation to obtain people's perception about the project;
- Propose mitigation measures;
- Develop an environmental and social management plan (ESMP) with mechanisms for monitoring and evaluating the compliance and environmental performance which was include the cost of mitigation measures and the time frame of implementing the measures;

1.4. Team in charge of the ESIA Study

More than eight senior professionals with diverse backgrounds and having extensive relevant experience were involved in the process of the ESIA. The Team Composition and their Task assignments are attached in annexes (annex 12).

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 about socio-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 environmental and social safeguard 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 socio-environmental impacts of the proposed development in particular. The review of these policies, proclamations, and guidelines are summarized in section 3 of this report. In addition, available documents on the previous studies of the proposed projects, the 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 how to deliver the projects. The list of the documents reviewed is provided in the list of references and footnotes.

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 that can be negatively affected by the construction of operation of the projects.

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 socio-environmental baseline data for the project influence area and 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. The checklist was filled at the site and used to identify potential adverse socio-environmental impacts and to categorize and determine the level of ESIA to be conducted.

Figure 1: FSTP Site visit at Jigjiga

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, project beneficiaries, and affected parties and to obtain their views and concerns. Groups of community members PAPs, concerned government officials, and professionals (social and environmental experts) at the Regional State and municipal or city administrators 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, PAPs 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 officials and experts. Outcomes of the consultations are summarized in section- 7.

2.2.5. Use of Relevant Data Generated by other Disciplines

Data collected by the project feasibility study and design consultant (engineering team), literatures and other studies were reviewed. The relevant data was 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 Environmental and Social Impacts

The impact assessment was based primarily on the selected valued environmental and social components. Field investigation, public consultation, literature survey, and expert judgment were applied to screening the valued environmental and social components. Impacts and their depth and significance were outlined concerning environmental and social settings on a temporal and spatial basis. The following stepwise approach was followed:

- ***Identification***- This includes a description of the existing environment, determination of the project components, and definition of the environment that the project will modify.
- ***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 and adverse impacts on the physical, biological, and socio-economic environment associated with the project operation were identified with the help of the 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 knowledge gap 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 detailed design.

3. DESCRIPTION OF THE PROPOSED PROJECT

3.1. Overview of UWSSP-II project

The disposal capacity of fecal sludge and wastewater in urban areas in Ethiopia is currently insufficient, resulting in pollution of natural resources and endangering human health. To address this issue, the Government of Ethiopia has successfully obtained funding from the World Bank through the Second Ethiopia Urban Water Supply and Sanitation Project (UWSSP-II).

The objective of UWSSP-II Project is 'to increase access to improved sanitation facilities and improve efficiency in water supply service delivery and to comprehensively and equitably enhance urban sanitation, as well as improve operational effectiveness in 22 secondary cities.

This objective will be addressed through the following three major components: (i) sanitation and water supply services improvement in Addis Ababa; (ii) sanitation and water supply services improvements in selected secondary cities; and (iii) Project management and institutional strengthening.

Jigjiga City is one of the secondary cities benefiting from the portion of the finance secured under Component 2 of the UWSSP-II. The main goal of the projects is to enhance and expand the availability of proper sanitation facilities and establish a long-lasting waste management system.

The proposed development interventions in JIgjiga city for the short term are

- The construction of a Fecal sludge treatment plant with necessary facilities
- Construction of 19 new Type II communal toilets, primarily in residential areas where existing access to services is low.
- Construction of 18 new Type II public toilets in public areas.
- Replace existing fleet of vacuum trucks and provide additional vehicles to meet the total required number of 3 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 is prepared pursuant to the service contract between MOTION Consultancy and Training PLC, the consultant, and the Ministry of Water and Energy, the client, to undertake an Environmental and Social Impact Assessment of the envisaged FSTP project to be implemented in the city.

3.2. Project Location

Jigjiga, the capital of the Somali National Regional State, is a city in the Jigjiga Woreda within the Fafan Zone of Ethiopia. The town is also the administrative center of Fafan Zone. It is located in the eastern part of the country, approximately 640 km from the capital city, Addis Ababa. The geographical coordinates of Jigjiga are approximately between 9º 16' to 9º 24' North latitude and 42º 44' to 42º 51' East longitudes. The town has an average elevation of approximately 1680 meters above sea level with flat Jigjiga plains along the Jerer River.

The city is characterized by flat to slightly undulating plain topography. Owing to the plain topography, the majority of locations are found to be affected by flood.

The proposed fecal treatment plant's project area is located 8.5 km south of the city center with GPS coordinates 9°16'24"N and 42°48'19"E. The project site has a gentle slope and low risk of flooding which is favorable for construction. The project requires a total of 4.25 ha of land for the Fecal Sludge Treatment site, including a buffer zone. The land ownership of the project site is a farm land owned by about 15 farmers hence, land acquisition requires ARAP study and proper compensation. There is no settlement and/or commercial area within 1 km diameter from the site.

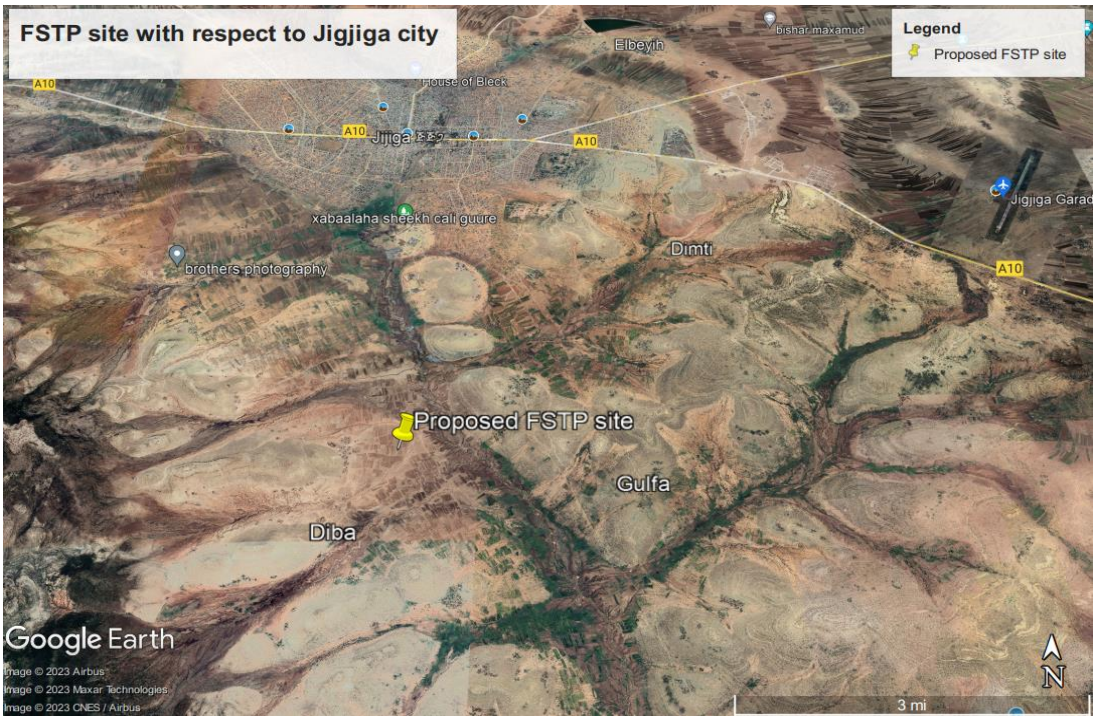

Figure 2: Jigjiga city, project site
Source: Google Earth

3.3. Project Components

The FSTP will have an average capacity of 48.64m³/day or 12,646 m^3/year in the short term. The fecal sludge treatment plant will include fecal sludge treatment units, dried sludge storage administrative buildings, interconnecting pipework between process treatment units and discharge pipelines, drainage canals, internal access roads, and land scraping works.

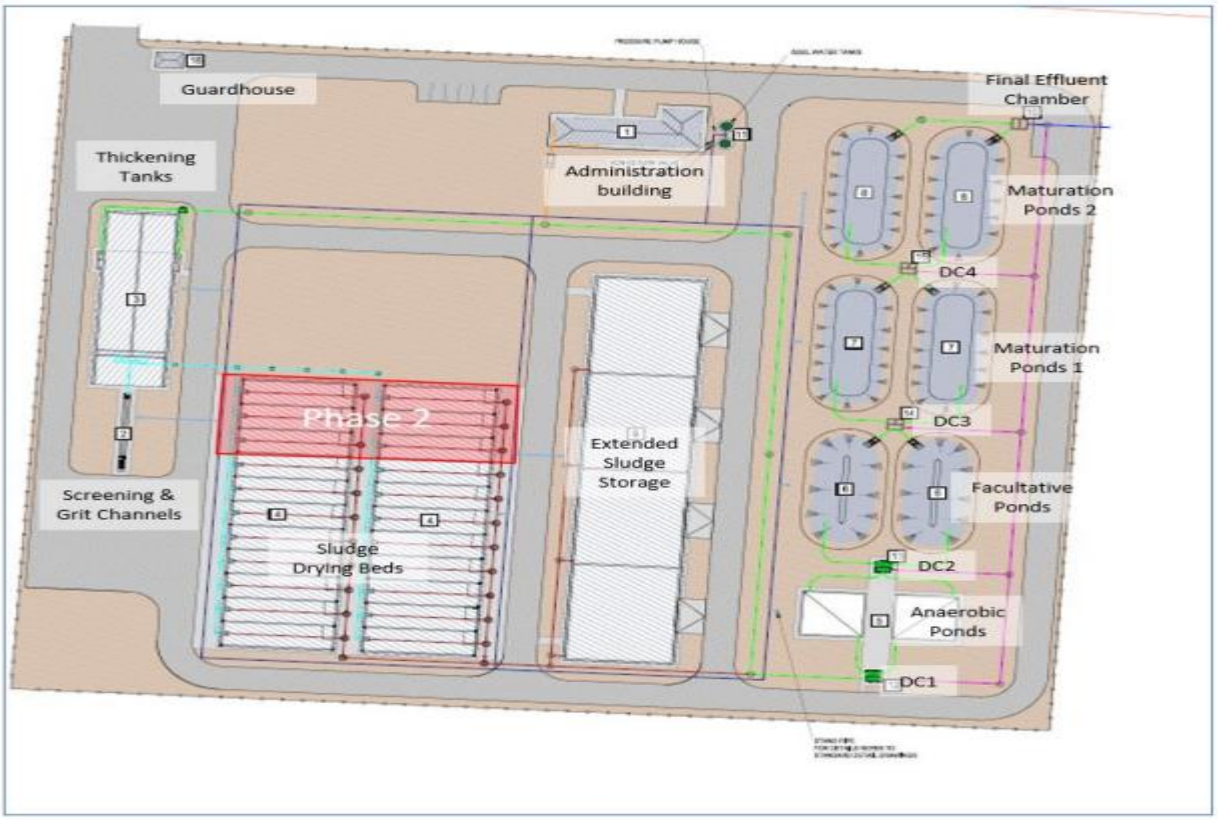

Figure 3: Layout of the FSTP and Facilities
Source: [6]

3.3.1. 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 with a high dry solids content cake.
4. Before being reused or disposed of, the cake may undergo additional treatment (storage for more than 18 months) to decrease the concentration of pathogens.
5. The liquids from both 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.

3.3.2. Components of the fecal sludge treatment unit

The fecal sludge treatment unit has the following components

- **Preliminary Treatment:** Screens & Grit Removal Unit;
- Solid-liquid **separation:** Sludge Thickening Tanks
- **Solids treatment line:** Unplanted Drying Beds

- **liquid treatment line:** Wastewater stabilization ponds(anaerobic ponds, facultative and maturation ponds)
- **Biosolid treatment**: Storage for dried sludge for an Extended Period and
- **Tertiary treatment:** constructed wetland
- Treated Effluent Tank
- Discharge pipe line

3.3.2.1 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. Manually cleaned coarse bar screens will be used to remove rags and large solids from the septage flow due to their simplicity, robustness, and relatively low cost to avoid the supply of spare parts and the requirement of skilled labor.

Parabolic grit channels are recommended for grift removal due to their simplicity and effectiveness in removing the grit from the incoming sludge. This solution has no moving parts and is easy to maintain. Two grit removal channels in a duty/standby configuration will be provided, so that operation can continue while grit is being removed from one channel.

Table 1: 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	number	2
	Selected grit chamber depth	m	0.13
	selected grit chamber width	m	0.3
	selected grit chamber length	m	15

Source: [6]

3.3.2.2 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 421 m3 each with dimensions of 6m Width X 27 m Lengthx2.6 depth will be provided for the solid-liquid separation.

3.3.2.3 Unplanted Drying Beds

Sludge drying beds are the longest-established and simplest option for sludge dewatering. It is a simple, permeable bed which collects percolated leachate and allows the sludge to dry by percolation and evaporation when loaded with sludge. Approximately 50% to 80% of the sludge volume drains off as liquid or evaporates [7]. Unplanted drying beds are preferable and more suitable for developing countries due to

its low capital and operating costs, simple operation, and good dewatering efficiency, especially in dry and hot climates [7].

Moreover, dried sludge can be used for composition, 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 stabilization, pathogen, odors, and flies reduction. The FSTP will have 16 unplanted drying beds with a dimension of 20m length, 6m width, and 1m depth. A target dry solid concentration of 20 % will be achieved in the proposed unplanted drying beds, and the dewatered sludge from the drying beds will be transferred to extended storage as a part of the sludge removal cycle while the supernatant will be sent to the Anaerobic Ponds for further treatment.

After a 30-day dewatering time cycle in each of the sludge drying beds, the dried sludge will be manually removed and stored in a covered area.

3.3.2.4 Waste stabilization ponds or lagoons /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. Depending on the effluent volume to be treated each day, 2 anaerobic ponds, 2 facultative ponds, and one maturation pond will be needed in parallel.

Table 2: Sizing of WSPs Pons

Parameter	number of structures	Length/ m	Width/m	Depth/m
Anaerobic pond	2	19	11	3
Facultative	2	32	16	2.5
Maturation ponds	2	31.5	11	1

Source: [6] [8]

Treatment Principles

Anaerobic pond: The pond is designed to reduce the organic load and serves as a primary pretreatment of the effluent. Without solids/liquid separation or other pretreatment 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 3 m with a retention time varying between 1 and 7 days.

According to the design report based on the loading rates, it is estimated that the settled sludge will be required to be removed every 166 days (2032 design horizon) and dewatered into unplanted drying beds, while the separated liquid is transferred into facultative ponds for further treatment.

Facultative ponds: Facultative ponds are the simplest form of secondary treatment. Its main purpose is to remove organic material and solids, but it can also remove ammonia incorporated into biomass [9]. 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 photosynthesis occurring. The oxygen in the upper layers is mainly produced by photosynthesis due to natural algae growth together with incident light energy, and oxygen from the atmosphere. Pond bacteria then use the oxygen for organic waste oxidation and results in CO_2 production, necessary for algae growth and vis-versa.

The treatment plant will have 2 facultative ponds operating in parallel; each will be a 2.5m deep permeable clay earth-type pond.

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 the pond's bottom 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.
Two Maturation Ponds in series will be provided to improve the discharge quality to the local watercourse. Each pond will be 1m permeable clay earth pond with a 694 m² footprint.

3.3.2.5 Effluent treatment/ Tertiary Treatment

FSTP is designed so that the effluents released from it need to ensure 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.

Table 3: 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
Ammuium	10	mg/l
Phosphorus	2	mg/l
Sulphate	1	mg/l
Coliforms	400	per/100ml
Helminth egg	< 1	helminth egg/L
Temperature increase	°c	3

Constructed wetlands will be provided downstream of the stabilization ponds to provide final tertiary treatment before reuse or disposal. The integrated constructed wetland will receive flows from the final effluent chamber of the FSTP via an inlet structure of cell 1. In general, 3(Three) cells of 4,625 m^2 each (13,875 m2 in total) will be constructed in this phase.

Table 4: Integrated Constructed Wetland design

Description	Unit	Provided in phase I
No. of cells.	No 3	3
Treatment area per cell	m2	4,625
Total area provided	m2	13,875
Planting area per cell	m2	3,237.50
Total planting area provided	m2	9,712.50

Source: [6]

3.3.2.6 Final Effluent Chamber

The chamber contains two inlet pipes from the maturation ponds and one outlet pipe to allow final effluent to be discharged. There is a weir and penstock between the inlet and outlet chambers; under normal operation, the penstock remains open, and the effluent exits the chamber to the outfall pipeline and is discharged into the river. When final effluent is required to be withdrawn for irrigation or other purposes, the penstock can be closed, and effluent removed from the inlet chamber side by a vacuum truck or similar.

3.3.2.7 Discharge Outfall

The treatment plant has an effluent discharge pipeline that can accommodate the final treated effluent flow of 107 m3 /day (1.2 ℓ/s) as well as the peak surface water discharge for the site, collected by the internal stormwater network, which is calculated as 500 ℓ/s for the 1 in 5 year return period. The effluent discharge pipeline will be an approximately 300 meter long 600 mm diameter HDPE-lined concrete sewer that discharges into a stormwater headwall.

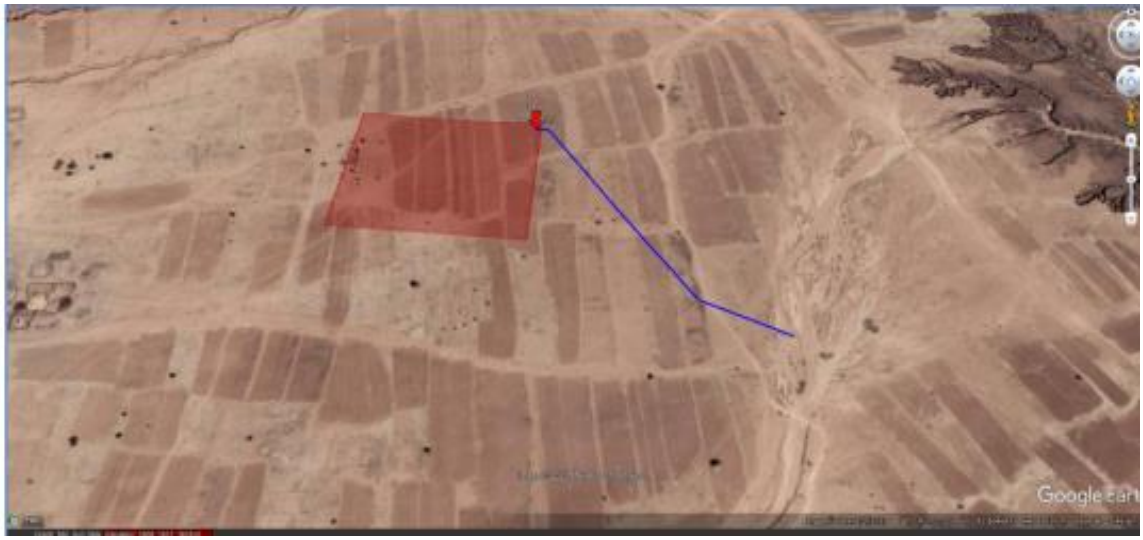

Figure 4: outline of Discharge Outfall Pipeline

Source: [6]

3.3.2.8 Dried Sludge Management

A warehouse of 1850 m² with four central compartments, each one with its own access ramp, 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[1]. 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 to the local community.

Bio-solids that are not reused will be disposed of in an appropriately designed and licensed solid waste disposal site landfill.

3.3.3. Infrastructures and Auxiliary Facilities

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

- Administrative building
- Interconnecting pipework between process treatment units;
- Bypass/diversion arrangements;
- Internal site roads 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

3.3.3.1 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 security guard house.

3.3.3.2 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 treatment processes and operations parameters. 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.

[1] Suitable for use on arable land used to grow crops that are not to be consumed raw and to which there will be no public access for more than a year after application.

3.3.3.3 Interconnecting pipework between process treatment units and discharge pipeline

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

3.3.3.4 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 of the building, roads, lanes, and corners of the ponds to ensure proper illumination.

3.3.3.5 Roads, walkways, and parking areas

Other facilities include roads, walkways, and parking areas. Internal site roads and services are required to ensure access to all plant areas for operation and maintenance purposes. 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.

3.4. Project Activities

Construction and operation of the works follow normal routines pre-construction, construction activities, and operations and maintenance activities.

3.4.1. Mobilization, Construction, Demobilization Contractors

Mobilization involves the deployment of the construction teams and transporting and storing equipment, plant and construction materials. The contractor may hire additional labor 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, re-profiling 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 result in solid and liquid waste generation; such as waste from construction sites, oil and grease from machineries and power generators, and liquid waste from vehicles. These may contaminate the air, soil and nearby rivers.

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, JWSSA, for the operation phase.

3.4.2. Operation

Up on 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 the institution's septic tanks and offloaded at the treatment plant. Dried sludge will be used as manure.

During operation, emission from the Fecal sludge treatment will release toxic gasses which may affect the workers and cause bad smell in and around the FSTP, smell from the treatment ponds, accidents due to frequent transportation of sludge to the site, leakage from sewer pipes, over flow of ponds and septic tanks generate liquid waste with potential contamination source.

JWSSA 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. JWSSA will be crucial in maintaining and managing the infrastructure to ensure its long-term sustainability.

3.4.3. Project Decommissioning

The design period and implementation period indicated in the feasibility study for the FSTP project is up to 2032. However, according to the feasibility study and detailed design report, the project will be upgraded for medium and long-term use by the construction of additional structures, and it will be expected to be used until for. Accordingly, the decommissioning of the project and the socio-economic and environmental impact of the project will depend on the further construction and activities.

3.5. Project Costs

The estimated capital costs for the construction of the fecal sludge treatment plant are summarized in Table below). The costs are shown in US Dollars ($). The estimated total cost by the engineering consultant for the construction of FSTP and associated facilities is ETB USD 6,076,088.00.

Table 5: Estimated Cost of the Proposed Fecal Sludge Treatment Facilities

Item Total Cost	(USD)
Inlet Screening	72,029
Settling/ Thickening Tanks	397,942
Sludge Drying Beds	981,047
Anaerobic Ponds Works	127,810
Facultative Ponds Works	60,166
Maturation Pond Works	68,642
Dried Sludge Storage Area	1,010,140
Administrative Building	180,597
Ancillary Site Works	480,957
Sludge Pumping	17,912
Electrical Installations	81,008
Pipeline Costs	264,070
Internal Access Road	424,800
Constructed Wetlands	675,000
SUBTOTAL	4,860,870
General Items (15%)	729,870
Contingency (10%)	486,087
TOTAL	6,076,088

Source: [6]

3.6. Project Schedule

As indicated in the following table, the construction of FSTP and all ancillary works will take 26 months.

Table 6: 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	23	24	25	26
mobilizations																										
civil works																										
structural works																										
M& E installation																										
Testing & commissioning																										
Handover																										

Source: Development of Integrated City-Wide Sanitation Plans and Waste Water Management Systems for Jigjiga and Degahbur Towns- Annex III.

4. POLICIES, LEGAL AND ADMINISTRATIVE FRAMEWORK

The implementation of the FSTP sanitation project of JigJiga city could have the potential to cause environmental and social impacts that shall be addressed following relevant Ethiopian legislation as well as the requirements of the World Bank Environmental and Social safeguards and standards. The subsections below provide more details on the applicable legislative framework for the ESIA.

4.1. Relevant National Policies and Strategies

This section addresses the legislative and institutional framework relating to ESIA, specifically relevant to the proposed 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: Summary of Relevant National Guiding Regulations

Category	Summary
Constitution of FDRE	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 [10]. The Ethiopian Constitution also acknowledges the right to private property and ownership (Article 40), stating that laws should be in place to regulate the acquisition, transfer, and use of land. Consequently, 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):** 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 [11]**:** 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 [12]**:** 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.
Policies	**National Policy on Women** [13]**:** 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

Category	Summary
	carried out by government institutions. In line with this policy, the proposed project in Jigjiga city 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.
	National Policy on HIV/AIDS [14]**:** 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** [15]: 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. This would result in a reduction of 250 $MtCO_2e$ per year. Additionally, 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 [16]**:** 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 [17]**:** 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 [11] 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) [18]**:** 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 with preparation of ESMP.
Strategies and Programs	**Integrated Urban Sanitation and Hygiene Strategy** [19]**:** The strategy was issued by the Ministry of Health (MoH) in 2016. The goal of the strategy is to mitigate the negative impacts of poor urban sanitation and hygiene on health, environment, society, education and the economy by promoting full sanitation and hygiene systems. The strategy encourages all sanitation related interventions to be based on city and town development plans, taking advantage of economies of scale, sharing of best practices within the country, and involvement of the private sector and Community Based Enterprises.
Proclamations and Regulations	**Proclamation on Establishment of Environmental Protection Organs** [20]**:** 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

Category	Summary
Proclamations and Regulations	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.
	Environmental Impact Assessment Proclamation: General EIA Guidelines 299/2002 [21]**:** 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 [22]**:** 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 through the appointment of 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 [23]**:** 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 [24]**:** 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 are required to 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 [25]**:** 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.

Category	Summary
Proclamations and Regulations	**Proclamation on Hazardous Waste Management** [26]**:** 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 in terms of handling hazardous wastes such as fuels, chemicals, and others based on the requirements in this proclamation. Subsequent implementation of the procedures needs to be inspected by an environmental expert involved in the project.
	Proclamation on the Development, Conservation, and Utilization of Wildlife [27]**:** 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 [28]**:** 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 Jigjiga city that does not cause any permanent damages to the forest/natural resources in the surrounding environmental settings.
	Proclamation on Research and Conservation of Cultural Heritage/ Proclamation No. 209/2000 [29]**:** 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 [30]**:** 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 towards poverty reduction and maximize the economic and social benefits of 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 Jigjiga city is not under the category of any of the above wildlife conservation areas and does not impact the wildlife and their habitats.

Category	Summary
	Land Laws-Expropriation and Payment of Compensation (Proclamation 1161/2019 and Regulation No. 472/2020) [32][33]**:** 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 the compensation, the government has developed a regulation (Regulation 472/2020) which 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)).
	Labour Law/Proclamation 1156/2019 [34]**:** 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 provides limits for 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. The intended Environmental and Social Impact Assessment (ESIA) will assess the availability and level of labor required for the project and considers measures to safeguard the socio-cultural component of the area.

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) [35], Safety of Dams (OP/BP 4.37) [36], Physical Cultural Resources (OP/BP 4.11) [37], 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) [40] 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; national environmental action plans; 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, as identified during the EA.

Based on the outcome of the Bank's environmental screening, 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 subprojects 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 subproject activities; Environmental Assessment (OP/BP 4.01); Involuntary Resettlement (OP/BP 4.12); and Physical Cultural Resources (OP/BP 4.11).

OP/BP 4.01 requires environmental and social impact assessment (ESIA) of projects/to ensure that they are environmentally sound and sustainable. The ESIA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the sub-projects under the core urban sanitation infrastructure component. The environmental and social impacts are anticipated to come from the implementation of subprojects activities by the contractor. The ESIA process will lead in the preparation of an ESMP for proposed project activities in the town. The ESMP is set 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 to avoid or mitigate 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. Physical cultural resources may be located in urban or rural settings, and may be above ground, underground, or underwater. The cultural interest may be at the local, provincial or national level, or within the international community.

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 lose or is denied or restricted access to economic resources including tenants, squatters should either be compensated for use of the land or assisted to move. 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.

4.2.4. General Environmental Health and Safety (EHS) Guidelines [40]

The General EHS Guidelines, 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 and social screening is required to identify whether the project is subject to an environmental impact assessment. Screening processes in both cases address the need for further ESIA and its level and scope. However, the categorizations that result from the screening processes are slightly different in their definition but still are roughly equivalent.

In general, it is understood that "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 the implementation of mitigation measures in the context of an environmental and social screening process. However, the Ethiopian guidelines do not make provisions for screening projects 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 not compatible with the Bank's OP

4.12 provisions. Table 8 below compares Ethiopian Law on land acquisition and 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 only give entitlement to those with formal legal rights over their land holdings (properties).	Eligibility criteria for compensation and assistance shall align with the WB eligibility for 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 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.	There is a specific Guideline entitled with" Guideline on Public Consultations in Environmental and Social Impact Assessments Process," which was 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 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 pre-displacement levels or better. OP 4.12 further requires attention to the needs of vulnerable groups such as those 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 ARAP or LRP.

4.4. Multilateral Environmental Agreements

There are many 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. They are, hence, important to be considered when checking for the compliance of economic activities with laws in force in Ethiopia. Some 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 has 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 proposed sites' biodiversity.

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 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 the greenhouse gas emissions.

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

Each state which is party to this convention recognizes that 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 for the coordination and supervision of 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.

4.4.6. Basel and Bamako Conventions:

Both of these Conventions have been acceded by Ethiopia. The agreements regulate the transboundary movement of hazardous waste for reclamation or final disposal. In preparing this proposed project, these international agreements that Ethiopia signed shall be considered when it deems necessary at various phases of the project intervention in Jigjiga City.

4.5. Administrative and Institutional Framework

The project's most lined administrative and institutional framework are briefly described below.

4.5.1. The Ministry of Water and Energy

MoWE is responsible for the overall coordination, monitoring, and evaluation of the project, facilitating capacity building and policy formulation. As it is the responsible organization for the implementation of SUWSSP for secondary cities, the feasibility detail design and the ESIA studies were conducted under the supervision of the Ministry. The project's construction 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 protecting and conserving natural resources in the country.

The environmental legislation gives the EPA powers 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, sectoral 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 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 are important 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 and design and implementation in collaboration with MoWE. Environmental and social personnel assigned for the ongoing UWSSP at the 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 projects found in their respective regions.

4.5.4. Somali Regional State Environmental Protection Authority

Following the principles of government decentralization and the Proclamation no. 295/2002, in which The Environmental Protection Organs Established, each national, regional state shall establish an independent Regional Environmental Agency or designate an existing agency that shall, based on the Ethiopian Environmental Policy and Conservation Strategy and ensuring public participation in the decision-making process, be responsible for:

- coordinating the formulation, implementation, review, and revision of regional 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 state of the environment and sustainable development of their respective states and submit them to the EPA. For the Somali Regional State where the Jigjiga city sanitation project is located, the Somali Environment Protection Authority is responsible for environmental protection matters. The Bureau is responsible for the review and approval of ESIA of development proposals under the mandate of the Regional Government. It follows up on the implementation of ESIA recommendations of such proposals. Therefore, for the implementation of the ESIA, the project proponent, the Ministry of Water and Energy, and Jigjiga City town Municipality should closely work with the Regional State EPA.

4.5.5. Jigjiga City Water and Sewerage Services Utility

As specified in the ESMF of the project, the utility must allocate an appropriate budget assign/recruit safeguards experts for implementing and monitoring the ESMP and ARAP study documents. Besides, utilities will be responsible for preparing the periodic safeguards implementation status report and submitting 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 chapter describes the physical, biological, and socio-economic baseline of the proposed project area 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

The climate of Jigjiga City is a Sub-tropical highland climate. The average annual rainfall of the town is about 600 mm. The mean monthly rainfall varies between 7.13 mm and 103.11mm in December and April, respectively.

The area's rainfall is characterized by bio-modal rainfall seasons, main rainfall, and short rainfall seasons. The main rainy season of the area around Jijiga town is from July to September, while short rainfalls are in April and June.

The mean annual temperature of the town and its surrounding area is 20^0C. The mean monthly temperature of Jigjiga City varies from 15.2°C to 27.73°C in December and April, respectively. The hottest month is May, while December is the coldest month. Generally, the town is characterized by woyena Dega (sub-tropical) climate conditions.

The major average hourly wind direction in Jigjiga City varies throughout the year. The southerly wind is the most prevailing wind in the city. The Southerly wind lasts for 6.3 months while easterly wind lasts for about 5.7 months. The wind is most often from the south, from March 28 to October 7. The wind is most often from the east from October 7 to March 28. [41]

The windier part of the year lasts for 3.0 months, from June 7 to September 8, with average wind speeds of more than 17.0 kilometers per hour. The windiest month of the year in Jijiga is July, with an average hourly wind speed of 23.5 kilometers per hour. The calmer time of year lasts for *9.0* months, from September 8 to June 7. The calmest month of the year in Jijiga is October, with an average hourly wind speed of 10.5 kilometers per hour.

5.1.2. Geology and Soils

Regarding geology, Jigjiga City is characterized by four main formations: Quaternary Sediments, Hamanilei formation, Jessoma formation, and Ashenge formation. The first three formations are the most prevalent, while the fourth formation is less common. According to the FAO-ISRIC Soil Database2, the soils in and around Jigjiga city are primarily eutric cambisols, chromic vertisols, eutric fluvisols, chromic luvisols, and lithosols. A soil and materials investigation conducted for the Jigjiga Storm Water Drainage Project revealed that approximately 87.5% of the soil types in the study area consist of sandy silt, sandy clay, and brownish silt soils. A smaller proportion of dark silt clay soils occupies the remaining 12.5% of the area.

5.1.3. Water Resources of Jigjiga City

Jigjiga City is situated in the Wabi Shebele river basin system and is surrounded by numerous seasonal streams and rivers. The prominent rivers in the project area are the Biyeda Dere and Elbahiy rivers, located in the northern part of the city. These rivers eventually merge to form the perennial Toga River.The Biyeda Dere and Elbahiy are among the intermittent streams that join in the northern part of the town and form the Toga River. While the Bidbidis drains the western and southwestern areas of the town. It collects stormwater from the eastern part of the Karamara ridge and the western part of Jigjiga City and drains into the Toga River.

During the rainy season, the Toga River collects water from the hinterlands of northwest, north, northeast, and eastern parts, flows through the town, and then empties into the river Jerer, which eventually empties into the Wabe Shebelle River basin. In general, runoff in the town and surrounding areas are drained to Toga River.

5.1.4. Noise

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 as established by WHO (1997) is representative of urban city areas. The FSTP is located outside the city and is rural area and there is no nose from commercial industrial or road traffics. The maximum allowable noise standard issued by the EPA for day and night-time as well as for industrial and residential areas is shown in table below.

Table 9: Noise Standard of Ethiopia

Category of Area	Limits in dB (A) Leq	
	Day time	Night time
Industrial area	75	70
Commercial area	65	55
Residential area	55	45

Source: [42]

5.1.5. Air Quality

Air quality is influenced by anthropogenic activities distinguishing two main sources, namely mobile and stationary sources associated with the human activities. However, a s the proposed FSTP site is a rural area it is not expected to have such type of emissions from and industrial or construction activities. Emissions to the ambient air from FSTP may include pollutants particulate matter (PM), Carbon dioxide (CO2), Nitrous oxide (NOx), TVOC and so on.

5.2. Biological Environment

The proposed Jigjiga City sanitation project is located outside the town boundaries, around 8.5 km south of the town center on the western side of the Jerer River. This land is dominated by agricultural land, in some extent, 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

An observation-based biodiversity assessment was made in the sites proposed for the FSTP. The area proposed for the project 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 sites. There are no sensitive bird species that would occur in the vicinity of each of the sites. Most of the immediate habitat surrounding the proposed development is farm land. As such, there are no known rare or endangered species in the FSTP and its vicinity (e. g. by IUCN categories). Therefore, the conservational issue is insignificant, and the project can have minimal or no impact on local Vegetation & flora. There are limited types of shrubs such as Acacia tortilis, Acacia nilotica, Aloe vera, Prosopis Julifera, Balanites aegyptiaca, species.

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, fox, different birds are among the wildlife found in the vicinity of the FSTP.

5.2.2. Land Use

The land use in the town is dominantly a residential area with road and transport networks, followed by services and facilities. The services and facilities category includes institutions such as education institutions (KG up-to-University level), health institutions (including health posts, health centers, and hospitals), civic and cultural service-giving places (ceremonial places, youth centers), and worship places & cemetery places; market and industrial areas. The percentage land use distribution for the major land use category of Jigjiga is described in table 10 below.

Table 10: Existing Land Use Distributions and Area Share for Jigjiga

	Major Land Use Category	Area in sq.m	Area (%)
1	Roads and transport	12,993,050	15%
2	Residential Areas	36,757,700	44%
3	Administration	617,125	1%
4	Commercial	10,614,500	13%
5	Services and Facilities	3,155,100	4%
6	Manufacturing and Storage	673,225	1%
7	Recreational	8,596,075	10%
8	Special Function	6,254,175	7%
9	Agriculture and Forest	2,712,750	3%
10	Water Bodies	1,604,000	2%

Source: Jigjiga City Structure Map 2022

The current land use of the proposed fecal sludge treatment site is farm land it is also designated for "Urban / Agriculture'' by the masterplan.

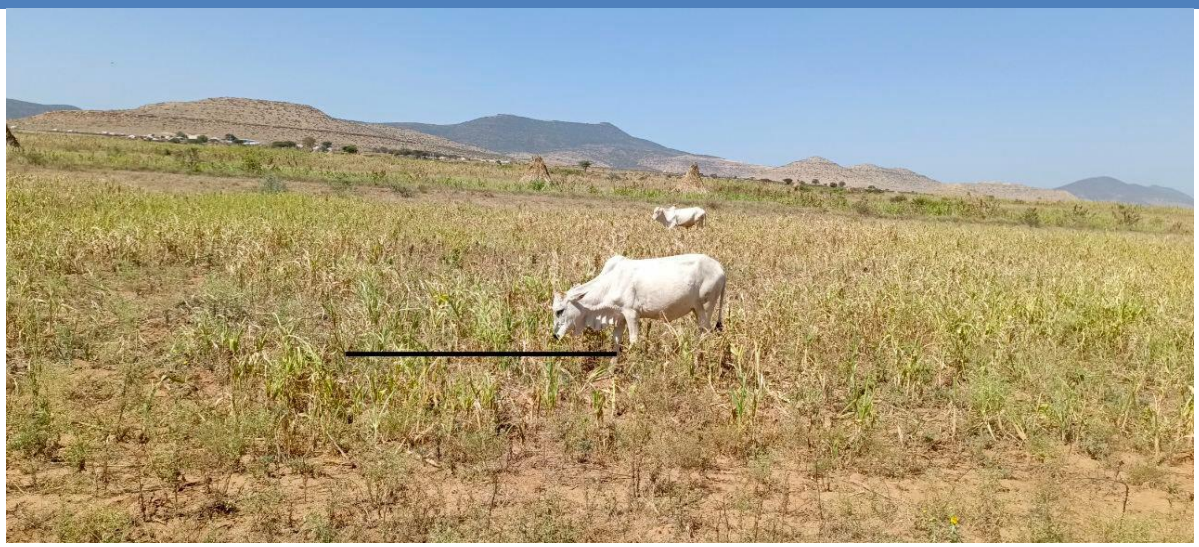

Figure 5: partial view of the proposed FSTP site

5.2.3. Conservation Areas

The selected project investment area (FSTP) has no forest reserves, no National Parks, or any form of the 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. Socio-Economic Environment

Administrative Context

JigJiga city divided in to 20 Kebeles (lowest levels of administration in the country). The total area coverage of the city is about 84km2. The Kebele populations, areas, and boundary lines are summarized in Figure 5 below.

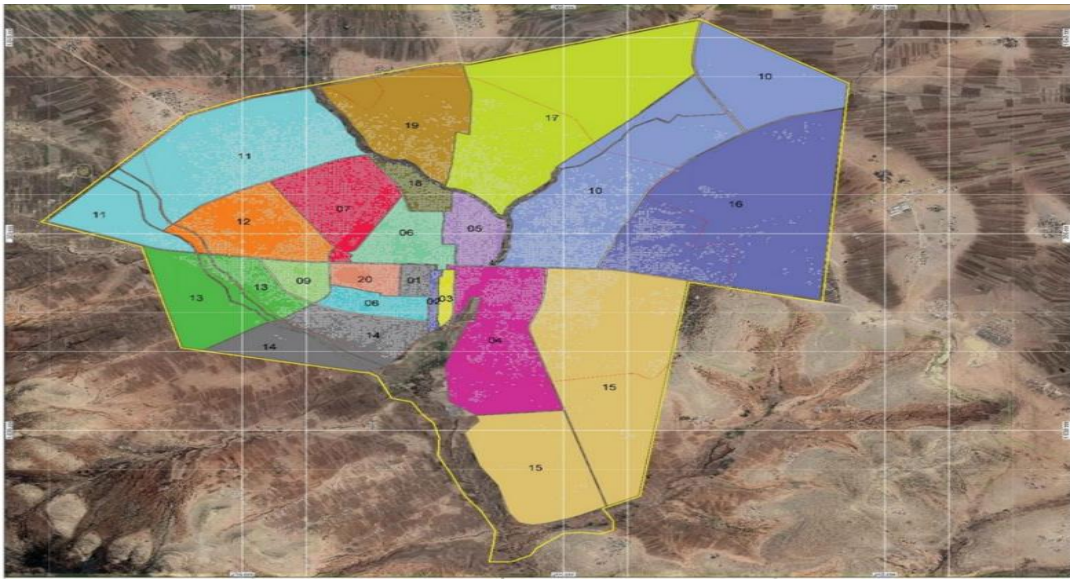

Figure 6: Jigjiga Project area Kebele Boundary

Source: [8]

5.3.2. Population and Settlements areas:

Jigjiga City is one of those rapidly expanding urban centers in Somali regional state in terms of population and physical size. In the 2007 national population census, the population of JigJiga was about 203,588 of whom 109,138 were men and 94,450 women. Ethnic groups in the city include the Somali (168,551, 82.79%), Amhara (16,837, 8.27%), Oromo (8,775, 4.31%), and Gurage (4,379, 2.15%); all other groups made up 2.48% of the total population. Religion wise, majority of the inhabitants are Muslims followed by orthodox Christians and others [43]. As of July 2023, the population of the city is estimated to be about 204,249 [44] of which 105,486 are Male and the remaining 98,763 are Female. With the total area coverage of the city is about 84km2 with a population density is estimated 2431.5/km^2.

5.3.3. Economic Conditions

The dominant economic activities of the town include employment in public and private sectors, petty trading, 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 open markets, several government and non-governmental institutions in the town.

The livelihood in FSTP site is semi-pastoralist mainly based on animal production but agricultural production such as maize and sorghum is also practiced in the area.

5.3.4. Health

The health institutions found in the town include Hospitals, Health Centre, health posts, Clinic pharmacies, and drug stores owned by public and private. A majority of the pharmacies and clinics are operated by private owners. Hospitals, and health centres are operated by the government. As the data obtained from Jigjiga City administration, malaria, respiratory diseases, severe febrile disease, and Skin diseases /itching, Eye diseases Diarrhea are among the top ten prevalent diseases occur in the town.

Table 11: Number of health facilities in Jigjiga City/2021

Facility	Public
Health center	4
Health post	12
Clinic	23
Hospital	2
Pharmacies/ Drug Stores	201
Total	242

Source: JigJiga city administration development indicators/2021 [8]

5.3.5. Education

In the year 2021/22, there were 130 governments and privately owned educational facilities in the town. These facilities include nursery, elementary and secondary schools. JigJiga University is one of the higher educational institutes in the town. The total number of students registered in the schools and in the year 2019/2020 was 57,666 as indicated in the table below.

Table 12: Number of schools and students

	institution	Ownership			No. of students		
		Public	Private	Total	Public	Private	Total
1	KG & nursery	10	65	75	1,311	4,822	6,133
2	Grade 1-8	25	65	90	23,104	13,403	36,507
3	Secondary Grade 9-12	2		2	6,191	1,210	7,401
4	Preparatory (9-12 & TVET)	3	12	15	5,879	925	6,804
5	university	1		1	821		821
	Total				**37,306**	**20,360**	**57,666**

Source: [8]

5.3.6. Public Services

Major transportation facilities in the city comprise roads leading to different parts of the region, neighboring zones of the Somali Regional State. As the town is an administrative center of the Somali region, Fafen Zone, and JIgJiga woreda, the influx of visitors and travelers in and out of the town is increasing from time to time, which is expected to contribute and increase waste generation in return. Regarding electricity power supply, the town is being serviced on a 24-hour basis by the national grid (hydropower source). Although there is occasional power supply interruption, the town has almost 100% power supply coverage. The town also has communication facilities (mobile phones, line phones, internet, fax, and postal services). These facilities will not be negatively affected by the project.

5.3.7. Water Supply

Besides fulfilling basic life requirements, water availability is a cornerstone for public services and economic developments like providing sanitation services, public health, agricultural production, industry, recreation, environmental maintenance, and urban development.

The primary water sources in Jigjiga are located 20 km southeast and north of the town. There is also a proposed wellfield called Fafam to the west of the town. The majority of Jigjiga's water supply comes from the Waji wellfield. This water is used for drinking, cooking, and washing purposes. The residents of Jigjiga obtain their water supply through various methods, including the town's piped water supply system, traditional water sources, and water vendors. Approximately one-third of households in Jigjiga rely on the town's piped system, which offers three options: house connection, yard connection (private or shared), and public taps. Private water sellers play a significant role in Jigjiga, distributing 55% of the total water supply. This group includes private water vendors, water trucks, and animal-driven water barrels.

However, the current water supply is insufficient in quantity and quality. The existing water sources cannot meet the current demand, resulting in severe water shortages in Jigjiga. According to a feasibility study by RJ Burnside and MS Consultancy, the estimated water demand in 2020 was 37,000 m3/d. The existing water supply only provides 10,000m3/d, and when accounting for water losses (estimated at 50%), the actual supply is only 5,000m3/d – a mere 13.5% of the demand.

The Water Resources Development Bureau (WRDB) is implementing an Emergency Action Plan (EAP) to address this water shortage. This plan involves utilizing the Fafam Wellfield as an additional groundwater source, which is expected to double the water supply to Jigjiga.

5.4. Waste Management Practices

5.4.1. Solid Waste Management

Solid waste collection, transportation, and safe disposal are critical sanitation services that require attention in towns. Proper management of solid waste contributes to resource management, recycling, and reuse. It also significantly reduces the amount of waste disposed of in the environment, thereby minimizing potential environmental and public health impacts.

In Jigjiga City, the major sources of solid waste can be categorized into domestic, commercial, institutional, industrial, and construction & demolition. The largest quantities of waste are generated from domestic and commercial sources, followed by others. The streets and open markets of the town also contribute significantly to solid waste generation, with large quantities of inorganic and organic materials being deposited daily, such as vegetables, fruits, and chat (khat).

Currently, there is no evidence that the collected waste in Jigjiga City is being used for various usable productions like fertilizers (compost) or biogas. Solid waste collection is carried out by six Micro and Small Enterprises (MSEs), but only three of them were observed to be active on-site [8]. These MSEs provide collection and transportation services to some Kebeles (neighborhoods) but lack solid waste collection and transfer services. The existing collection and transfer capacity is estimated to handle only about 40% of the solid waste generated in Jigjiga each day.

The solid waste collected is transferred to the newly established Dinity dumping site. However, this site does not have appropriate containment measures, making it an environmental and public health risk. The dumping site is also located near the Jerer River, and solid waste pollution can be seen along the riverbanks. It is important to note that this site is upstream of the Waji wellfield mentioned earlier, which could pose a risk to public health through water contamination.

5.4.2. Wastewater and fecal sludge Management

According to the Ethiopian Demographic and Health Survey (EDHS) 2016, the sanitary condition of Jigjiga City is poor, like many towns in Ethiopia. One of the major concerns is poor liquid waste management, which is threatening public health and the natural environment. Graywater and blackwater are main types of wastewater being generated from various sources. There is no existing sewer network in Jigjiga City and emptying and transporting fecal sludge is carried out entirely by vacuum trucks. Emptying and transportation of fecal sludge is carried out entirely by vacuum trucks. The JWSSA currently operates 3 old vacuum trucks, each with a capacity of 8 m3. This service is supplemented by 4 privately owned and operated vacuum trucks, each with a capacity of 8 m3.

A disposal site for fecal sludge consists of an open excavated pit 5km southeast of the town. The disposal site for fecal sludge is not designed to treat the waste, presenting a high risk of overflow and contamination of surrounding areas, groundwater, stormwater, and land.

6. PROJECT ALTERNATIVE ANALYSIS

The alternatives analysis aims 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; and

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.

Repeated field visit and study was conducted by the feasibility study and design consultant team, ESIA team, JWSSA, 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); 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 impact on vegetation and water bodies /lower vegetation cover, distance from water bodies
- From the point of view of minimizing air pollution and impact to the surrounding community/ distance from residential/commercial areas considering the existing and future land use, as presented in the current masterplan.
- Distance from the city center
- To the point of view minimizing susceptibility of flood and soil pollution/slop of the area and

Accordingly, two (2) sites were proposed for further site assessment. These sites are shown in Figure 6 and described below.

Figure 7: Identified Sites for FSTP Using Google Earth

- Both sites are geographically located outside the town to the south-east of the town center.

Site 1:

- **Location**: the site is located approximately 5 km south of the town center on the east side of the around 9°18’27’’ N latitude 42°19’19’’ E longitude
- **Land Use**: the site is currently used as a fecal sludge dumping site. The land use of the area is denoted in the masterplan as “Recreational”. , The site is close to settlements within 250-300 meter diameters.
- **Topography:** The site is at a higher elevation than the nearby river basin, has a relatively low gradient within the site, and is located outside of the river flood plains.
- **Access**: an existing access road exists at the site as it is actively being used for dumping fecal sludge. But the access road requires upgrading.
- Gully and unproductive and there is no significant vegetation around to be affected
- Nearly about 600m far from the Jerer River

Site 2:

- **Location**: the site is located outside the town boundaries around 8.5 km south of the town center on the western side of the Jerer River. (around 9°16’24’’ N latitude 42°48’19’’ E longitude)
- **Land use**: it is an agricultural land and the land use of the area is denoted by the masterplan as “Urban / Agriculture”. The site is not located near major settlements or commercial/industrial centers (far more than 1 km from settlements)
- **Topography**: the site is at a lower elevation than the town, meaning that the entire town could be served by gravity sewers (no pumping required).
- **Access:** no appropriate access road.

- The site is an agricultural land owned by about 15 farmers and the surrounding area is also s farmland.
- About 800 m near a tributary but these tributaries are non-perennial which only flow in rainy season.
- More than 1.5 km far from Jerer River
- Space to upgrade and expansion

Each of the 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 (settlement, archeological, 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, land use and cover etc. as the key criteria.

Emphasizing on Socio economic and Environmental criteria, the ESIA consultant evaluates the alternatives 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 13 below. The site with the lowest total weighted score was deemed the most favorable site for the construction of FSTP.

Table 13: Summary of FSTP Site Multi-criteria analysis

Evaluation Criteria	Criteria Weight	weighted Score (site 1)	weighted Score (site 2)
		score	**score**
Possible physical displacement	20%	20%	0%
Disturbance to the community (noise, odour)	10%	10%	0%
Economic importance of land /fertility/loss of land	20%	0%	20%
Impact on vegetation	10%	5.00%	5.00%
Impact on watercourses	20%	13%	7%
Accessibility	5%	0%	5%
Distance from city centre/cost	5%	0%	5%
Link with possible future wastewater treatment site	10%	10%	0%
Total	**100%**	**58%**	**42%**

As indicated in the table above Site 1 is suitable in terms of easily accessibility, capital expenditure, operation costs and land acquisition as it is currently used for the same purpose. Moreover, in terms of, link with possible future wastewater treatment site Site 2 is preferred to locate these two treatment plants together, because site 2 has enough space for upgrade and expansion as well as favorable for gravity flow. Generally based on the multi criteria analysis Site two is a better choice for the proposed FSTP.

6.2. 'No Project' Option

One of the many choices provided and examined in the comprehensive ESIA to meet the program objectives is the "no action" option. Technical, economic, environmental, social, and climate risk comparisons were made amongst the alternatives, considering the public's concerns as expressed during public consultation. To reduce the requirement for compensation, the project alignment was assessed to look into alternative FSTP sites. 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 of fecal sludge to the environment surrounding the town will continue. The do-nothing alternative would mean that land, 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 Jigjiga City is expected to improve sanitation and public health in the urban setting. The municipal population is growing fast amid inadequate 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 various ways, and there is no single best option considering the widely varying conditions of urban areas. Subsequent treatment processes may include solid-liquid separation, liquid treatment, solid treatment, and pathogen removal in a liquid stream. Primary sludge treatment technologies best suited for developing countries were identified through literature review and document analysis. Table 14 below presents Screened Fecal sludge Treatment options for Jigjiga City; However, considering the physical environment, local operation and maintenance capabilities, and local socio-economic conditions, the combination of primary treatment technologies with unplanted drying bed with waste stabilization ponds and constructed wetland emerged to be the most viable alternative for liquid part treatment and storage for an extended period for Bio-solid treatment for the town.

Table 14: Screened Fecal Sludge Treatment Options for the Town

Solid Line	Liquid treatment	Dry sludge Treatment	Tertiary treatment
– Unplanted Drying Beds; – Planted Drying Beds; – Geotextile Dewatering Bags – Screw presses; – Belt filter presses, and – Centrifuges.	– Anaerobic ponds; – Facultative ponds; – Maturation Ponds	– Storage for an extended period – Solar drying; – Composting; – Black soldier fly treatment	Constructed wetland

Source: [6][8]

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 dewatered sludge (disposal or safe reuse), further solids treatment may be required after dewatering. Several advanced mechanical dewatering technologies can potentially be used to dewater 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 feasible for the short or medium-term development horizons for the same financial and operational reasons.

Table 15: 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 (Centrifugation, Screw presses, Belt filter presses) for the reasons of high construction and operation costs, skill and energy requirement Unplanted Drying Beds; Planted Drying Beds; and Geobags 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 8 below.

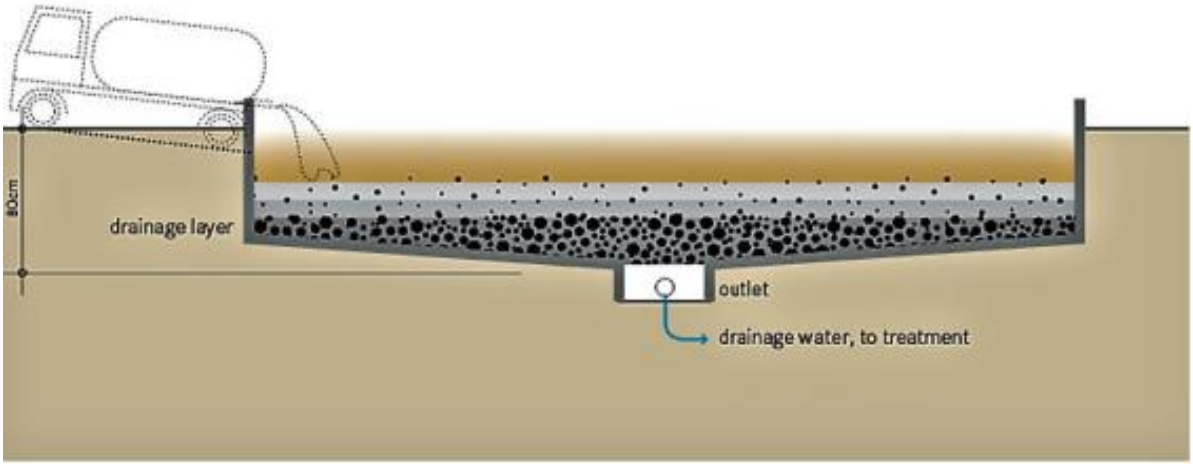

Figure 8: Schematic of an unplanted drying bed
Source: [7]

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 odour 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 a large number of drying beds
- Require more labor for desludging compared to other alternatives as the volume of dry sludge is high and need removal frequently compared to other alternatives
- The dewatered 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 occurs through a combination of evaporation, evapotranspiration from plants, and percolation through the bed. Like unplanted 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 evaporation and percolation.

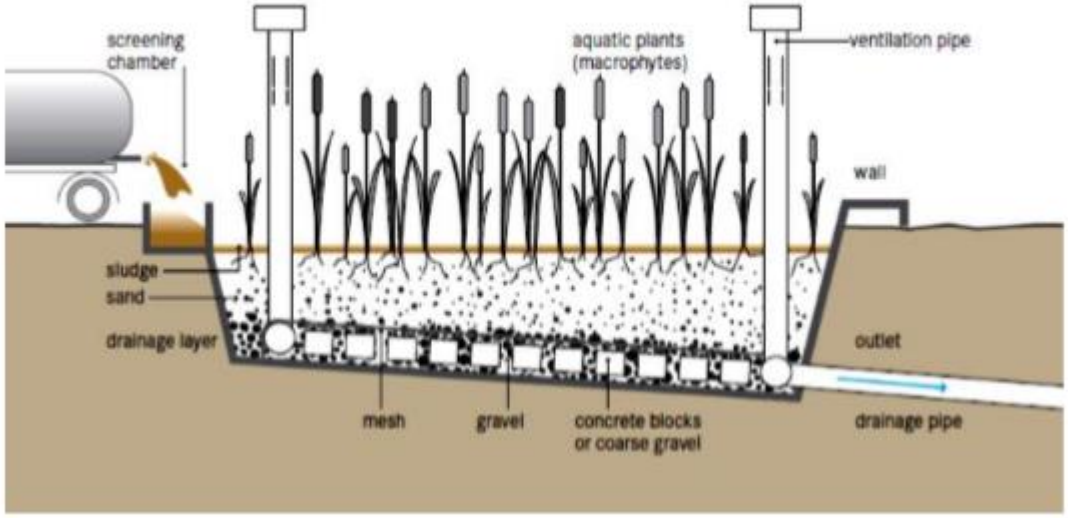

Figure 9: Schematic of an unplanted drying bed
Source: [8]

Advantage

- It has excellent removal efficiency- more than 20% dry solids (DS) concentration is achievable
- Provides effective sludge mineralization 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, ultimately leading to a lower environmental risk in terms of sludge handling and disposal.
- It has less visual impact
- land Requirement is relatively small than Unplanted Drying Beds but is higher than Geobags
- 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 Geobags

Disadvantage

- The process does not provide stabilization of the fecal sludge so it is susceptible to odour issues.
- Operation and maintenance is relatively complex compared to unplanted drying beds. Eg. replanting
- Design and Construction complexity compared to unplanted drying beds. This process is relatively complex as it requires a specialist supplier to select and provide the plants. Construction may need a supervisor with experience in planted drying bed treatment.

Geotextile Dewatering Bags (Geobags)

Geobags are constructed using a durable, permeable fabric with 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 can seep through the pores, reducing the volume of the material being contained. The strength of the seams in a geotextile 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 the geotextile Dewatering bag is depicted in the figure below.

Figure 10: Schematic of Geotextile Dewatering Bags
Source: [8]

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

- Dewatered 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 sludge handling and disposal.
- The geobags are not biodegradable, and are contaminated and not reusable; hence, the disposal of the used Geobags 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 odour 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 geobags.

Table 16: Summary of Weighted Score for Solids Line Technology Selection

Evaluation criteria	Weighting Factor	Geobags	Unplanted drying beds	Planted drying beds
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%
Total Weighted Score	**100%**	**45%**	**27%**	**28%**

It can be concluded from Table above that, following the MCA, unplanted 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 Jigjiga.

6.3.2. Liquid Line Technology Options

The liquid portion of the fecal sludge and the supernatant 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 in table 17 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 17: Comparison of technologies for liquid treatment organics removal

Technology	Design and Construction					Operation			
	Capacity range	Treatment process	Construction	Equipment need	Energy need	Labor	Consumables /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 Jigjiga 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 an embankment 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 the sludge cake in the solids line. Long hydraulic retention times are used because the oxidation rate is slow due to the usage of natural processes; these times typically range from 30 to 50.

Anaerobic ponds 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 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 septage/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 3.3.2.4in chapter three.

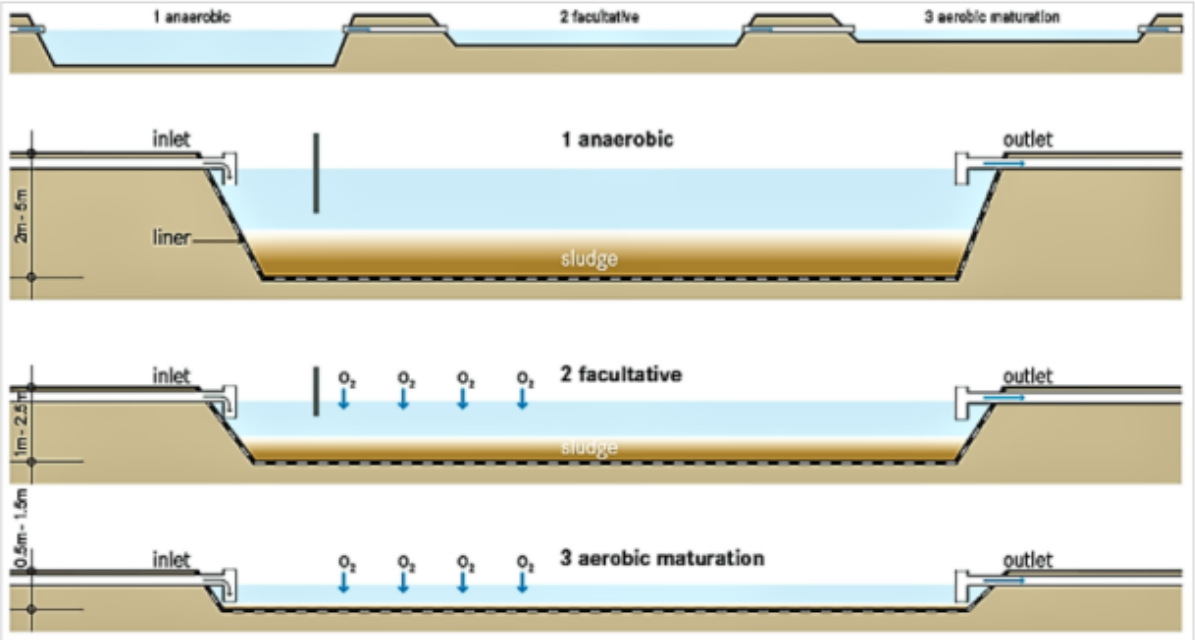

Figure 11: typical features of anaerobic, facultative, and maturation ponds
Source: [8]

6.3.3. Bio-solids Treatment and Management Options

Solids treatment technologies are primarily used for dewatering and drying sludge, stabilization, and pathogen reduction. The septage entering the treatment plant is typically 1% to 3% dry solids content (by mass). The solids liquid separation step thickens the solids in the septage 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 dewatered 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, extended storage cannot be guaranteed to meet the standards for Class A biosolids reuse. Instead, it is assumed only to 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 bio-solids

Disadvantage

- Required relatively larger area for storage of longer period

- Requires relatively higher cost for construction of shelter
- Manual labour is still needed for the process.
- Potential to cause surface water pollution (if poorly managed).
- The class B biosolids may pose a risk to animal/human due to their higher pathogen concentration as it uses large area is not easily concealed from public view/impact on aesthetics.

Solar Drying

Solar drying is effortless and effective for obtaining high dry solids content. Still, it 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 composition. 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 the cost of the solar drying beds and mixing equipment
- Require some mechanical and electrical components, and this may also increase operating costs.
- Manual labour is required to feed, mix, and empty the beds.
- Similar to storage for extended periods it is not easily concealed from public view
- Require relatively experienced experts for electromechanical design and installation.

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

- Beds housed within greenhouse-type structures, 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, 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 solar drying should, at best, be considered as Class B biosolids and reused accordingly.
Therefore, it is not recommended for Jigjiga city.

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 compost production, 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 thermophilic 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 before 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 labour 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 biosolids
- Has the lowest risk for the environment, 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 labour 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 an extended period, it is not easily concealed from public view
- Require relatively experienced experts 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 are able to break down organic material and return 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 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 pre-pupal stage. The harvested larvae are rich in protein (approximately 35%) and fats (around 30%), making them suitable as animal feed, similar to fishmeal. The leftover residue can also be used as a soil conditioner, but it requires additional treatment before reusing it.

Advantage

- This technology has the smallest footprint and requires a small area of land

- It can be generated from the sales of animal feed is a potential benefit of this solution.
- Not requiring sophisticated instrumentation
- Lower risks to the environment/ humans/animals compared to the other technologies.
- It 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)
- Requires trained and skilled operators
- Required experienced expert to design hatcheries, so compared to others above, there would be a limited number of contractors with sufficient capabilities to implement this solution.

Multi-criteria analysis was prepared to assess these four technologies described above. Based on this analysis, 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 Jigjiga. (See table 18 below)

Table 18: Summary and Multi-criteria analysis comparison of technologies for solids treatment

Criteria	Category Weight	storage for extended period	solar drying	solar drying followed by composting	Black soldier fly treatment
		Weighted score	**Weighted score**	**Weighted score**	**Weighted score**
Impact on Environment	40%	16.00%	16.00%	8.00%	0%
Cost	25%	2.30%	4.50%	9.10%	9.10%
operation& maintenance complexity	15%	0.00%	1.90%	5.60%	7.50%
Treatment Performance	10%	4.00%	4.00%	0.00%	2.00%
Technical Feasibility	10%	0	0.17	0.17	0.67
Total score	**100%**	**22.30%**	**28.10%**	**24.40%**	**25.30%**

In general, based on the above evaluation of selection criteria, a combination of unplanted drying bed for solid treatment); WSB with a combination of constructed wetland for Liquid treatment and Storage for extended periods for Bio solid treatment is found suitable for the FST in Jigjiga .

The main advantages of the recommended treatment technologies are the low cost 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 favors for the use of WSP and sludge drying beds more than other technologies in Jigjiga.

7. CONSULTATION PROCESS

During the preparation of the ESIAs, extensive consultations were conducted at various levels. The public consultation process in Jigjiga was conducted following 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 PAPs, individuals, groups, stakeholders, and organizations who have a stake in the project and its outcomes.

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 component and activities, as well as the attitudes of the officials, local communities, PAPs, design consultant's staff, Client's officials and experts towards the planned scheme were assessed. This information and opinions have been considered in this socio-environmental impact analysis.

7.1. Public Consultation with the Community at Project Intervention Site

The people in the project impact areas of influence were consulted. A total of 46 (11 male and 35 female) participated in the meeting (Annex-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 is open 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 JWSSA staff), clarifications were offered, and their recommendations were received for further deliberation.

All members of the consultation meetings were very interested in participating in the discussions, and they shared their views and opinions on the discussion points.
The land of about 15 farmers may be affected by the project and the main issue of concern raised in the discussion was the loss of land and Impact on the livelihood of PAPs.

The attitudes of the participants towards the realization of the proposed FSTP projects were also discussed. The community is happy to hear about the project and express their will and commitment to supporting the project. All the participants do not have any opposition to the implementation of the project. But the PAPs have to be properly compensated.

In general, the meeting participants raised the issue of proper compensation to ensure their livilhood will not be affected and access to water when the project implemented. They concluded that they would support the project and participate in its implementation with full heart if they are sure that they would get the anticipated benefit from the project.

Figure 12: Consultative meeting with local community

Figure 13: Consultative meeting with PAPs at FSTP Site

7.2. Consultation with Governmental Stakeholders at Jigjiga City

Stakeholder meeting was held with different stakeholders, which consists of the mayor office, environmental protection, land administration, Agriculture, Women and children affairs, youth representatives, Health, and other relevant key stakeholders.

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.

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

- The current dump site has a lot of health effects on the local community
- 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. a long-standing problems of the city of Jigjiga, need the engagement of all stakeholders in the design, implementation, and operation;
- Many of the stakeholders lack awareness and prior knowledge about similar projects and capacity building training is necessary.
- Proper design and implementation of the project is necessary not to pollute the nearby Jere River and the downstream tributaries.
- Reusing of FSTP effluent for irrigation and its sludge fertilizer were also one interest areas discussed and agreed; but it need proper awareness creation and training to the local community to utilize this positive impact.
- Loss of land and impact on livelihood of the farmers
- Moreover, they also recommend proper mitigation methods to control foul 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 adequately 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.
- The Municipality has discussed with the PAPs and will pay appropriate compensation for possible loss of land based on study.
- Training and awareness should be given to the community to use the dry sludge and waste water from the FSTP effluent for fertilizer and irrigation.

Figure 14: stakeholders' consultation at Jigjiga

7.3. Summary of Consultation Findings

The summary of public and stakeholder consultations is indicated in the table below.

Table 19: Issues and Concerns rose during stakeholder and public consultations

Stakeholder	project impacts/concern raised	Mitigation suggested
Institutional/Town stakeholders	Project delay, appropriate compensation issues Lack of coordination, and perior awareness and Knowledge in FSTP managmnet	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, water pollution	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
PAPs	Loss of land and livelihood	Appropriate compensation/ARAP
Management issues /JWSSA	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

The Start of the project study has been disclosed to relevant stakeholders through a series of consultations made at the town administrations. Through these consultations, project information (including purpose, project type, project location) and the ESIA requirements was disseminated to the stakeholders and local community. This helped to gain feedback and concerns that must be addressed during the project planning, construction, and implementation processes. This ESIA report has been prepared, considering all the feedback from stakeholder and community consultations. Following the World Bank policy on access to information, disclosure of relevant project information needs to be posted on MoWE website (executive summary translated in local language 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 FSTP project for Jigjiga City and measures for avoidance, reduction, or restoration of the negative impacts and enhancing (improvements) of positive impacts. For the assessment of the socio-environmental impacts of the proposed projects, the following issues were considered:

- Impacts should be assessed for all phases of the project cycle, including construction, operation, and decommissioning;
- All elements of the project infrastructure and activities associated with the project, including actions by third parties on which the project depends, should be assessed, whether they are funded as part of the project or by other parties;
- The assessment should address 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 assessment should address positive impacts as well as adverse impacts, and measures to enhance the beneficiary impacts and mitigation measures for the adverse impacts should be proposed.
- Any impact analysis should be viewed in light of available data and information on the baseline environment, an appropriate description of the project, and subsequent positive and negative changes anticipated as the result of project implementation.

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 irrelevant, or with less importance to the project and therefore proposed to be scoped out.

Topics of less importance and therefore proposed to be scoped out

- 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 (as the proposed intervention is very local, it does not have a significant impact on climate change).

8.2. Impact Identification

When identifying the potential impacts of the project on the existing environment, it is necessary that it should be measured against the existing baseline conditions. In this section, the possible impacts that are expected 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, while 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. 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 to restore vegetation and the land are taken 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 impact the local community in terms of resettlement. Still, there will be some loss of communal land due to the construction of FSTP.

Table 20: Estimated temporal boundaries of the project

Project phase	Duration
Construction	Up to 26 months
Operation	Designed for population project of 5 years and to upgrade in the subsequent medium and long term intervention for next 20 years
Decommissioning	After 20 years depending on the conditions

8.2.2. 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 legal framework of the project, 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 infectious 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. For this project, decisions are made mainly at the regional, woreda/ Municipality, and kebele administration levels. In addition, environmental protection and JWSSA, 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, 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 21 below, and the Matrix of Potential impacts against classification and significance for each project.

The detailed impacts classification is provided in Table 21 below, and Matrix of Potential impacts against classification and significance for each project (table 22).

Table 21: the 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	Probably will not occur
		Likely	May occur
		Certain	Will occur
Consequence	How severe will the impact be?	Marginal	Little impact
		Critical	Moderate impact
		Severe	High impact
Significance	How important is impact in Project design?	None	No impact
		Low	Impact of little importance, needs limited mitigation
		Medium	Impact has influence and requires mitigation
		High	Impact of great importance, mitigation is a must
		Very high	Very Significant Impact (positive or negative impact). Where the negative impact is very high, it causes irreversible alteration of natural functions, properties, and processes.
Spatial influence:	How the impact shall be extended spatially?	Local	Within the surrounding area of the project,
		Regional	Impacts are expected to cover up to a 200km radius.
		National	Impacts are likely to cover from the project boundary up to the boundary of the country/nation.
		International	Extent of Impacts extending beyond the country's boundary
Temporal influence	How shall the impact extend over time?	Short term	Impacts to last for up to 2 years or less.
		Medium term	Impacts to last from 2 to 10 years.
		Long Term	When the impacts due to the project remain permanent for more than 10 years as residual impacts.
Reversibility:	Can the influence of the impact be removed once the impact ends, or will the influence remain?	Reversible	The influence of the impact can be reversed
		Irreversible	The influence of the impact cannot be reversed and shall be permanent

Table 22: 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.	Impact Flora on fauna		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.	Loss of land and livelihood		X			X	X			X				X		X				x
6.	Noise and dust		X			X		X		X		x							X	
7.	Occupational Health and Safety of Workers		X		X			X				x			x	x				X
8.	Health impact (HIV AIDS/ STDs) etc.		X		X			X		X			X						X	
9.	Labor influx		X		X		X			X		X			X				X	
10.	GBV/ SEA/SE		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 soil		X		X		X			X				X	X					X
2.	Impact on water bodies		X		X		X			X				X	X					X
3.	emission and Air pollution		X			X	X			X				X	X			X		
4.	Noise pollution		X		X		X			X								X		
5.	Odor (Foul smell) at the site and surrounding environments		X			X		X		X				X	X				X	
6.	Impact on public health/use and contact from sludge		X		X			X		X			X		X				X	
7.	Impact on public health/ Malaria		X		X			X		X			X		X				X	

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
8.	Health impact (HIV AIDS/ STDs) etc		X		X			X		X			X						X	
9.	Occupational safety		X		X			X		X						X			X	
10.	GBV/ SEA/SE		X		X			X					x	X	X	X			X	
11.	Job creation	X								X				X						
12.	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.	Impact on soils /Spoil disposal		X		X					X				x		x			X	
4.	Soil compaction and erosion		X		X		X			X								X		
5.	Health impact		X		X					X									X	
6.	GBV/ SEA/SE		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 the project will be the well-developed institutional capability for sanitation and hygiene service delivery and eventually a cleaner natural and living environment and greatly improved health standards in the Jigjiga city targeted by the project. This then has much broader implications in terms of better economic productivity, and it will contribute to boosting development, particularly in the tourism sector, and boosting service sector investment (hotels) for which reliable and affordable sanitation and hygiene facilities are essential.

The fecal sludge management will contribute to alleviating the impacts of the existing uncontrolled fecal waste disposal into the environment, which include nuisance odors, poor aesthetics, and risk of groundwater pollution/contamination, among others. The identified impacts and their enhancement measures are briefly described in the sections below.

8.4.1. Job Creation

The construction and operation of the project activities will create both short and long-term employment opportunities. Most of it will be during the construction phase, where the possibility of engaging skilled and unskilled labor from the project area can be created. Indirect job opportunities like coffee and tea selling around the construction site, mainly by women, are another project benefit, particularly during the construction phase.

Enhancement measures: Benefits from job opportunities can be enhanced by prioritizing women and local people of the project area. By providing on-the-job training and capacity building, it is possible to enhance job opportunities for poor women in the project areas.

8.4.2. Impact on Gender and vulnerable groups

Sanitation services are highly gender sensitive; hence, improvement of public health and safety as a result of the implementation of the proposed project will have an important impact on vulnerable groups of society (children, women, and the elderly).

8.4.3. Improvement of Public Health

The implementation of the proposed project will prevent any health-related problems, particularly from outbreaks of waste-related diseases (such as cholera dysenteric disease caused by poor sanitation). The proposed project will improve environmental sanitation and community health in Jigjiga City.

Enhancement measures: Health advantage from FSTP would be enhanced by creating awareness of fecal sludge management in the community and awareness among the users on clean and polluted water as well as its advantages and disadvantages.

8.4.4. 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, discharged to a wider environment

without treatment, will be treated at FSTP to remove harmful elements. As the project itself is designed to mitigate environmental pollution, the project's impact on air quality will be highly positive.

Enhancement measures: To improve the air quality in the FSTP project intervention sites by properly managing the treatment plants.

8.4.5. Improvement of Water Quality

Properly designed and operating FSTP protects water resources from pollution. The quality of water flowing from the FSTP to the nearby rivers can be improved by way of changing water quality parameters such as the BOD, COD, turbidity, color, pH, temperature, total dissolved and suspended solids, conductivity, coliforms, nutrients, and trace metals positively.

Enhancement measures: To enhance the positive impacts on downstream water quality, it would be important to regularly monitor the quality of the effluent, if any, to be released to downstream rivers and check whether the effluent quality complies with the Ethiopian effluent discharge standards. Furthermore, it is advisable to plan and implement integrated watershed management in the micro-catchment that helps to enhance the quality of water resources and reduce the negative impacts. This can be implemented with the regional water and energy and, agriculture and natural resource bureaus.

8.4.6. Production of Compost/Fertilizers

De-watered sludge removed from the FSTP process can be utilized for fertilizer and conditioning of the soils in the immediate agriculture area and/or beyond downstream and upstream. Biodegradable materials removed from the processes can be given to the agricultural sector to produce natural fertilizers and to be used in place of other inorganic products that may be harmful to people and the environment. This could be an additional benefit for the project area people.

Enhancement measures: Creating a demonstration field and training 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 concerned authority/enterprise (establishing small enterprises that prepare marketable compost). This needs to work closely with the regional bureau of agriculture to ensure the quality of compost prepared.

8.4.7. 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 JWSSA, municipality, and other relevant stakeholders, including environmental protection, health, and agriculture. The implementation of training and capacity-building programs would serve the sustainability of the project.
- **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.

- Minimize or avoid misuse and encourage timely maintenance of FSTP and create awareness among users and people who manage the facilities.
- Give priority to job opportunities for the local people in general

8.5. Negative Impacts of FSTP Activities 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 bio-physical elements that include water bodies (surface and ground), soils, ambient air, flora and fauna as well as the human or socio-economic 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 that are of concern for implementing the project and its proposed mitigation measures are presented below:

8.5.1. Construction Phase

Impact on Soil (Compaction Erosion and Pollution): The construction activities will cause soil compaction as well as damage to soil structure and expose the soil to runoff water erosion. This will increase the risk of soil erosion. Soil pollution could also occur due to hazardous substances (fuel, lubricants, and oil), cement sludge, and detergents 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 without applying any mitigation measures.

Mitigation measures

- Limit excavation works only to what is 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.
- Use only existing roads to the extent possible, and do not drive through unpaved soil.
- Provision of well-designed and constructed culverts and side ditches for the access roads to minimize potential erosion.
- The Contractor shall install drip pans and fuel funnels at dispensing points of fuels and lubricants.
- Oil exchange and Washing of vehicles should take place only in the pre-prepared workshop area and never done in rivers and open soils.
- Properly manage and dispose of construction waste, including packaging materials, concrete debris, and other non-hazardous waste, in designated waste disposal areas.
- Park all the vehicles and types of machinery at only designated parking areas.
- Disposing of grit screenings in a landfill.

Land Use change and impact on Fauna and Flora: The proposed project activities would lead to the land-use change. The FSTP is planned to be implemented in an agricultural, changing the land use of the site. The new land-use type will be semi-built. This change is permanent. The construction of the proposed project is not expected to cause significant adverse impacts on fauna and flora. There are limited types of shrubs (Acacia tortilis, Acacia nilotica, Aloe vera, juliflora species) that would be affected by the project development. In addition, as the site is near the Jere River, there may be some movement of wild animals from the riverine hence the construction may cause accident & obstruct their movement.

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 for replacement of the removed trees (10 seedlings per removal of a single tree)
- Limit land clearing works only to what is 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.

Pollution of Water Bodies: Pollution of water bodies could be anticipated during the construction phase due to inadequate handling and spillage of pollutants (like fuel, oils, and paints). In addition waste from the workers camp may also pollute the 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 only, thereby minimizing erosion or transport of excavated materials by runoff water to water bodies.
- Prevent environmental pollution by hazardous through proper storage and handling of substances such as oil, fuel, cement sludge
- Providing suitable facilities for workers, and
- Disposing of waste according to approved waste management plan (avoid open waste disposal practices).

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

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

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.
- Limit stockpiling of excavated topsoil to a maximum of 2m height.
- As much as possible, use paved roads and
- Limit the speed of vehicles to 30km/hour on unpaved access roads, especially in the vicinity of residential and business areas, social services, and religious places.

Loss of land and livelihood: The FSTP is planned to be implemented in agricultural lands and it will have impact on livelihood of PAPs. The number of households affected due to land acquisition for FSTP is about 15. Total area of farm land required for construction of the proposed treatment plant is about 4.25 ha. Therefore, all the affected households at treatment plant sites need to be compensated ahead of mobilization and commencement of construction works. The significance of impact on land resources is rated to be high impact. Resettlement Action plan is recommended to be prepared by independent consultant.

Mitigation measures

- Prepare an appropriate compensation plan for the affected households and implement it before the start of mobilization and construction works.
- Provide alternative land in the nearby area if applicable to support the livelihood of the affected persons or pay adequate compensation for the loss of farmlands (provide support to those households who lose their livelihood according to the federal land expropriation and compensation laws).
- Give priority to the project-affected people for job opportunities created by the project.
- Give on-the-job training to build the capacity of PAPs so that they would fit for the available job rather than filtering out using education or training level requirements.
- Prepare and implement a livelihood restoration program.
- JWSSA has to redress grievances raised by former landowners amicably.

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

The activities that are expected to generate significant noise and/or vibration 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

There is no settlement in near to the project area and considering the nature and extent of construction works and types of 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 plant or heavy machinery and workers in vicinity of noise emissions;

Occupational Health and Safety Impact: Large-scale construction work, by its nature, is a hazardous job. There might be accidents of various natures to project workers moreover, there could be safety risks related to the storage and use of hazardous substances. Furthermore, dust and exhaust emissions may affect the respiratory tract of project workers exposed to such emissions. The impact on the health and safety of project workers affected during the construction of FSTPs is anticipated to be a moderate to high, short-term to long term and direct adverse impact.

Mitigation measures

- Contractor to provide a Healthy and Safety Plan before the commencement of construction works
- Create awareness for workers on safety issues.
- 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
- Provision of protective wearing (gloves, gum boots, overalls, masks and helmets).
- Provide first aid kits at construction worksites and inside vehicles.
- 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 labour 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 affect the local economy, and 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.

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 local community, animal and 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 roadside poles, trees, ditches, and 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 be 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
- 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.
- Assign traffic regulators or police to control traffic flows at critical sections or periods where/when traffic safety is a significant issue.
- Provide awareness training 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 etc.
- Ban use of substances such as alcohol and khat while at work

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

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, mobile and partly they are forced to live in hotel rooms or 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. The nature of the impact is medium and short term in impact.

Mitigation Measures

- Launch awareness and education campaigns about HIV/AIDS and STIs among 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.
- Town administrations and health offices, HIV/AIDS Prevention and Control Office, Elders, and NGOs operating in the area need to work jointly to create a positive impact and bring major attitudinal and behavioral changes.

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/ Sexual Harassment /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;
- Provide awareness on the GBV/SH to the staff/workers;
- Provision of gender-disaggregated bathing, cloth changing areas & sanitation facilities.
- Assign women in works that do not affect their biological condition;
- Provide women workers with appropriate types of safety equipment and protective materials.
- The Contractor should ensure that 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

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 of 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 low significance.

Mitigation measures

- Monitor the proper functioning of the treatment plant

- Regularly check the effluent quality for its compliance with acceptable effluent discharge standards
- 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 of the FSTPs, such as camels, shoats, cows, and oxen, may be affected by the discharge of improperly treated wastewater and sludge production from the FSTPs. This problem is improbable, of low significance, and long-term duration 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.

Impact on ambient air quality/ Odor (Foul smell /: multiple contaminants gases (CH_4, CO_2, and H_2S) will be generated from fecal sludge treatment plants, and there will be a release of these gases into the atmosphere and an impact on the environment through the generation of bad odors. In addition the frequent dumping of truckloads of fecal sludge may cause bad smells in and around the FSTP. However, as the FSTP is located outside the town and far from settlement areas, an obnoxious smell from the treatment plant area is localized, reversible, moderate significance but long term that can be minimized by applying the following mitigation measure.

Mitigation Measures:

- Plant layers of shrubs and trees along the periphery and provide adequate stack height to exhaust emissions.
- Provide adequate buffer zone at least 400m from any settlement area
- 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
- Proper maintenance of the facility, including 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.
- Adopt effective and efficient housekeeping procedures (regular cleaning of the grit and screenings).
- Operate especially the secondary treatment processes at optimum condition.

Occupational health & Safety:

Workers may be affected by handling partially treated dry sludge, , and the gas emission from the treatment plant **such as** Hydrogen sulfide which is a toxic gas. The OSHA permissible exposure limits for hydrogen sulfide are 10 ppm (time-weighted average) and 15 ppm (short-term exposure limit). Other potential health and safety impacts include accidents of various natures such as 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.
- Regular checking of 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 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, ‘jardia’, 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 attracted to the area, increase the routes of contamination and disease transmission.

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 JWSSA 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 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 the other possibility to disinfect sludge without using expensive technologies.
- Avoid the 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 the 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 that flies and rodents could not be attracted.

Public health impacts /Mosquito breeding and disease transmission

As indicated socio-economic baseline, malaria is among the major diseases in Jigjiga area. If the project is not properly managed, the waste stabilization pond and water discharged from the treatment plant 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

Gender and 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.
- JWSSA should ensure that women are paid equal pay for equal work with their male counterparts.

Impact on aesthetic value: During the operation, the FSTP there will impact on Aesthetic values /visual from the waste stabilization ponds and dry sludge storage.

Mitigation measures

- New developments of housing should be limited in the safety area zone around the FSTP.
- A 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 always neat.

8.5.3. Decommissioning Phase

JWSSA 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 them 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 of structures and scraped contaminated soil that would 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 it 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 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, JWSSA 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 Woreda/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 starting the operation to the local community and administration, including (agriculture, water, 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 to establish their own small-scale enterprises through the facilitation of loan or financial support. Create links with appropriate government agencies and financial sources.

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

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 purpose of the ESMP is 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.

This ESMP provides a schedule for the implementation of recommended mitigation activities. 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.

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 full integration in operational activities. Responding adequately to the nature of the envisaged FSTP construction, the ESMP is referring 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 amongst concerned parties.

Due to the long-term life of the intervention facilities and related components, a decommissioning assessment will be undertaken at least 1 year before the process for any of the components commences, following a notice to decommission. 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. The contractor's camp and installations will need to be removed without compromising the safety and general welfare of the immediate residents. Special care is to be given to associated wastes and dust emitted in the process.
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 be prepared depending on the degree of rehabilitation.

The following table shows environmental and social management plans for proposed works for FSTP

Table 23: ESMP for Enhancing Beneficial Impacts

Sr. No	Issue/ Main impacts	Proposed Mitigation measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
			Implementation	Supervision		
	CONSTRUCTION PHASE					
1.	**Impact on Soil (Compaction Erosion and Pollution)**	• Limit excavation works only to what is necessary and Execution of earthworks during the dry season and refill 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 to minimize potential erosion. • Use only existing roads to the extent possible, and do not drive through unpaved soil. • install drip pans and fuel funnels at dispensing points of fuels and lubricants. • Oil exchange and Washing of vehicles and oil changes should take place only in the pre-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 sequencing, put stockpiles away from watercourses, and disposing of grit, screenings in a landfill.	Construction Contractor	JWSSA/ Supervisory Consultant /SC,	Throughout Construction phase	Part of the construction and supervision cost to be covered by the contractor and consultant
2.	**impact on Fauna and Flora**	• Plant appropriate trees in and around the project site to replace the removed trees • Restricting land clearing to what is 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	JWSSA and Supervisory Consultant	Throughout the Construction Phase	Part of the construction and Supervision cost is 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		
3.	**Impact on Water Bodies**	• Minimize soil erosion by refilling the trenches and other excavated/exposed places soon and establishing protective covers 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	JWSSA,	Throughout construction phase	Part of Contractor's Contract
4.	**Air pollution due to dust, exhaust emissions, and noise generated by the construction activities**	• Regular spraying of water on unpaved access roads, exposed earth, and any stockpiles on site, feasible, covering stockpiles on site with plastic materials. • Construction workers should wear dust masks 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. • As much as possible, use paved roads 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).	Construction Contractor	Supervisory Consultant (SC),	Throughout Construction phase	
5.	**Loss of land and livelihood**	• Prepare an appropriate compensation plan/ ARAP/ for the affected households and pay adequate compensation for the loss of farmlands and livelihood • Give priority to the project-affected people for job opportunities created by the project. • Prepare and implement a livelihood restoration program.	Jigjiga city Municipality office	JWSSA WB	Before the start of mobilization and construction works.	Part of Municipality budget
6.	**Impact of Noise**	• Carryout noisy construction activities during normal working hours only; • Provide ear protection equipment (earplugs) for workers operating plant or heavy machinery and workers in the	• Construction Contractor	JWSSA/ Supervisory Consultant SC	Throughout construction phase	Part of the construction & supervision cost to be covered by

Sr. No	Issue/ Main impacts	Proposed Mitigation measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
			Implementation	Supervision		
		vicinity of noise emissions;				the contractor & consultant
7.	**Occupational Health and safety**	• Contractor to provide a health and Safety Plan before the commencement of works to be approved by the resident engineer. • There should be a safety policy displayed on the site. • Create awareness for workers on safety issues. • Provision of protective wearing (gloves, gum boots, overalls, and helmets). • Provide temporary toilets and bathrooms for the construction workers at the work sites. • 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. • 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 is taken, etc. • Regularly spray water in dusty roads and work areas.	• Construction • Contractor	Supervisory Consultant JWSSA,	During construction	Part of the construction and supervision cost to be covered by the contractor and consultant
8.	**Traffic accident risks**	• Develop and strictly implement and follow up a well-designed work program considering local conditions like the normal traffic and socio-economic conditions. • Provide awareness training 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	• Construction Contractor	Supervisory Consultant, the traffic management office of the city	During construction	Part of the construction and supervision cost is 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		
		traffic safety measures at public meetings, social gatherings, schools, mosques, churches, etc.				
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. • Town administrations and health offices, HIV/AIDS Prevention and Control Office, Elders, and NGOs operating in the area must work jointly to create positive impact and bring major attitudinal and behavioral changes.	• Construction Contractor	Supervisory Consultant JWSSA	Prior to start & during construction	Part of the construction and supervision cost to be covered by the contractor and consultant and Birr 50,000.00 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-disaggregated bathing, cloth changing areas & sanitation facilities. • Provide women workers with appropriate types of safety equipment and protective materials. • The Contractor should ensure that women are paid equal pay for equal work with their male counterparts.	• Contractor	Supervisory Consultant JWSSA	Prior to start & during construction	Part of the construction and supervision cost to be covered by the contractor and consultant Birr 50,000.00 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, JWSSA	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		
12.	**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.	Construction Contractor	JWSSA	During construction	Part of the construction and supervision cost to be covered by the contractor and consultant
	Operation phase					
1.	**Soil**	• Ensuring that the dry sludge to be disposed or used for agriculture complies with the national effluent standards • Dispose of sludge with dangerous substances only in a designated sanitary landfill	JWSSA Facility manager	JWSSA, City EPA. and agriculture & natural resource offices	Throughout the entire operation phase	Part of the FSTP operation budget
2.	**Water Bodies**	• 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 a class A rating above 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. • 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	JWSSA Facility manager	JWSSA City/regional environmental protection and water & energy bureau	During design, construction, and operation of TPs	Part of the FSTP operation budget
3.	**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	• FSTP Quality Control	• JWSSA, EPA Office(both city administration and region)	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		
		standard, stop discharging the effluent into receiving rivers. • As appropriate, promote integrated watershed management schemes around the FSTP, which to reduce any potential spillover of liquid wastes into the natural environment. • Proper quality control of 'treated' sludge before releasing 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.				
4.	**Ambient air quality (Odor/obnoxious smell from the TP**	• Regular monitoring of the ambient air including measuring H2S presence in the air, • Control an aerobic digester parameter (pH, Temperature, oxygen level, etc.) for H2S producing bacteria/microorganism (creating unfavorable environment), • 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.	Facility manager	JWSSA City 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		
		• Provide adequate buffer zone,(400m) particularly along the major windward				
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. • Appropriate warning signs shall be placed in areas where accidents are expected to occur. • Regular checking of 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.	• JWSSA Facility manager	• JWSSA • Health bureau and office	Throughout the entire operation phase	Part of the FSTP operation budget
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 have been in contact with the community who use it. • Use of protection clothes such as gloves and masks and good hygiene (washing hands after work, etc. • The department dealing with sludge should introduce rules for the use of protection by their staff, and care should be taken to enforce those rules. • Create appropriate awareness of the preparation and utilization of composts from such sources. • Fecal sludge should always be treated before its use in agriculture • Avoid the 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).	• JWSSA Facility manager	• JWSSA • Health	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		
		• 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.				
7.	**Public health Mosquito breeding & 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 mosquito breeding site.	JWSSA Facility manager	JWSSA	Throughout the entire operation phase	Part of the FSTP operation budget
8.	**Gender and Gender Based Violence/SH/SEA Risks**	· Prepare and implement a code of conduct that, among others, strictly forbid 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 in works that do not affect their biological condition.	JWSSA Facility manager	JWSSA Women and children affairs, office of Opossum	Throughout the entire operation phase	Part of the FSTP operation budget
9.	**Impact on Aesthetic value**	· New housing developments should be limited in the safety area zone around the FSTP. · A 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	• JWSSA Facility manager	• JWSSA	Throughout the entire operation phase	Part of the FSTP operation budget
	Decommissioning phase					
1.	**Air pollution**	• Systematically demolish structures considering reuse of materials for other uses. • Wet the materials before demolishing to suppress the release of dust. • Avoid the burning of any material.	JWSSA	Jigjiga city EPA	Decommissioning	Part of the Municipality/JWSSA operation budget

Sr. No	Issue/ Main impacts	Proposed Mitigation measures	Responsibility		Timing of Execution	Cost Estimate (Eth. Birr)
			Implementation	Supervision		
2.	**Impacts on Soil and Water Bodies**	• Remove all the contaminated soil from the treatment plant site and dispose of it at a designated waste disposal site or sanitary landfill. • Level the ground so that it will be used for other 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.	JWSSA	JigJga City EPA	Decommissioning	JWSSA operation budget
	Health Impact	• Create appropriate awareness before starting the operation to the local community and local administration (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.	JWSSA	JIgjiga city EPA	Decommissioning	Municipality/ JWSSA 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 in the set range of pension. • Organize, train, and promote to establish their own small-scale enterprises through the facilitation of loan or financial support. Create link with appropriate government agency and financial sources	JWSSA	Jigjiga town Labor and Labor Affair bureau	Decommissioning	Municipality/ JWSSA operation budget
8.	**Gender and Gender Based Violence/SH Risks**	• 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. • Ensure equal pay for women and men for equal jobs.	JWSSA	EPA and Jijiga town women and social affair	Decommissioning	Municipality/ JWSSA 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, operation and decommissioning 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 improvement in environmental performance.
- Provide environmental information to the community/stakeholders.
- Provide early warning signals on potential environmental degradation for appropriate actions to prevent or minimize environmental consequences.

Recommendations for monitoring responsibilities and estimated costs have been included in the implementation of the ESMP. Table 24 below provides the monitoring indicators and monitoring activities at various phases. Monitoring plan: As the Executing Agency, JWSSA will bear overall responsibility for monitoring the implementation of the ESMP. In addition, the relevant Jigjiga city stakeholders shall be engaged as deemed necessary.

However, for day-to-day monitoring, it is expected that the supervising Consultant will hold the Contractor(s) accountable for all ESMP implementation requirements, including implementation of all approval conditions as stated in the approval. It is expected that the regional and Federal EPA (or appropriate regulatory body), as the agency responsible for the environment, will also monitor ESMP implementation as appropriate. The WB, on the other hand, will conduct routine bi-annual supervision missions to ensure all activities, including ESMP implementation, is on track. The individual ESIAs and ESMPs have identified areas for monitoring by the enterprise, the contractor(s), the Supervising Consultant(s), and other relevant stakeholders. Critical aspects of the monitoring program will include, among others, water quality monitoring, especially concerning effluent discharged FSTP and receiving waters, sound operation of fecal sludge treatment plants, reinstatement of areas disturbed by earthworks, occupational health and safety aspects, and related construction-related accidents and protection of workers as well as the status of PAPs livelihood programs after compensation.
The key verifiable indicators which will be used to monitor the impacts will mainly include pollution (noise, soil, air-dust, waste), erosion and loss of resources, occupational and health safety, land use change, the spread and occurrence of diseases (Pathogenic and nonpathogenic-HIVE/AIDS, etc.) and accidents as well as job creation.

Table 24: Environmental and Social Monitoring Plan

S.n	Issue/ Subproject main Impacts	Monitoring Indicators	Monitoring Party	Monitoring Frequency	Method of Measurement/monitoring	Budget Estimate (in Birr) for monitoring
	CONSTRUCTION PHASE					
1.	Impacts on soils	• Evolution of erosion signs (sheet erosion, gully formation, siltation 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, and slope failures or to improve the quality of the affected landscape. • Area of land affected due to exploitation of quarries and borrow sites and area reinstated after exploitation has ceased; • Incidence of soil pollution by spillage of hazardous substances	JWSSA	Minimum twice per month during the construction contract period	Visual observation, area measurement, Collaborative field visit and reporting the result	100,000.00
2.	Impacts on water quality; sedimentation, pollution by hazardous substances	• 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.	JWSSA	As required	Visual observations, water quality analysis in the laboratory or using field kits Collaborative field visit and reporting the result	100,000.00
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 construction vehicles and equipment. • No. of complaints due to nuisance noise or dust pollution.	JWSSA	As required	Visual observations & Recording of case	50,000.00

S.n	Issue/ Subproject main Impacts	Monitoring Indicators	Monitoring Party	Monitoring Frequency	Method of Measurement/monitoring	Budget Estimate (in Birr) for monitoring
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 and survived to replace the trees removed and the plantation affected. • Number of wild animals killed during the construction works.	JWSSA	As required during the contract period,	Visual observations, & Recording of trees affected & Animal fatalities Collaborative field visit and reporting the result	80,000.00
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 adequate number of protective kits and whether workers are using protective kit	JWSSA	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	20,000.00
6.	Impacts on public health	Number of awareness raises and education campaigns about HIV/AIDS for project workers and vulnerable local populations.	, JWSSA	As required	Communication with the implementers & Interviewing the vulnerable groups Collaborative field visit and reporting the result	50,000.00
	OPERATION PHASE					
1.	Odor	Intensity of odor and spatial coverage around the treatment plant and nearby surrounding areas	JWSSA, City EPA,	Whenever there is compliant from the affected people	Visual observations & Recording of cases Collaborative field visit and reporting the result	Part of the regular budget of regulatory body

S.n	Issue/ Subproject main Impacts	Monitoring Indicators	Monitoring Party	Monitoring Frequency	Method of Measurement/monitoring	Budget Estimate (in Birr) for monitoring
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	JWSSA City EPA	As required	Visual Observation Collaborative field visit and reporting the result	Part of operation cost & cost of regulatory body and monitoring cost ,100,000.00
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	JWSSA City 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 JWSSA operation cost & cost of regulatory body & monitoring cost 200,000
4.	Public health & Environmental sanitation issues	• Number or availability of adequate drainage facilities for wastewater disposal.	JWSSA City Health office	As required	Visual observations, review of drainage plans & documents	Part of the regular budget of regulatory Body and 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	JWSSA	Monthly	Performance reports Collaborative field visit and reporting the result	Part of JWSSA regular maintenance cost & monitoring cost 250,000
	Total monitoring costs for the planned activities					**1,050,000.00**

11. INSTITUTIONAL/IMPLEMENTATION ARRANGEMENTS AND CAPACITY BUILDING

The project will use the existing institutional arrangements and a dedicated Program Implementation Team, who are employees of the executing agency (JWSSA). JWSSA is the central unit responsible for implementing the overall project activities together with municipal and regional stakeholders. In this regard, JWSSA is a project management unit which will oversee front-line activities and day-to-day management during the implementation. JWSSA is responsible for the preconstruction (designing), construction, operation, and decommissioning phases. The responsibility for implementing the ESMP during construction will be of the contractor, JWSSA, and concerned Government Offices of Jigjiga City.

The project management unit will be headed by the Water supply sanitation Authority and supported by Regional Water and Energy Bureau. The management unit is further composed of the divisional officers concerned from relevant sectorial offices. Experts or consultants on technical issues may assist the unit. JWSSA has an established position for an Environmental and social safeguard Officer, which will provide oversight on the implementation of the environment and Social (ESIA) component of the program.

To minimize potential environmental and social negative impacts, the project will require the support of various stakeholders in the project area. MoWE and Somali Region Water and Energy Bureau are the overarching institutions to facilitate the implementation and sustainability of the proposed project. The regional environmental authority is also mandated for the follow-up and compliance monitoring of the E&S-related aspects. The Jigjiga City environmental protection unit will also help ensure all relevant environmental and social standards and guidelines of sanitary facilities. The other entities include health, education, agriculture, culture and tourism, urban development and construction, women and children affairs, labor affairs, etc. The city Health Office and other relevant health centers in the city shall play a significant role in creating awareness and promoting health standards, disease prevention and control during the project implementation. Moreover, the office should inform the community of the proper use of improved sanitation and hygiene facilities.

A WB's Supervision team is another part of the institutional structure, to monitor the Project, including monitoring physical progress and compliance, procurement supervision and quality assurance of technical solutions and physical deliverables. The WB supervision team will sit alongside the PIU (JWSSA) and MoWE to review all implementation tasks. MoWE as the project proponent of the proposed works may be assisted by the supervision consultants. This will ensure that the contractor and sub-contractors, if any, who will win the tender for implementing the works adhere to the laid down procedures for the construction and commissioning of the proposed project.

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, JWSSA must allocate sufficient resources for training and capacity building. These efforts will not only benefit the authorities but will also 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 JWSSA. They are responsible for carrying out ESMP and monitoring activities. The findings indicated that these different groups have different capacity-building and training needs for raising awareness, sensitization to the issues, and detailed technical training. The JWSSA is found to have a limited institutional capacity to implement the provisions of the ESMP, especially regarding the FSTP management project. Although general awareness of environmental issues exists within the steering committee stakeholders and JWSSA professional staff, focused training, and capacity building would enhance the ESMP implementation capacity substantially on their part.

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 JWSSA management team. The JWSSA environmental and social experts should get short-term training in the management of environmental and social issues. 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
Jigjiga City Administration	Allocate Budget to the project office and monitor its utilization; Monitor the implementation and operation of the proposed project; Coordinate the activities of the sub-cities and Kebele Administrations for the successful implementation of the project. Ensure any complaints raised from the communities and PAPs are properly treated and managed.
JWSSA	Responsible for the implementation of the proposed project as proponent and Coordinates the efforts of the different organizations responsible for the management and monitoring plan. Coordination of stakeholders during monitoring of project activities at various phases.
Jigjiga City-EPA	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.
Jigjiga health office	**Provides** technical advice related to health issues such as HIV/AIDS, STDs, accidents, and others.
Jigjiga Women and Children office	**Provides** technical advice about the social issues of GBV, child labor, etc., and monitoring at various phases.
Somali Region Water and Energy Bureau	Responsible for the overall coordination of the project study, and design, and implementation in collaboration with MoWE. Environmental and social personnel assigned for the ongoing UWSSP at the Regional level will assist the JWSSA environmental unit in monitoring and following up on the implementation of the proposed ESMP.
MoWE	Responsible for 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 the ESIA studies were conducted under the supervision of the Ministry.
The World Bank	**Financed** the project as per the agreement. Monitor and evaluate the progress of the project and the budget utilization allocated for allocated funds. Demand work progress reports, including ESIA performance 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

Stakeholders	Roles and Responsibilities
	gender specialist at construction site.
Supervision Consultant	The Consultant's EHS team, in cooperation with AWSSA social and environmental 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 financers environmental, social and health safeguard guidelines.
Community	Engaged in the monitoring of the E&S through their representative

11.1. Training Programs

Training programs need to be developed and shall be delivered to the project developer for the implementation of environmental safeguards of the proposed project. Following training needs assessment; specific and tailored training shall be developed and agreed upon by the developer and key stakeholders for implementation of safeguards in the course of project implementation.

- Target groups for the training: JWSSA 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 every year, and their content will be updated and adapted to implementation issues. Training frequency and the content will be reviewed during the project's operation lifespan depending on needs or technical requirements. Based on the assessment carried out for preparing the ESIA, the following training program is recommended.

Table 26: Training Programs for Capacity Building and associated costs

Target Group	JWSSA Staff, MoWE (regional water and energy bureau), Health officers, Regional EPA, and other relevant stakeholders	Description
Training title	Environmental and Social supervision, monitoring and reporting	
Participants	Environmental staff and social workers of JWSSA 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
Training frequency	Soon after sub project effectiveness but at least 2 weeks -1 month before the start of project work. In-service /refresher training during operation.	
Time	Training twice a year, and then to be repeated every year until year three of implementation.	
Training content	·Public health and safety of FSTP management. ·Social mitigations 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	JWSSA 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
Duration	After bidding, and determining based on needs	

Target Group	JWSSA Staff, MoWE (regional water and energy bureau), Health officers, Regional EPA, and other relevant stakeholders	Description
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, forman and ES expert	/2 years /2timea/year = 360,000 **Supervisor** and client /4 person /2 years,(2time a/year = 96,000
Training Content	• Overview of environmental and social monitoring • Requirements of environmental and social 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	JWSSA with facilitation from the MoWE	
Target groups	Local communities/ stakeholders, JWSSA, Health Officers and, municipality, urban infrastructure technicians/ Engineers/EPA	30 persons/for 2 days 2 times/year for 2 year 30*2*2*2*3000 =720,000
Training title	Environmental sanitation and safety	
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	JWSSA and another relevant stakeholder	
	Subtotal 1	**2,526,000.00**
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	JWSSA and another relevant stakeholder/every 6 month for 5 years	
Training title	Safety measures for proper FS emptying up to 8 persons	12*2*5*3000 360,000
Course content	Training on risks, safety measures and good practices for FS sludge collection and conveyance	
Target group	Head of Core Process, FS Emptying Customer Service Team Leader Sludge Truck Drivers Sludge Emptying Crew	
Responsibilities	JWSSA and another relevant stakeholder	
Training title	Operation and maintenance of treatment plant 3 days every year for 5 years	8*5*3000*2

Target Group	JWSSA Staff, MoWE (regional water and energy bureau), Health officers, Regional EPA, and other relevant stakeholders	Description
Course content	Treatment plant operation principles, operation and maintenance procedures, and treatment processes	240,000.00
Target group	Head of Core Process FSTP Team Leader FSTP operators	
Responsibilities	JWSSA and another relevant stakeholder	
Training title	Leadership and communication	8p*2d*5t*3000 240,000.00
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	
Responsibilities	JWSSA and another relevant stakeholder	
	Subtotal 2	**2,340,000.00**
	Total estimated cost	**4,866,000.00**
	Contingency 10%	**4 86,600.00**
	Grand Total	**5,352,600.0**

11.2. ESMP Implementation Costs

Environmental and social management/monitoring is essential for ensuring that identified impacts are maintained within the allowable levels, unanticipated impacts are mitigated early (before they impose problems), and the expected project benefits are realized. Thus, an ESMP aims to assist in systematic and prompt recognition of problems and the effective actions to correct them, and ultimately, good environmental performance is achieved. 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, including mitigation, monitoring, and capacity building, is detailed in the table below.

Table 27: Summary of Budget Estimate for ESMP and monitoring

	Component	Project phase	Unit/ Reference	Estimated cost in ETB
1	**ESMP**			
	Buffer zone protection for FSTP sites	Throughout all phases	Lump sum	500,000.00
	HIV/AIDS and Gender awareness and prevention	construction phases	Lump sum	100,000.00
	ESMP enhancing beneficial impacts(traing on compost production & establishment of demonstration site)	All phases	Lump sum	500,000.00
		Subtotal 1		**1,100,000**
2	**Environmental and Social Monitoring Costs**			
	Air Noise quality monitoring	Throughout all phases	Table 24	50,000.00
	Water quality monitoring	Construction and operation	Table 24	300,000.00
	soils and landscape quality	Construction	Table 24	100,000.00
	flora and fauna	Construction	Table 24	80,000
	Monitoring Impacts on traffic mobility and safety issues	Construction	Table 24	20,000
	Monitoring Impacts on public health Environmental sanitation issues	Construction and operation	Table 24	350,000.00
	Sludge water treatment & disposal of the cake	Operation	Table 24	100,000.00
	Operation and Maintenance of the TPs System	Operation	Table 24	250,000.00
		Subtotal 2		**1,050,000.00**
3.	Capacity building Training cost including skill	All phases	Table 26	**5,352,600.00**

	Component	Project phase	Unit/ Reference	Estimated cost in ETB
	development			
		Subtotal 3		**5,352,600.00**
			Subtotal 1+2+3	**7,502,600.00**
			Contingency 10%	**750,260.00**
			TOTAL	**8,252,860.00**

11.3. Grievance Redressing Mechanisms

A grievance redressing mechanism (GRM) is expected to outline procedures to respond to project-related grievances efficiently and effectively. As per OP 4.12 of the WB, GRM should be accessible and appropriate to bring about remedial measures for complaints. Appropriateness and accessibility signify the need to have a workable GRM arrangement tailored to the local context. Without these main ingredients of GRM, complaint procedures will have no expected outcome in redressing grievances. In case of complaints by PAPs on project-related activities, the preferred way of settlement is through amicable means to save time and resources as opposed to taking the matter to formal courts.

To ensure that the PAPs have avenues for redressing grievances related to any aspect of environmental and social impacts, compensation, construction management negligence, and any other relevant project related matters procedures for the redress of grievances should be established for the project. The objective is to respond to the complaints of the PAPs efficiently, i.e., the mechanism to be easily accessible, transparent, and fair and to avoid the need to resort to complicated formal channels to redress grievances. Accessible and appropriate GRM not only helps to have more effective and efficient procedures but also has a strong bearing on the project implementation progress, as PAPs' grievances tend to wart timely accomplishments of project activities. For the project, a grievance redress committee needs to be established that consists of members from the project administration office, PAPs, elders/religious leaders and local NGOs.

Procedure

- Complainants can log/file their complaint(s) in written form, verbally, through a telephone call, text message, or any means of channels convenient to them;
- The filed complaint(s) need to be itemized, clear, and concise with remedial suggestions;
- Complainants should submit their complaint to the relevant designated officer (first contact point, in this case, secretary of the Grievance Redress Committee-GRC);
- The secretary of the Grievance Redress Committee should register Complain in a standard format prepared for the same purpose;
- The form should include detail of the Address of the PAP or PAPs (Telephone number, kebele, etc.) and the remedial measure they require.

Obligation of the GRC

- Check the complaint is project-induced;
- Registering all complaints and organize them properly (Secretary of the GRC);
- Forwarding the case to the committee;
- If the GRC does not settle it, inform/forward the same to the next step level GRM or the Project promoter and amicable dispute settlement continues to be explored;

- Feedback /or GRC committees' decisions should be communicated to the PAP(s) at a maximum of 7 working days;
- In case amicable arbitration not working, PAP(s) can use their own right in formal court procedures;
- 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, but it also consider all other project–induced complaints partly listed above; and
- Capacity building and awareness creation interventions for local level GRC are essential. The project owner/client is expected to facilitate such training for better performance of the project at large.

11.4. Code of Conduct

The project shall develop and implement a Code of Conduct to deal with the environmental and social risks related to construction. The Code of Conduct shall be applied to all staff, laborers, and other employees at the construction site or any other places where construction-related activities are being carried out. It also applies to the personnel of each contractor, subcontractor, consultant, and any other personnel assisting the contractor in executing the Works.

The purpose of the Code of Conduct is to ensure an environment where unsafe, offensive, abusive, or violent behavior should not be tolerated and where all persons should feel comfortable raising issues or concerns without fear of retaliation. More specifically, 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:
  - 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; and
  - 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 which 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 on 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 the contractor's personnel may result in serious consequences, up to and 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 of the Code of Conduct and
- A copy of the Code of Conduct in Amharic 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 that affects billions of people around the world, 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 Jigjiga City. Lack of sufficient sanitation facilities such as PCT and FSTP in Jigjiga City are among the bottlenecks for the development of the town. This poor sanitary situation is affecting the socio-economic and environment of the town. Hence, efforts to increase access to improved sanitation will have a great contribution to the overall sanitation improvement of the town. Considering all these conditions of the town, 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 constructed on the outskirts of the town. To maintain current treatment as well as future goals, unplanted Drying Beds with waste stabilization ponds and constructed wetlands are recommended for the proposed Fecal sludge treatment plant (FSTP). The selected technology for the fecal sludge treatment plants allows the 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 and social implications of the project activities. The proposed works will have high socio-economic benefits for the residents of Jigjiga. 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 effects on ambient air quality due to dust, soil erosion, poor solid waste disposal, and clearance of vegetation. In addition, loss of land and livelihood, traffic accidents, occupational health, and the spread of social diseases, e.g., HIV/AIDS risk, may result from project activities.

Many of the adverse environmental and socio-economic impacts in the FSTP site are minor and can be easily mitigated. The identified ‘major impacts’ may happen under rare conditions, such as in 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 works 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.

Jigjiga 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, especially the creation of a healthy environment (social and natural environment).

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

- Preparation of ARAP and proper compensation of PAPs
- Proper design to accommodate measures for effects soil erosion and slope destabilization during construction.
- Measures to safeguard job opportunities and gender balance during both 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, socio-culturally, 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 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 and social management plans should be made part of the contract documents of the contractor so that ESMP compliance is ensured. The ESMP recommends environmental and social monitoring at the different phases of the project. The monitoring should be conducted to check the efficacy of mitigation measures. The Environment and Safety officers should develop an environmental checklist for the daily environmental and social audit of the project activities. The environmental and social safeguard expert of the contractor should fill this up and should be verified by the City environmental protection office.

Moreover a resettlement plan should be prepared (ARAP) and PAPS should be compensated appropriately, and support after displacement for a transition period should be provided with development assistance such as credit, training or job opportunities.

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ANNEXES

Annexes	Annex title	Annex Attachment
1	Minutes of community consultation	Jigjiga minute of community consultati
2	Lists of stakeholder consultation participants	jigjiga list of stakeholders.pdf
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	Response to Comments	Response to Commnets.docx
12	Team involve in ESIA study	Team involved in the ESIA Study.docx

DEFINITION OF TERMS

Anaerobic digestion: A process which 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 the human beings including land, water, atmosphere, climate, sound, odor, taste, the biological factors of animals and plants, and the social factor of aesthetics and 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 impacts on the environment.

Environmental Monitoring: the continuous determination of the actual and potential effects of any activity or phenomenon 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 of 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 so as 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 on the environment if implemented.

Significant effect: substantial/ potentially substantial, adverse changes in any of 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: those affected by the outcome of a project or can affect the outcome of a proposed either negatively or positively.

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

Vulnerable Groups: Households below the poverty line, women, children, elderly, 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.

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MINISTRY OF WATER AND ENERGY

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

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