

**OROMYA NATIONAL REGIONAL STATE
JIMMA CITY ADMINISTRATION**

**Jimma Sanitary Landfill
Environmental and Social Impact
Assessment Report**

Prepared by MS Consult

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Acronym

MSW	<i>municipal solid waste</i>
<i>agl</i>	<i>Above ground level</i>
<i>asl</i>	<i>Above Sea Level</i>
BOD	<i>biochemical oxygen demand</i>
BOD5	<i>5-days Biochemical Oxygen Demand</i>
<i>cm</i>	<i>Centimeter</i>
CO2	<i>Carbon dioxide</i>
COD	<i>chemical oxygen demand</i>
CSA	<i>Central Statistical Authority</i>
CSE	<i>Conservation Strategy of Ethiopia</i>
<i>Dur.</i>	<i>Duration</i>
EIA	<i>Environment Impact Assessment</i>
EIA	<i>Environmental Impact Assessment</i>
EL	<i>Engineered Landfill</i>
EPE	<i>Environmental Policy of Ethiopia</i>
EPE	<i>Environmental Policy Ethiopia</i>
ESMF	<i>Environmental and Social Management Framework</i>
EWRMP)	<i>Ethiopian Water Resources Management Policy</i>
FC	<i>Field Capacity</i>
FDRE	<i>Federal Democratic Republic of Ethiopia</i>
<i>Fig</i>	<i>Figure</i>
FML	<i>Flexible Membrane Liner</i>
FS	<i>Faecal Sludges</i>
FWS	<i>free water surface</i>
H2	<i>Hydrogen</i>
H2S	<i>Hydrogen Sulfide</i>
<i>ha/yr.</i>	<i>Hectare per year</i>
HDPC	<i>High density Polyvinyl Chloride</i>
HDPE	<i>high density polyethylene</i>
IDP	<i>Integrated Development Program</i>
IR	<i>Income Restoration</i>
ISWM	<i>Integrated Solid Waste Management</i>
ISWM	<i>Integrated Solid Waste Management</i>
<i>Kg/d</i>	<i>Kilogram per day</i>
<i>Kg/m3</i>	<i>kilogram per cubic meter</i>
<i>Km</i>	<i>Kilometer</i>
<i>l/cap/day</i>	<i>liter per capita per day</i>
LEPO	<i>Land and Environmental Protection Office</i>
LL	<i>Liquid Limit</i>
LR	<i>Livelihood Restoration</i>

<i>M</i>	<i>Meter</i>
<i>M³/sec</i>	<i>cubic meter per second</i>
<i>masl</i>	<i>Meter above sea level</i>
<i>MDG</i>	<i>Millennium Development Goals</i>
<i>MEDC</i>	<i>Ministry of Economic Development and Cooperation</i>
<i>Mm</i>	<i>Millimeter</i>
<i>Mm/hr</i>	<i>Millimeter per hour</i>
<i>MSE</i>	<i>Micro and Small Scale Enterprise</i>
<i>MSW</i>	<i>Municipal Solid Waste</i>
<i>MWUD</i>	<i>Ministry of Works and Urban Development</i>
<i>N₂</i>	<i>Nitrogen</i>
<i>NH₃</i>	<i>Ammonia</i>
<i>O₂</i>	<i>Oxygen</i>
<i>PAC</i>	<i>Project Affected Community</i>
<i>PAF</i>	<i>Project Affected Family</i>
<i>PAP</i>	<i>Project Affected People</i>
<i>PI</i>	<i>Plasticity Index</i>
<i>PL</i>	<i>Plastic Limit</i>
<i>RAP</i>	<i>Resettlement Action Plan</i>
<i>REPA</i>	<i>Regional Environmental Protection Authority</i>
<i>ROW</i>	<i>Right of Way</i>
<i>RPF</i>	<i>Resettlement Policy Framework</i>
<i>RUPI</i>	<i>Regional Urban Planning Institute</i>
<i>SBPDPU</i>	<i>Sanitation, Beautification and Park Development Process Unit</i>
<i>SPG</i>	<i>Specific Purpose Grant</i>
<i>SSF</i>	<i>subsurface flow</i>
<i>SWM</i>	<i>Solid Waste Management</i>
<i>ToR</i>	<i>Terms of Reference</i>
<i>TSS</i>	<i>total suspended solids</i>
<i>UDCBO</i>	<i>Urban Development Capacity Building office</i>
<i>ULG</i>	<i>Urban Local Government</i>
<i>ULGDP</i>	<i>Urban Local Government Development Project</i>
<i>USEPA</i>	<i>United State Environmental protection Authority</i>
<i>VEC</i>	<i>Valued Environmental Components</i>
<i>VFA</i>	<i>Volatile Fatty Acids</i>

Executive Summary

ES-1. Introduction

Jimma town is one of the oldest, largest and commercial centers of the country which is situated in Oromia regional state. Like most towns in the country settlement expansion and increase in number of population is observed in the town. Despite its age old urban history of the town, waste disposal practice is still backward and is inadequate, from environmental and public health protection points of view. There is no proper waste management system at present. To improve the Jimma Municipality commissioned design of Sanitary Landfill Project and committed to ensuring that waste disposal is conducted in an environmentally responsible way. This includes ensuring that landfill designers, contractors and operators are aware of the risks landfill poses to the quality of air, water, and land and community amenity.

Land filling is a common treatment and disposal method for municipal solid wastes (none hazardous solid wastes). This has been identified as a preferred technology option for treatment and disposal of solid waste generated in the City. ESIA study for the landfill project implementation is, therefore, planned to guide and ensure Environmental Compliance of the project activities at all stages (design, construction, operation and closure of the landfill) of the project implementation. The overall objective of the ESIA study is to ensure that the intended goals of the solid waste landfill project is met to the satisfaction of the health and safety of the environment and to that of the requirements of both national and international environmental safeguard policies and guidelines.

Accordingly, the ESIA study through data collection, analyses of existing solid waste management practices and its consequential impacts, analyses of alternative sites and site selection for landfill construction, identification of possible impacts due to the project and proposals for mitigation of adverse impacts have been made. Data was collected both from primary and secondary sources; including site visit and site investigation, consultation of relevant stakeholders, review of documents and literature.

ES-2. Review of Policies, Legal and Institutional Frameworks

The implementation of the project should be realized in compliance with the available norms and standards, policy guidelines, legal and institutional frameworks. Projects to be implemented under the (Urban Local Government Development Plan (ULGDP) should adhere to acceptable environmental and social safeguards. The projects should, as far as possible, not result in significant disturbance of sensitive ecological resources. Accordingly relevant national and international policies were discussed. The following are among the prime ones:

- The Federal Constitution Article 43 and Article-44 and Article 92
- Environmental impact assessment Proclamation No. 299/2002
- Environmental Protection Organs Establishment proclamation No. 295/2002
- Environmental pollution control proclamations NO. 300/2002
- Solid waste management proclamation No.513/2007
- Environmental Impact assessment Proclamation No. 199/2002
- Rural land use and Administration Proclamation No.456/2005
- Proclamation NO455/2005 discusses on expropriation of land holding, determination of compensation

In addition, Environmental Protection Organs Establishment proclamation No. 295/ 2002 that specifies responsibilities among environmental agencies at Federal and Regional states was discussed.

ES-3. The Project Description

ES-4. Existing Solid Waste Management System

The current situation in Jimma, as well as in the entire country, is characterized by poor solid waste managing practices that endanger the public health and the environment. The existing solid waste disposal facilities are inadequate to manage the huge volume of waste generated by the city residents. Sanitation and Beautification and Park Development Work Process is the responsible for the solid waste management. However, the Agency's effort to collect the waste from source of generation is limited to the city center accessible for vehicular truck. The collected fraction of the solid waste is dumped in urban peripheries without treatment.

The solid waste stored in skips is house to house collected at intervals of three days, and directly transported for disposal at Koshe on Bonga road some 4km in the southwestern part of the city. The road side skips for solid waste storage are causing odour nuisances and urban environmental pollution, as the skips are not regularly emptied on time and residents continue to dump waste in open fields around the skips.

The uncollected wastes and improper disposal mechanism results in sanitation-related diseases; thus the city health institutions and facilities face the challenge of controlling the sanitation borne diseases. Most of the municipal solid waste is dumped by the banks of the streams in the town like Awetu and Boye. The major pollution sources are solid wastes dumped into the river from households, commercial areas and slaughter houses.

The solid waste management system is totally under resourced and under financed, leading to inadequate waste collection and transfer facilities and improper disposal pattern that pollute urban environment and public health.

The prevalent poor waste management system, lack of adequate facilities and low level of community awareness and participation, need immediate action if resulting health problems of illness and death from diarrhea, intestinal parasites, and malaria and subsequent retardation of growth and development of the town is to be avoided. Towards this the project proposed, Integrated Solid Waste Management System with final disposal in to sanitary landfill.

ES-5. The Proposed Sanitary Landfill project

The sanitary landfill, as an ultimate disposal facility for solid waste disposal, its design and operation needs to comply with health and environmental safety requirements. The very basics of these criterions depend on locating the facility in a way that minimizes, all the impacts associated with landfill construction and operation. The Jimma solid waste management system consists of Sanitary landfill, leachate evaporation pond, inter-facility access road and other ancillary structures as solid waste management units. The sanitary landfill construction project will be lying on an area of 10 hectare.

There are five principal environmental management techniques that have been considered during implementation of a landfill project in order to achieve the best environmental outcome:

- Site selection - an appropriate location will have natural barriers and buffer distances to help reduce environmental risk
- Design and construction - including all aspects of the design and construction of the landfill and associated infrastructure
- monitoring - including all performance and quality monitoring and reporting of air, water, noise and waste
- Site operations management - including all operational measures required to manage a landfill in an environmentally acceptable manner
- Remediation and post-closure management - including the measures needed to minimize the impact of closed landfills and ensure the beneficial use of landfill sites after closure.

The very basics of sanitary landfill environmental and social safety depend on locating the facility in a way that minimizes, all the impacts associated with landfill construction and operation. Accordingly qualitative analyses of three potential sites were undertaken against social, environmental and technical criterion. And finally the site at Ela-Dale in Gudeta-Bula kebele is selected for project use. The socio-economic impacts of this site do not involve physical displacement, and this requires less compensation budget for land and vegetation to be compensated.

Finally the design of sanitary landfill is conducted to ensure the basic objective of providing appropriate Solid Waste Management System. The landfill is provided with liner to restrict contaminant flow to the ground, and

under drain system to collect and convey percolated leachate to the treatment unit.

Sanitary landfill designed in such a way that provide daily cover for fresh refuse, incorporate mitigate measures to manage leachate and gas produced within the landfill cells, provide for a final soil and vegetative cover, and establish an environmental monitoring system of up gradient and down gradient groundwater monitoring wells and surface water sampling locations.

During the first stage of the works, construction of the first basin and a four meters embankment, the working surface encircled by this embankment will be waterproofed. The entire landfill bottom and the frontal parts of the banks will be made waterproof. A system for leachate collection and treatment pond will also be installed.

The recommended construction layers for the sanitary landfill of the project are as follows:

- 300mm thick compacted drainage sand layer;
- Sealant material: Flexible waterproofing membrane (polyethylene sheet) laid over compacted sub-grade, which will act as composite sealant.

The percolated liquid: Leachate is proposed to be treated by provision of stabilization ponds (Anaerobic and Facultative Pond). Wetland is used to refine the effluent from the facultative pond. All the leachate treatment units are provided with bottom and slope liner. The treated effluent is free for surface disposal.

The proposed projects also consist of construction of access road, auxiliary services building, composting yard, guard house, run-on and runoff channelling facilities and landfill fencing.

ES-6. Environmental and Social Baseline Data

This EIA defines the area where the Project Site is located and environmental and socio-economic baseline data is provided for this area. It provides assessment of likely environmental impacts that may be the result of Project activities as well as mitigation measures to be taken so as to minimize these impacts. These mitigation measures and the monitoring program, prepared for the assessment of the environmental performance of the Project, are presented in the Environmental Management Plan. A summary of the impact mitigation measures and monitoring plan is given in the following tables.

The base line environmental data considered are,

- Physical Environment
- Hydrogeology and geologic Environment

- Biological environment
- Socio-Economic Environment

ES-7. Assessment & Mitigation Impacts

The objective of a sound sanitary landfill design and operating practice is to minimize the impact of potentially polluting waste on the surrounding environment and to people living in the landfill's vicinity. The development of Jimma Sanitary landfill, including its construction, operation and management, is associated with a range of potential environmental impacts. The key environmental impacts (negative and positive) identified during this EIA were assessed as minimal, moderate or significant and are summarized in table below.

The key 'negative and positive' environmental issues highlighted in the table below represent the key areas where it is necessary to ensure the implementation of mitigating, management and monitoring measures in order to control these impacts, which are included in the conceptual design of main design report and environmental management plan.

The currently proposed project includes the construction of a sanitary landfill site with leachate treatment system, access road and other ancillary requirement, waste hauling facilities and improvements to the current SWM system to alleviate existing waste management problems.

Potential Impacts and Mitigation Measures

Impact	Potential Significance of Impact	Proposed Mitigation Measures
Loss of land in productive use	Minimal	<i>The increased collection of waste throughout the city will lead to a reduction in land spoiled by illicit waste dumping and littering. On balance, it is considered that the potential impacts will be mostly positive. Disposing of waste is however potentially polluting in a variety of way.</i>
Job Opportunities	Minimal	<i>There may be some employment opportunities for the local inhabitants during both the construction and operation of the site, depending on the required skill profile.</i>

<p>Impacts on Human Health</p>	<p>Minimal</p>	<ul style="list-style-type: none"> ▪ The operational practices advocated for site management and operation are designed, inter alia, to minimize any potential health risks from the disposal of MSW, ▪ Operational Phase Impact on sector workers mitigation plan is proposed.
<p>Impact on Water Resource</p>	<p>Minimal</p>	<p>Construction Phase</p> <ul style="list-style-type: none"> ▪ Care should however be exercised when handling fuel and oil (hydraulic, transmission, engine, etc.) ▪ all earth-moving and other equipment should be in good working condition and well maintained (no leaks) <p>Operation Phase</p> <ul style="list-style-type: none"> ▪ bottom and slope lining of sanitary landfill with clay and HDPE FML ▪ installation of leachate collection and conveyance ▪ leachate treatment system with stabilization ponds and wet land
<p>Odour Impacts</p>	<p>Moderate</p>	<ul style="list-style-type: none"> ▪ Application of daily cover ▪ Periodical venting of landfill gas through leachate collection end pipes ▪ Provision of buffer zone along the facility perimeter fence
<p>Dust Impact (Air Quality)</p>	<p>Moderate</p>	<p>Landfill covering and/or spraying water on the top of the landfill in dry weather conditions in order to reduce the potential for windblown dust, and spraying water over the site roads in dry weather conditions; landscape organization and planting of vegetation in order to hide the works from view from the nearby settlements.</p>
<p>Emission of the exhaust gases from vehicles</p>	<p>Minimal</p>	<p>As there are very few existing traffic movements and a few other air pollution sources in the vicinity of this area, the landfill-related vehicles are likely to generate most of the total emissions. Baseline levels of pollutants are low; the additional emissions from these landfill-related vehicles are highly unlikely to raise the level of air pollutants to an acute level.</p>

<p>Increased traffic</p>	<p>Minimal</p>	<p>Strict traffic regulations should be put in place and traffic signals posted at critical locations along the route and within the plant compound. Bumpers and speed breakers need to be constructed at the approach of, and within the plant compound. The traffic leaving and entering the site should take necessary precaution while leaving and accessing the site.</p>
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ES-8. Monitoring & Management Plan

Finally the project Prepared environmental management and monitoring plan that would assist to incorporate environmental considerations at all levels of project implementation; at design stage, construction stage, operation stage and closure stage of the proposed project taking in to consideration applicable policy parameters. The monitoring matrix is incorporated.

1 INTRODUCTION

Background to the ESIA Study

Jimma town is one of the oldest, largest and commercial centers of the country which is situated in Oromia regional state. Like most towns in the country settlement expansion and increase in number of population is observed in the town. Despite its age old urban history the town, waste disposal practice is still inappropriate and inadequate from environmental and public health protection points of view. There is no proper waste management system for the town at present. Waste is simply dumped at environmentally sensitive locations, and posing pollution impacts and public health treats. Hence, the need for design and implementation of a sustainable and environmentally sound waste treatment facility becomes apparent. .

The current study aims at filling this gap by implementation of a standard sanitary landfill for proper treatment of solid waste generated in the town during the coming 10 years. *The Jimma Municipality is committed to ensuring that waste disposal is conducted in an environmentally responsible way.* This includes ensuring that landfill designers, contractors and operators are aware of the risks landfill poses to the quality of air, water, and land and community amenity.

Land filling is a common treatment and disposal method for municipal solid wastes (none hazardous solid wastes). This has been identified as a preferred technology option for treatment and disposal of solid waste generated in the City. Environmental and Social Impact Assessment (ESIA) study for the landfill project implementation is, therefore, planned to guide and ensure Environmental Compliance of the project activities at all stages (design, construction, operation and closure of the landfill) of the project implementation. TOR requires the consultant to conduct investigations to assess the environmental impact of the construction of the sanitary land fill and recommend mitigation measures as per the guidelines and procedures set out in the Urban Local Government Development Project (ULGDP) Environmental and Social Management Framework (ESMF). That the consultant will prepare the Environmental Management Plan and/or other applicable documents as may be required as per the ESMF.

Environmental and Social Impact Assessment (ESIA) is a basic tool for the sound assessment of development proposals; to determine the potential environmental, social and economic effects of a proposed development. The environmental assessment process supports the goals of solid waste management, environmental protection and sustainable development and helps to; integrate environmental protection and economic decisions at the earliest stages of planning an activity; predict environmental, social, economic, and cultural consequences of a proposed activity and plans to mitigate any adverse impacts resulting from the proposed activity. It also

provides opportunities for the involvement of stakeholders in the review of the proposed activities.

Objectives of the ESIA Study

Environmental & Social Impacts Assessment (ESIA) study is conducted with the intention of incorporating environmental issues and concerns in development projects; so that likely adverse impacts arising from project implementation are identified and mitigation measures are proposed early in the project implementation process.

Solid waste management projects have the primary objectives of ensuring environmental protection and sustainability, both by upkeep of the sanitary conditions of an area and through resources recycling exercises. Improved solid waste management, in densely populated urban centers, is considered as one of the indicators for public health safety, reduced pollution of the surrounding natural resource (water, air and soil) in its premises. This can also be considered as one of the means for tourist attraction to an area and yardstick for preferred habitation.

The overall objective of the ESIA study is to ensure that the intended goals of the solid waste landfill project is met to the satisfaction of the health and safety of the environment and to that of the requirements of both national and international environmental safeguard policies and guidelines.

The ESIA study has the objective of ensuring and supplementing the proper achievements of this overall goal of the landfill project. The ESIA study focuses on two major aspects of the project; one is to enhance the positive impacts expected of the project implementation (i.e. proper and safe waste disposal system implementation), while on the other hand it endeavors to minimize the likely adverse impacts expected to be caused as a result of construction and operation of the sanitary landfill facility.

Methodology of ESIA Study

The ESIA study followed standard procedures as per the ESIA guidelines set by Environmental Protection Authority (EPA), and similar international guidelines.

Accordingly, Data collection, analyses of existing solid waste management practices and its consequential impacts, analyses of alternative sites and site selection for landfill construction, identification of possible impacts due to the project and proposals for mitigation of adverse impacts have been made. Data was collected both from primary and secondary sources; including site visit and site investigation, consultation of relevant stakeholders, review of documents and literature.

2 Policy, Legislatives and Institutional Framework

The implementation of the project should be realized in compliance with the available norms and standards, policy guidelines, legal and institutional frameworks. Projects to be implemented under the (Urban Local Government Development Plan (ULGDP) should adhere to acceptable environmental and social safeguards. The projects should, as far as possible, not result in significant disturbance of sensitive ecological resources. It should not result in involuntary resettlement and land acquisition, and where this is necessary it is minimized by exploring all viable alternatives and where it is unavoidable, compensatory programs are prepared and implemented

In addition, in Ethiopia there are several policy and legal documents that deal with land ownership, land acquisition or expropriation, compensation and resettlement issues. Some of the key documents dealing with issues related to resettlement planning and operations for social impact and livelihood restoration include:

- The Constitution of the Federal Democratic Republic of Ethiopia (FDRE),
- The Civil Code of Ethiopia, Environmental Policy of Ethiopia, Proclamation No. 455/2005 on Expropriation of Landholdings for Public Purposes and Payments of Compensation,
- Proclamation No. 456/2005 on Rural Land Administration and Land Use, and
- Regulation No. 135/2007 Council of Ministers Regulations on the Payment of Compensation for Property Situated on Landholdings Expropriated for Public Purpose

Legal Frameworks

2.1.1 The Constitution

As a supreme law of the land, the Constitution of FDRE is the single most important source of all policies, laws and regulations both at national and regional levels.

The Federal Constitution of 1995 sets out important articles related to Development and Environmental rights.

Article 43 and Article-44 discuss the right to development and about environmental rights as follows:

- All persons have the right to a clean environment.
- All persons who have been displaced or whose livelihoods have been adversely affected as a result of state programs have the right to commensurate monetary or alternative means of

compensation, including relocation with adequate state assistance.

Under Article 92 the constitution discusses about environmental objectives as:

- Government shall endeavour to ensure that all Ethiopians live in a clean and healthy environment.
- The design and implementation of Programs and Projects of development shall not damage or destroy the environment.
- People have the right to full consultation and to the expression of views in the planning and implementation of environmental Policies and Projects that affect them directly.
- Governments and citizens have the duty to protect the environment.

The Constitution also states the following article

- "Land is the common property of the Ethiopian people and cannot be subject to sale or to other means of exchange." (Art. 40.3)
- "Every Ethiopian shall have the full right to the immoveable property he builds and to the permanent improvements he brings about on the land by his labour or capital", (Art. 40.7)
- "All persons who have been displaced or whose livelihoods have been adversely affected as a result of state programs have the right to a commensurate monetary or alternative means of compensation, including relocation with adequate state assistance." (Art. 44.2).
- "Without prejudice to the right to private property, the government may expropriate private property for public purposes subject to payment in advance of compensation commensurate to the value of property.

2.1.2 Federal Level Proclamations

- Environmental impact assessment Proclamation No. 299/2002 is promulgated in December 2002
- Environmental Protection Organs Establishment proclamation No. 295/2002 was provided in October 2002.
- Environmental pollution control proclamations NO. 300/2002 sets rules on control of pollution, management of hazardous waste, chemical and radioactive substances, management of municipal wastes, outlines sectors that require environmental standard, environmental inspectors, incentives, rights to appeal, Offences and penalty.

- Solid waste management proclamation No.513/2007 is issued on 13th February of 2007 to enhance the capacities at all level to prevent the possible adverse impacts while creating economically and socially beneficial assets out of solid waste.
- Environmental Pollution Control Proclamation No 300/2002 has been promulgated in December 2002. The proclamation under Chapter- Tow describes control of pollution, management of municipal wastes, Management of hazardous wastes and under its chapter- three it discusses environmental standards and other relevant issues there off.
- Environmental Impact assessment Proclamation No. 199/2002 is promulgated in December 2002. The primary objectives of this proclamation are to make EIA mandatory for defined Categories of activities undertaken either by the public or private sector. The proclamation under its General provision Article –3, sub article-1 states that without authorization from the Authority (EPA), or from the relevant regional environmental agency, no person shall commence implementation of any project that requires environmental impact assessment as determined in a directive issued pursuant to Article-5 of the proclamation.'
- Article –5 describes projects requiring Environmental Impact Assessment. Any directive provided under sub- article-1 of Article –5 should among other things, determine categories of; a) Projects not likely to have negative impacts and so do not require EIA, b) Projects likely have negative impacts and thus require environmental impact assessment. EIA-Guide lines have been prepared both at Federal & Regional level. These guidelines follow the conventional procedures adopted elsewhere in the world.
- Regarding land tenure issues, proclamations No. 31/1975 and 47/1975 State that land in Ethiopia is state owned. The constitution of 1995 also retained land ownership under the people. It is stated in the constitution that the right to ownership of rural and urban land as well as all natural resources, is exclusively vested in the state and in people of Ethiopia. Buying, selling or exchanging to other means is prohibited, however, tenure rights and leasing of use rights to or from others is ensured.
- The right of private property is guaranteed by the constitution; under Article-40 the right of property, it is stated that every Ethiopian citizen has the right to the ownership of private property. However, the government may expropriate private property for public purposes subject to payment in advance of compensation commensurate to the value of the property.

- Concerning compensation proclamation No. 4/1975 states that government pays compensation for property found on the land, but the amount shall not take into account the value of the land.
- Regional level policies and guidelines are more or less derivatives of the federal policy frame work, but incorporating region specific issues.
- Proclamation No.4/1995 defines powers and duties of the executive organs of the Federal Democratic Republic of Ethiopia. Proclamation No. 9/1995 establishes the Federal Environmental Protection Authority (EPA). EPA prepares environmental protection proclamations and does the federal government approve it.
- Environmental Protection Organs Establishment proclamation No. 295/2002 was provided in October 2002. The proclamation differentiated responsibilities among environmental agencies at Federal and Regional states. By this proclamation the EPA is Re-established as an autonomous public institution at the Federal Government. EPA has among others powers and duties to coordinate measures to ensure that the environmental objectives provided under the constitution and the basic principles set out in the Environmental policy of Ethiopia and the conservation strategy of Ethiopia are realized.
- Article-15 of the proclamation states the power & duties of the Regional Environment Agencies. Powers and duties are also proposed in relation to Zonal, Woreda and community Environmental Coordinating Committees

2.1.3 Land Tenure and Rural land Administration

The Constitution of the FDRE states that the right to ownership of rural and urban land, as well as all natural resources, is exclusively vested in the state and in the people of Ethiopia. Article 40 of the constitution indicates that land is a common property of the nations, nationalities and the people of Ethiopia and shall not be subjected to sale or to other means of transfer.

The right of private property is guaranteed by the constitution; under Article-40 the right of property, it is stated that every Ethiopian citizen has the right to the ownership of private property. However, the government may expropriate private property for public purposes subject to payment in advance of compensation commensurate to the value of the property

Rural land use and Administration Proclamation No.456/2005 describes; the right to hold and use rural land, acquisition and use of rural land, transfer and duration of rural land use right, obligation of rural land users. Restrictions on rural land use (land use planning and proper use of sloppy, galley and wetlands.

Proclamation No. 455/ 2005 specifically promulgated and provided provisions for compensations. Proclamation NO455/2005 discusses on expropriation of land holding, determination of compensation, base and amount of compensation, displacement compensations valuation of property.

Council of Ministers Regulation No.135/2007, Regulation on payment of Compensation for property situated on land holding expropriated for public purposes. This regulation discusses the assessment of compensation for properties, provision of replacement land and payment of displacement compensation.

Relevant Policies

2.1.4 ESMF Urban Local Government Development Project

Financing for the ULGDP is provided by the International Development Association of the World Bank. Participating urban local government (ULGs) and Regional governments will also provide funds to finance ULGDP capital investment projects. The Ministry of Urban Development and Construction (MoUDC) is the agency responsible for overall implementation of the ULGDP.

For ULGDP investment projects that are expected to result in significant environmental and social impacts, an EIA report in the form set by national law and guidelines is required. Jimma sanitary Landfill Project is Schedule-I projects, the RPF provides clear guidelines on how this will be implemented under the ULGDP. An important aspect of the study is to also assess the location and design of the ULG investment project to ensure that there are no alternatives which may minimize or avoid these potential environmental and social impacts. If an alternative is not feasible, then the ESMF requires ULG to prepare an EIA and/or RAP.

The purpose of EIA is to generate sufficient information on significant impacts that enable the preparation of an Environmental Impact Assessment report, which will be used to determine whether or under what conditions a project should proceed.

The ULGDP RPF demands the Environmental Impact Study to involve:

- a) Impact prediction,
- b) Impact analysis,
- c) Consideration of alternatives,
- d) Preparation of management plan (mitigation, monitoring activities),
and
- e) Preparation of contingency plan.

Assessing impacts characteristics is also expected to:

- a) Be carried out with well defined values of significance,
- b) Compare all feasible alternatives,

- c) Document the values and beliefs on which judgments are based, and
- d) Be based on acceptable methodology, research and experimental findings.

Design of mitigation measures seeks to:

- a) Find better ways of doing things,
- b) Minimize or eliminate negative impacts,
- c) Enhance benefits, and
- d) Protect public and individual rights to compensation,

Mitigation options include:

- a) Alternative ways of meeting the needs,
- b) Changes in planning and design,
- c) Improving monitoring and management,
- d) Clauses in construction contracts that mitigate construction impacts,
- e) Monetary and in kind compensation,
- f) Performance bonds,
- g) Replacing, relocating, rehabilitating, etc.

As part of the EIA process, Environmental Management Plans (EMPs) will be prepared and implemented for Schedule 1 projects. Effective implementation of the EMP will ensure that the appropriate mitigation measures have been employed to avoid and/or minimize any potential impacts resulting from the proposed activity.

The RPF also requires the EMP to include:

- A description of the possible adverse effects that the EMP is intended to address;
- Identification of project design alternatives that would meet similar objectives, and a description of why these design alternatives are not viable, especially if they have a lesser environmental or social impact;
- A description of planned mitigation measures, and how and when they will be implemented;
- A program for monitoring the environmental and social impacts of the project, both positive and negative;
- A description of who will be responsible for implementing the EMP; and
- A cost estimate and source of funds.

The RPF also requires Environmental contract clauses to be included in construction contracts.

The EIA and EMP will be submitted to the Regional Environmental Protection Authority – with copies to the BWUD and MoUDC/UDCBO– with a request for approval. The Regional Environmental Protection Authority will review the EIA and EMP and will:

- (a) Accept the document - with conditions relating to implementation;

- (b) Accept the documents with required and/or recommended amendments; or
- (c) Reject the document with comments as to what is required to submit an acceptable EIA and EMP.

2.1.5 Environmental Policy of Ethiopia

The environmental policy Ethiopia (EPE) of the Federal Democratic Republic of Ethiopia was approved by the Council of Ministers in April 1997 (EPA/MEDAC 1997). It is based on the CSE which was developed through a consultative process over the period 1989-1995.

The overarching goal of the EPE is the improvement and enhancement of the health and quality of all Ethiopians, and the promotion of sustainable social and economic development through the adoption of sound environmental management principles. Emanating from mandates given by law to it, the EPA has issued a series of guidelines needed to fulfill its duties. One of the guidelines that is more relevant to the issue at hand is the Environmental Impact Assessment (EIA) guidelines.

The EIA guidelines was issued in 2002 and it is meant to serve as design guide for projects that may entail resettlement activities. Some of the key points of the guidelines that are relevant to issues of involuntary resettlement are summarized below

- *Minimize resettlement as far as possible,*
- *Carry out detailed plans for compensation and resettlement,*
- *Discourage entrepreneurial intervention that might deplete the level of compensation reaching the resettled people,*
- *Develop a long term support program for the resettled,*
- *Encourage public participation and ensure that displaced people are informed about the options and rights,*
- *Provide structures for consultation with the host communities and local government and for conflict resolution,*
- *Select replacement sites with a combination of productive potential,*
- *location advantage and other factors at least equivalent to the advantages of the old site,*
- *Ensure that adequate infrastructure and services are provided in the host*
- *community to meet the needs of the resettled community,*
- *The carrying capacity of the host area must be determined,*
- *Provide people displaced by a project with the means to improve, or at least restore, their former living standards, earning capacity, and production levels,*
- *As far as possible provide land-for-land compensation,*
- *Resettlement must ensure equal rights to women, children and indigenous populations and other vulnerable groups,*

- *Create a long term monitoring system with the establishment of performance criteria.*

The policy has also broad aim of rectifying previous policy failures and deficiencies which, in the past, have led to serious environmental degradation. It is fully integrated and compatible with the overall long-term economic development strategy of the country, known as Agricultural Development-Led Industrialization (ADLI), and other key national policies.

The EPE's overall policy goal may be summarized in terms of the improvement and enhancement of the health and quality of life of all Ethiopians, and the promotion of sustainable social and economic development through the adoption of sound environmental management principles. Specific policy objectives and key guiding principles are set out clearly in the EPE, and expand on various aspects of the overall goal. The policy contains sectorial and cross-sectorial policies and also has provisions required for the appropriate.

2.1.6 Sectoral Policies

Several detailed sectoral environmental policies are currently in various stages of preparation, or are completed and endorsed. Some of the sectoral environmental policies cover:

- Soil husbandry and sustainable agriculture
- Forest woodland and tree resources
- Genetic species and ecosystem bio-diversity
- Water, energy and mineral resources
- Human settlement, urban environment and environmental health
- Pollution from industrial waste and hazardous materials
- Atmospheric pollution and climatic change
- Cultural and natural heritage

2.1.7 Water Resource and Sanitation Policies and Legislatives

Ethiopian Water Resources Management Policy (EWRMP), 1997 deals with the general water resources management policy and different sub sectoral issues; Water supply and sanitation, irrigation development, & hydropower. The policy, under section - 2.2.2 discusses the issue of environment, water shade management and water resources protection and conservation issues.

The policy discusses the sanitation policy under the water supply and sanitation sub sector. The policy among other issues emphasizes the adoption and promotion of affordable and culturally acceptable low cost sanitation technology options, setting of frameworks, coordination of efforts and encouraging involvement of stakeholders both government and non government institutions, the integration of water supply and sanitation, need for setting frame works affirming the inseparable nature of water supply and

sanitation activities and need for decentralized approaches for sanitation projects implementation and management are some of the guiding principles indicated in the policy.

The general policies of FDRE, MoWR, and Ethiopian Water Resource Management Policy 1999 are extracted and summarized below,

- Recognize that water supply and sanitation services are inseparable and integrate the same at all levels through sustainable and coherent framework.
- Promote the "User Pays" principle for urban water supply and sanitation services.
- Promote as far as possible that the development as well as the operation and maintenance of water supply and sanitation systems are carried out at decentralized and appropriate body.
- Ensure efficient and sustainable management of water supply and sanitation system by avoiding fragmented management on one hand and at the same time by avoiding over-centralization of management.
- Create conducive situations for the participation of all stakeholders in integrated water supply and sanitation activities and legalize the same.
- Develop national standards, guidelines and procedures on the different aspects of urban water supply and sanitation.
- Work in partnership with all concerned for water supply, drainage and wastewater master plans in major urban areas and prepare water supply and sanitation strategies in rural and other urban centers.
- Ensure that water supply and sanitation financing is based on established set of criteria that incorporate the relevant factors.

2.1.8 The Health Policy of Ethiopia

The health policy under its articles; Article 3.4 reads developing safe disposal of human, house hold, agricultural, and industrial wastes, and encouragement of recycling. Article 5.3 reads prevention of environmental pollution with hazardous chemical wastes

Public health proclamation No 200/2000 was promulgated by the Federal Republic of Ethiopia on 9th march 2000. The proclamation is meant to promote the participation of the society in the health sector and enforce the objectives of the health policy of Ethiopia. The proclamation under its part –II discusses public health issues including; Food quality control, water quality control, waste handling and disposal, Availability of toilet facilities, control of bathing places and pools etc. The article which deals with waste handling and disposal further elaborates that;

- Any person shall collect waste in a specially designated place and in a manner which does not affect the health of the society.

- No person shall dispose solid, liquid or another waste in a manner which contaminates the environment or affects the health of the society.
- Any solid, liquid and other wastes generated from hospitals should be handled with special care and their disposal procedures should meet the standards set by the public health authorities.

2.1.9 National Hygiene and Sanitation Strategy for Ethiopia

The strategy is set as a road map which leads to 100% adoption of improved sanitation and hygiene in Ethiopia. The 100% adoption of improved sanitation and hygiene is defined from Ethiopia's perspective as the process where people demand, develop and sustain a hygienic and healthy environment for themselves by erecting barriers to prevent the transmission of diseases, primarily from faecal contamination. The strategy paper further elaborates that improved sanitation and hygiene is about erecting physical and behavioral barriers to stop contamination, and emphasizes that the primary barriers have the biggest preventive impacts and concentrate on the safe management of faeces to prevent contact with fields, fluids, fingers, feet, flies and food.

2.1.9.1 National Hygiene and On-site Sanitation Protocol

The protocol is designed to follow the national strategy for universal access (100% hygienic and sanitized households) of hygiene and sanitation. It is primarily concerned with the safe 'On – site' containment and management of human excreta in the domestic, institutional and public context.

The objective of the protocol is described as to improve implementation of the National Strategy for Hygiene and 'on – site' Sanitation improvement at Local Authority level. The protocol gives a clear set of guidelines for all stakeholders promoting Improved Hygiene and Sanitation (HIS), leading to better co-ordination and clearer lines for responsibility at the national, regional, zonal and woreda (district) levels.

- ❖ Strengthen the integration of all programs with an HIS components within woreda development plans and the health extension services program.
- ❖ Provide the basis for a comprehensive budgeting and investment framework
- ❖ Improve sector co-ordination with all HIS stakeholders working from one set of guidelines
- ❖ Define minimum standards and a framework for information management and monitoring to ensure adequate sub sector performance evaluation.

The protocol will be applied in all aspects of Hygiene and sanitation promotion. It will ensure that all development partners and NGOs adhere to

the protocol when promoting improved hygiene and 'on-site' sanitation in each locality.

The protocol is a simple eight step guide to the improved Hygiene and on -site sanitation program cycle. These steps are to be followed by all those engaged in promoting Hygiene and on –site sanitation improvements in Ethiopia. The eight steps are briefly outlined as Step; 1) Participatory situation analyses, 2) Advocacy, 3) Inter-sectoral broad based planning(reflecting mandates), 4) Human resource development, supervision, reporting, 5) Financing Improved Hygiene and Sanitation, 6)HIS promotion, empowerment and enforcement, 7) Access to hardware for latrines and 8) Monitoring and evaluation linked Information management system

2.1.10 International Conventions, Safeguard Policies & Guidelines

There are several international conventions and guidelines regarding environmental protection, water and sanitation issues. Some of those include;

Agenda 21 of the United Nations Conference on Environment and Development has underlined the importance of conserving and protecting the natural resource base and pollution abatement measures.

The European Union EIA guide requires landfill disposal projects to be subjected to environmental analysis, as they are likely to cause significant environmental impacts.

The World Bank environmental guideline requires and categorizes land fill projects is subjected to full scale EIA, for projects funded by the bank. The African Development bank also puts similar requirements.

2.1.10.1 African Charter on Human and Peoples' Rights

The charter was adopted in June 27, 1981 and affirmed that equality of all human beings to be respected and practically recognized.

The Human Rights Council also made an important legal statement: "Emphasizing that international human rights law instruments, including the Covenant on Economic, Social and Cultural Rights, the International Convention on the Elimination of All Forms of Discrimination Against Women and the Convention on the Right of the Child, entail obligations in relation to access to safe drinking water and sanitation." This statement clearly indicates that all governments are bound by human rights obligations to ensure access to safe drinking water and sanitation for all.

The charter reiterates that Recognition of the right to water and sanitation is a useful resource for governments and civil society. It is therefore, absolutely necessary to support words with actions, and to mobilize the expertise and independence of United Nations human rights bodies in support of implementation.

2.1.10.2 World Bank Safe guard Policies

There are 10 safeguard policy frameworks set for projects financed by the World Bank fund, and are required to be met as regards to environmental and social safeguards. These include; OP/BP 4.01 Environmental Assessment, OP/BP 4.04 Natural Habitats, OP/BP 4.36 Forests, OP 4.09 Pest Management, OP/BP 4.11, Physical Cultural Resources, OP/BP 4.10 Indigenous Peoples, OP/BP 4.12 Involuntary Resettlement, OP/BP 4.37 Safety of Dams, OP 7.50 Projects in International Waters, OP 7.60 Projects in Disputed Areas

Institutional Set up

The Federal Democratic Republic of Ethiopia (FDRE) has two levels of administrative structures, Federal level Government and regional governments. There are nine regional governments under the Federal Government. Roles and responsibilities of governments at different levels (Federal, Regional, and Zonal & Woreda) have been defined by the constitution and proclamations Nos. 33 of 1992, 41 of 1993 and No. 41 of 1995. Under these proclamations, duties and responsibilities of regional states are included. The regional states are structured as regional administration, zonal, Woreda and Kebele/ Peasant Associations (PAs) Urban centers have city administrative structure and municipalities.

The Jimma Sanitary Landfill Project shall be implemented in The Oromia Regional Government, Jimma City Administration.

Environmental Protection Authority (EPA)

The EPA was established under proclamation No. 9 of 1995 with the responsibilities of environmental development and management as well as environmental protection. The proclamation states that EPA shall prepare directives and systems necessary for evaluating the impact of social and economic development projects on the environment, follow-up and supervise their implementation.

EPA has prepared a guideline "Institutional Responsibilities for implementation of Environmental Policy of Ethiopia". The guideline has identified responsible institutions for implementation of the policy issues, area of responsibilities and the role of EPA in the implementation process. It further explains that the policy is to be implemented at all levels of the government and by the people, including people's organizations, religious organizations, NGOs and the private sector.

Regional Environmental Authorities are being organized to deal with their share of responsibilities at regional level.

The Jimma City Administration Environmental and Land Administration Office are responsible at local government level.

And, Finally the UDCBO has also responsibilities as per the ESMPF

Accordingly, several stakeholder institutions are taking part in the sanitation service of town. Including;

- Federal Environmental Protection Authority
- Oromia Environmental Protection Bureau
- Urban Development Capacity Building office
- Jimma City Administration and its various organs
- Jimma Sanitation, Beautification & Parks Development Agency
- Jimma town Health Bureau
- Jimma Town and Mana Woreda Administration
- Environment and land administration offices

3 The Project Description

General

This chapter presents a short description of the current solid waste management system and establishes rationale to briefly describe the proposed project components for solid waste management sanitary landfill.

The current solid waste management situation in Jimma, as well as in the entire country, is characterized by poor solid waste managing practices, which endanger the human health and the environment. The solid waste is collected in an organized manner only in central areas accessible for vehicular truck. There is no organized method of waste collection in the rural areas. There is no separate system for the collection of dangerous waste. The frequency of waste collection is not determined by needs, since it depends on the capacities of the municipal services. There are no sanitary landfills, only open dumpsites for the disposal of municipal waste along Bonga road.

Existing Solid Waste Management System

3.1.1 Overall Management System

The solid waste management of the city is run under Sanitation, Beautification and Parks Development of the City Administration. As per the information of this office, there is a well established organizational set up to follow up and control the proper solid waste collection both at house hold level and centrally, to create awareness on the principles of waste segregation in to degradable organic and none degradable material, storing and recycling of the waste for reuse. The staffs are located centrally at City Manager's office and at each Keble's of the city.

The existing solid waste disposal facilities are inadequate to manage the huge volume of waste generated by the city residents. Sanitation and Beautification and Park Development Work Process is the responsible for the solid waste management. However, the Agency's effort to collect the waste from source of generation is limited to the city center accessible for vehicular truck. The uncollected wastes and improper disposal mechanism results in sanitation-related diseases as per the ToR and Jimma Health Bureau sources; thus the city health institutions and facilities face the challenge of controlling the sanitation borne diseases.

Uncollected and improperly dumped solid wastes observed on the street side ditches, causing nuisance to the city residents and sometimes create problems by clogging drainage manholes. This resulted in overflowing and damage of roads built with huge investments.

The solid waste stored in sucks is house to house collected at intervals of three days, and directly transported for disposal at Koshe on Bonga road some 4km in the southwestern part of the city. The road side skips for solid waste storage

are causing odor nuisances and urban environmental pollution, as the skips are not regularly emptied on time and residents continue to dump waste in open fields around the skips.

Moreover, most of the municipal solid waste is dumped by the banks of the streams in the town like Awetu and Boye. The major pollution sources are solid wastes dumped into the river from households, commercial areas and slaughter house. Defecating on the bank of the river, connecting septic tanks, toilet, and other effluent pipes directly to the river courses are some of the major pollution sources. Boye dam is also another challenge for residents. On top of its bad smell which exacerbates the asthmatic problem, it is a cause for malaria infestation and other water born diseases.

The brief summary of existing solid waste management is presented below, detail and comprehensive review of existing solid waste management could also be referred from Volume-I: Draft Design Report of this study document.

The solid waste management system involves planning of solid waste storage, collection and transportation, and disposal practices. Solid waste management in Jimma is not well organized and executed. There are a chain of malpractices and problems that tangled the urban sanitation; with inappropriate practices from house hold storage, municipal skip transfer and storage, collection and transfer to disposal in dump site.

Primary Waste Storage

The solid wastes generated by different group of city residents are stored temporarily in the back yard with plastic bags and sometimes in open spaces along streets sides, gullies, drainage canals etc. similarly, commercial establishments, governmental and non-governmental institutions, temporarily store waste of different composition in their backyard before transferring to communal skips in their vicinity. Some of the most common source of solid wastes in the city has been visited to study the solid waste management practices.

There is no waste segregation at every level of the waste cycle in Jimma, and wastes of all categories are stored and disposed together.

Collection and Transfer

The collection and transfer of solid waste of all kinds generated by different group of city residents is the task of the Sanitation and Beautification Unit. The wastes from domestic, commercial, and institutional sources are collected by the agency through skip truck to be transferred to dump site located on Bonga road.

The current collection and transportation of solid waste is limited to residential and institutional establishments in the center of the town, it is also limited to

places and institutions accessible to municipal vehicles and animal driven carts.



Figure 3-1: Skip Turned Up-side-down by nearby Resident

It is reported that, each truck makes 6-8 trips/day depending on its relative location to disposal site. The collection and transfer activity are inadequate with the magnitude of waste generated in the city, and this resulted in spilling over of almost all the skips and accumulation of rain in open skips that facilitate the generation of leachate in the transfer skips; this practice not only causes environmental pollution and public health hazard, but also causes rusting of containers that result in early damage of skips.

Almost all the skips in the city were full during the preliminary site visit, the following picture shows a skip in the municipal office left uncollected for several weeks, and the waste formed a leachate swamp in the skip that causes eye irritation and offensive odour for the passerby.



Figure 3-5: Solid Waste Skip filled with waste and leachate waiting to be emptied inside the municipal office

Waste Disposal

The solid waste collected both by the municipal truck openly dumped at south eastern part of the city near the Jimma Airport on Bonga road. The dump site is located at about 4km from the city center. The municipal trucks dispose waste both to the right and left side Bonga road over a length of several hundreds of meters.

During dry season the trucks go off road some hundreds of meters, whereas; during rainy season the trucks hardly go off roads; rather dump their load along the road left and right. It is also reported that some farmers request for wastes to be dumped on their farmland as fertilizer and soil enhancement.

The windblown waste is scattered all over the site and some light plastics and papers might travel back all the way to the town, while ashes and fine sand is blown in the area. In addition, both human and animal scavengers have been observed on the disposal site. The Scavengers operates under critical health hazard conditions, the following pictures shows the scavengers rushing to get hold of material of any salvage value. Most of the scavengers collect charcoal for firewood.

The waste is carried downstream during rainy season by the river stream and may cause both environmental and human health problems. The problem is more sever considering the main drainage of the area is along the Awetu and Boye streams.

3.1.2 Impacts of Existing Waste Management

I. Health Impacts

Waste scavengers are in a worse situation, since they sort through the waste materials in subhuman conditions and without any kind of protection. Because of their precarious socioeconomic status, they are usually lacking in basic services —water, sewerage, and electric power— and often suffer from chronic under nutrition.

They are also more likely to suffer from gastrointestinal disturbances (parasitic, bacterial, or viral) than the rest of the population. Furthermore, they show higher injury rates than industrial workers. Such injuries occur to their hands, feet, and back, and may involve cuts, wounds, blows, hernias, and damage to the skin, teeth and eyes, respiratory infections, etc. Frequently, these health problems cause disability.

Scavengers may become vectors and potential transmitters of health problems to the people they are in contact with.

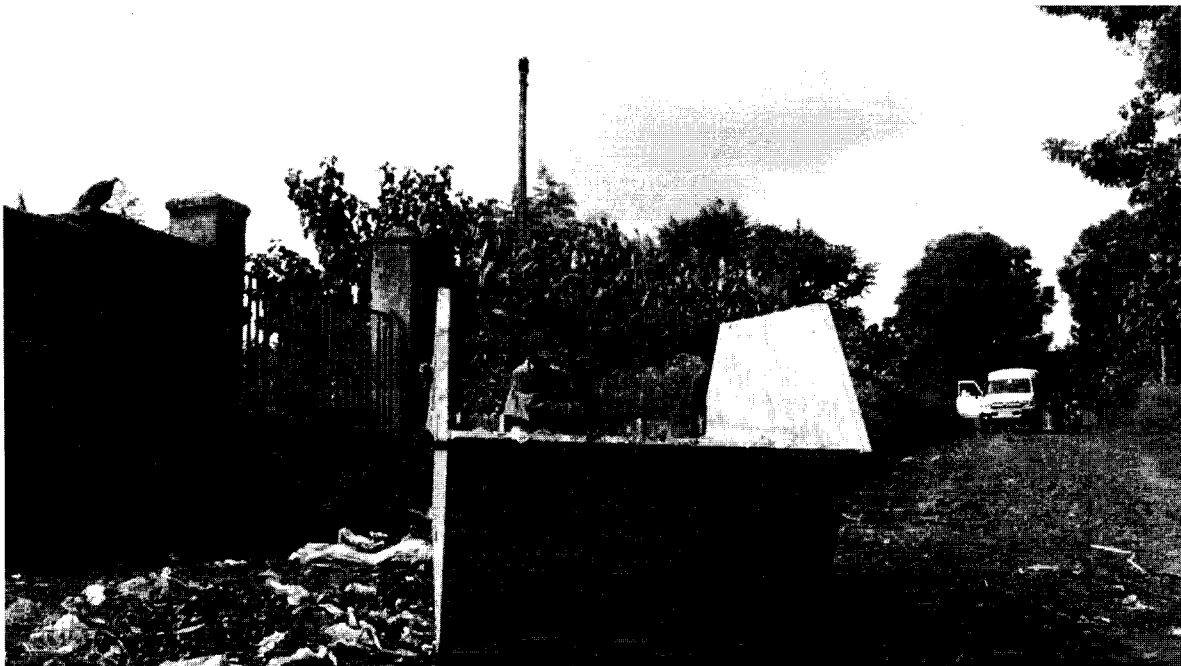


Figure 3-2: Scavengers Collecting on skips at center of town

II. Water Pollution

The most serious impact on the environment, although perhaps the least apparent one is the pollution of surface waters and groundwater. Water pollution is a result of people's throwing garbage into the nearby rivers and streams, and it is also due to the leachate produced by the decomposition of solid wastes in open dumps.

Polluted water affects the life of plants, animals and human beings. It also reduces such activities as cleaning, drinking, domestic use, swimming and

fishing. Such waters have some simple indicative signs such as bad taste of drinking water; offensive odours from lakes, rivers, and ponds; unchecked growth of aquatic weeds in water bodies; decrease in number of fish, size of water bodies and oil and grease floating on water surfaces are some of the indicative signs.

In Jimma City, rivers like Aweytu, and Kito are polluted from different sources. There are different pollution sources like washing of clothes along the river courses and taking baths which discharges detergents to the rivers. The other major pollution sources are solid wastes dumped into the river from households, commercial areas and slaughter house. Defecating on the bank of the river, connecting septic tanks, toilet, and other effluent pipes directly to the river courses are some of the major pollution sources. Untreated waste water from slaughter house and diesel stations is also discharged directly into Aweytu River. Boye dam is also another challenge for residents. On top of its bad smell which exacerbates the asthmatic problem, it is a cause for malaria infestation and other water born diseases.



Figure 3-3: Waste Dumped in to Aweytu River at the Center of town

III. Soil Pollution

Another visible negative effect of open dumps is the aesthetic deterioration of villages in the town, and the consequent devaluation both of the land where the garbage dumps are located, and the surrounding areas. The pollution or poisoning of soils is another of the harmful impacts, because of the varied nature of substances disposed of in the dumps.

IV. Air Pollution

Solid waste disposal in open dumps deteriorates the air quality near the dump site: the smoke from burning waste reduces visibility; wind-borne dust during dry seasons may convey harmful microorganisms that cause respiratory

infections, and nose and eye irritation; the permanent bad odors are a serious nuisance factor.

V. Risk to Urban Development

Open dumps are often located in areas where the poorest members of the community live, compounding the deterioration of all conditions, and in consequence causing property prices to drop, and jeopardizing the development of the town or city.

Inadequate and inefficient MSW disposal also results in the deterioration of border urban ecosystems such as agricultural land, recreational areas, and places of interest. The local flora and fauna are affected.

VI. Risk to Aviation

The Jimma solid waste disposal practice and its proximity to the Airport have been considered a series air safety risk. The Airport Administration repeatedly requested the City Administration not to dump solid waste in the area. As per the Air Safety standard no solid waste disposal facility should be located with 4km radius, and written approval is required between 4-8km radius.

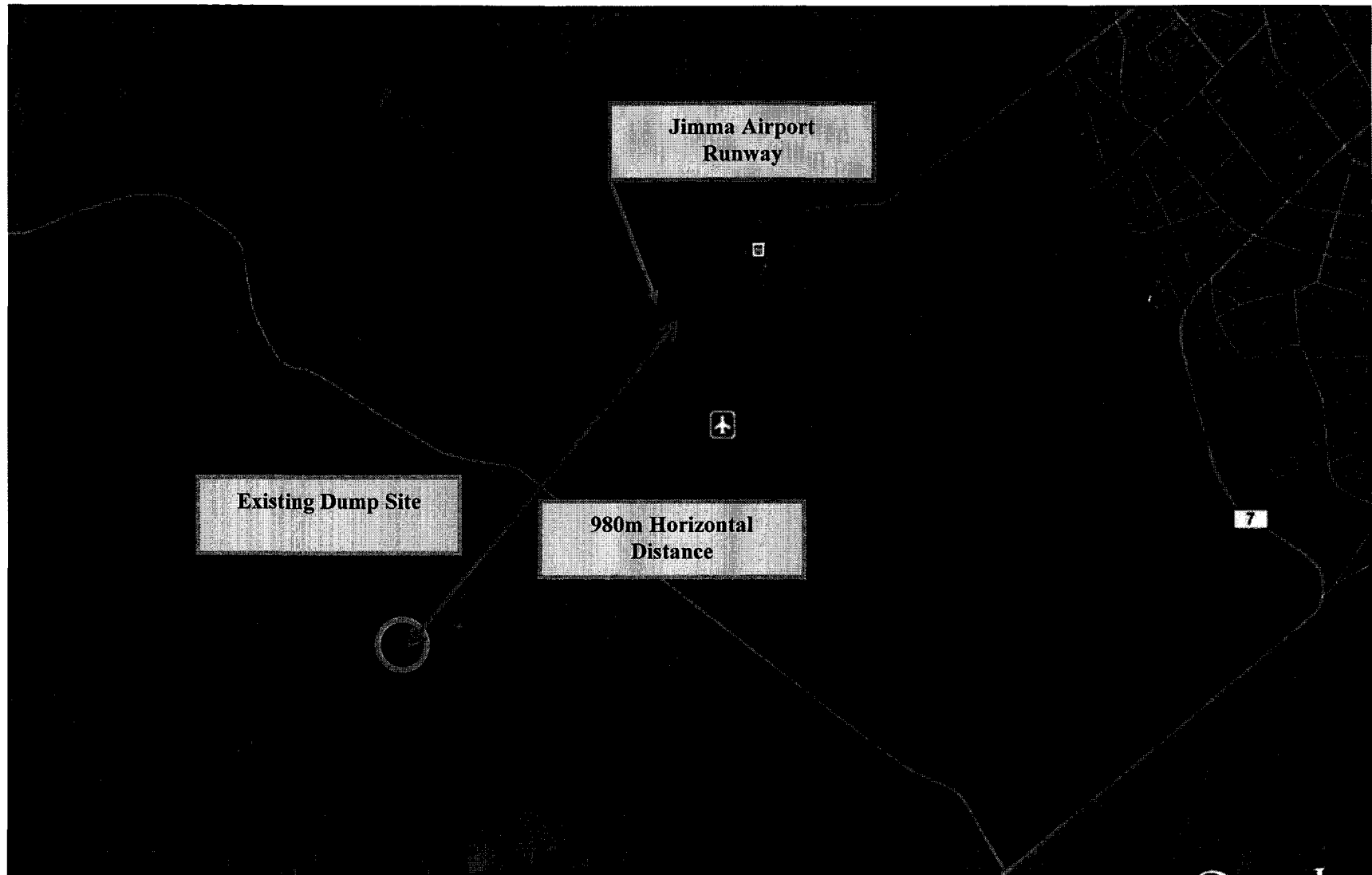


Figure 3-4: Existing Dump Site close to Jimma Airport

3.1.3 Conclusions on Existing Waste Management

In general, the existing solid waste disposal facilities are inadequate to manage the huge volume of waste generated by the city residents. Sanitation and Beautification Work Process unit is the responsible organization for the solid waste management. However, the agency's effort to collect the waste from source of generation is limited to the city centers accessible to vehicular truck. The uncollected wastes and improper disposal mechanism results in sanitation-related diseases; thus the city health institutions and facilities face the challenge of controlling the sanitation borne diseases. In addition, huge amount of government and public money is diverted in vain to tackle these problems. According to the reports from City health institutions, sanitation borne disease is among the ten top diseases in the town.

The solid waste management system is totally under resourced and under financed, leading to inadequate waste collection and transfer facilities and improper disposal pattern that pollute urban environment and public health. The prevalent poor waste management system, lack of adequate facilities and low level of community awareness and participation, need immediate action if resulting health problems of illness and death from diarrhea, intestinal parasites, and malaria and subsequent retardation of growth and development of the town is to be avoided.

3.1.4 Composition and Volume of Waste

A study by Jimma University and K.U.Leuven Department of Chemical Engineering on Municipal Solid Waste Management in growing Urban Areas in Africa, Current Production and Practices in Jimma found out that 87% of solid waste in the city is generated by households and 13 % by commercial and other institutions, while negligible fraction of 0.1% is generated by street sweeping.

The Study by Jimma University and K.U.Leuven concentrated on the biodegradable waste composition that is reported to be 54% by weight and non-biodegradable and miscellaneous account for 34.4% and 14.4% respectively. The moisture content is reported to be 60%.

The annual volume of waste expected to be generated annually over the next 10 years is a daily average of 47,437.25kg.

The Proposed Solid Waste Sanitary Landfill Project

3.1.5 Brief Description of Landfill Project

These huge volume of solid waste generated by ever increasing urban population and economic activity needs to be properly dealt with, towards achieving these; a solid waste management system that is relevant to community under consideration, in view of capital cost requirement and operation and management simplicity have been proposed. To conclude, an Integrated Solid Waste Management System that consists of a series of activities linked with the control of waste generation, segregation, presentation, storage, collection, hauling, sweeping, treatment, and final disposal have been analyzed and proposed. Accordingly the following are recommended as an Integrated Solid Waste Management System. Appropriate applicable technologies discussed, and opportunities towards implementing the technology are also shown in the Main Design Report. Thus, the very basics from public involvement that are crucial for waste segregation and source minimization, recycling and composting of waste, and ultimate disposal to landfill are proposed as an ISWM plans.

The sanitary landfill, being the ultimate disposal facility, its design and operation needs to comply with health and environmental safety requirements. The very basics of these criteria depend on locating the facility in a way that minimizes, all the impacts associated with landfill construction and operation.

The planned sanitary landfill project is to enable improvements in the current problems related to waste disposal practices of the town. The project to be implemented should enable reduce the adverse impacts posed both to the natural environment as well as to the socio-economic environment of the town and its environs. To this end, the current project focuses on provision of properly located, designed and constructed sanitary landfill, which can be easily managed and operated by the available local skilled and unskilled manpower.

Landfills are a mechanism for effectively treating and disposing of those wastes which, at the present time, it is neither technically feasible nor economically viable to avoid, re-use, recycle or reprocess

Solid waste treatment in landfill involves both physico-chemical and biological processes. The solid waste has to be sorted out into hazardous and non-hazardous material before receiving for treatment.

The solid waste dumped is compacted in layers, followed by soil cover for every cycle. The covered waste pile is then left to decompose and stabilize.

The land filled waste undergoes five distinct phases of decomposition as either aerobic or anaerobic decomposition. In the process of decomposition several gaseous products are generated as Carbon Dioxide, Methane, Nitrogen and hydrogen that escape into the atmosphere. Also some carboxylic acids like acetic acid, Butric acid are generated and get out along with the leachate generated.

3.1.6 Environmental requirement of Landfill projects

There are five principal environmental management techniques which have to be considered during implementation of a landfill project in order to achieve the best environmental outcome:

- Site selection - an appropriate location will have natural barriers and buffer distances to help reduce environmental risk
- Design and construction - including all aspects of the design and construction of the landfill and associated infrastructure
- monitoring - including all performance and quality monitoring and reporting of air, water, noise and waste
- Site operations management - including all operational measures required to manage a landfill in an environmentally acceptable manner
- Remediation and post-closure management - including the measures needed to minimize the impact of closed landfills and ensure the beneficial use of landfill sites after closure.

It is important to realize that environment protection is achieved through a combination of good planning and an integrated and thorough approach to design, operation and management. There is no substitute for selecting an environmentally sound site and adopting ongoing management measures to protect the environmental integrity of the site. Appropriate site selection for landfill operation is, therefore, very essential for safe and sound environmental protection endeavors.

3.1.7 Analysis of Alternative Sanitary Landfill Sites

Proper landfill site selection is the fundamental step in sound waste disposal and the protection of the environment, public health and quality of life. Proper landfill site selection determines many of the subsequent steps in the landfill process, which, if properly implemented, should ensure against nuisances and adverse long-term effects. For example, a well-selected landfill site will generally facilitate an uncomplicated design and provide ample cover material, which would facilitate an environmentally and publicly acceptable operation at a reasonable cost.

Therefore, the general objectives of landfill site selection are to ensure that the site to be developed is environmentally and socially acceptable, and thus sustainable. Thus, landfill site selections are technical, but often include environmental experts and criterion.

The criteria involved in landfill site selection include environmental, economic and socio-political criteria, some of which may conflict. With increased environmental awareness, legislations and certain other developments over time, the landfill site selection process has become much more sophisticated, as new procedures and tools have been developed. In selecting the landfill site

3.1.7.1 The Generic Site Selection Process

The selection of a new landfill site is critical to minimizing the impact of a facility on the environment. Careful selection will minimize the design and operational controls required to ensure environmental protection of the site and surrounding environments. By selecting the most suitable site, the impact of the facility on the environment can be minimized, as can operational and rehabilitation costs.

It is important that any potential landfill sites identified are assessed against standard criteria. The following section provides criteria and the minimum acceptable standards considered in the site selection process.

We have considered in early site selection, technical process that the size (land area) and the strategic location of the proposed site, to ensure that the facility meets the disposal need. While the size depends on the waste stream over the predicted site life and provision for sufficient buffer zones, strategic location is determined by the waste generation areas to be served and transport routes. It is economically sound practice to establish the proposed facility as close to the generation areas as possible, with a view to minimising transport costs. An economic radius of 8km is determined, based on the existing or proposed mode of waste transport along main roads from the city. This will define the initial area of investigation.

Once working in the study area, the next phases are the elimination of all areas with associated Fatal Flaws. In this instance, Fatal Flaws are defined as phenomena that prohibit the development of an environmentally or publicly acceptable waste disposal facility except at excessive cost.

Once the economic radius and study area has been identified, a stakeholder participation process have been initiated by the consultant and maintained throughout the site selection process among the Consultant, Municipal officials and Rural Administrations where prospective site is identified.

After potential and candidate sites have been identified, they have been compared and technically evaluated. Unsuitable sites eliminated and the best sites short listed for further consideration. The short listed sites are then ranked in order of suitability. The ranking process is, however, controversial and is often open to criticism because it may be seen as subjective, which in some instances is the case.

The top-ranking site is then subjected to a more detailed investigation to confirm that it has no Fatal Flaws and is environmentally and publicly acceptable. The site feasibility study comprises many administrative and technical aspects. However preliminary investigations as well as a preliminary Environmental Impact Assessment (EIA) were also considered by the study team. The site selection and feasibility report was initially submitted to Jimma City Administration as part of the Inception Report.

Then following approval of the proposed site among alternatives evaluated by the authorities, further detailed investigations were undertaken. These involve detailed Geotechnical and Soil Investigations, a detailed Environmental and Social Impact Assessment (EIA), and a detailed design. There are no Fatal Flaws encountered in the detail investigations, therefore, the site would be developed for the envisaged project.

The comparative analysis of alternative sites is presented in this section while detail geotechnical and

3.1.7.2 Location of Prospective Sites

Four potential sites were looked for in all possible direction of the city. The possible sites were assessed on Addis Ababa road, Agaro Road, and Bonga/Seka roads. The site along the Seka and Bonga road is rejected at preliminary stage due to the requirement to place the site at about 8km from Jimma international Airport, that is already located about 4km away from the town center, and this will result in long haul distance which in turn increase operational costs. Accordingly two sites along Jimma-Agaro road and, one site proposed by municipal staff along Addis Ababa road were considered for detail evaluation and investigation. Site 1&2 are located along Jimma-Agaro road. **Site -1: Ela-Dare, Site -2: Gudeta Bula, Site-3: Beda-Buna/Sombo** were visited and assessed for their suitability. Accordingly, their respective technical, social and environmental characteristics were recorded as follows.

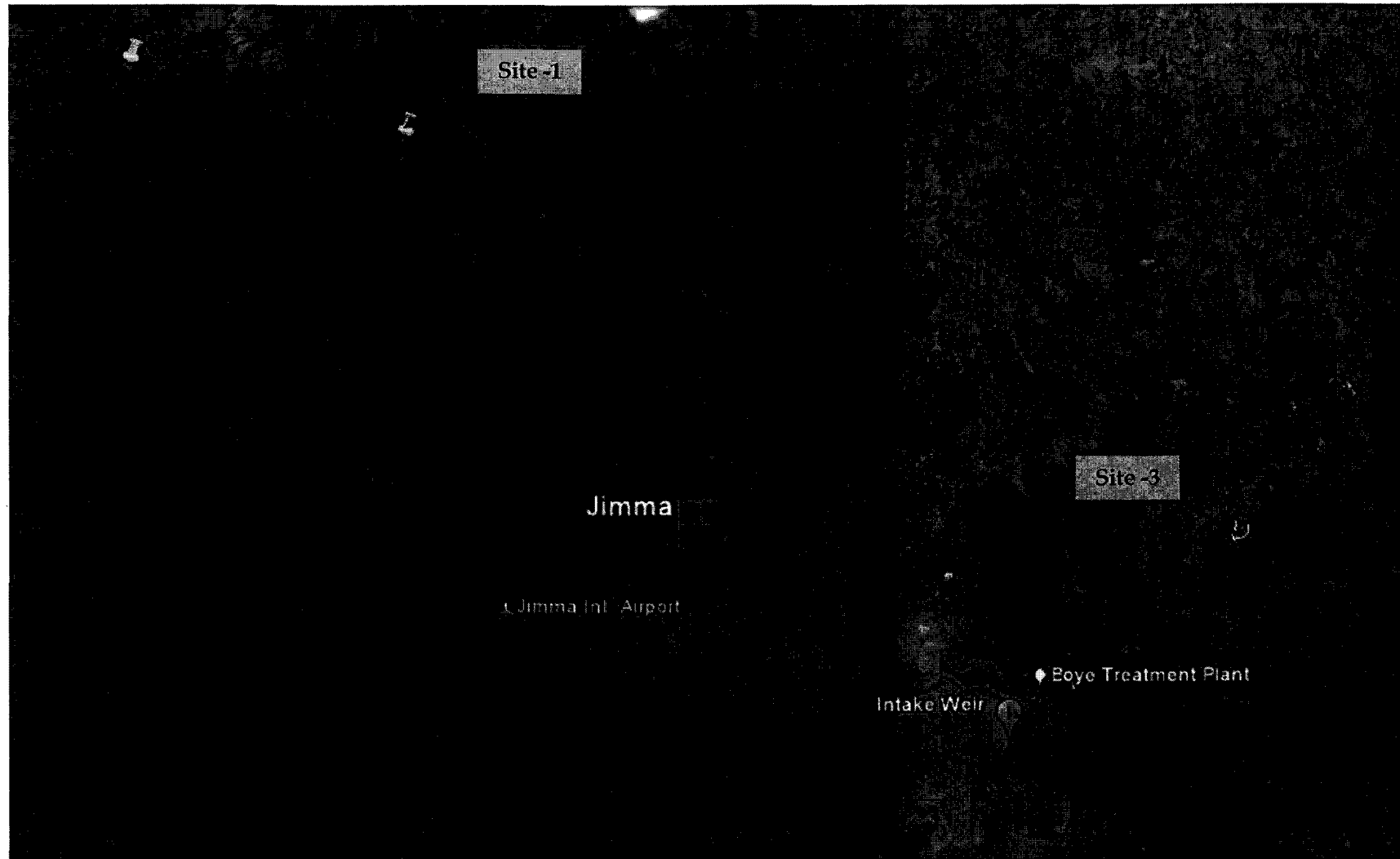


Figure 3-5: Location of Potential Alternative Sites

As per our observation, and site selection requirements the following advantages and disadvantages are evaluated and recommendations suggested on the suitability of each site for the solid waste management project.

Basically the objective of having the treatment system is ensuring public health and environmental safety; in addition the site should be as economical as possible. Thus Treatment plant sites should be located as far as practicable from any existing commercial or residential area or any area that will probably be developed within the plant's design life. The site should be separated from adjacent uses by a buffer zone and provided with ample area for any foreseeable future expansion. Plant outfalls shall be placed so as to minimize impacts on commercial and recreational area, and public water supply intakes. Thus we will evaluate the suitability of the proposed treatment plant site with respect to these parameters,

- Site life and size
- Location in relation to waste generation center
- Topography
- Surface water and susceptibility of flooding
- Soil type
- Geology
- Ground water
- Site proximity and accessibility
- Land use in the area
- Public health and safety,
 - Noise (Offsite Impacts)
 - Visual Aesthetics
 - Air/Air Quality
 - Bird and Animal Control
 - Buffer Zone

Therefore, the following discussion describes the sites compliance with the above criteria,

Site-1: Ela-Dare

- The Site is located in Mena Woreda, Gudeta-Bula Rural kebele
- The site is located at about 7km along Jimma-Agaro asphalt road some 100 meters off to the right side in front of DMC Construction main camp.
- There site is currently a farmland and require compensation for resettlement and farm land is expected
- There is sufficient land for envisaged project and future expansion
- The Site topography and slope allow for development of sanitary landfill by the area and trench method, this minimize earthwork and allow leachate collection by gravity,

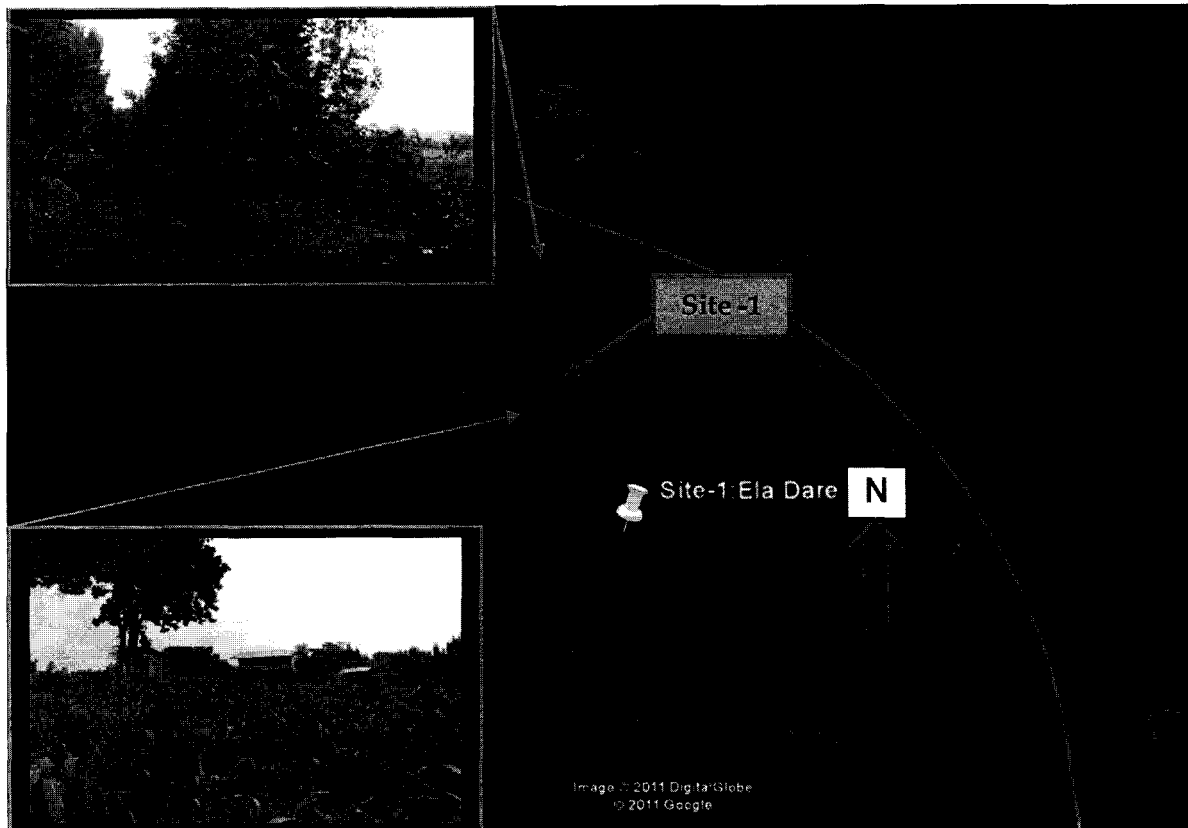


Figure 3-6: Site-1 location and existing structures

- The site is away from residential and commercial centres, if farmers are compensated
- The Eucalyptus trees to the north of the site provide sufficient buffer and forms a natural barrier between the main highway and site, but compensation should be settled for owners
- Existing Land use is cultivated crop field where maize is mainly grown.
- The western and south-western part of the site is covered with indigenous natural forest
- No settlement is found in the proximity of the proposed site,
- No water source in close proximity of the site were identified during preliminary assessment
- No dense vegetation cover within the plot limit is expected to be removed.
- Electric poles pass through the north corner of the facility, this might limit site efficiency but there are sufficient areas to compensate for this
- There is a dynamite store on the site owned by DMC, but this is a temporary facility that might be expected to be demobilized before construction of the facility, in case it lasts beyond, the municipality should provide alternative sites,
- The site is located in the direction of proposed liquid and solid waste management facility by the Structural Plan of 2008, but we were un able verify if it is the same site referred by the master plan.



Figure 3-7: Land Use and Crop grown on the site



Figure 3-8: Crop and facilities on the site

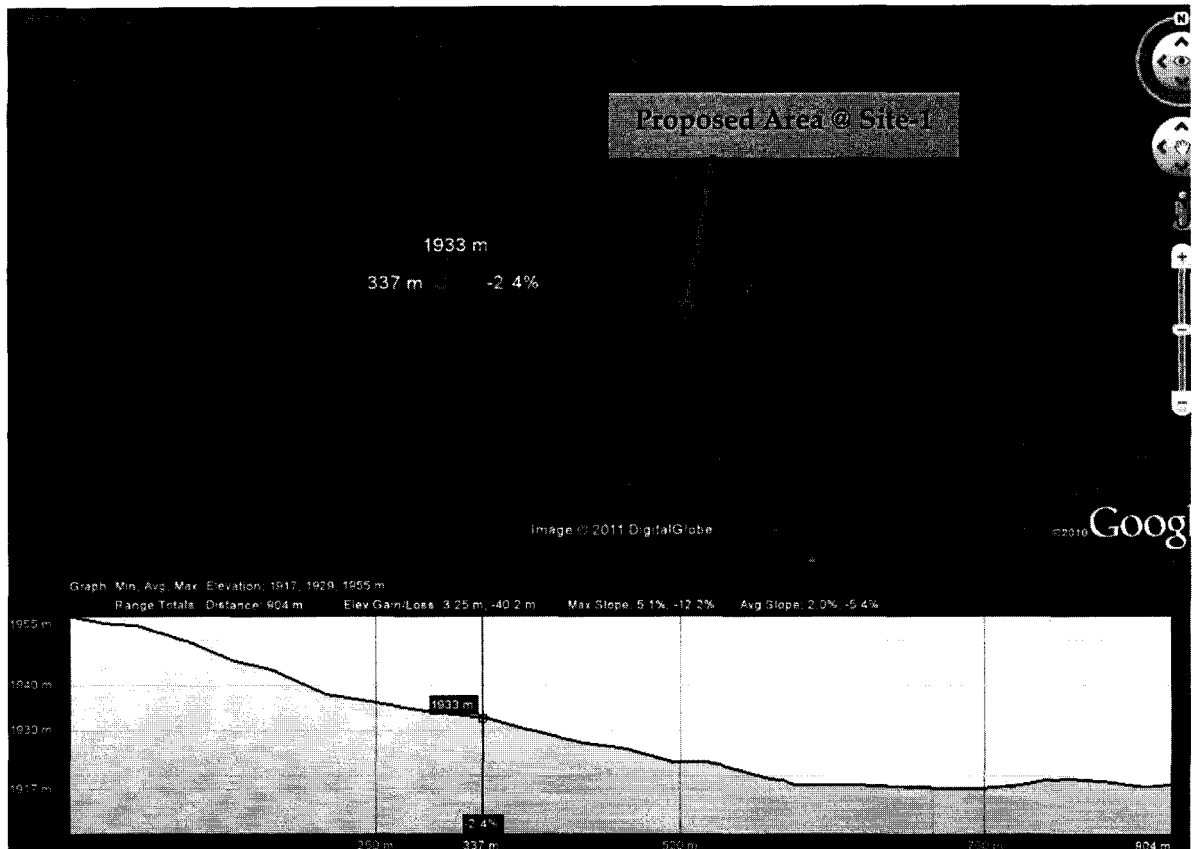


Figure 3-9: Topography and ground slope along North-South direction

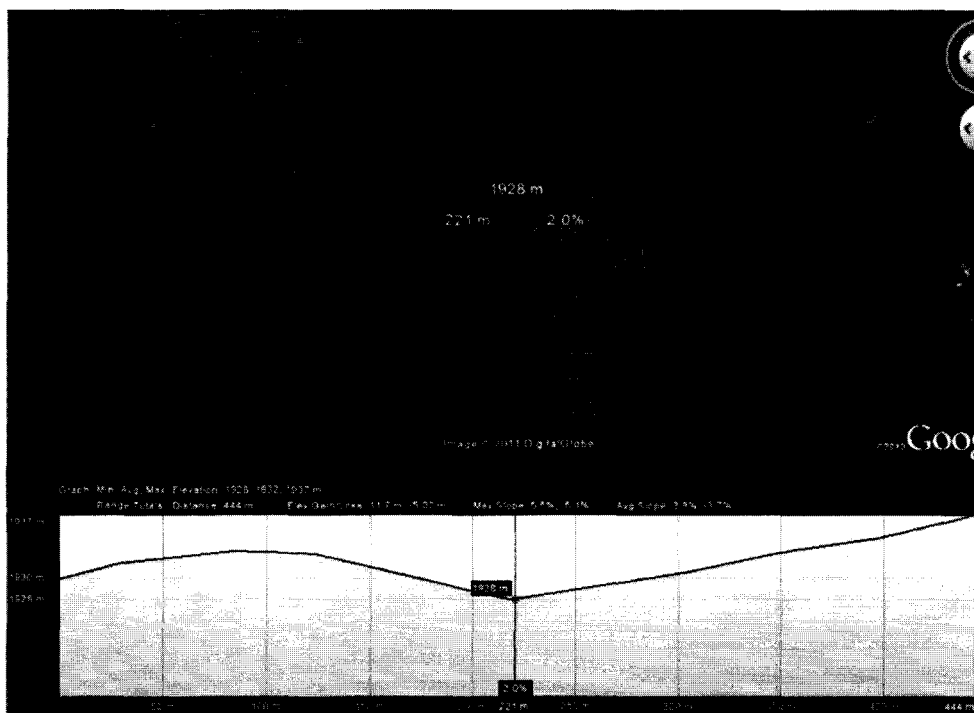


Figure 3-10: Site Slope along East-West with saddle at center

Site-2: Gudeta-Bula: located close to Lime Junction

- The site is located at about 11km along Jimma-Agaro asphalt road some 300 meters off to the right side just before reaching Mazoria
- There site is currently a farmland and require compensation for resettlement and farm land is expected
- There is sufficient land for envisaged project and future expansion
- There is sufficient land for the envisaged project
- The site topography is less favourable due to steep slopes that will result in heavy earthwork and slope stabilization works
- The Eucalyptus trees to the around the site provide sufficient buffer and forms a natural barrier between the main highway, the community and the site,
- The major land use is cultivated crop field and animal grazing ground.

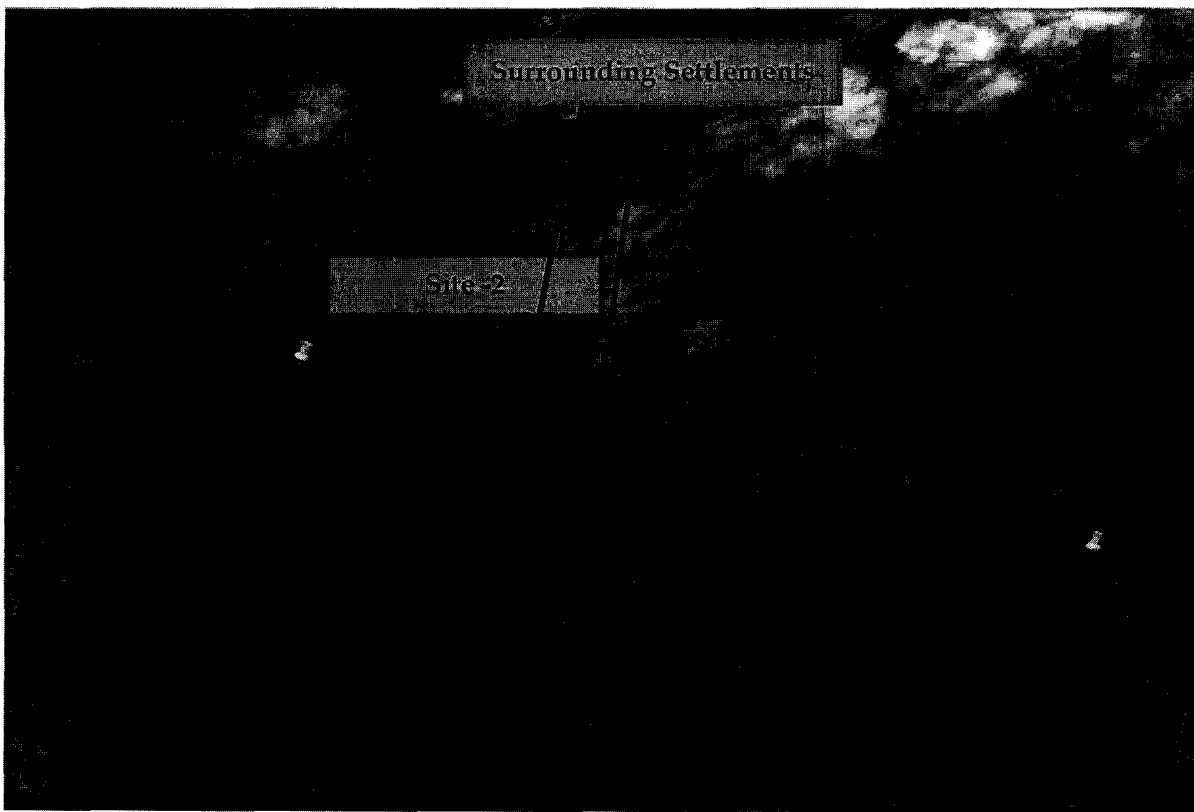


Figure 3-11: Location of Site-2 and settlements

- It is surrounded by houses and population settlement, and this will result in settlement encroachment and might restrict expansion of peripheral settlement to converge together
- No perennial river or stream in close proximity
- The site needs travelling of about 11km on main highway and results in higher operation and running costs, with the escalating fuel price travel distance is main factor.

- The site is located in the direction of proposed liquid and solid waste management facility site by the Structural Plan of 2008, but we were unable to verify if it is the same site referred by the master plan from the land use map, the description of the site resembles this site.
- The site is less suitable due to settlements, steep slope and longer travel distance

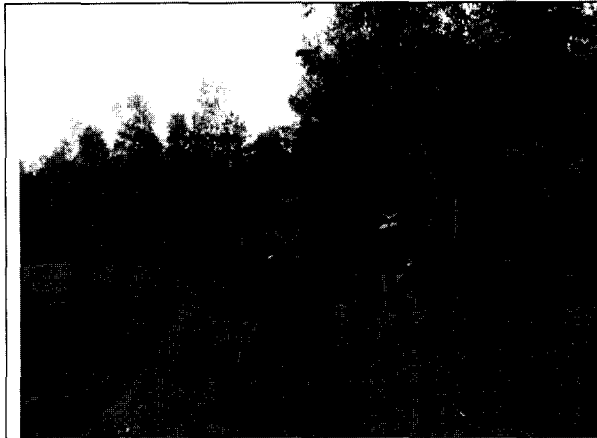


Figure 3-12: Land Use and Land Cover(Farm &Forest)



Figure 3-13: Land Use and Land Cover(Grazing Land &Forest)

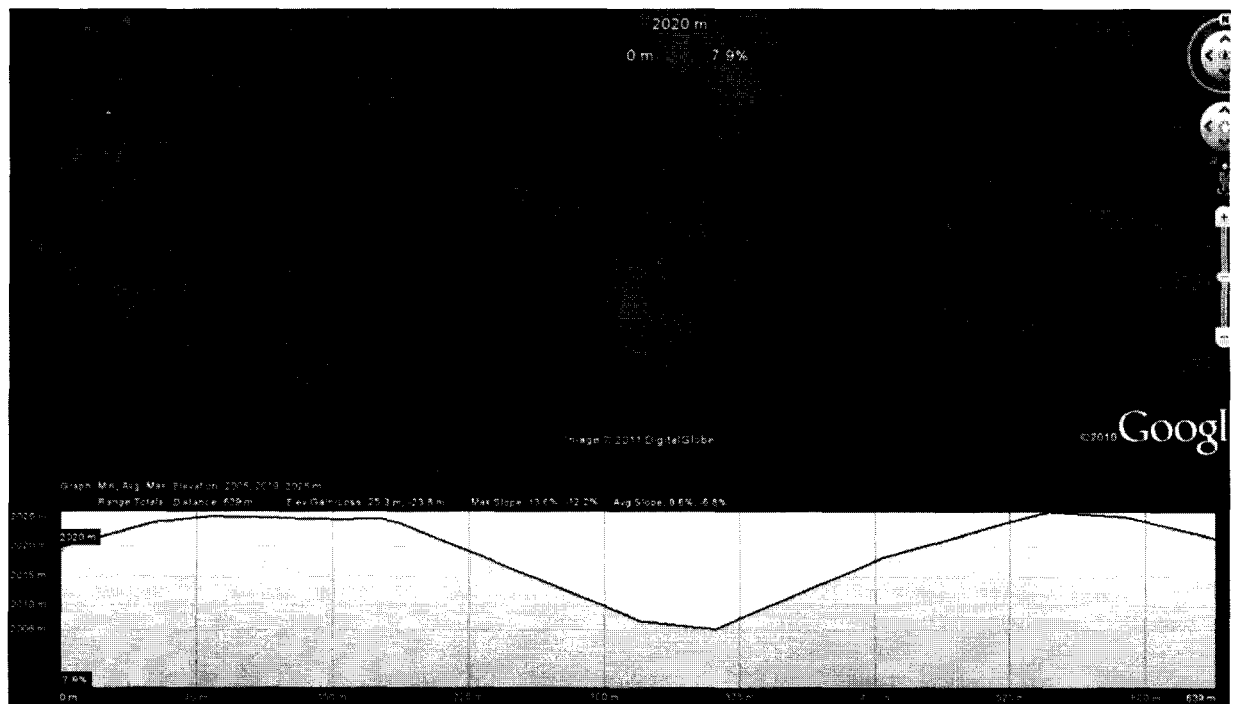


Figure 3-14: Site-2 Slope along the East-West with Saddle at center

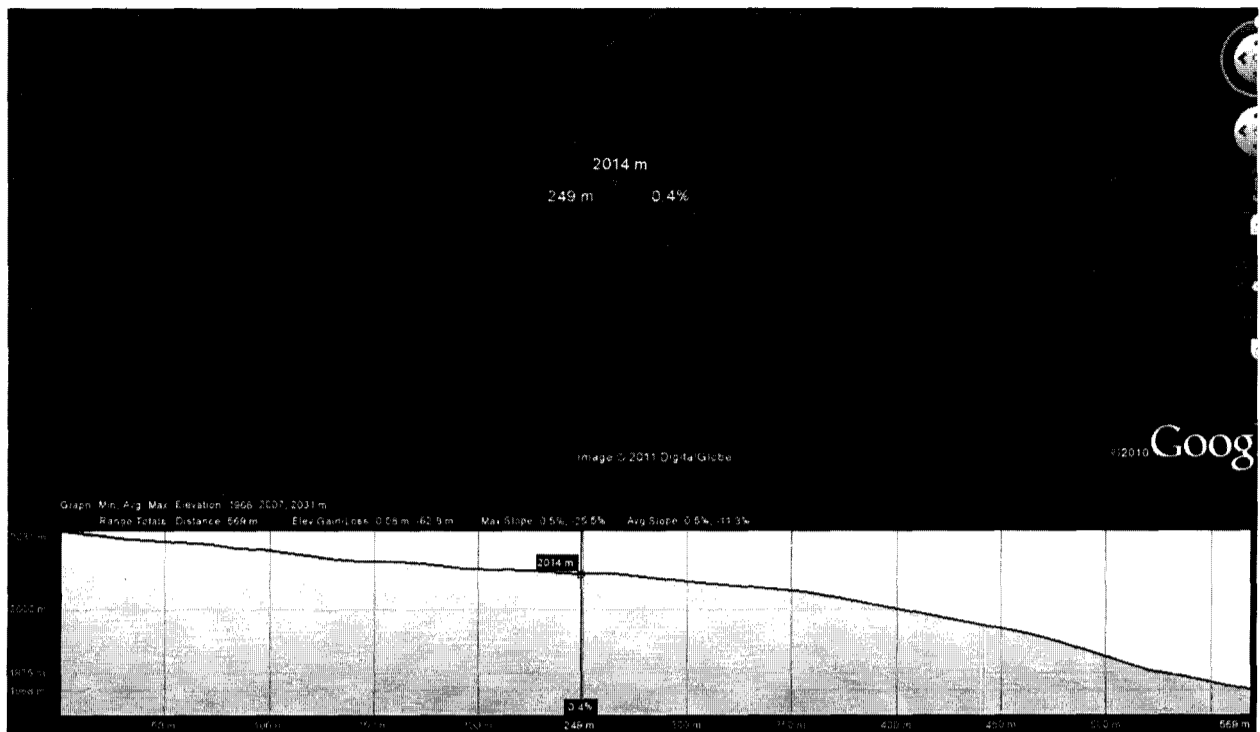


Figure 3-15: Site-2 ground Slope along the North-South direction

Site-3: Beda-Buna/Sombo

- This site is located on Jimma-Addis Ababa highway at about 6km from the Municipal office just 50meters off to the right side
- Located on abandoned quarry site.
- There is no sufficient land for the envisaged project and future expansion
- The rocky subsurface condition might escalate the project cost and endanger the financial viability of the project
- The drainage from the surrounding hills passes adjust to the site
- Dense vegetation cover and agro forestry in the fields that has to be cleared
- There are settlements in the area close to the site; some immediate physical displacements might be expected.
- The site involves travelling along the Jimma-Addis Ababa road along upward gradient and busy vehicular traffic; and this will increase traffic accidents especially considering the truck drivers working around the clock all the time in all weather condition. We have documented two traffic accidents happened on the same date we have visited the site, and this are a clear indication of what might happen,
- The site is least appropriate and should not be considered for the project



Figure 3-16: Land Use and Land Cover at Site-3



Figure 3-17: Settlements around the site

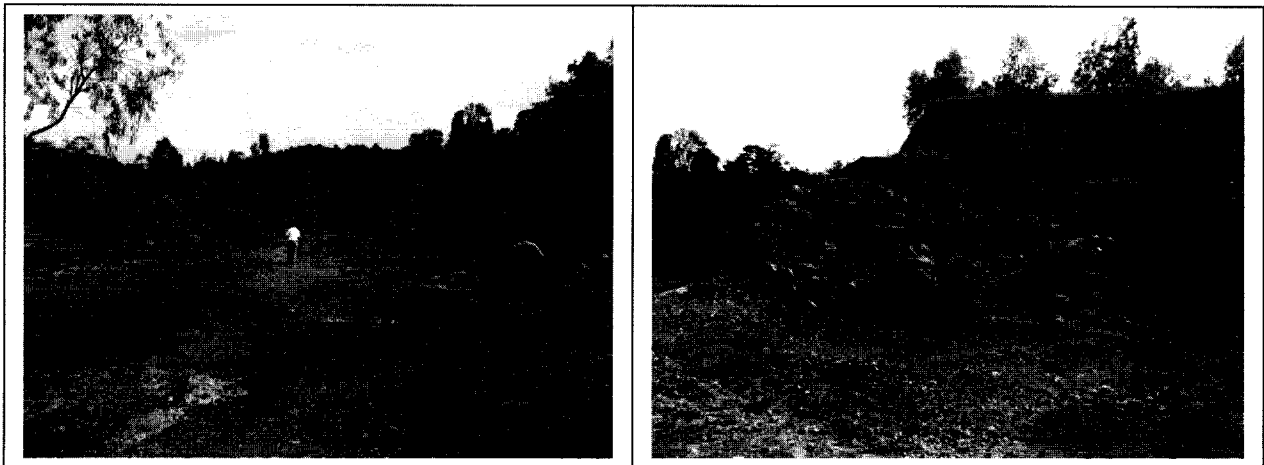


Figure 3-18: Land use and Land Cover at Site-3



Figure 3-19: A) Road, B) Traffic Accident, C) Traffic Accident



3.1.7.3 Conclusion and Recommendations

Summary of the assessed alternative landfill sites technical, social and environmental factors assumed sensitive are considered, according to the relative evaluation criterion described above, site-1 at Ela-Dare just in front DMC main camp is more appropriate and should be considered for intended purpose. Site-1 is not only technically sound, but also the adverse social and environmental impacts posed due to the sanitary land fill project implementation will be least for site -1. The socio-economic impacts of site-1 do not involve physical displacement, and this requires less compensation budget for land and vegetation to be compensated. Whereas, site-2 is less feasible technically might involve both land compensation and physical displacement that might result in higher compensation budget.

However, some of the inevitable adverse impacts accompanying the project implementation will still have to be dealt with. These impacts can easily be mitigated as per the management plan to be prepared and proposed during the detailed engineering design and the detailed EIA and Social Impact Assessment and Safe guard study. It is, therefore, the recommendation of this report the site-1 locally called Ela-Dare be considered and selected as a location for the sanitary land fill project implementation.

Therefore, the City Administration was advised to proceed with the necessary preparation to secure the site in the earliest time possible. The City Administration mobilized all relevant agencies that deal with resettlement and compensation matters as per the legal requirements of the Federal and Regional Governments. Accordingly, the Jimma city Administration notified the Menna Woreda Administration about the project and requested the Woreda Administration to arrange for stakeholder and public consultation. The Stakeholders and public consultation conducted and agreement had been reached between project stakeholders to use the plot of land for project use.

3.1.8 Description of Sanitary Landfill Design and Operation

The basis of a good solid waste management system is the municipal solid waste (MSW) landfill. MSW landfills provide for the environmentally sound disposal of waste that cannot be reduced, recycled, composted, combusted, or processed in some other manner. Sanitary landfill is adopted for disposing of solid waste in Jimma.

A properly designed MSW landfill includes provisions for leachate management and the possible collection of landfill gas and its potential use as an energy source. Innovative planning will also facilitate productive use of the landfill property after closure. Good design and operation will also limit the effort and cost necessary for maintaining the landfill after final site closure.

A sanitary landfill is a contained and engineered bioreactor and attenuation structure, designed to encourage anaerobic biodegradation and

consolidation of compacted refuse materials within confining layers of compacted soil. At a proper sanitary landfill, there are no nuisance impacts of constant burning, smoke, flies, windblown litter, and unsightly rubbish heaps.

Sanitary landfill design that provide for daily cover of fresh refuse, incorporate mitigate measures to manage leachate and gas produced within the landfill cells, provide for a final soil and vegetative cover, and establish an environmental monitoring system of up gradient and down gradient groundwater monitoring wells and surface water sampling locations.

Accordingly, design of sanitary landfill and associated facilities is conducted on about 10hectares of land in such a way to ensure the basic objective of providing appropriate Solid Waste Management System. The landfill is provided with liner to restrict contaminant flow to the ground, and under drain system to collect and convey percolated liquid to the treatment unit. The percolated liquid: Leachate is proposed to be treated by provision of stabilization ponds.

The description of the works relates to the preparation of the area for a landfill, waterproofing, construction of initial fill and closing banks, collection of leachate and gas evacuation, storm water evacuation, the establishment of a control area, and the construction of a leachate treatment plant, construction of access road, auxiliary services and landfill fencing.

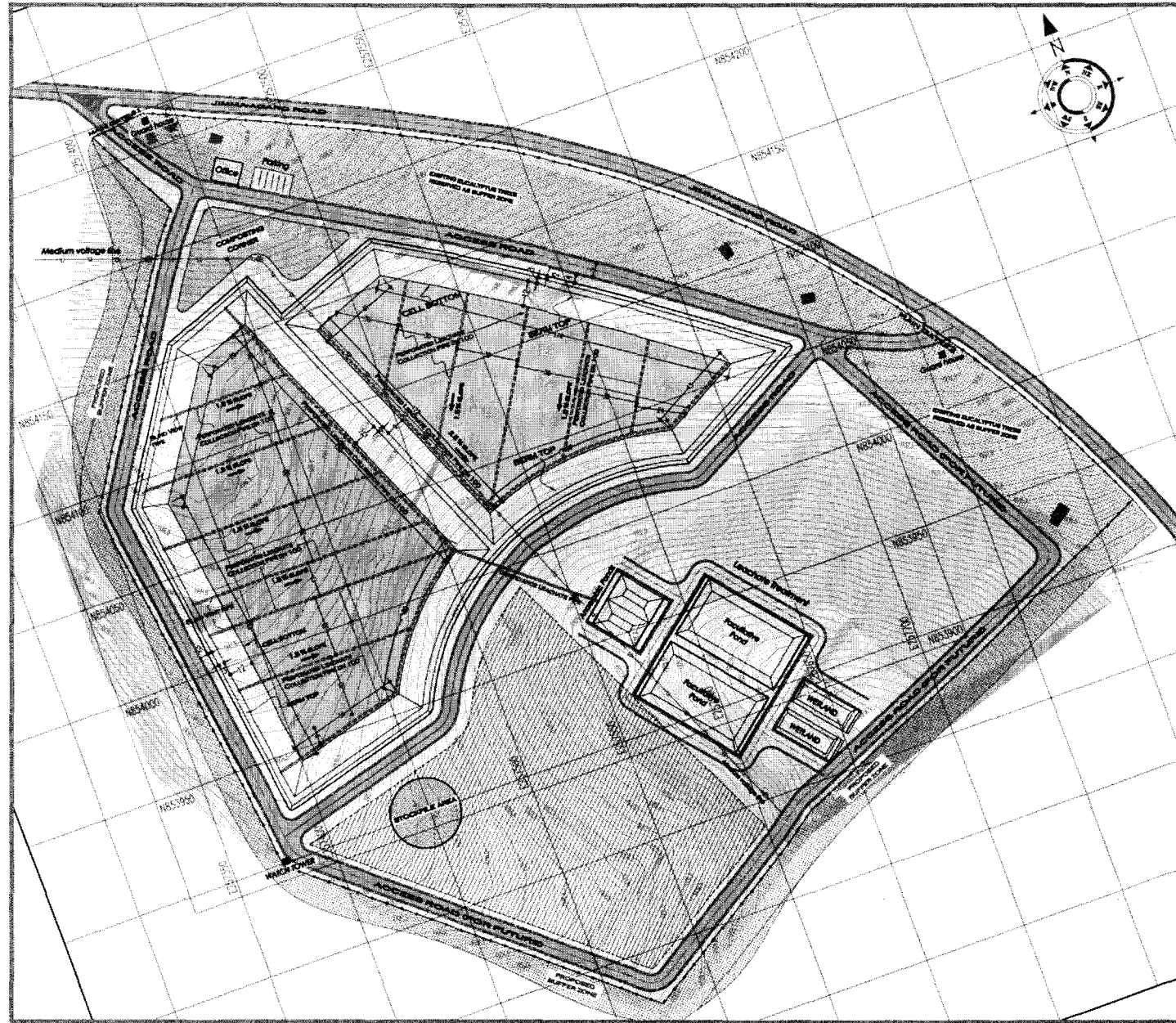


Figure 3-20: Sanitary Landfill and Facilities Layout

The sanitary landfill site consists of the following facilities:

3.1.8.1 Sanitary Landfill

It is advantageous to locate the sanitary landfill at the north-western side of the site, on a relatively elevated ground terrain, as more depth can be attained for the landfill and at the same time, the foundation will be located on the competent layer of the site. In addition, the existing eucalyptus trees and bushes at the northern and western sides of the site can serve as buffer zone, significantly limiting the air pollution.

The dumping area will be prepared by removing the soil in the process of excavation of the landfill bottom. The soil will be used to build the banks/berms, until the gradient is obtained right for waterproofing.

The total area will be waterproofed. Waterproofing of the dumping area will be carried out by means of FML liner as a barrier on compacted clayey sub-grade. The area size covering the clay bottom, slopes and embankments for cell one sanitary cell equals 23,009 m², the clay layer and FML should be ensured to cover the bottom of sanitary cell

During the first stage of the works, including the construction of the first basin and a four meters tall embankment, the working surface encircled by this embankment will be waterproofed. The entire landfill bottom and the frontal parts of the banks will be made waterproof. A system for leachate collection and treatment pond will also be installed.

The recommended construction layers for the sanitary landfill of the project are as follows:

- 300mm thick compacted drainage sand layer;
- Sealant material: Flexible waterproofing membrane (polyethylene sheet) laid over compacted sub-grade, which will act as composite sealant.

3.1.8.2 Leachate Collection & Gas Evacuation System

On the top of the clay layer at the bottom of the landfill, uPVC/HDPE grooved pipe Ø150 [mm] in diameter will be installed for the drainage and collection of leachate. 2/3 of the upper part of the pipe will be perforated, the perforation detail of the leachate collection pipe is provided in design drawings. The pipe will be protected with a layer of gravel, to provide for the draining, (gravel granulation of 16/32 mm). The secondary drains will be 100 [mm] in diameters. The end of these pipes will be used also for gradual venting of landfill gas.

Perforated pipe is placed along the whole sanitary landfill cell. The leachate that is generated in a sanitary cell is collected, and then transported by via gravity to leachate treatment Evaporation Ponds located downstream.

3.1.8.3 Leachate Treatment System

The recommended leachate treatment system consists of:

Anaerobic ponds

Anaerobic digestion is a very important process in wastewater treatment or leachate treatment. Contaminants are substantially reduced in anaerobic pond due to anaerobic decomposition. The recommended depth of anaerobic pond is usually from 2.5 to 5.0m, and for the site under consideration, 3m depth may be adopted. The recommended slope cut is 1:1.5.

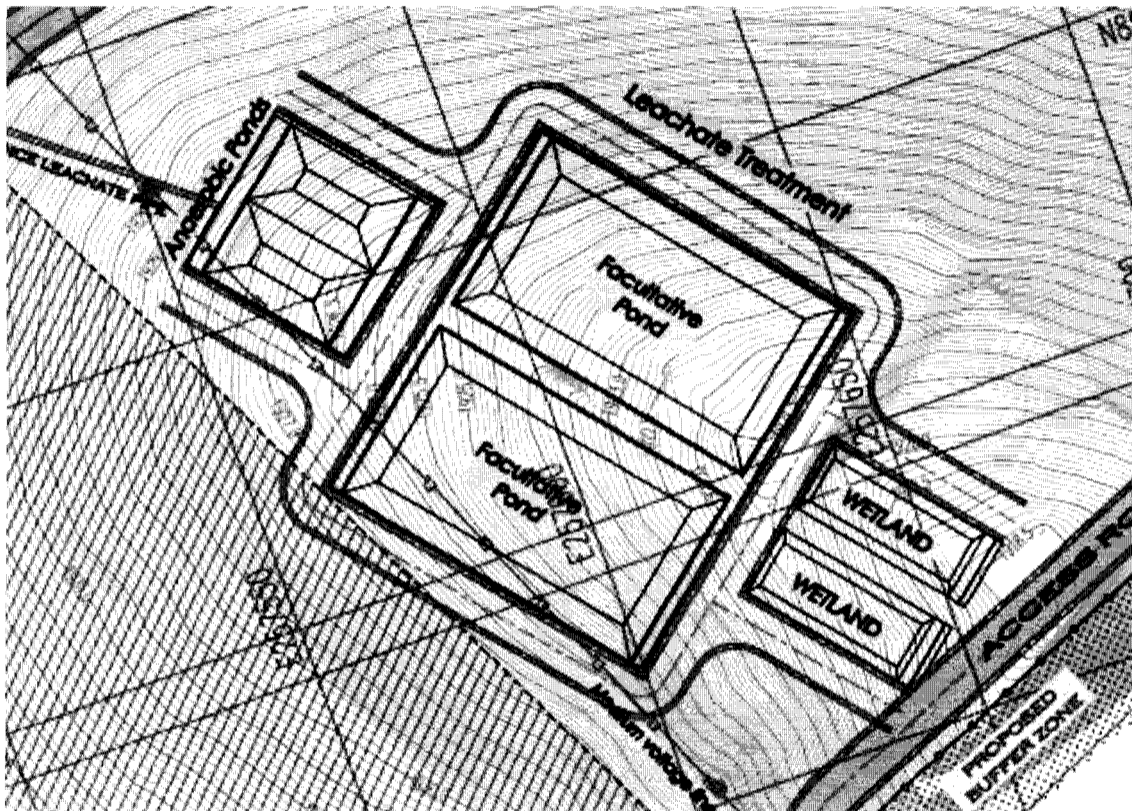


Figure 3-21: Leachate Treatment Facilities

Facultative ponds

Facultative ponds are photosynthetic ponds – that is the oxygen needed by the pond bacteria to oxidize the wastewater BOD is mainly supplied by micro-algae that grow naturally and profusely in these ponds (and thus give them their characteristic green colour); and the carbon dioxide needed by the algae is mainly provided by the pond bacteria as an end-product of their metabolism. For facultative ponds, the recommended range of depth is from

1.0 to 2.0m, and the depth recommended for the current project is 1.5m. The recommended slope cut is 1:2.

Wetlands

Wetland is commonly used for polishing the final waste as well as for the removal of suspended solids. The productivity of wetlands is high due to their large capacity for absorbing wastewater. Constructed wetlands are the engineer-made equivalent of natural wetlands, and they are designed to intensify the wastewater treatment processes.

For the current project, gravel-based 'subsurface-flow' wetland is recommended. The type of surface-flow shall be horizontal-flow unit. Horizontal-flow wetlands are the most common ones and vertical-flow wetlands are occasionally used in temperate climates as a secondary stage to horizontal-flow wetlands.

3.1.9 Ancillary Facilities

Guardhouse: - In order to keep the guard attendant on the site the guardhouse has to be constructed at the disposal site. A fulltime attendant must be needed to monitor the landfill site.

Roads: all weather access road as shown on the design drawing has to be constructed.

Surface water management: - Control of storm water runoff at landfill disposal facility is provided to minimize the potential of environmental damage due to storm water run-on and runoff.

3.1.10 Sanitary Landfill Operation

The operating plan for solid waste management at sanitary landfill is typically the management of working phase. The working face is the area presently being worked with new refuse being deposited and compacted into it. Once the working face has been completed and daily cover material is provided it is compacted or daily cell. If the landfill is not expected to receive additional wastes closer activities must begin within 30 days the final receipt of the waste.

The minimum width of the working phase or daily cell is set to be wide enough to accommodate as many trucks or vehicles expected to be at the landfill at a given time typically 3 to 4.5m per truck. The working phase should be kept as small as possible because it is this area that can attract birds, provide visual problems for passer-by, and become a source of blowing paper, keeping a freshly deposited refuse in well defined and small working face is a good indication of a well operated landfill.

A landfill operator has to carefully plan and control the following waste management activities.

Waste unloading

The waste should only be unloaded on active or working face.

- Incoming vehicles should be inspected to identify and isolate unacceptable wastes (hazardous bulky wastes)
- The unloading activity should spread waste on a working face followed by compaction.

First layer fill: - to protect the FML precautions has to be taken while placing the first layer of waste. The first operations layer should be selected waste. Selected waste includes household waste but not demolition and land clearing debris or other materials that may damage the liner system. Compaction of the first fill should also be carefully monitored and controlled to avoid Leachate collection and removal pipe break.

Compaction: - The waste has to be spread in their layer of 70cm and compacted with 3 to 5 passes of compactor on slopes of about 3:1 (H:V).

Daily cover: - The daily cover (15cm) should be placed on all exposed solid waste at the end of each operating day.

Intermediate cover: - It is placed on top and side slope of an advancing lift which will not receive additional waste for at least two month. It should consist at least 30 cm compacted low permeability soil.

Interim cover: - It is placed on the landfill waste that reaches final elevations before final cover installation. During rainy season it has to be placed immediately after cell reaches final elevations.

Special wastes

Hazardous and bulky wastes should not be disposed on the site. These special wastes include:

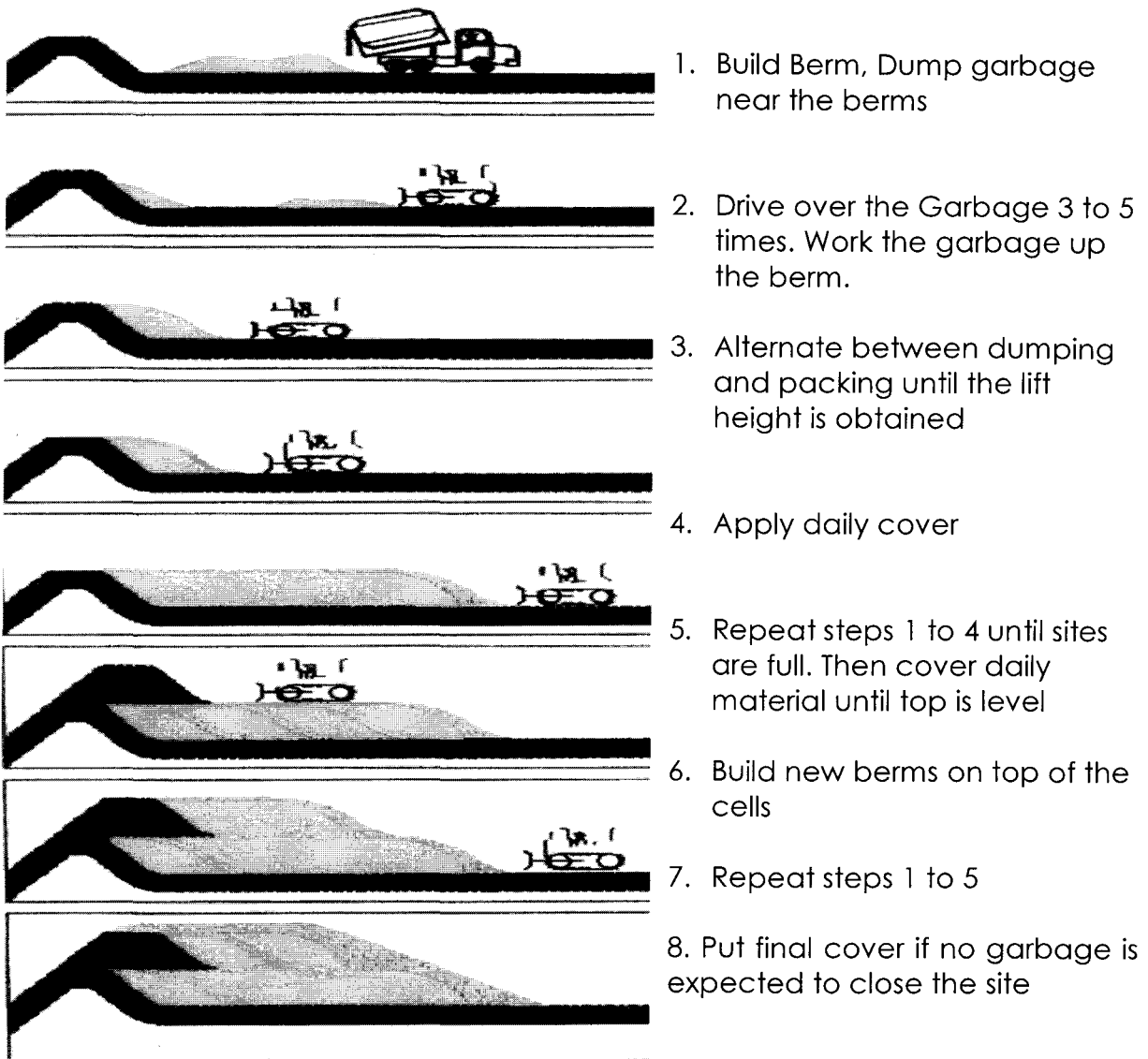


Figure 3-22: Landfill operational Procedures

4 Environmental and Social Baseline Data

This Section presents data on baseline environmental and social conditions with respect to the selected project sites. The baseline data describe the existing situation in the project area that could be influenced by the establishment of sanitary landfill, the associated roads, accesses and infrastructures.

The data are presented and discussed under the following headings;

- General Environmental Conditions in the Study Area
- Geology and Soils
- Hydrogeology and Hydrology
- Ecology
- Socio-Economic Factor

General environmental Conditions

4.1.1 The Site Location

Jimma town is located in the south-western part of Oromia Regional State at about 352 kms from Addis Ababa at a latitude of 7°40'N and longitude 36°50'E. The town is located on gentle to irregular slopes with an elevation variation of 1700 to 2020 m.a.s.l.

The proposed landfill site is located on approximately 13.8 ha of farm and forest land which is located nearly 7 km north-western of Jimma along Jimma-Agaro asphalt road. The selected site is located in Menna' Woreda, Ela Dare Kebele along Jimma-Agaro asphalt road, and at some 100 meters off to the right side, just in front of the DMC Construction main camp.

The site elevation variation is between 1915 to 1961 m.a.s.l. and the average elevation is 1938 m.a.s.l., and generally sloping from north-west to south-east. The site location is defined by 257524.6 E and 854029.4 N. The site is easily accessible from the main Jimma-Agaro Asphalt Road. The western and south-western part of the site is covered by indigenous natural forest. The general view of the site is as demonstrated by the picture in Fig.4-1 given below.

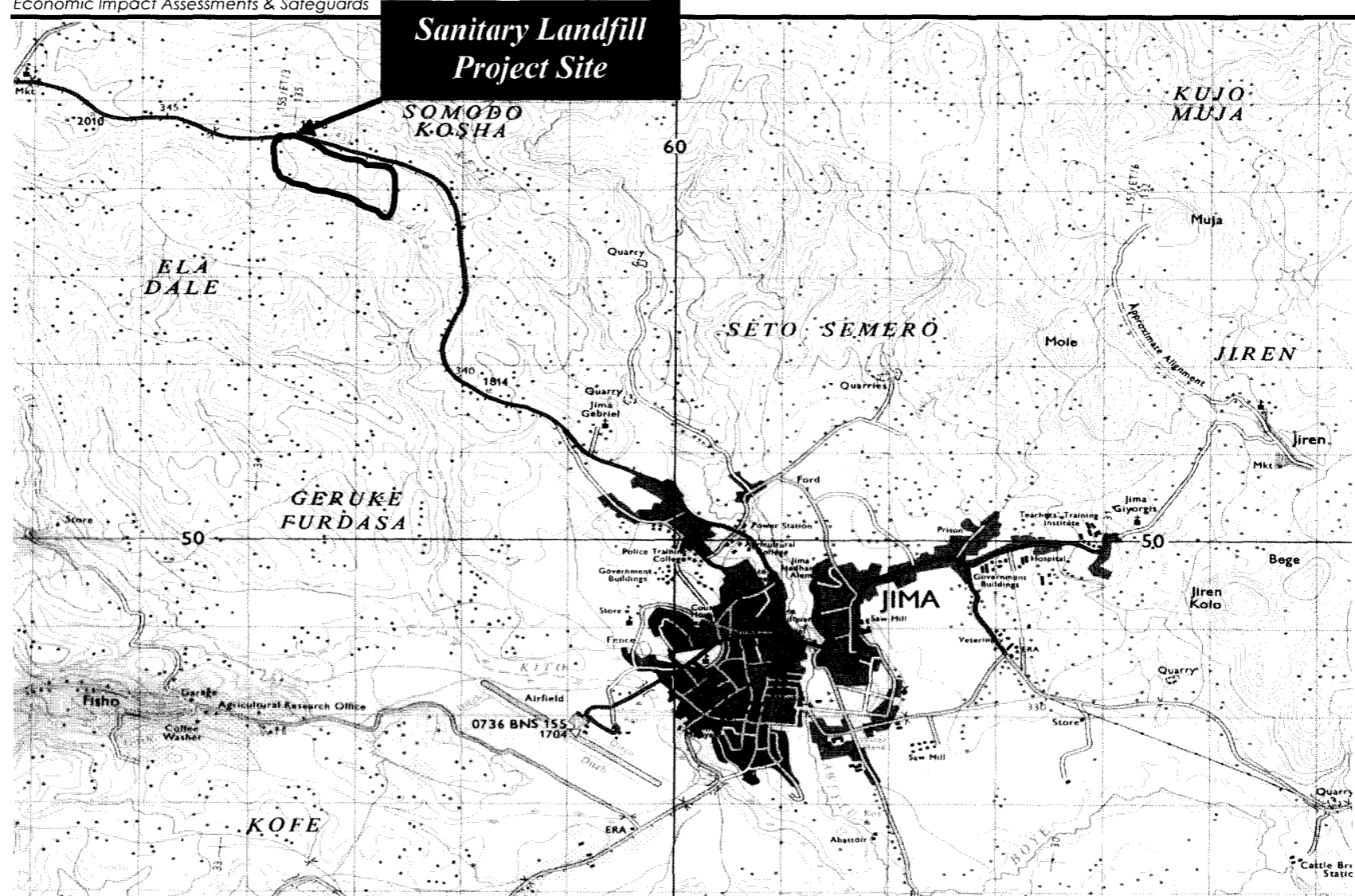


Figure 4-1: Location Map of Sanitary Landfill Site

4.1.2 Climatic conditions

According to five years rainfall data collected from the National Meteorological Agency of Jimma Sub-branch, the annual rainfall of Jimma Town varies from 1414.4mm to 2392.3mm with a mean annual value of 1769.7mm. Although Jimma area has almost all year round precipitation, most of the rain occurs in July followed by August as indicated in the five year rainfall distribution data. The rainfall in May and June is almost quite significant. Maximum temperature in Jimma Town occurs in March and April and minimum temperatures are at their lowest in November to February. The mean monthly metrological data of the area is presented in table below.

The air is always humid due to the presence of abundant trees heavy rainfall in the town. The sky is predominantly covered with clouds and the air is calm for most of the year.

Table 4-1: Mean Monthly Metrological Data of Jimma Town

Parameter	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Mean Monthly Max. Temp, (°C)	28.86	29.30	29.98	28.46	27.94	26.58	24.36	25.10	25.26	26.47	24.70	27.70
Mean Monthly Min. Temp, (°C)	9.02	9.88	10.28	13.23	13.30	13.80	14.17	13.87	14.02	12.11	9.20	7.69
Mean Monthly Rainfall, (mm)	39.08	33.94	117.98	117.06	220.36	195.30	243.76	238.12	198.76	98.78	65.76	34.74
Monthly Percentage contribution of rainfall, (%)	2.44	2.12	7.36	7.30	13.74	12.18	15.20	14.85	12.39	6.16	4.10	2.17

Source: Design Review of Jimma Town Water Supply System, MS Consultancy, 2011, Final Report

4.1.3 Topography

Jimma town lies on gentle slope with an elevation varying from 1,700masl to 2,020masl. Topography the town can generally be divided in two main zones:

- Escarpment and
- Alluvial plain zones

Escarpment zone: represents topographically elevated areas and surrounds the city in the northwest, north and east.

Alluvial Plain zone: contains fairly broad valleys and represents lower grounds and elongated low-hills. It starts from the foot of the escarpment zone and trends to the south- south east. This zone covers most of the settlement area of the town and diminishes into flat further south of the town.

The topography of the sanitary landfill site is quite irregular with variable slopes ranging from about 5% to 8%. The site slope is generally from north-west to south-east. Therefore, the most feasible drainage outlet for the site is towards the south-east by introducing the appropriate drainage system through the valley-type depressed area at the middle zone of the site.

Jimma area is mostly characterized by intense rainfall, which is believed to be accompanied by excessive surface runoff due to high slopes. Therefore, the surface runoff water, particularly from the existing asphalt road side should be controlled and diverted away from the site for the safety of the proposed sanitary landfill.

On the other hand, the site topography and slope are highly suitable for development of sanitary landfill, minimizing earthwork and allowing leachate collection by gravity.



Figure 4-2: Land Use, Land Cover and Drainage of Sanitary Landfill Site

4.1.4 Land Use & Land Cover

Ecologically the Jimma city lies in wet land ecosystem. It is bounded by wet ever green montane forest ecosystem. Because of the climatic suitability the green coverage of the city is very significant and estimated to be about 35% including farm lands and vacant areas. Green areas in Jimma give recreational services, and are also used to produce fuel wood, charcoal, fodder, fruits, etc. Moreover they contribute in reducing air pollution, controlling flood and protection of land and soil from degradation as per the structural plan of Jimma by Oromia Urban Planning Institute.

Jimma has green areas in its various parts as well the peri urban areas. In the city, green areas are found along streets, in urban parks, in public and private

gardens, along stream banks and flood plains, in upstream and down streams, ridges and hills and left over spaces. In these areas various indigenous and exotic tree species, flowers, grasses have been maintained.

According to the Structural plan recommendations, the most important green areas in the city include private green yards and small public green areas, semi public institutions, land between buildings, street trees, green areas along Aweytu River, stream channels, flood plain green areas, private horticulture, trees and wood lands, and peri- urban thick forest.

Urban Agriculture in Jimma includes horticulture (vegetables and fruits); livestock like cattle, sheep, goats breeding and equines for transport purpose (Table 9). Moreover, dairy farming also exists in the cities which are 40 in number with average holding capacity of 10 cattle/farm. There are about 20000 cattle, 500 sheep, 1000 goats and 1500 horses in the city

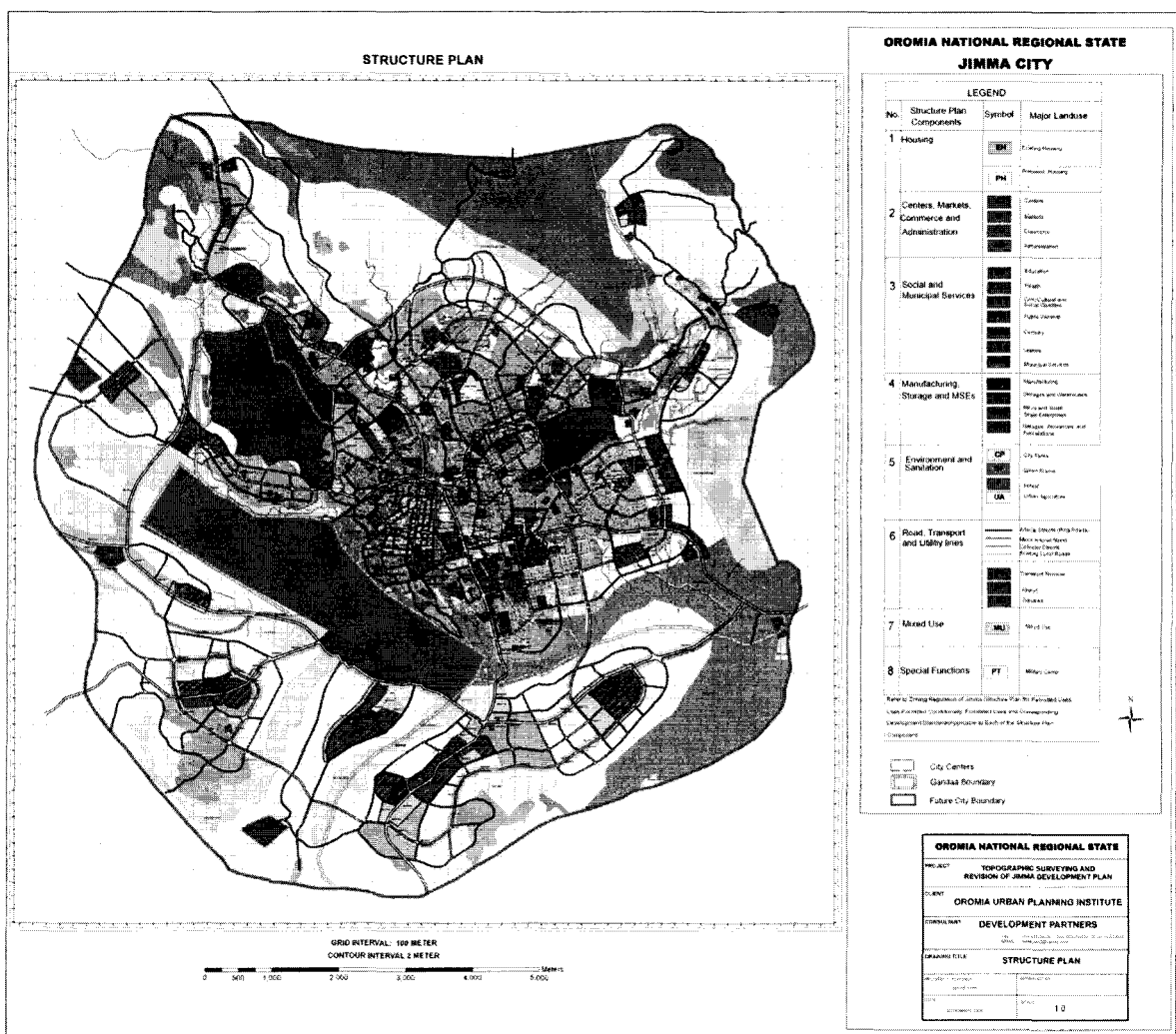


Figure 4-3: Revised Land Use Plan Jimma
Source: Jimma Structural Plan, Oromia Urban Planning Institute, November 2008.

The land use of the Jimma in the north western part of the city is mainly forest belt and agricultural, therefore, it is not in conflict with the sanitary landfill project. The following picture shows the revised land use map of Jimma.

Table 6: Land use share and percentage of Jimma Structure Plan

Land Use	Area_Sq.mt	Area_Ha	Percentage %
Administration	673,284.67	67.33	0.64
Residence	12,020,787.34	1202.08	11.38
Housing Expansion	38,003,922.54	3800.39	35.97
Mixed Use	6,285,624.57	628.56	5.95
Commercial	1,872,776.61	187.28	1.77
Service	7,782,238.29	778.22	7.36
Manufacturing & Storage	1,580,772.23	158.08	1.50
Recreation	4,692,540.30	469.25	4.44
Special Function	4,842,625.42	484.26	4.58
Forest	12,520,319.11	1252.03	11.85
Square	6,884.14	0.69	0.01
Transport	5,941,721.33	594.17	5.62
Urban agriculture	3,696,337.59	369.63	3.50
		9991.98	
New City Boundary	105,665,914.78	10566.591Ha	
Area covered by roads	574.608Ha		

Source: Jimma Structural Plan, Oromia Urban Planning Institute, November 2008.

The Structural Plan proposes to maintain forest cover of the city; especially forest area in the north western, north, and north eastern part of the city where the slope is greater than 15% are proposed for forestry.

The following are the possible development scenario envisaged for the city as per the Structural Plan

- Scenario 1: Existing trend north, south and some to the east
- Scenario 2: West
- Scenario 3: Containment

This expansion is recommended to be undertaken in phases defined based on the following prioritization.

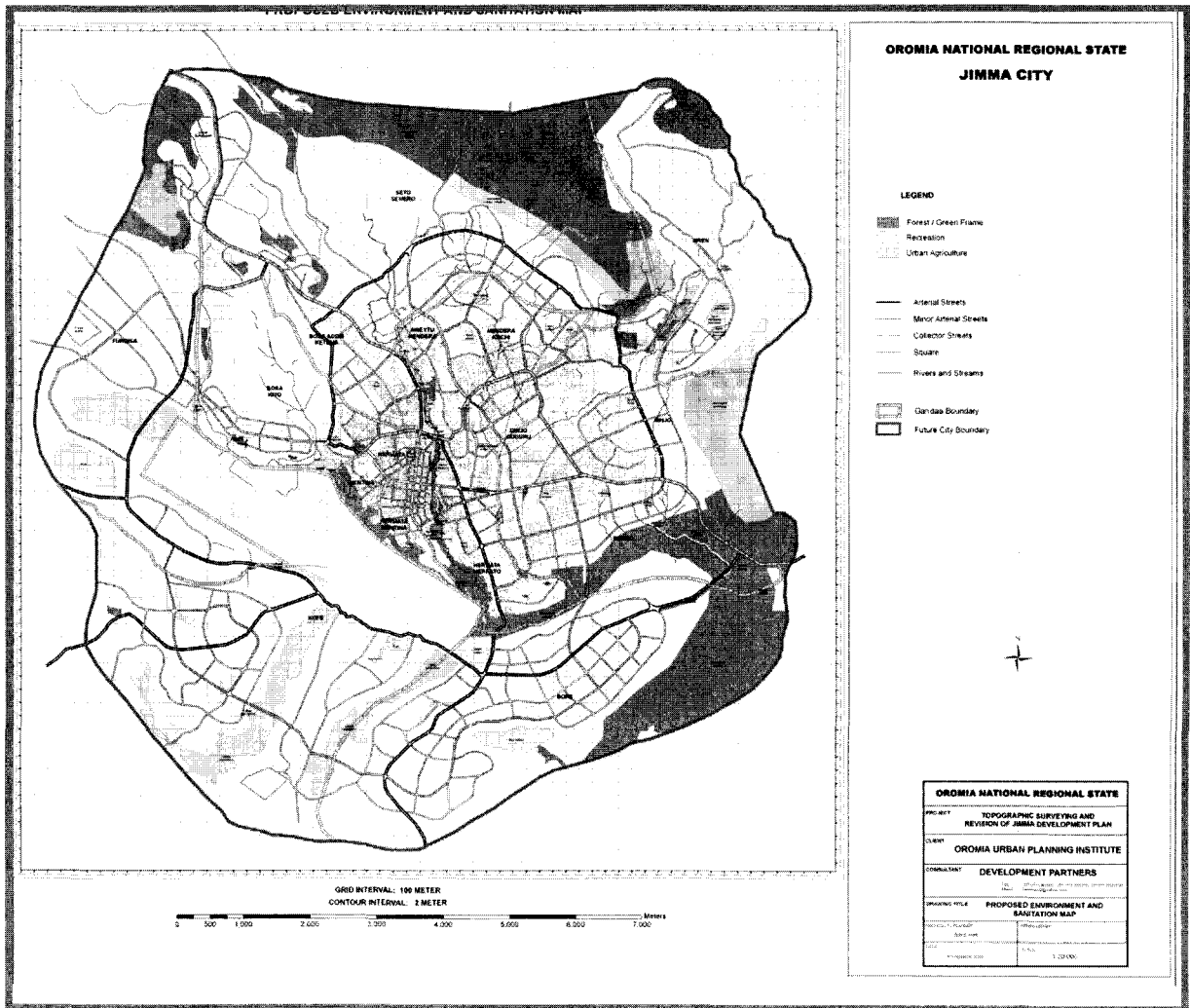


Figure 4-4: Environmental and Sanitation Map of Jimma
 Source: Jimma Structural Plan, Oromia Urban Planning Institute, November 2008.



Figure 4-5: Land Use and Land Cover of Project Site (Farm land & Forest)

Geology & Soils

4.1.5 General Geology of Jimma Area

From the aspect of general geology, Jimma area is formed of residual soils derived from acidic rocks such as Ryholitic rock. This can be easily evidenced by the Ryholite hills at most areas and surrounding Jimma town.

Most of the depressed areas of Jimma town and its vicinity are formed of firm silty clay material. In the depressed areas, with the exception of the hilly areas, the Ryholitic rock is mostly encountered at much deeper depth.

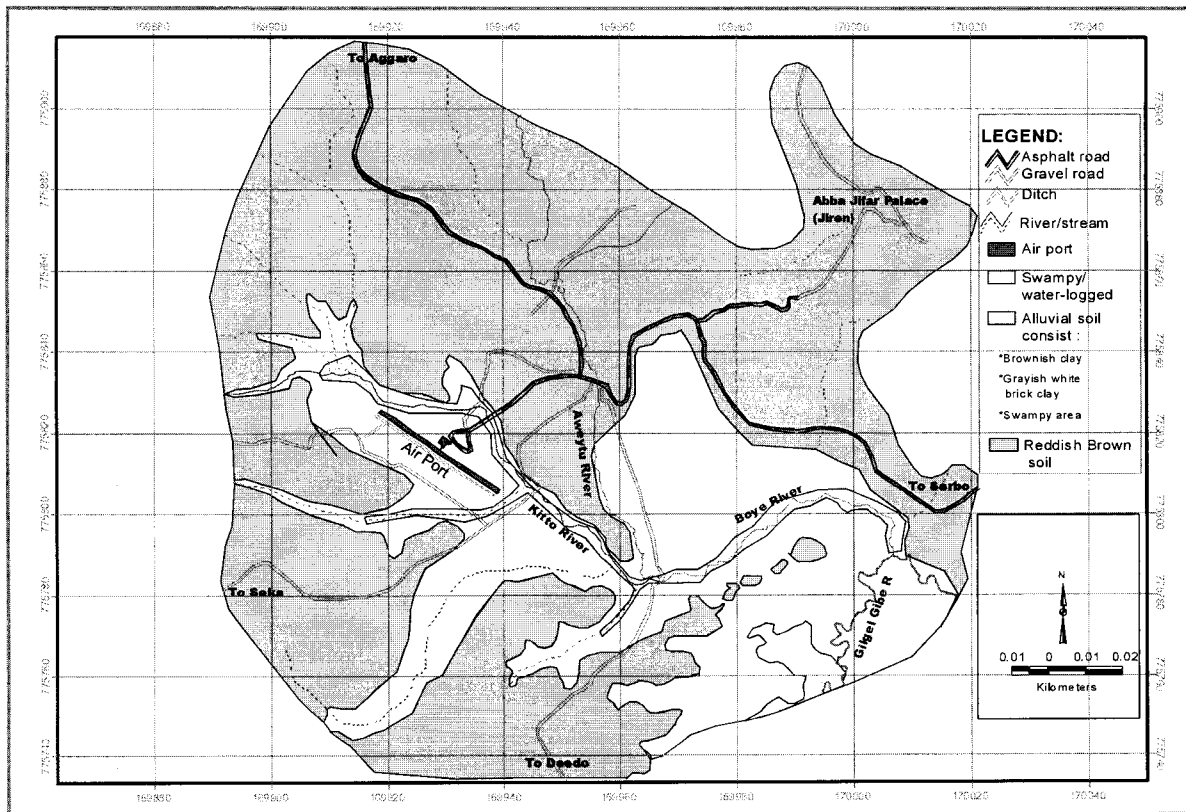


Figure 4-6: Soil Map of Jimma City and environs
 Source: Jimma Structural Plan, Oromia Urban Planning Institute, November 2008.

4.1.6 Local (site) geology

The project area is predominantly underlain by volcanic rocks from regional geology. These rocks are naturally light in colour and are highly susceptible to physical and chemical weathering. The soils of the area are predominantly Dystric nitosols. These are reddish brown to dark reddish brown soils, with clay to clay loam texture.

For the purpose of Geotechnical Investigation, six test pits were dug over the site area to a depth of 3.0 meters from the natural ground level. The test pits were reasonably distributed over the site area in order to obtain maximum information on the in-situ soil conditions.

The site plan together with locations of test pits dug on the site and the lithologic descriptions of the in-situ geotechnical layers are attached to this report.

The site is dominantly constituted by residual soils comprising: Top dark to red, loose silty clay with grass roots covering the entire site area as superficial layer, firm to stiff silty clay encountered as intermediate layer and stiff silty clay massively forming the deeper layer. The stiff silty clay layer, which is encountered generally below depth variation of 0.90 to 1.20m, is the most competent layer of the site with good potential bearing capacity and low compressibility.



Figure 4-7: Local Site Soil Condition

Hydrology & Hydrogeology

4.1.7 Surface water

The catchment of the natural drainage of Jimma city is defined by the Jiren, Seto Semero, Jiren Kolo, and Ela Dale at the north and flows down into the core of the city then to the south to Boye Wetland and Gilgel Gibe River. Areas beyond the hills at the north also drain to Aweytu River.

Whereas, although only few erosion gullies were observed at the middle zone of the sanitary landfill site, it can be concluded that the intense rainfall in the surrounding elevated areas is normally accompanied by excessive surface runoff due to high slopes and from the adjacent asphalt road. Considering this condition, it is mandatory to divert the surface runoff water coming from the surrounding higher ground terrains away from the proposed sanitary landfill area by providing the appropriate drainage system and by slope-grading the area towards the site drainage outlet as noted earlier. The drainage system to be introduced can be made of earth or masonry ditch.

Given the conditions that the site silty clay layers are only slightly to moderately permeable and that groundwater is not expected at shallow depths of the site area, contamination of groundwater by the infiltrating surface water through the sanitary landfill is unlikely. Contrarily, unless leachate treatment is implemented, rivers in the vicinity of the site are vulnerable to pollution, due to infiltrating surface water through the sanitary landfill.

Having considered this condition, it is essential to divert surface runoff water from the sanitary landfill area as recommended above and the procedure should be coupled with slope-grading of the area towards the appropriate direction. In addition, leachate treatment system is mandatory in order not to impair the quality of the local groundwater or not to contaminate other subsurface or bedrock aquifers if possibly found at shallow depths.

4.1.8 Hydrogeology & Groundwater

Regional

The Jimma area is located in the southwestern Ethiopia plateau in an area of moderate relief and is situated on a low hill to the north of the wide alluvial plain of the Gilgel Ghibe River. It is also underlain by tertiary volcanic rocks, while the valleys bedrock is overlain by alluvial sediments. These alluvial sediments occupy the broad valleys of the study area. The thickness of the alluvial sediment beneath the surface ranges from 20m in the upper part to greater than 200m in the deeper part of the valley. The volcanics is mainly composed of massive rhyolites with alternating trachytes, tuffs, ignimberites, and subordinate basalts. Based on topography, variation in hydraulic properties of the volcanic rocks and alluvial sediment, and their location the main hydrological basin the Jimma area is classified into three sub-basins as the Kochi, Awetu and Kitto sub-basins. The Kochi sub-basin is drained by the Kochi stream which joins Awetu stream at Boye. On the other hand, the Kitto sub-basin drains by the Kitto stream finally joins Awetu stream at Dedo Bridge. Awetu

stream, a perennial stream, originate from north of the town and flows along the middle of the valley in the south direction. Groundwater occurs in many types of geologic formations; those known as aquifer are of most importance. Alluvial sediments are the main aquifers in Jimma, however, the rhyolytic rocks (volcanic rocks) lack primary and secondary permeability and are considered as poor aquifers.

Local (Site) Condition

Based on physical observation, no groundwater encountered in all the test pits, and groundwater is not expected at shallow depths of the site area.

With reference to previous studies, and based on local information, the depth of potential groundwater in and around Jimma town is estimated at around 100 to 120m from surface. Static groundwater level for domestic wells may be at shallower depths in the rural areas but with low yield. The area has substantial groundwater and recharge due to the high rainfall and permeable Rhyolitic rock formations.

Jimma area is known for its high precipitation (rainfall) for about 8 months annually, and accordingly, the average precipitation for 5 months of the wet season is greater than 200mm while for the rest 3 months of the season, it is about 100mm. The major recharge occurs in the wettest months of July, August and September.

Groundwater was not encountered in all of the test pits during the Geotechnical Investigation as the pits were excavated to limited depths using human power. Groundwater is also not expected at shallow depths of the site, which is advantageous from groundwater pollution perspective.

However, given the conditions that the site geotechnical layers are moderately permeable and considering the nature of the project facilities; the use of flexible membrane on compacted sub-grade clay material is mandatory for such site condition in order not to impair the quality of the local groundwater or not to contaminate other subsurface or bedrock aquifers.

Biodiversity

The natural vegetation cover of the project area comprising broad leaf high forest has been considerably modified by man, largely in connection with the development of agriculture. The site is mainly a farm land to cultivate cereals, and some fruits like Manago and Papaya, the eastern, south eastern and northeastern part of the site is covered with Eucalyptus forest with bushes and shrubs. There are also small amount of coffee plants in the peripheries of the Eucalyptus. The detail count is provided in the Inventory Sheet annexed to RAP.

Jimma Wetlands are also main ecological components found in southern and low lying area of the town. Wetlands are foci of biodiversity, and are valued for their ability to act as filters, sinks and transformers of sediments, nutrients and

pollutants. They act as buffer systems between other aquatic systems and human activities on upland areas. Wetland ecosystems favor particular type of plants, animals, and soils because of their unique hydrologic conditions.



Figure 4-8: Biological Features on Sanitary Landfill Site

The Jimma wetlands are grouped under the wetlands of the western highlands. These wetlands are year-round evergreen, and are the only source in Jimma to support high livestock population throughout the year in both dry and wet seasons.

There are no national parks and wild life reserves in the sanitary landfill project site. The wildlife population and native habitat have been significantly impacted by subsistence agricultural practices and this has resulted in low wildlife diversity in the in the project site. However, according to the Ethiopian Wildlife and Natural History Society (EWNHS, 1996), none of the 67 nationally designated important birds are found in Jimma Town and its environs.

Socio-Economic Environment

4.1.9 Population Size

The 2007 Population and Housing Census results for Jimma provide comprehensive information on the population's distribution by sex, age structure, and type of residence, ethnic identity and religion. It also shows the number of households and average household size.

The 2007 Population and Housing Census results reported the population of Jimma to be 120,600 in 2007. The city population estimated to have reached 145,105 in 2011. The population is also projected to reach 240,678 in 2023 and 353,350 in 2033.

4.1.10 Health Situation

The most common diseases of the city population are those of water born and water related communicable diseases. These diseases are related to personal hygiene and unsanitary conditions of the living environment, some of them are direct trace waste mismanagement and lack of sanitation facilities.

There is one referral hospital and three health centres in the town owned and operated by the government. In addition there are non- governmental and private health institutions.

According to the information obtained from the Health Bureau of the town, there is a plan to establish three additional health centres in the town within the coming five years. Besides, there are 30 private clinics giving health services for the dwellers. There are some non-governmental organizations supporting the health care activities of the town.

Table 4-2: Governmental and Non-Governmental Health Institutions in 2003 E.C

Type of institution	Gov	Private/NGO	Total
Hospital	1	-	1
Health Center	3	-	3
Clinics		30	30
Spec higher	-	1	1
Higher clinic	-	6	6
Medium clinic	-	13	13
Small clinic	-	10	10
Pharmacy	-	17	17
Drug store	-	32	32
Rural Drug Vendor	-	2	2
Diagnostic labs	-	3	3

Source: Jimma Health Bureau

Officials from the Health Bureau reported diseases that are prevalent and among the top ten diseases of the town which are shown in the table below.

Table4-3 :Top 10 leading causes of morbidity in 2003 E.C

In Jimma University Science Hospital		In Health Centers	
Type of Diseases	% of total cases	Type of Diseases	% of total cases
Dental diseases	16	Malaria	25
Other helminthes	11	Primary atypical & unspecified pneumonia	11.4
All other diseases of skin	9.4	Acute upper respiratory system	9.2
Primary atypical &unspecified pneumonia	8	Other helminthes	7.2
All other diseases of genitor-urinary system (UTI)	4.4	Benign neo plasma of breast	5.6
Bronco pneumonia	3.5	Infections of skin & subcutaneous tissue	4.7
Malaria	3.4	Typhoid fever	3.6
All other respiratory diseases	3.3	Gastro-eneritis & colitis	1.9
Non toxic goiter	2.4	All other diseases of genito-urinary system (UTI)	1.8
Other benign & unspecified neo plasma	1.8	Sepsis of pregnancy, childbirth and peripherum	1.8

Source: Jimma Health Bureau

5 ASSESSMENT & MITIGATION IMPACTS

Contents of this Section

In this section of the ESIA Report, possible environmental impacts that will result from existing solid waste management system and activities to be carried out during construction and operational phase of the Project are assessed. Main sources of these impacts are solid and liquid wastes as well as noise and dust emissions. Magnitude of these impacts on such receiving elements of the environment such as air, water and soil are explained under respective subtitles, along with the mitigation measures that are required to be taken in order to minimize these impacts.

It is good practice to focus the ESIA studies on the particular environmental and social issues which are most likely to give rise to the most significant impacts or are of great concern to the decision makers and stakeholders. This allows the available resources to be focused where they are most needed and the ESIA report to focus on issues relevant to decision making. It also helps ensure that the environmental information used for decision making provides a complete picture of the important effects of the project, including issues of particular concern to affected groups and individuals. The result is that the environmental information provides a balanced view and is not burdened with irrelevant information. The study can, therefore, focus resources on the important issues for decision-making and avoid wasted effort on issues of little relevance.

Identification & Scoping of Impact Areas

Development activities may give rise to environmental and social impacts when physical changes caused by construction, operation or decommissioning of facilities interact with sensitive aspects of the receiving environment, where the receiving environment comprises human beings and human systems plus biological organisms and biological systems. The currently proposed project includes the construction of a sanitary landfill site with leachate treatment system, access road and other ancillary requirement, waste hauling facilities and improvements to the current SWM system to alleviate existing waste management problems. The potential for impacts arises primarily from the following physical changes,

- Land taken for siting facilities and infrastructure and for improvement of roads
- Movement of heavy vehicles
- Emissions from the waste (leachate, odor, litter, smoke)
- Control of the sites (restriction of access)
- Activity at the sanitary landfill site

5.1.1 Key Impact Areas

This section provides an overview of the key environmental and social impacts and a description of the analysis of these impacts that was undertaken in this study.

Land use: the increased collection of waste throughout the city will lead to a reduction in land spoiled by illicit waste dumping and littering. On balance, it is considered that the potential impacts will be mostly positive. Disposing of waste is however potentially polluting in a variety of ways.

Impacts related to potential ground and surface water contamination: The project is located Jimma; where especially abundant surface water resource including the exotic Jimma wetlands and groundwater resources are expected to be affected without proper planning and design of sanitary landfill. Decomposing waste within the landfill and during collection and transfer is potentially very polluting if it comes into contact with water resources. Moreover, the entire area around the project lacks natural barriers to the migration of water into aquifers; the geotechnical investigation showed that the ground is moderately permeable under optimum moisture content and maximum compaction. This study pays a great deal of attention to the movement of water above and below the surface and how the design of the facility addresses these critical issues. Attention has also been paid to the predicted quantities and management of waste water, the protection of water resources, surface drainage and the ultimate fate of water passing through and around the project sites.

Socio-economic impacts: The sanitary landfill project will result in acquisition of farm land from peoples working and producing on the site, therefore, proper compensation and resettlement package will be prepared as per the existing government guidelines.

Fences will enclose the new sanitary landfill for safety purposes. Access to the facilities will be restricted to licensed operators. As a result a large number of individuals, who collect valuable wastes for resale, will have their livelihoods affected. But as the existing disposal in Jimma is not well organized and no specific disposal site have been used, the waste-pickers are not common on the existing dump site on Bonga/Mizan road. Therefore, no migration of waste pickers is expected to settle in new landfill site.

General Environmental Quality: A major purpose of the project proposals will be to improve environmental quality. There will be effects in terms of odor and air quality impacts (associated with waste decomposition and waste burning as well as dust from construction and vehicle movements), noise (traffic and site operations), visual and landscape impacts (the visual impression created during operations, the appearance after closure, and the potential presence of windblown detritus/litter). There is also a potential impact from vermin such as flying insects, scavenging birds, rats, etc. if the facilities are not operated in

accordance with good practice. The stakeholders place great importance on the maintenance of good environmental quality at the new site, and the management procedures to control these are therefore a key focus of the ESIA.

Potential impact of landfill gas: Landfill gas is a product of the degradation of waste materials under anaerobic conditions (*i. e.* in the absence of oxygen). With its high content of methane and toxic and inflammable gases, the generation of landfill gas poses significant risks to human, animal and plant health and life. The risk is greatest where gas is allowed to build-up in confined spaces, such as within buildings or in collapsed void spaces within the deposited waste. Accordingly, the study has investigated how the design incorporated measures to minimize these risks, and assessed the residual impact to be minimal.

5.1.2 Other Impacts

Other potential impacts of the proposed project are not expected to cause significant impacts either because of the nature of the site or due to the relative ease with which they can be avoided or mitigated.

Such issues have not been treated as key impacts unless they were identified as such by stakeholders. Nevertheless these have been subject to scrutiny during the ESIA, the impacts assessed against significance criteria and the necessary design or operational measures included in the ESMP. They include the following.

Seismic Impacts: The impact from potential seismic activity is not significant in landfill development. Nevertheless, the recommendations of geotechnical investigation are incorporated. Moreover, all practicable engineering and operational mitigation measures have been incorporated into the landfill design to minimize any potential impact from seismic activity.

Impacts related to off-site Sourcing of Landfill Earthwork Materials: If site engineering works make a large demand on the importation of materials sourced from off-site, there could be environmental damage at such sites. As far as practicable, materials won from the sanitary landfill site will be stored and used in landfill construction and as cover material.

Impacts related to Contamination of Water Resources by Fuel Spillage: Potential contamination exists for fuel/lubricant spillage in the waste reception area from activities associated with vehicle refueling, repair and maintenance. These are readily controlled by good operational practices.

Potential Health Impacts of MSW Disposal: The operational practices advocated for site management and operation are designed, *inter alia*, to minimize any potential health risks from the disposal of MSW.

Impacts related to emission of greenhouse gases. Emission of green house gases under the proposed project is expected to be considerable less than in comparison with the current solid waste disposal and dumping practices, due to the proposed landfill gas collection and venting system and the alternative waste management system.

Impacts related to biodiversity and ecological habitats-The proposed landfill site is largely devoid of natural vegetation, with man-made Eucalyptus dominating the eastern part of sloped area and agriculture on the central floor. Accordingly the development is likely to have little impact on biodiversity or ecological habitats, especially the provision of wetland will provide a habitat for ecological diversity.

Impacts related to Littering and Cleanliness during Waste Transit- It is envisaged that waste delivered to the project site will be enclosed either in a haulage container or will be covered by sheet or netting (in the case of open bulk-loaded containers). This practice will ensure that waste materials do not spill onto public roads. Timely removal of skips or using house to house collection and covering the transfer container.

Impacts on the Cultural Heritage: There are no known places of archaeological, religious or cultural significance at Ela-Dale sanitary landfill sites, nor have any artifacts been found or previous land uses been identified that might suggest that there will be any impacts on cultural sites or property.

Beneficial /Positive impacts of the project

The solid waste collection and storage within the town and at house hold level is gradually improving in Jimma town. However, the disposal of the solid waste is posing significant adverse impacts on the environment and as well on the public health. The solid waste collected is haphazardly dumped at open field and also very close to residential site and close to the major trunk road. Due to its location and proximity to those sensitive sites, it is posing environmental, health and aesthetic risks. The implementation of the sanitary landfill project will alleviate all those problems and create conducive living environment in the area.

Development in trade and tourism in the area, demands standard sanitation infrastructure, which can have significant promotional and enhancement impacts of the local economy

However, land filling of waste can also pose adverse impacts to the environmental resources and to socio-economic welfare of the community, if not properly planned, designed, constructed and operated to meet the intended objectives. Major adverse impacts of solid waste landfill are discussed under the following section.

Adverse/Negative Impacts of the Landfill Project & Mitigations

The adverse impacts of implementing the landfill project can be caused both during construction and operation phases. Construction phase impacts are related to site clearance, excavation, material site development and spoil soils disposal. Major impacts will be felt at the landfill site, along the access road to the site and at material production sites. Operation phase impacts on the other hand, are mainly observed in the premises of the landfill site and along the waste haulage road route. These adverse impacts are manifested in the form of loss of vegetation cover, soil erosion, loss of properties and crops, water source pollution, air pollution, risks to public health and safety, landscape & aesthetics problem. Hence, landfill design, monitoring, management and remediation must comply with the respective migration management plan to minimize the anticipated adverse impacts and to comply with the desired environmental goals.

5.1.3 Air Quality Impacts & Mitigation

5.1.3.1 Odour Impact & mitigation

Odors at landfill sites are generated from:

- the movement, placement and decomposition of waste;
- landfill gas; and
- collection, storage and treatment of leachate

Waste transported to the landfill is likely to have already undergone some decomposition and as a result, may be odorous on arrival at the landfill site. Specified procedures for sanitary landfilling include a range of measures intended to provide effective control of odors during waste deposition, primarily the disposal of waste in small well-defined cells, the compaction of waste and the application of cover to prevent prolonged exposure of vulnerable wastes to the atmosphere. These measures will be implemented on site as routine operational practice. In addition, any particularly odorous wastes will be buried immediately within previously deposited waste and covered immediately.

Cover materials at the site will be derived from excavated material from the construction of the landfill which will be stored on site.

Landfill gas also has significant potential to generate odor impacts. These can be minimized through the collection and gradual venting of landfill gas. Both of these measures are incorporated in the proposed landfill design.

Treatment of leachate can give rise to strong and persistent odors, particularly since project proposals advocate, as one of the principal measures for leachate control and management, the leachate treatment ponds, especially the Anaerobic pond, with effective control and management, odors can be minimized but can never be eliminated in their entirety.

Accordingly, potential impacts are considered to be negative and of moderate significance.

I. Emissions from Construction Activities

Dust emissions are likely during all significant construction activities at the landfill site. Dust from site earthworks, including the construction of peripheral embankments, road works, site facility construction and installation of the basal lining system are all likely to impact ambient air quality, particularly during the initial phases of construction. **In the case of the landfill site**, there are no nearby dwellings or occupied buildings likely to be affected. There could, however be some disturbance to road users and adjacent farm land that could be considered as very minimal considering the weather condition in Jimma.

II. Dust from Operation

At the landfill it is proposed that dust generated from site operations will be minimized and managed through good site practices, as follows:

- filling the landfill in small, well-defined cells;
- compaction of the deposited waste and application of cover material;
- use of temporary wind breaks in the active waste deposition area;
- use of vegetative screens wherever possible;
- damping down when water is available;
- construction of well-formed and well-maintained site roads throughout the site;
- ensuring that there is no burning of waste on site; and
- ensuring that the wheels and chassis of all vehicles are cleaned prior to departure from the site,

With judicious application of these mitigation measures the quantity of dust emissions can be kept to a minimum.

Vehicle Exhaust Emissions from On-Site Vehicle Movements

Vehicles exhaust emissions from landfill plant and refuse collection vehicles have the potential to cause deterioration in local baseline air quality. Vehicle emissions from the development and subsequent operation of the landfill site will, inevitably, have some impact on the ambient air quality at the site, although such impacts will be so small as to be undetectable, except locally on the site access road and internal site roads and, only then, during the peak hour(s) of waste deliveries.

Any effects witnessed on a local-scale will be temporary nature and restricted to the immediate point of exhaust emission. The number of vehicles delivering waste to the landfill in the first year of site operations is very small. Accordingly, no significant impacts on ambient air quality have been observed as a consequence of traffic movements. Overall, the potential

impact of vehicle emissions resulting from landfill-related traffic is considered to be minimal.

Effects from Emission of Greenhouse Gases

There is considerable debate over the sources and impacts of greenhouse gasses. However, methane gas, one of the major gaseous products from the decomposition of waste in anaerobic conditions, is widely understood to be a major greenhouse gas. Gas from the decomposition of domestic wastes is a minor contributor to the overall problem of methane emissions into the atmosphere, with emissions from animals and natural decomposition of vegetable matter likely to be the main sources of emissions.

Nevertheless, the proper disposal of waste in regulated landfill together with the capture and gradual venting is a step in the overall movement towards control of greenhouse gas emissions and so the effect is assessed as positive.

Measures to control dust generated from on-site vehicle movements and the placement of waste and cover materials:

- filling the landfill in small, well-defined cells;
- compaction of the deposited and application of cover material;
- use of temporary wind breaks in the active waste deposition area;
- use of baffles and vegetative screens wherever possible;
- damping down when water is available;
- construction of well-formed and well-maintained site roads throughout the site;
- ensuring that there is no burning of waste on site; and
- ensuring that the wheels and chassis of all vehicles are cleaned prior to departure from the site,

Measures to mitigate dust and emissions from construction activities

A variety of measures to reduce the potential impacts will be employed, including covering of stockpiles of friable materials in order to reduce the potential for windblown dust; damping down of site roads, supplies of water permitting; early construction of the wheel wash and mandatory use for all vehicles leaving the site.

Measures to mitigate air quality impacts from vehicle emissions

At the start of site construction works, these impacts can be minimized through the use of modern, well-maintained and regularly serviced vehicles, scheduled to operate, as far as is practicable, outside of peak traffic periods.

Measures to reduce emission of greenhouse gases

Gas venting through end of collection pipe is incorporated in the design of sanitary landfill.

5.1.3.2 Noise Impacts & Mitigation**I. Construction Phase**

The most significant period of construction activity will be during the initial site infrastructure works, to be undertaken over a period of 5 to 6 months from the start of site construction. Construction works will be undertaken at the margin of the project site. Effective noise management protocols to be implemented as part of the project proposals include:

- planting of buffer trees and shrubs where appropriate;
- locating stationary equipment that is noisy as far as possible from the sensitive area;
- switching off unnecessary or idle equipment;
- fitting of noise mufflers to mobile plant and equipment; and
- Preventative maintenance of equipment to minimize noise emissions

Notwithstanding these measures, construction work will be limited to daytime periods, thus avoiding the night-time which is the most noise-sensitive.

In the light of the prevailing low ambient noise levels in the area surrounding the project site, it is inevitable that some noise disturbance will be experienced, particularly during the initial construction phase. However, the noise will not interrupt sleep (because there will be no activity at night), nor is the level at the site sufficient to disrupt normal activity (conversation, listening to radio etc).

II. Operational Noise

Sources of operational noise from the landfill site will include:

- movement of refuse collection vehicles on the site and along the site access road;
- crushing of construction debris to provide site road and cover materials;
- deposition, leveling and compaction of waste;
- placement of waste and daily cover material; and
- Site capping and restoration..

On the whole, operational noise will be at a lower level than construction noise although still above prevailing baseline conditions. Operational noise will have less impact than construction noise for the following principal reasons:

- mobile plant equipment tends to be used singly; with multiple use of mobile plant equipment is restricted to short time periods, unlike construction activities;
- landfilling activities are mobile and not fixed in that they move across the landfill footprint. Therefore, no area is subjected to the operation of the dozer and/or track loader, for example, for long continuous periods of time; and
- all site screening measures will be in place in advance of the start of site operations.

The increased noise level as a result of operational activities is considered to be negative and of moderate significance.

Summary of Mitigation Measures

Measures to minimize construction noise

- planting of buffer trees and shrubs where appropriate;
- locating stationary equipment that is noisy as far as possible from sensitive and working areas
- switching off unnecessary or idle equipment;
- preventative maintenance of equipment to minimize noise emissions,

Measures to minimize operational noise

- mobile plant equipment will be used singly, with multiple use of mobile plant equipment is restricted to short time periods, unlike construction activities;
- Landfilling activities will be mobile and not fixed in that they move across the landfill footprint. Therefore, no area is subjected to the operation of the dozer and/or track loader, for example, for long continuous periods of time; and
- all site screening measures will be in place in advance of the start of site operations,

Measures to reduce traffic noise

- As a matter of routine it is considered good practice to use only modern, well maintained and regularly serviced vehicles in order to minimize the potential negative impacts of increased traffic flows.

5.1.4 Roads and Traffic Impacts & Mitigation

Construction Phase

The construction phase impact of significant load is the hauling of drainage sand of about 10,000 m³ from Arjo about 265 kms from the site along Bedele-Nekemte Raod. Therefore, there is a genuine need to carefully plan and

execute the huge volume of transportation. In order to avoid traffic congestion, the contractor should plan to transport the sand from early construction phase, than hauling of the entire volume in the short duration in the final construction phases.

Operation Phase Impacts

Approximate road travel distances between the proposed landfill and the city is 7-12 km; it is anticipated that collector trucks would take 15 minutes to reach the site from the center of the city. All waste disposal vehicles will need to access the site via the Jimma-Agaro highway.

It is anticipated that the disposal vehicles are expected to make up to 6-7 trips/day/truck, the waste delivery traffic represents a minor traffic increase in the early operation phase compared to existing very light traffic flows. As a proportion of the 'slow-moving' vehicles, the waste delivery traffic to the site, it is not anticipated that there will be any significant impact on the speed of road users or the capacity of the road during operation phase.

The traffic load in the inner city traffic is also insignificant in comparison with the volume of other traffic. In addition, the ongoing road construction is expected to result in increased mobility in the city.

Mitigation Measures

Strict traffic regulations should be put in place and traffic signals posted at critical locations along the route and within the plant compound. Bumpers and speed breakers need to be constructed at the approach of, and within the plant compound. The traffic leaving and entering the site should take necessary precaution while leaving and accessing the site.

5.1.5 Geology and Soil Impact & Mitigation

Pollution of the underlying soil ecosystem of the landfill site is inevitable unless proper mitigation measures are put in place. Pollution effects can be due to the produced leachate and gas products infiltrating or diffusing in to the soil layer.

Impact on soil can also result during site clearance, excavation and grading activities of the land fill construction. All of these activities cause disturbance to natural ground. The soil in the area is already highly degraded and the available top soil layer is very thin. Disturbance and excavation exposes the soil to erosion effects both by wind and rain water.

Mitigation Measures

In terms of cost-effectiveness of landfilling, it is preferable to maximize the available void space (within geotechnical and geometrical constraints) and minimize the area of the landfill footprint. Steeper slopes can lead to slope instability and associated risk of loss of containment and visual impacts. The

design of the landfill has considered the stability issues surrounding landfill development slope stability.

Measures incorporated into the project design include:

- ❖ maximum landfill bed slopes of 1v:3h;
- ❖ construction of embankment dams at the north and east boundaries of the landfill footprint which act as a counterweight to the load imposed by the fill materials;
- ❖ maximum slope on the restored landfill surface of 1v:4h;
- ❖ maximum fill of embankment slopes of 1 v:2h on outer berm;
- ❖ a phased and progressive sequence of filling, with individual waste lifts no greater than 2.5 m thick;
- ❖ temporary waste slopes no greater than 1v:2h

Mitigation measures for the water resource and air quality discussed above can also apply to minimize the pollution impact on the soil.

5.1.6 Impact on Water Resource and Mitigation Measure

Impacts during Construction

No on-site impacts on water resources are anticipated during the construction phase of the facility. No streams, rivers or springs were found in the area. The entire site drains centrally in the southern eastern direction and runs in to a valley downstream.

Mitigation Measures

Care should however be exercised when handling fuel and oil (hydraulic, transmission, engine, etc.) to power and maintain the different equipment on site. Measures should be taken to avoid spillage of such material to the ground. Additionally, all earth-moving and other equipment should be in good working condition and well maintained (no leaks).

Operation Phase Impacts

Adverse impacts on water resource from solid waste landfill is related to the effect of seepage / leachate/ generated in the fill. Leachate or seepage from land fill contains fine particulates of decomposition product, dissolved solids, and microorganisms. of the land fill waste, solubilized and carried away by surface run off and rain water to the surrounding environment. There are several water sources in the premises of the proposed landfill site.

- Spring Water source downstream of the proposed landfill site and are the most adversely affected water resources. These water resources are the major water sources used by the surrounding community both for domestic purpose and animal watering. The leachate from the land fill can affect the water quality to the extent that it can no more be used for consumption. Pollution of both surface and ground water source would be severe as it could result in aquifer degradation which is very difficult to regenerate if at all possible.

- Run off from the upland buffer zone and Cell-2 areas and rain water transport the leachate from the landfill to the surrounding environment.
- The soil of the site has moderate percolation rate that facilitates pollutants movement both to the under lying soil and the ground water regime. The pollution of the ground water source would be significant due to this fact. It is to be noted that ground water is the only dependable source in that area for use.

Mitigation Measures

In consideration of the potential sensitivity of the groundwater beneath the site and spring water downstream, and in accordance with international norms and good practice, the design for the landfill has specified several integral engineering mitigation measures in order to minimize any potential contamination from leachate. Accordingly, a leachate containment, collection and treatment system is a fundamental component of the engineering measures proposed, comprising:

- ❖ the installation of composite lining systems in the zone of leachate accumulation, both designed to meet a maximum permeability specification that is lower than 1×10^{-7} ms;
- ❖ the use of a lining system comprising HDPE layers which, in will provide a robust and well proven barrier layer inhibiting uncontrolled leachate seepage;
- ❖ the provision of a high permeability leachate collection and transfer system to facilitate the collection of leachate percolating through waste materials and to drain leachate from the landfill in order to prevent a build-up of leachate within the body of the deposited waste;
- ❖ the provision of a leachate treatment system consisting of waste stabilization ponds for leachate treatment, and wetland for further polishing of effluent.
- ❖ The treatment system is designed to attain leachate effluent qualities of the filtered effluent BOD is 33mg/l i.e. about 96.7% total percent BOD removal in stabilization ponds.
- ❖ The final effluent from the wetland is expected to attain effluent BOD5 of 25mg/l
- ❖ the adoption of routine operational measures to minimize leachate generation and the volumes of leachate to be treated, including control of surface water run-on, cellular filling and the adoption of intermediate and final cover to minimize leachate generation,

When these measures have been adopted, the risk of leachate seepage to groundwater will be extremely low. In order to ensure that leachate emissions do not occur at any stage, the following measures will also be implemented as part of the project development:

- Provision of alternative piped water supply to communities using the downstream spring, these has been discussed with the communities and the City Administration has agreed to provide alternative source of drinking water. The procurement of consultants has been commissioned by the City Administration.
- the employment of experienced sub-contractors to install the geosynthetic components of the composite lining system;
- high standards of construction quality assurance during installation of the lining system and the leachate collection system, monitored by an experienced expatriate technical advisor;
- pro-active control over leachate levels within the landfill during site operation;
- regular monitoring of leachate levels within each sub-area of the landfill to ensure no unforeseen build-up of leachate over the basal lining system; and
- monitoring of any leachate breakthrough between the double liners at the downslope side of inter-liner drainage measures.

With the implementation of all of the above protective measures the potential impact of leachate emissions is considered to be of minimal significance. Recommended monitoring requirements are discussed next sections.

5.1.7 Impact on Vegetation cover and Wildlife Resources and Mitigation Measure

The plot of land selected for the landfill has no significant vegetation cover, and has already been cleared for crop production. Only few acacia trees are found dispersed in the crop fields. The eucalyptus tree along the north and south eastern will be used as good opportunity for providing buffering belt between the site and Jimma-Agaro access road.

Proposed Mitigation Measures

The few trees removed due to the project should be compensated for the owners in monetary terms, but also replacement trees have to be planted at sites to be reserved as buffer zone around the landfill. Trees can reduce impacts due to odor and smell in the premises of the landfill.

5.1.8 Public Health and Safety Impacts and Mitigation Measure

This Section discusses the range of potential health and safety impacts to the public and to the workforce associated with MSW disposal. Most potential impacts are associated with the disposal sites. Any impacts that may arise due to transfer and haulage of waste may be controlled by worker health and safety procedures, which will apply to workers on all aspects of the project. The following therefore focuses on the waste disposal areas but the management measures apply across all project sites and activities.

Potential Health Impacts of MSW Disposal

Public health impacts from MSW disposal may include exposure to toxic chemicals through air, water and soil; exposure to infection and biological contaminants; stress related to odor, noise, vermin and visual amenity; risk of fires, explosions, subsidence, spills and accidents. In addition increased incidence of respiratory ailments can be caused by transport emissions and smoke; vermin attracted to the site (birds, rodents and insects) can act as disease vectors; and, the contamination drinking water by leachate can cause severe damage in a variety of ways depending on the nature of the contaminant.

Waste pickers face particular risks from direct contact with the waste, especially when, as is usually the case, they are not wearing protective clothing. The risks to the public and workers are much greater if hazardous waste is mixed with the MSW. Changes in transport intensities and routes may raise the risk of accidents and of harm to pedestrians.

The workers engaged on the landfill operation may be exposed to contamination and to water born communicable diseases related to the waste.

- ❖ Respiratory tract infection can be posed due to odor problem at the site. Significant odor problems could be caused by the operation of the landfill. The major odor is due to the rotten organics, garbage and dead animals brought to the site and are mainly felt during dumping of the waste. The unsanitary conditions at a poorly managed landfill site can pose filth and odour problem in the compound.
- ❖ Odour can also be due to the release of decomposition products of organic wastes. Gaseous products like methane and carbon Dioxide are produced due to the anaerobic decomposition of the waste (organic material). These gases are toxic substance for human health.

Though there is no major settlement around the proposed landfill site, odor generated from the site could be a major annoyance to few number of people and housing units located some kilometers away from the site. The severity of the odor nuisances could hinder the future development potential

of the neighboring land use. Odor will be realized by the nearby residents when prevailing winds are towards their residences. The odor from the works will not travel too far downwind but will definitely affect the surrounding properties.

- Contaminated food ingestion may be cause for the labourers engaged on the work, if adequate hand washing is not practiced on regular bases.
- Skin disease may be a problem among workers exposed to the waste with bare hand and body.

Measures to mitigate potential health impacts of MSW disposal:

- ❖ strict control over entry and exit to sites;
- ❖ measurement documentation and inspection of incoming waste loads;
- ❖ defined standard operating procedures for waste discharge and deposition;
- ❖ control of vermin, insects and birds by compaction of deposited waste and application of cover materials in small, clearly-defined operating cells;
- ❖ training in safe working methods and good hygiene practices;
- ❖ the use of personal protective equipment, as required, when working on-site;
- ❖ provision of first aid facilities;
- ❖ regular health checks for personnel;

to minimize such health hazards, proper safety and precautionary procedures need to be followed. Measures include; training and awareness creation programs for workers on safe waste handling and hazards protection measures, provision of protective cloths and devices like gloves, goggles, protective cloths, provision of adequate water and soaps for bathing, and adequate bathrooms to enable them day to day bathing after work, their periodical health check-ups, vaccinations etc. The workers should have free health services and medical checkups.

Measures to mitigate exposure to, or explosion of landfill gas

- ❖ Installation and maintenance of the gas collection and venting system by adequately trained and qualified staff as per the design
- ❖ A program of landfill gas monitoring to assess the effectiveness of the gas control measures

Measures to limit exposure to vermin

- ❖ Controlled access to the sites
- ❖ Reduction of vermin by daily waste cover and spraying with insecticides, distributing pesticide/raticide as and when necessary

Measures to reduce risk of traffic accidents

- ❖ control of the routes that drivers take

- ❖ grading and maintenance of access roads
- ❖ Placing necessary traffic signs

5.1.9 Impacts Due to Accidental Fire and Mitigation Measure

Fire accident can be caused either due to flammable materials brought along with the solid waste or due to gasses (like methane) emitted from the landfill itself as a decomposition product of the waste.

Proposed Mitigation measure

Fire accident should be prevented by taking the proper measures and preparatory works in advance; these measures should include controlling type of waste received at the land fill, preventing gas emissions from the land fill; assuring quality of design, construction and Operation of the landfill, organizing adequate fire-fighting capacity and providing adequate staffing and training for the workers.

The design and construction of landfill should provide properly designed gas release or collector pipe to minimize fire risk due to gas emission from the decomposition of the waste.

All fuels or flammable solvents for operational use should be stored in an appropriately ventilated and secure store. This store should be located on unfilled land, and all flammable liquids should not be stored full tank, but with provisions of open volume so that any release of raw or burning fuel would not cause a fire in the filled waste.

5.1.10 Social and Socio-economic Impacts & Mitigation Measures

5.1.10.1 Impacts

Land Acquisition and Land loss are the main socio-economic impacts of the sanitary landfill project; the landfill site is on agricultural land with two inhabitants within 200m range. The total area including the facility site is owned by some 40 households, some of the households depend for their livelihood on produce from the land, and others depend on selling eucalyptus tree grown on the peripheries of the site. There are also few coffee and fruit vegetation grown in the area.

The land needed for the landfill is a fertile land that has been used for agriculture. Therefore, compensation for agricultural land is essential as per the government rule and regulation. The Constitution of the FDRE Art. 44.2 states that

“All persons who have been displaced or whose livelihoods have been adversely affected as a result of state programs have the right to a commensurate monetary or alternative means of compensation, including relocation with adequate state assistance.” and

Rural Land Administration and Land Use Proclamation, No. 456/2005:

Art. 7.3 states:

“... Where the rural landholder is evicted by federal government, the rate of compensation would be determined based on the federal land administration law. Where the rural landholder is evicted by regional governments, the rate of compensation would be determined based on the rural land administration laws of regions”,

Therefore, the social impact assessment mitigation measures are studied based on these legal requirements,

Potential Impacts	Mitigation/Management Proposed	Positive	Residual Impact
Impact on land acquisition on land use	Yes	-	Significant
Loss of Arable and grazing land	Yes	-	Significant
Impact on income & livelihood	Yes	-	Significant
Impact on cultural and social structure	No	-	slight

5.1.10.2 Mitigation Measures

The landfill will strongly influence the socio-economic situation of the people whose livelihood is dependent on the land. Conducting census and socio-economic surveys of project affected areas and populations as a basis for identifying and measuring the types and magnitude of impact of the project and the associated displacement and loss of household and community assets in order to determine the required amounts of compensation and other resettlement measures and assistances for the restoration of income and livelihoods; had been conducted.

The socio-economic study of this project examined the construction of the sanitary landfill would result in the resettlement of 40 households and 277 people from the site.

The Federal Republic of Ethiopia Ministry of Works and Urban Development Resettlement Policy Frame Work (RPF) process requires undertaking Resettlement Action Plan (RAP) **when the affected peoples are greater than 200; accordingly RAP is administered** for the Social Impact Analysis of the Jimma Sanitary Landfill Project.

The project impact on involuntary resettlement of Project Affected People (PAP), Resettlement Action Plan will be implemented in order to ensure a fair

economic compensation for the affected landholders through a consultative and mutually agreeable process.

The Resettlement Action Plan report presented separately covers the following elements:

- *A census survey of affected persons and valuation of assets*
- *Assessment of Project impacts, land acquisition and resettlement*
- *Objectives, policy framework and compensation entitlement criteria*
- *Framework for public participation, consultation and grievance redress*
- *Relocation and rehabilitation options*
- *Livelihood Restoration Strategy*
- *Institutional framework*
- *Resettlement cost estimates and budget*
- *Implementation arrangements and schedule*
- *Monitoring and evaluation*

The RAP report is presented in separate volume as an annex to this report.

Measures to reduce impacts on local social structure

The management of the project sites will be sensitive towards the concerns of surrounding communities and land users by,

- Enforcing planning controls and implementing the abbreviated Resettlement Plans to ensure that an unregulated community of waste traders and pickers does not develop around the sites
- Operating an effective complaints management system

6 The Environmental and Social Management & Monitoring Plan

Introduction

The ESMP constitutes a critical link between the management and mitigation measures specified in this report and the proper implementation and management of the measures during the construction and operation of the project. It summarizes the anticipated environmental and social impacts and provides details on the measures responsibilities and scheduling to mitigate these impacts; the costs of mitigation; and, the ways in which implementation and effectiveness of the measures will be monitored and supervised.

Mostly, especially in comparison with current conditions, the project will have positive impacts on the quality of peoples' lives. Consistent with the scope of the project and the available resources, measures have been proposed that maximize these benefits. The Jimma Sanitary Landfill Project is basically an environmental improvement project. From first planning its design has incorporated a significant number of measures directed specifically towards environmental protection and the minimization and/or mitigation of potential environmental impacts. However, there is still potential for some negative impacts due to the nature of project sites or the risk that design features will not be implemented. These have generally been addressed in three ways as follows.

- Additional prevention or abatement measures have been incorporated into the design of the facilities.
- Operating and management procedures will be enforced that specify how staff will carry out their duties at project sites.
- Capacity development and administrative measures have to be developed to ensure the responsible institutions have the legal, administrative and human resources necessary to fulfill their functions.

Structure of the ESMP

The measures required by the ESMP will be incorporated in a series of documents that will be linked through the ESPM and the associated Monitoring Plan. These documents are as follows.

Relevant provisions of the ESMP will be incorporated into the Contract Documents prepared for firms bidding to work on major project construction activities (i.e. the construction of the landfill, the construction of the leachate treatment unit and all other site facilities) forming a binding contractual obligation that specifies not just design features but, where the ESMP so requires, management of workers, vehicles, machinery, operating times, methods of working, complaints management etc.

Relevant provisions of the ESMP will also be incorporated into the operational phases (i.e. the operation of the landfill and the operation of the collection vehicles). These binding contractual obligations will specify, where the ESMP so requires, site management and maintenance routines, employment practices, vehicle routes, operating times, methods of working, complaints management etc.

Relevant provisions of the ESMP will also be incorporated in project management. This will include a monitoring plan for noise, dust, and water. A supervision plan to check the progress and effectiveness of the environmental and social mitigation measures, arrangements to implement the provisions of the Resettlement Action Plans, and provisions to implement a training program in environmental management, for national and local government officials.

It will be the responsibility of the project proponent to prepare these documents, based on the provisions of the ESMP. Accordingly, the EMP contained herein identifies:

- all key mitigation measures required for successful project implementation (whether or not these are already included in the project design);
- any associated compliance monitoring recommended to ensure successful implementation of the recommended mitigation measures;
- the environmental monitoring program recommended to assess and evaluate the ongoing environmental impacts of project development; and
- the institutional arrangements and responsibilities by each party for execution of the mitigation measures and for compliance and environmental monitoring.

Environmental Management Plan

The integration of environmental management and monitoring plan in the overall project management exercise would enable to evaluate the proper implementation of the proposed project. This should aim at providing a quality control, leading to a project which will be properly designed, constructed and functions efficiently and sustain ably.

Environmental management refers to the implementation of measures required to minimize adverse impacts to the social and natural environment due to the implementation of the road project. The environmental management program should consider the over all project implementation phases; design, construction, operation and phases and closure of the land fill.

Environmental monitoring is concerned with two major objectives; Compliance monitoring and Effects monitoring.

- Compliance monitoring deals with the proper and timely implementation of the prescribed mitigation measures proposed to offset the expected impacts. It also tries to identify and include unforeseen impacts and measures required to minimize the impact.
- Effects monitoring deals with recording the consequences of the project implementation on the overall environmental components. This involves measuring certain indicator parameters.

The environmental management for the landfill will be a performance-based site assessment and management to ensure landfill operators select the most appropriate and innovative means of meeting the specified environmental goals. Accordingly, the landfill Environmental Management will have to comply with the following environmental goals;

- Proper collection of solid waste from the sources, and transportation to the transfer station
- Regulate, Control and prevention of open field disposal of solid waste
- Control of littering and off disposal of waste at the transfer station
- Awareness creation program on solid waste handling, consequences of waste mismanagement.
- Timely removal of skips when full and transporting to the landfill site
- Regulating hazardous waste disposal along with domestic municipal solid waste.
- Management of leachate collection and treatment provisions
- Management and monitoring of ground water and surface water source pollution
- Control of dust and mud on the site, and off site discharge of the waste.
- Control of vectors, birds, rats
- Litter management, traffic management
- Management of landfill gas
- inspection of fire incidences
- Re-vegetation of degraded land and the buffer zone surrounding the landfill.
- Record keeping and reporting of waste types, and quantity, compaction methods, compaction equipment, any recycling/reuse options
- Storm water control from entry to already completed areas as well as operational areas
- Erosion control of stockpiles, excavated sites, embankments.
- Assuring whether the proposed mitigation measures are adopted in the actual project implementation.
- Reinstatement of cover soil material production sites graded and excavated grounds.

Key Operational & Management Controls

Solid waste personnel work in all types of weather, with many types of heavy equipment, with a variety of materials setting. The types of accidents possible at landfills include injury from explosion or fire, inhalation of contaminants and dust, asphyxiation from poorly vented leachate collection system manholes or tanks, falls from vehicles, injury associated with operation heavy earth-moving equipment, injury from attempting to repair equipment while engines are operating exposure to extreme cold or heat, and traffic accidents at or near the site.

Safety guidelines specific to the operation of landfill will be given in operation and management manual.

Access Control

Public access to landfills must be controlled by use of artificial barriers, natural barriers, or both to prevent unauthorized vehicular traffic and illegal dumping of wastes. These barriers can include fences, ditches, berms, trees, etc. Access should be controlled by gates that can be locked when the site is unsupervised.

Good housekeeping procedures are necessary for landfill operations. A well-planned and maintained landfill effectively controls for the following:

- **Aesthetics:** Although making the site pleasing to look at is cosmetic, it is not frivolous. Addressing aesthetic concerns may include using fences, berms, plantings, or other landscaping to screen the landfill's daily operations from roads or nearby residents, and providing an attractive entrance with good roads and easy-to-read signs.
- **Wind-Blown Paper:** On-site litter control is accomplished by using fences to stop blowing paper and plastic. Frequent manual or mechanical litter pick up is also needed.
- **Insects:** Flies and mosquitoes are the most common insects of concern to neighbors. They are best controlled by covering the solid waste daily and eliminating any open standing water, such as in appliances stored for recycling or in surface depressions.
- **Rodents and Wildlife:** Rats were once a problem at open dumps, but at sanitary landfills, burying all food wastes with daily cover material usually eliminates rat problems.
- **Birds:** Birds can be a nuisance or even cause problems with planes if the landfill is near an airport. Federal Aviation Administration (FAA) should be notified if the landfill is within five miles of an airport runway used by

jet aircraft. Methods to discourage birds include use of noisemakers, wire grids, and liberal use of cover soil. The best approach is to keep the working face small and to provide adequate cover.

- **Odors and Fires:** Odors are best controlled by daily cover, as well as by adequate compaction. Daily cover also forms cells that reduce the ability of inadvertent fires to spread throughout the landfill. Any burning or smoking waste should be dumped off to the side and extinguished before placing it in the working face. Fire-fighting equipment and an emergency water supply should be available on site or arranged for with local authorities.
- **Noise:** Equipment should be operated behind berms, which shield the surrounding area from noise as much as possible. Access should be designed to minimize the impact that landfill site traffic has on nearby neighborhoods.
- **Dust and Tracking:** Roads should be watered in dry periods to keep dust to minimum roads should be crowned and well-drained to minimize mud tracking. Adequate wheel-cleaning and mud knock-off areas should be provided. Entrance roads should be paved or have all weather surface concrete or asphalt to keep mud tracking on-site and should be cleaned whenever a mud buildup occurs.

Scavenging: While recycling at a landfill may be desirable, scavenging (or uncontrolled picking through waste to recover useful items) is not desirable. Because scavengers have been injured, sometimes fatally, while picking through the wastes, the practice should be prohibited. Salvaging, which is the controlled separation of recoverable items, should be distinguished from scavenging. Any salvage operations should be kept away from the landfill, usually at the gate area, and residues should not be allowed to accumulate.

Awareness Raising and Capacity Development

Addressing the major social and environmental concerns depends in large part on raising public awareness of the issues and changing behavior in waste production and separation. The behavior and capacities of the public sector in managing, supervising and monitoring project activities also needs to be enhanced.

The implementation of an environmental management plan on the level of the proposed project could enhance environmental conditions. The objectives of this plan are to reduce the waste volume, recover recyclable material, achieve better quality compost if pilot plant proved effective, and develop the recycling and compost markets. Three main tasks are suggested to achieve the specified objectives: training, conducting local awareness campaigns, and ensuring markets for compost and recyclables. The training

workshops having some common objectives with the awareness campaign will be also opened for the locals.

Two types of training workshops are required. The first workshop is to increase environmental awareness of all individuals concerned with the project (construction, operation, mitigation, monitoring), whereas the second is to train the workers who will be involved in the facility operation.

6.1.1 Environmental Awareness Workshop

Municipality members, contractors, and personnel who will be involved in the construction and operation of the facility, and the mitigation and monitoring plans will be required to attend an environmental training workshop prior to the initiation of the project activities. The objective of this workshop is to ensure appropriate environmental awareness, knowledge, and skills for the implementation of environmental mitigation and monitoring measures. In an effort to increase local environmental awareness, the workshop should also be opened for individuals from the local community. The workshop shall be conducted in one or two days during the construction, and once a year during the operation phase. The workshop will increase environmental awareness of the participants by covering at least the following topics:

- Environmental laws, regulations, and standards
- Pollution health impacts
- Pollution prevention and mitigation measures
- Sampling techniques and environmental monitoring guidelines
- Integrated solid waste management (source reduction, separation, processing, etc.)
- Compost quality and usage (land application, standards and application rates)
- Health and safety measures

6.1.2 Institutional and training needs for environmental management program

Facility operators should receive appropriate training to assume the duties of managing the facility, implementing the suggested mitigation measures, and monitoring potential impacts. The training workshop should cover the following issues:

Waste separation: workers should be informed about appropriate waste separation required to prevent the production of contaminated compost. Furthermore, they should be able to identify all hazardous material, which could contaminate the sanitary landfill and compost yard such as batteries, and glass, and that should not enter the composting drums.

Negative impacts: to prevent the occurrence of negative impacts, workers should be aware of all potential impact, their causes, and mitigation measures

Environmental awareness: workers should have a sense of environmental awareness in order to understand the importance of environmental protection

Health and safety regulations

The contractor should be responsible for ensuring adequate training of all facility operators. This could be achieved by workshops that will be conducted, in the facility, before the operation phase for a period of one week, and during the operation phase for one day on a quarterly basis. The objective of the week workshop is to ensure appropriate operation of the facility and implementation of mitigation measures. It will cover all project components with respect to operational activities, composting process, mitigation measures, and maintenance activities. The objective of the one-day workshops is to monitor operation activities and further ensure appropriate operational skills, as well as solve any operational problems that might occur.

The environmental management and monitoring program should be implemented through institutionally organized and professionally staffed manpower. The environmental management shall be implemented at all level and by all parties involved in the project implementation process. Including the design consultant, the construction contractor, the owner of the project (the client), and the operator of the facilities if other than the owner and the community / beneficiary of the project.

The managing institution needs the appropriate authority and competence to assume the required responsibilities.

- The status given at Main Process owner for the solid waste managing institution of Jimma at present is a proper level of mandate. However, it has to be staffed with appropriate grade - level of professionals.
- The institution also needs to be empowered to generate its own revenues adequate to cover costs.
- The institution needs to have the mandate and capacity to provide public education and awareness creation programs regarding waste management needs and standards.
- Also the institution should have the mandate to enforce solid waste regulations.
- Managers and professionals in the solid waste field should develop their skills through short term training packages and by attending conferences which enable them acquire experiences.

6.1.3 Awareness Raising

The objective of the campaign is to increase environmental awareness, induce home waste separation, which will lead to waste volume reduction, material recovery, and better quality compost, and inform the locals about the uses of compost. Community acceptance of the project and participation in waste separation is a vital component of a successful solid waste management system that as well results in waste reduction. The negative perception associated with the re-use of waste material should be overcome by explaining to the local community the role of integrated solid management plan in societal development.

Waste separation requires a change of attitude of the leaders of households, services and enterprises. The leaders of households, services and enterprises have to acknowledge that it is their responsibility to care for sustainable and environment friendly development. This responsibility starts with the production and separation of solid waste as a public service for reducing the costs for waste collection and disposal for all stakeholders. The beneficiaries of the municipal waste management system also have to pay at a level that allows the public sector to recover the cost of providing a modern, well regulated and efficient service.

Environmental awareness campaigns should be conducted with focus on:

- ❖ Pollution health impacts
- ❖ ISWM (reduction, separation, composting, landfilling)
- ❖ Waste reduction: minimizing consumption, re-using, and home waste separation
- ❖ Recycling
- ❖ Composting

Table 6-1: Environmental Management and Monitoring Plan

Project Phases	Issues to be monitored	Monitoring measures	Responsible body	frequency
CONSTRUCTION PHASE	Loss of land and property due to project	<ul style="list-style-type: none"> • Ensure that PAPs have been timely and adequately compensated and relocation/ or replacements are given in time. • Ensure that rehabilitation and reinstatement works done to mitigate damages caused have been complied with and have proved effective. • Ensure that service utility lines have been relocated prior to commencement, and that continued service has been secured. 	<ul style="list-style-type: none"> • Jimma Urban Development, Trade and Industry office • Mana Woreda Administration • Mana Woreda Land Administration and Development Desk • Mana Woreda Agricultural and Rural Development Office • Mana Woreda Environmental Protection office • Ele - dare Kebele Administration 	Up on commencement of construction works
	Traffic safety and ROW maintenance	<ul style="list-style-type: none"> • Check timely backfilling of trenches at densely settled and traffic loaded sites • Timely removal of spoil soils • Traffic signals posted at critical sites 	<ul style="list-style-type: none"> • Contractor • Traffic police and supervising consultant 	regularly
	Workers safety and health	<ul style="list-style-type: none"> • Ensure proper safety measures are arranged for workers, especially while working in deep trenches • Protective clothing and first aid treatment facilities are arranged on site 	<ul style="list-style-type: none"> • Contractor • Consultant 	Regularly while on duty

	Water source pollution	<ul style="list-style-type: none"> • Spoil soil is damped at designated dumping site, not in river courses or other open places. • Leaking machinery and vehicle parts are maintained on time • Waste disposal at river banks is prohibited 	<ul style="list-style-type: none"> • Supervising consultant • Contractor 	Regularly while on duty
OPERATION PHASE	Water quality	<ul style="list-style-type: none"> • Quality test of downstream water sources, water quality tests of samples from ground water sources, water supply lines and rivers along sewer line. 	<ul style="list-style-type: none"> • Project owner, Jimma City Administration • Agricultural and Rural Development Offices at Zone and Regional level • Regional EPA or Health Bureau • Regional and Zonal Water Resource Development Bureau 	6months interval
	Workers health and safety	<ul style="list-style-type: none"> • Make sure that protective clothing and devices are availed for the workers • Ascertain that workers are utilizing protective clothes while on operation • Make sure that free medication facility is arranged for the workers, and medical checkups are regularly followed. • Check adequate water supply for bathing is provided in the compound, and sanitary facilities are available for all the workers 	<ul style="list-style-type: none"> • Project owner, Jimma City Administration • Local NGOs 	Regularly by responsible department of Sanitation and Beautification work Process owner

	<p>Proper Waste management</p>	<ul style="list-style-type: none"> • The waste should only be unloaded on active or working face • Incoming vehicles should be inspected to identify and isolate unacceptable wastes (hazardous bulky wastes) • The unloading activity should spread waste on a working face followed by compaction. • Waste Should be compacted • Daily cover, interim, and final cover should be applied 	<ul style="list-style-type: none"> • Project owner, Jimma City Administration 	<p>Regularly by responsible department of Sanitation and Beautification work Process owner</p>
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6.6. Conclusion and Recommendation

The implementation of the project shall have an overall positive impact and significantly improves the sanitary condition of the city. The solid collection efficiency shall increase, thereby reducing the garbage and plastic material seen in the open fields. The pollution caused to the water resources of the area shall be reduced. The health problems related to the solid waste gases, the odor problem, the aesthetically debilitating situation at the current dump site and the river course shall be improved. The Jimma international Airport adjacent to the current dumping site shall be free from bird hazard. The value of the land in the premises of the abandoned site shall appreciate as a result of the improved sanitary conditions. However, the current sewage sludge dumping at this location should also be stopped and similar improvement measures are put in place to achieve the required goal.

On the other hand, the construction and operation of the new land fill at the virgin land of the city outskirts can cause adverse impacts to the surrounding natural resources. The location identified for the proposed land fill falls in a sparsely populated area primarily inhabited by pastoralist community. The most significant adverse impact would be on the water resources of the area. Water is a very scarce commodity in this semi desert climatic zone. There is no perennial river in the area and the community depends heavily on ground water sources, and water ponds.

At downstream of the proposed land fill site there exists Spring Water Source, these are the major water sources used by the community both for domestic purpose and for animal watering. The leachate from the land fill can easily reach these water sources and can cause pollution problem. The seepage of leachates to the ground water might be facilitated by the subsurface condition.

So it is highly recommended that;

- Properly designed and construction of leachate collection and treatment facilities are provided along with the land fill structure
- Monitoring wells should be located between the land fill leachate treatment plant and the downstream spring source.
- Water Quality monitoring program shall be scheduled for periodic quality tests and control of impacts.
- Buffer zone be demarcated around the land fill, develop vegetation cover between the land fill and western and southern farming area is necessary.
- Capacity building in terms of required facilities and training of personnel in the field of solid waste management be programmed for those engaged in the service provision and administration.

- Awareness creation programs to be conducted for the community on the concept and need of proper solid waste handling, waste reduction on site, composting, recycling and reuse of materials in sustainable and sanitary conditions.
- Sanitation rules and regulations shall be enforced along with the other mitigation measures.

All the mitigation measures requiring physical work interventions shall be specified in the tender documents and construction contract documents. The supervising consultant, the client and the contractor have to assure the proper execution of the proposed measures along with the overall project implementation exercise.

The study emphasizes and recommends the strict adherence to waste management hierarchy advocated worldwide at present. The waste management hierarchy follows the principles of sustainable development that encourages using scarce natural resources more efficiently, and avoiding the environmental impacts of waste disposal. The waste management hierarchy to be advocated should, therefore, recognize the following trend;

- Avoiding waste
- Re-using materials
- Recycling and reprocessing materials
- Waste disposal (if the first three are not possible).

So it is recommended that capacitating all the actors in the project implementation is essential for the effectiveness and sustainability of the facility provided. Well established environmental management plan and operational guidelines have to be developed for the workers to follow.

8. Annexes

Annex .1. References

1. Constitution of the Federal Democratic Republic of Ethiopia, Proclamation No. 1/1995. Addis Ababa, Ethiopia.
2. Environmental Protection Authority (EPA) (1996), Conservation Strategy of Ethiopia, Addis Ababa, Ethiopia.
3. Environmental Protection Authority (EPA) (1997), Environmental Policy of Ethiopia: Addis Ababa, Ethiopia.
4. Environmental Protection Authority (EPA) (2000), Guideline Document: Environmental Assessment and Management; EPA, Addis Ababa, Ethiopia
5. Federal Democratic Republic of Ethiopia. (2002), Environmental Pollution Control Proclamation. Proclamation No. 300/2002, Addis Ababa, Ethiopia.
6. Federal Democratic Republic of Ethiopia (2002), Environmental Impact Assessment Proclamation. Proclamation No. 299/2002. Addis Ababa.
7. FDRE EPA, 2003. Guideline for reviewing environmental impact study reports (final drafts), Addis Ababa.
8. MEDAC/EPA (1997). The conservation strategies of Ethiopia, Volume 1. The resource base, its utilization and planning for sustainability, Addis Ababa.
9. J.Vymazal, Constructed Wetland for Wastewater Treatment, ENKI, o.p.s and Institute of System Biological and Ecology Czech Academy of science, Dukelska 145, 37901, Trebon, Czech Republic.
10. William H. Langer, Lawrence J. Drew, Janet S. Sachs, Aggregates and The Environment, American Geological Institute in cooperation with U.S. Geological Survey
11. Ministry of Works and Urban Development November. (2008). Environmental and Social Management Framework ULGDP

Annex-2: List of EIA report preparers

No	Name	profession	Assigned position in the project
1	MS- consultancy	Consultant in WATSAN	Design and supervision consultant for the project
1.1	Getahun Worku	Environmental Resource Management Consultant	Environmentalist
1.2			Socio - economist

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