EVALUATION OF LAND USE PLANNING AND IMPLIMENTATION WITH RESPECT TO ENVIRONMENTAL ISSUES IN SULULTA TOWN

MSc thesis in Environmental Planning and Landscape Design

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June, 2012

Addis Ababa

This thesis is submitted to the Ethiopian Institute of Architecture, Building Construction and City Development (EiABC) and to the School of Graduate Studies of Addis Ababa University in fulfillment of all requirements for the degree of Masters in Environmental Planning and Landscape Design

.Title of Thesis: **Evaluation of land use planning and implementation with respect to environmental issues in Sululta town**

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Declaration

I, the undersigned, declare that this thesis is my own and original work and has not been presented for a degree in any other university, and that all sources of material used for the thesis have been duly acknowledged, following the scientific guidelines of the Institute.

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The thesis can be submitted for examination with my approval as an Institute`s advisor.

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Acknowledgement

I am grateful indeed to the almighty God, the merciful and the compassionate. First and foremost I would like to extend my thanks and appreciation to my sincere advisor Dr. Hailu Worku who has been a source of intellectual inspiration and guidance. His constructive comments, enthusiasm, continuous guidance and feedback throughout the thesis process made this study possible. His valuable insight and comments were also greatly contributed towards shaping this thesis to the present form.

I would also like to extend my special thanks to Oromia Urban Planning Institute and Addis Ababa University for the financial support without which the research work could not have been done in the form presented here.

My special credit and appreciation goes to my friends, especially Mellese Firdisa and Adam Idossa for their unreserved comment, moral and support in various aspects of the research work. It is also my pleasure to express my deepest gratitude to my wife Selemawit Geleta for her invaluable comment, enriching support and encouragement throughout the research.

Finally, I am grateful to my parents, my brothers, sisters and friends for their motivation, support and understanding during the study. This work is dedicated to all of you and without you not be where to this level. Since it is difficult to mention all who assisted me, I take this opportunity to say, thank you.

Abstract

Urban land use plan is a tool to guide and manage the growth of cities/towns in a planned manner. The soul of land use plan lies in the preparation and its implementation, if not people are trapped in a mess of urban problems particularly environmental problems. The land use plans have been prepared for several towns of Ethiopia; however, its preparation and implementation is found at infant stage due to host of reasons and Sululta is the one. Thus, the researcher concerned with the evaluation of land use planning and implementation with respect to environmental issues in Sululta town.

In this regard, poor waste management, incompatible and unsuitable land use allocation and implementation, low level of awareness of private investors, limited knowledge and skill of municipality, the abundant distribution of quarrying areas, misuse of wetlands, were the major problems. Therefore, the economical, social, aesthetical, recreational and ecological values the town would get were adversely affected.

Thus, this research was conducted in order to evaluate the major land use conflicts and environmental problems of the existing land use plan and implementation with respect to environment in the study area. Specifically, the study focuses on issues like urban greenery, solid and liquid waste management, quarrying activities and pollution in order to curb the problems.

Based on these objectives the researcher discussed the issues of land use planning and its implementation with respect to environment in the study area. Accordingly, land uses like housing, commerce, road network were proposed on environmental sensitive areas, wetland. As well as incompatibly and unsuitably land use proposal of industrial area, abattoir and dump site and the elongated shape of the town which is difficult for the provision of infrastructure were identified. Moreover, the study boldly rationalize that the misuse of urban greenery, dumpsite, abattoir, industrial development and quarrying activities during plan implementation. These may result various environmental problems such as pollution and destruction of natural resources which adversely affects the recreational ecological, aesthetic and social-cultural values of the town.

Finally, the researcher concluded that there were contributing factors to the infectively prepared and implemented land use plan particular emphasis to environment in the study area. The external factors like community, investors and private participation, shortage of commitment of officials as well as internal factors such as experience and disciplinary gap of the plan preparation team were contributed to the limited quality of the plan. Moreover, the effectiveness of the plan implementation were hindered by lack of policy and commitment of officials, shortage of implementation tools, skilled man power and community awareness

Key terms: - land use planning, plan implementation, environmental problems

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ACRONYMS

FAO- Food and Agricultural Organization

WHO- World Health Organization

FUPI- Federal Urban Planning Institute

UTM- Universal Traverse Mercator

OUPI- Oromia Urban Planning Institute

CSA- Central Statistics Authority

GIS- Geographic Information System

CAD- Computer Aided Design

EIA- Environmental Impact Assessment

EPA- Environmental Protection Authority

OWWSDE- Oromia Water Works Design and Supervision Enterprise

SP- Structure Plan

FGD-Focus Group Discussion

CHAPTER ONE

1. INTRODUCTION

1.1 General Background

Environmental problems have attracted the attention of people of the world for the last (2-3) decades. People are now becoming increasingly conscious of variety of these environmental problems. Generally speaking environmental problems can be classified in to three parts. These includes the problem arising and associated with poverty and under development, the problems those arising as negative effects of the very process of development and the problems related with manmade pollution (ORAAMP, 2010).

As to ORAAMP 2010, population growth, industrialization and urbanization are the three main causes of environmental problems. This is due to the introduction of undesirable materials into physical environment like soil, water and air may that in turn interfere with human health, the quality of life and nature.

If these problems are not well considered at urban plan preparation and implementation, it may be farther intensified even beyond their immediate vicinity. Thus, bearing these environmental problems into consideration the study focuses on approaches of existing land use plan and its implementation in the study town.

Sululta is one of the town's of Oromia Special Zone Surrounding Finfine. In here the rate of industrialization, urbanization and population growth are high. Thus, today it is common to see improper quarrying, reclaiming of wetland and open spaces for other development, improper waste management and pollution (land, soil, air and sound) in the town. Hence environmental degradation is increasing from time to time. As the situation getting worst and worst, need great attention. This is due to the fact that environmental degradation may affect the recreational, aesthetical, ecological, economical and social values of the natural environment.

Taking such environmental problems in to consideration, the study evaluates major causes of environmental problems, impacts of problems on integrated and sustainable developments in the town. Moreover, attempts were also made to identify areas exposed to conflict with its reason.

1.2 Statement of the Problem

It is obvious that human activities have a profound effect up on the natural environment. People are becoming the main agent of environmental degradation as they depend on the natural environment for their survival. In this regard, urban centers like Sululta towns have exposed to such environmental degradation. This is due to the fact that the rate of population growth, urbanization and industrialization are relatively higher.

Moreover, poor waste management, incompatible and unsuitable land use allocation and implementation, low level of awareness of private investors regarding waste management, limited knowledge and skill of municipal decision makers to implement the plan and to carry urban law and regulation accordingly, and the abundant distribution of quarrying areas have contributed a lot for urban environmental degradation. As a result areas supposed to be allocated for urban green were qualitatively and quantitatively reduced. Most of them are found at urban periphery and are not furnished and even difficult to reach and use.

In the same manner, some part of the wetland areas have also occupied by developments like road network and settlements, still some part are also on converting to developments. Thus, the situation limits the benefits that the local community would get from wetland. In addition, the economical, social, aesthetical, recreational and ecological values that the town will get are also reduced.

Thus, the combined effect of the mentioned problems in the town has not only local environmental impacts but also large so-called 'ecological footprints' beyond their immediate vicinity. Intensive and extensive exploitation of natural resources to support urban economy includes over extraction of energy resources like fuel wood, charcoal, quarrying and excavation of gravel and building materials at large scales as well as reclamation of urban greens for other purposes.

In general these problems are as a result of either poorly developed land use plan or improper implementation that does not consider the environmental conditions. Therefore, this is the reason why the researcher was interested to the issue as research title. The main concern of the researcher is thus; to evaluate the current land use planning and implementation system of Sululta

town against environmental issues. Finally, the researcher aims to conclude and suggest feasible useful recommendations with planning proposal for future sustainability using different scientific methods and feasible software.

1.3 Objective of the Research

The general objective of the study was to evaluate the major land use conflicts and environmental problems of the existing land use plan and implementation with respect to environment in the study area.

The specific objectives of the study were to:-

- To identify the major environmental problems in the land use planning.
- To examine the major environmental problems due to plan implementation.
- To identify the major environmental land use conflict areas and reasons of conflict in land use planning.
- To examine the major environmental land use conflict areas and reasons of conflict due to plan implementation.
- To investigate and propose proper environmental land use planning and appropriate recommendation that target healthy environment and sustainable development.

1.4 The Research Questions

The Research questions of the study were:-

- What are the major environmental problems resulted in land use planning?
- What are the major environmental problems intensified due to plan implementation?
- Where are the localities where the major environmental land use conflicts in land use planning are widely seen and what are the reasons for the conflicts?
- Where are the localities where the major environmental land use conflicts due to plan implementation are widely seen and what are the reasons for the conflicts?
- What possible planning solution should be proposed and recommended to protect the land use conflict and environmental problems?

1.5 Significance of the Research

The study generally gives due attention on land use plan and implementation of Sp in relation to environmental issues in Sululta town. It furnishes the most important and first hand information regarding issues of environment resulted by land use planning and implementation in the study area.

Furthermore, the importance of the study were believed to identify areas of environmentally sensitive and exposed to conflict in the study area. Therefore, realizing the key determinants of environment in land use planning and implementation is generally important in designing effective and applicable policy intervention to enhance urban environment. These led to achieving targeted level of urban health and productive,

1.6 Scope of the Research

The scope of the study is spatially determined to Sululta town among the nine towns in special Zone Surrounding Finfine of Oromia Regional State. Thematically, the study focused on the evaluation of proposed land use plan and implementation of Sululta town structure plan in relation to environmental issues.

1.7 Limitation of the Research

Some limitation ought to be known concerning the study. The primary limitation is lack of organized secondary data as required. Thus more attention is given to primary data specially observation and ground survey data that needs long time and more finance to collect and manage these data. In here, it was with these limitations in mind and with the willingness to stand corrected on matters of fact and interpretations that this study was submitted.

1.8 Organization of the Research

The research is organized in to seven chapters. Chapter one presents introductory themes and the second chapter presents research methodology. Chapter three presents reviewed literatures to highlight the main concepts and theories. Chapter four of this study deals with situation analysis of the area, mainly the physical, biological and socio-economic environments. Chapter five presents problem identification and land use suitability analysis in relation with environment.

Chapter six deals with identifying, intervention areas and providing land use proposals of the area. Finally, chapter seven presents conclusion and recommendation of the study (See figure 1.1).

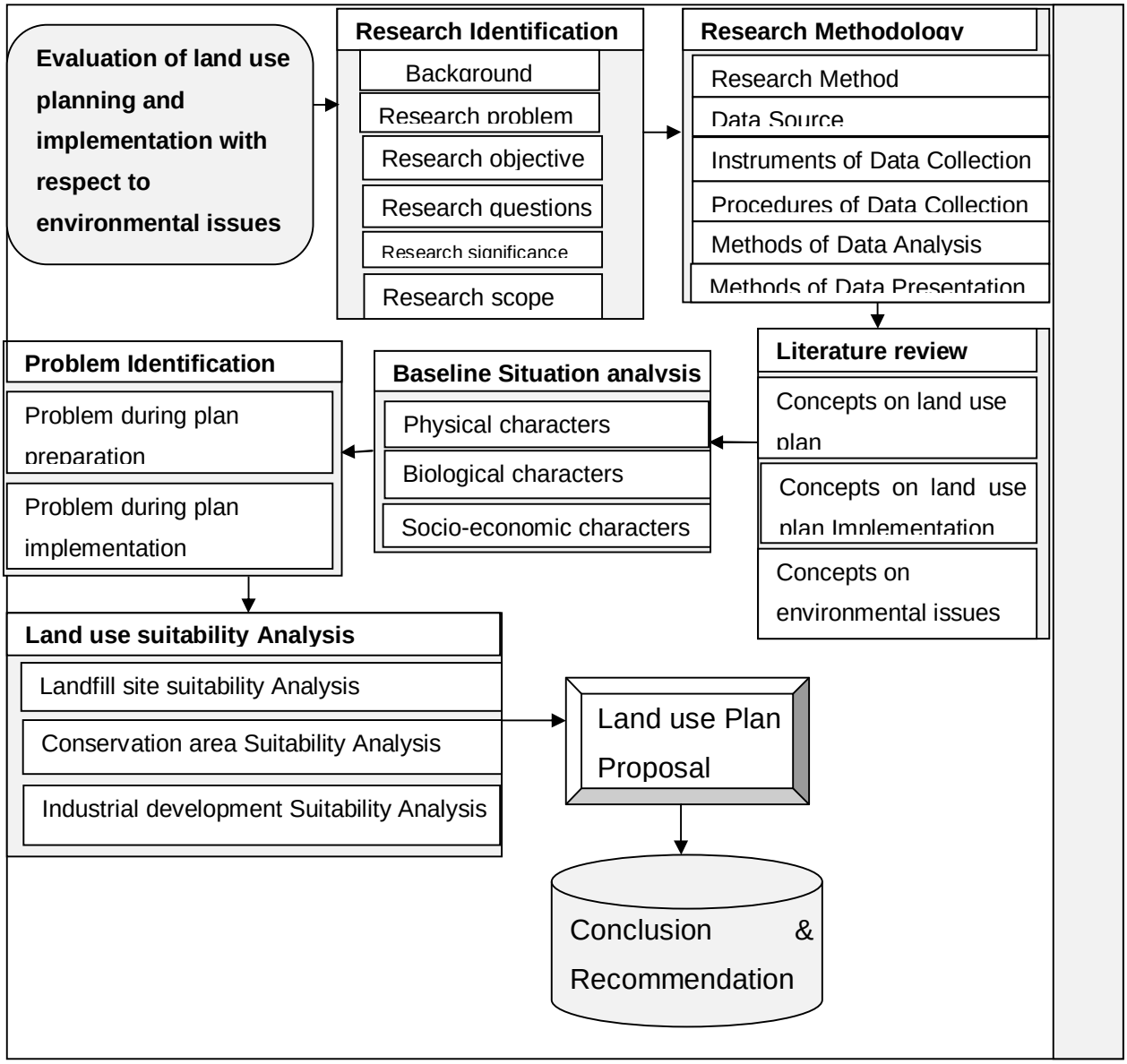

Figure 1.1 Structure of the Research

CHAPTER TWO

2. RESEARCH METHODOLOGY

This part of the study deals with the research methodology, which includes the research method, data source, instruments and procedure of data collection, sample size and sampling techniques as well as methods of data analysis and presentation.

2.1 Research Method

In this study both qualitative and quantitative methods were employed aiming at investigating the effects of land use planning and implementation on the natural environment in the town. The non-quantitative method was adopted because it helps to explain environmental phenomena that exist in the town, opinions that were held by the respondents and trends that are going on. Whereas, the quantitative approach was used to provide solid support to the assessment of the role of plan implementation, for example using grid overlays to quantify "accordance and deviations" between land use plans and actual land use (Alterman and Hil, 1978).

2.2 Data Source

In order to achieve the desired objective, both primary and secondary data were used in the research. The primary data were gathered through field survey at the four kebeles and different sites of the study area. The data were also gathered from different target informants like purposely selected elders, kebele administration, town sectoral officials and town administration.

The secondary data were obtained from existing literature on urban land use planning and implementation with particular reference to the situation of the environment. In general, the secondary data were collected based on social, economical, environmental and physical setting of the study area and the status of environment in urban land use planning and implementation. The data were collected from government reports and official documents regarding to Sululta town, such as research report, journals, base line survey and others.

2.3 Instruments of Data Collection

2.3.1 Questionnaire

A set of checklist questionnaire involving five clusters of open-ended items were prepared and administered by the researcher. These set of items dealt with issues related to, waste management, urban greenery, quarrying activities, pollution and water resources. In here the questionnaires were used to interview government officials at different level and individual dwellers to explore the actual situation of the environment in the town. Unstructured interviews were employed in face to face with purposely selected respondents. In addition, in depth interview was held with relatively skilled respondents to elicit rich and detailed data that could be used in analysis.

2.3.2 Field Observation

First hand data on the field was collected by direct observation on the plan implementation situation and related process in the study area. Observation was taken by physical inspection, reconnaissance, taking sketches of the existing problem areas and photographing. Observing and updating the existing land uses and its implementation condition was the central data for the analysis of this research, so as to capture a great variety of interactions.

Here existing natural and manmade green areas and open spaces in the town, solid and liquid waste management, quarrying operation, the wetlands and their impacts on the environment were considered as major observable variables. In addition to the field observation, field survey was employed to collect spatial data concerning the land use planning and implementation in relation with the environment. Generally, most of the required data for the analysis of this research was gathered through this instrument.

2.3.3 Focus Group Discussion

Focus group discussion was also conducted with those who have sufficient knowledge about the structure plan preparation and implementation situation in the town. There were five groups that the researcher made the discussion with. These are one group from the government offices and four from the four kebeles of the town. Thus, four to six voluntary participants in one group were

discussed on the issues of the environment aggravated as a result of plan preparation and implementation in the study town.

2.3.4 Document Review

Necessary documents of the selected town were reviewed in order to get the necessary information with regard to the effect of land use planning and implementation on the environment in the study area. Moreover, extra information was collected from relevant books, journals and other literature materials.

2.4 Sample Size and Sampling Techniques

There are four kebeles in the study town. Of these four representative respondents from each kebeles were purposely selected by the researcher. In addition, fourteen experts and six officials were also selected from government offices by the same method. Then, a sample size of thirty six respondents was employed in the town to undertake the research.

2.5 Procedure of Data Collection

The checklist questionnaires were prepared and presented to the selected respondents in a face-to-face situation. This was done at the most convenient time available to them to interview the purposely selected respondents. Sufficient time was also allotted in order to help the respondents give sufficient and complete response. Besides, personal observation, field observation and focus group discussion were administered by the researcher himself to explore the actual situation of environment.

2.6 Methods of Data Analysis

Both quantitative and qualitative data collected through the instruments were analyzed to get and generate meaning on the effects of land use planning and implementation on the environment. The qualitative data were analyzed by employing descriptive and narrative techniques of data analyzing. Whereas, the quantitative data were analyzed by using grid overlays of spatial maps to quantify accordance and deviations between land use plans and actual land use, moreover it also analyzed using percentage, ratio, arithmetic mean (average) and others.

On the other hand, graphical data was analyzed through the procedure of reclassifying, weighting and run Multi Criteria Evolution (MCE). Thus, it was processed using Civil Survey and

AutoCAD that in turn analyzed using GIS, ENVI, ERDAS and other related software's to be interpreted briefly and easily updated to new technology.

2.7 Methods of Data Presentation and Interpretation

The analyzed data were presented by using tables, figures, plans and maps, accompanied by textual discussions. The tables, figures, plans and maps were constructed and listed in such a way that they can clarify significant relationships and become self explanatory. After doing (conducting) the study as per methods identified earlier, the analysis made on the sample taken was interpreted for the population and conclusion was deduced. The results after interpretation was also be validated by using past data.

CHAPTER THREE

3. REVIEW OF RELATED LITERATURE

3.1 Definition

- **Planning: -** is "figuring out what needs to be done and how to do it." It is the process of "applying knowledge to action" or basic problem solving (Friedmann, 1987). It requires determining ends and means relationships. Simply, planning involves setting objectives, gathering and analyzing information, and formulating and evaluating alternative policies, projects, or designs to meet the objectives.
- **Land use planning (LUP):-** is an iterative process based on the dialogue amongst all stakeholders aiming at the negotiation and decision for a sustainable form of land use in rural and urban areas as well as initiating and monitoring its implementation (GTZ, 1999).
- **Pollution: -** can be defined as any action or condition interrupting on land, air or water, which is detrimental to health, sanitation or the public interest.
- **Wetland:-** "areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters"(Ramsa, 2005)
- **Urban open space: -** is open space areas for "parks", "green spaces", and other open areas. The landscape of urban open spaces can range from playing fields to highly maintained environments to relatively natural landscapes (Marilyn, 1975).
- **Solid wastes: -** could be defined as non-liquid and nongaseous products of human activities, regarded as being useless. It could take the forms of refuse, garbage and sludge (Leton and Omotosho, 2004).
- **Rock quarry:** - In the simplest term it is a place where little size rocks are made from big rocks (Enatfenta Melaku , 2007).

3.2 Concept of Land Use Planning Evaluation

In a performance oriented society, people expect to be able to judge how well plans achieve their objectives and how well planning processes have been conducted. We can look back at the outcomes of historic plans, such as the famous Daniel Burnham 1909 plan for Chicago that defined the City Beautiful Movement in the U.S. and proposed the city's distinctive lakefront parks and roadways.

As to Daniel Burnham the advantage of decades of hindsight we can form opinions about how effective these plans were in achieving their objectives. We can also evaluate the planning processes that were carried out in these cases, both of which took place well before the participatory era of urban planning.

The famous, Daniel also says it is more difficult to evaluate the outcomes of contemporary plans, whose effects will be realized in a future time when conditions have changed and different standards of evaluation may have been formulated. However, we can evaluate the plan itself according to contemporary standards of good practice. Such evaluations also enable us to judge the quality of plan-making, both to review the effectiveness of past processes and to guide future processes. Plan quality evaluation thus functions as a learning process that yields important planning lessons and guidelines.

If we do not evaluate our plans and planning processes, we miss a valuable opportunity to learn how to improve them. For example, evaluation of plans prepared under a statewide affordable housing mandate in Illinois showed that while most of the plans met the minimum legal requirements (procedural compliance), their content included widespread skepticism about the need for, and resistance to, the local actions necessary to implement this unfunded mandate (Hoch 2007). The author concludes that it may be difficult to meet the goals of the unpopular mandate without additional incentives to turn the paper goals into practice commitments.

The essence of a profession, such as city and regional planning, is its capacity to set and enforce high standards of practice. Good practitioners learn from reflecting on their experience and on the quality of their work (Schon 1983); their reflection is assisted by professional norms of good practice. Over time, this professional learning shapes criteria for best practices in land use

planning, as well as other areas of planning. Findings and lessons from best practices in plan quality evaluation, while not extensive, are available in the published.

Land use plans serve a number of public purposes, including developing sustainable communities that balance social, environmental, and economic values (Berke, Godschalk and Kaiser, 2006). Besides their major purpose of guiding future land use into desirable configurations, land use plans assist communities in addressing opportunities and threats, and choosing among policy alternatives.

As to Berke Godschalk and Kaiser, in the process, plans also can educate stakeholders about issues and options and help them to build consensus about community visions, mediating conflicts between stability and change. They become repositories of data and information and describe linkages among social, environmental, and economic conditions. Through their participatory processes, they educate future community leaders and create community networks for resilient responses to stresses, such as disasters. During their periodic updates, they offer opportunities to assess progress toward community goals, as well as changes in important conditions.

3.3 Concept of Plan Implementation Evaluation

The more recent approach of plan evaluation demonstrated by Berke et al (2006) represents another attempt to assess the impacts of plan in the implementation quantitatively. Berke (2006) use a sample of plans, permits, and district-council planning agencies in New Zealand, and examine two conceptions of success in plan implementation (conformance and performance), the effects of the implementation practices of planning agencies, and the capacity of agencies and permit applicants to bring about success.

Based on the evaluation outcome, a question appears, that is, is a plan with high implementation conformance good one? Another key point is that, if implementation is defined and measured in terms of conformance, plans and planners have an important influence on implementation success. Alternatively, if implementation is defined and measured in terms of performance, plans and planners are less influential in implementation.

These lessons have broad implications for the theory and practice of plan implementation. Alexander and Faludi (1989) argue that plans not implemented do not always indicate failure,

and on the other hand, plans do not cease to be a criterion of success. They hold the middle ground where implementation is still important but where, as long as outcomes are beneficial, departures from plans are viewed with equanimity.

Identifying the factors affecting implementation is as important as plan implementation. Laurian et al (2004) categorize the factors of plan implementation into two types: internal factors to the plan (e.g. its quality) and external factors to the plan (e.g. the characteristics of the planning agency and of local developers). Key factors of implementation are: the quality of the plan; the capacity and commitment of land developers to implement plans; the capacity and commitment of the staff and leadership of planning agencies to implement plans; and the interactions between developers and agencies.

Therefore, while analyzing the effects of plan, we cannot simply conclude that a plan with high level of implementation is a good one. Only the combination of quantitative analysis and qualitative analysis can help achieve better understanding of the role of plan in city development.

Failure to implement plans has long been considered a significant barrier to effective planning (Berke, 2006). Calkins (1979) names the lack of plan implementation as “new plan syndrome”: Plans are continuously redone or updated without regard to the implementation status of the originally prepared plan. The lack of an understanding of the degree to which plans are implemented and of the determinants of effective implementation has hindered planners from making better plans.

There are usually two types of evaluation approaches to assess the impact of plans: non-quantitative and quantitative methods. The non-quantitative method is frequently used; however, the evaluation criteria are subjective and vague. The quantitative approach is seldom applied due to methodological and data difficulties. Nevertheless, it has been proved to provide solid support to the assessment of the role of plan in implementation. Since the late 1970s, several categories of quantitative approaches have been developed with the advancing computer technology. For example, Alterman and Hill (1978) use grid overlays to quantify “accordance and deviations” between land use plans and actual land use.

3.4 Concept on Environmental Issues

The environmental degradation caused by inadequate disposal of waste can be expressed by the contamination of surface and ground water through leachate, soil contamination through direct waste contact or leachate, air pollution by burning of wastes, spreading of diseases by different vectors like birds, insects and rodents, or uncontrolled release of methane by anaerobic decomposition of waste (Visvanathan and Glawe , 2006).

The sustainability of the land filling system has become a global challenge due to increased environmental concerns. Growing public opposition together with unavailability of land is one of the reasons why obtaining sites for new landfill is becoming increasingly difficult. Locating a landfill far away from the urban area can be adventitious from public opposition. Site is far away from the source of waste generation increases transfer costs and additional investments for the infrastructure of roads, hence intensifying the financial problems of the responsible authorities (Visvanathan and Glawe , 2006).

Common problems for Municipal Solid Waste (MSW) management in the region include institutional deficiencies, inadequate legislation and resource constraints. Long and short term plans are inadequate due to capital and human resource limitations. There is a need to practice integrated solid waste management approach such as: Incorporation of more environmental and economic friendly concepts of source separation; recovery of waste; legitimization of the informal systems; partial privatization and public participation. Although some governments have formulated policies for environmental protection, they were only implemented in the national capital cities. In rural areas, open dumping is still considered the most popular method of solid waste disposal (Visvanathan and Glawe , 2006).

Urban areas do not have only local environmental impacts but also large so-called ‘ecological footprints’ (WWF 2000). In their immediate vicinity, cities have a variety of impacts: conversion of agricultural or forest land for urban uses and infrastructure, reclaiming of wetlands, quarrying and excavation of sand, gravel and building materials in large quantities and, in some regions, deforestation to meet fuel demand. The use of biomass fuel also causes indoor and outdoor air pollution.

Other effects can be felt further afield such as pollution of waterways, lakes and coastal waters by untreated effluent. Air pollution from cities has an impact on residents' health as well as on vegetation and soils at a considerable distance. Urban transport contributes to air pollution and the large concentration of cars and industries in cities causes the lion's share of urban global greenhouse gas emissions.

The Central Scotland Forest Forum (2003), Bains (2002) and the National Urban Forestry Unit (undated) all claim that taking a strategic approach to the planning and management of urban green space brings a wide range of environmental benefits. These include the filtering of air pollution (including soot and poisonous chemicals), the stabilization of ground surfaces, the interception of rainfall which reduces flooding, the creation of visual and sound barriers, the provision of temporary cover for derelict sites, and encouraging the sustainability of wildlife habitats.

Urban green spaces also play a vital role in urban biodiversity, and contribute to sheltering, shading and water protection, and decreased local air temperatures (MacArthur, 2002). Benefits for urban dwellers include the creation of a safe haven from city life, cultivation of an increased sense of pride in and stewardship of the local environment, and create a greater awareness and understanding of the needs of the countryside and of land management (Ulrich, 1984).

As will be demonstrated above, all of these environmental benefits also have direct and positive implications for public health and well-being. Yet for a number of reasons - the high level of urban pressures, lack of integrated planning and management, and limited specific knowledge of urban forests and trees - the full potential of urban green space is often not met. Land use plans serve a number of public purposes, including developing sustainable communities that balance social, environmental, and economic values (Berke, Godschalk, and Kaiser 2006).

According to WHO, cited in Good Practice of Urban greening (IDB), 1997, cities should provide 9m2 of undeveloped (unpaved) open space for each inhabitant. WHO also suggested that, designing green area networks so that all residents live within a 15 minute walk of from an open/green space. Likewise, NUPI, 2004, suggested 12-25% area of urban centers should be devoted for urban green area. Furthermore, urban parks and neighborhood green areas should

provide 2m2, for every person/resident. FUPI 2006, Structure Plan Manual also suggests 15-20% of the urban land use should be apportioned for urban green area.

Thus, incorporating adequate urban green area in the urban land use system is mandatory. Moreover, once every piece of urban land is developed for built up and other infrastructures, it may be difficult and/or expensive to develop new green areas unless there are planned for from the very beginning.

Overall, quarrying in the unsaturated zone is likely to result in relatively local impacts such as increased runoff, reduced water quality, rerouting of recharge water through the aquifer, and localized reduction in ground-water storage (Hobbs and Gunn, 1998).

There are wide ranges of potential environmental impact caused by quarry operation. Those impacts are landscape change, change to the visual scene, erosion, habitat loss, loss of flora and fauna and stability problem, noise, vibration, dust, security problem, effect on the amount and quality of water, high traffic and waste materials are the common problem in the development of quarry operation. The descriptions of some of the impacts are as follow.

A landscape comprises the visual feature of an area of land including physical elements such as land form, living elements of flora and fauna, abstract elements such as lighting and weather conditions and human elements (human activity) or the built environment (Gerhard, 2003).
Gravel and stone quarry operations result in extensive manipulation of the landscape and of the ecosystems of indigenous to their sites. Disturbance to the natural contour of the topography has repercussions, not only for those communities in the immediate vicinity, but also for those adjacent.

Quarrying presents prime conditions for accelerated erosion because the top soil environment required for establishment of stabilizing vegetation is eliminated. Once quarry resources are exhausted or operations cease, the landscape has often been degraded to an extent that re-colonization by pre-disturbance communities is difficult, if not impossible. The cultural perception of such degraded land is highly unfavorable for several reasons, spanning range from safety, and ecology to aesthetics.

The primary natural landscape will be, little by little, lost. This is against the widely accepted idea that “every untouched corner in the nature is beautiful”. Removing of a rocky hill or an esker may open a new view. It is possible more unaesthetic than the original one. In the worst case behind the primary formation may open up a view on a waste tip! The most obvious environmental impact of quarry operation is the conversion of land use.

Hence the operation involves wide range of activity starting from land clearing to excavation and making abandoned. All operation is in relation to the land and it will damage the different landscape element that give scenic value, tranquility (harmony and silence). The natural condition of the land is changed because of excavation and extraction of the material. This leads for unstable slope and land slide, rock fall, erosion. The slope will be deteriorated and become unstructured which result sliding, plane and wedge mode of failures (OECD, 1998).

Both surface and ground water impact are associated with the quarry level of operation. Impacts appear to be significant if the site lies completely within the watershed protected area. More over the geological material being extracted matter the degree of the impact adjacent water quality (Richard, 1999).

While wetlands may be the most productive of ecosystems on earth, they are also the most threatened. Wetland destruction and alteration has been and is still seen as an advanced mode of development, even at the government level. Wetlands and their value remain little understood and their loss is increasingly becoming an environmental disaster. While rates of wetland loss are documented for the developed world, the limited study of these ecosystems in countries like Ethiopia leaves us with little to say.

Wetland loss is evident wherever major developments like dams, irrigation schemes and conversion projects are present in the developing world. While most of the threats that wetlands face result from their misuse, many are also related to unsustainable resource extraction. Another important reason for their vulnerability is the fact that they are dynamic systems undergoing continual change (Barbier et al., 1996). As a result, many wetlands are temporary features that disappear, reappear and re-create themselves over time (Barbier, 1996).

Humans usually and very dramatically accelerate natural processes often unintentionally but usually in the course of activities like agriculture, industry and urban development. These activities can involve anything from drainage and diverting water, to dredging and loading water sources with toxic chemicals. Perhaps the most destructive of all activities is mining (Williams, 1990) which permanently destroys the substrate and prevents the natural restoration of a site. Wetlands whose biotic balance has been disturbed can often recover.

CHAPTER FOUR

4. ANALYSIS OF THE BASELINE SITUATION

4.1 Physical Characters of the Study Area

4.1.1 Location and Area

Sululta town is found in the central part of Ethiopia, Oromia Special Zone surrounding Finfinne and reached via the main high way of Addis Ababa-Bahir Dar. Astronomically, the study area is extends from 9^{o} 30'00"N to 9^{o} 12'15"N latitude and 38^{o} 42'0"E to 38^{o}46'45"E longitude. In relative terms, Sululta town is located at the distance of 24km along Addis Ababa-Bahir dar road. Its location at this spot favors the town with many opportunities to share development with Finfinne city.

The administrative area of the town is about 4471hectars including some part of the rural kebeles of Chancho district. These are Keta Welele in the north-east, Wererso Nono Menabechu in the west, Weserbi Guto in the south and Wele Lube Akako in the east direction are administered under Sululta town Administration at the moment (See figure below for detail information).

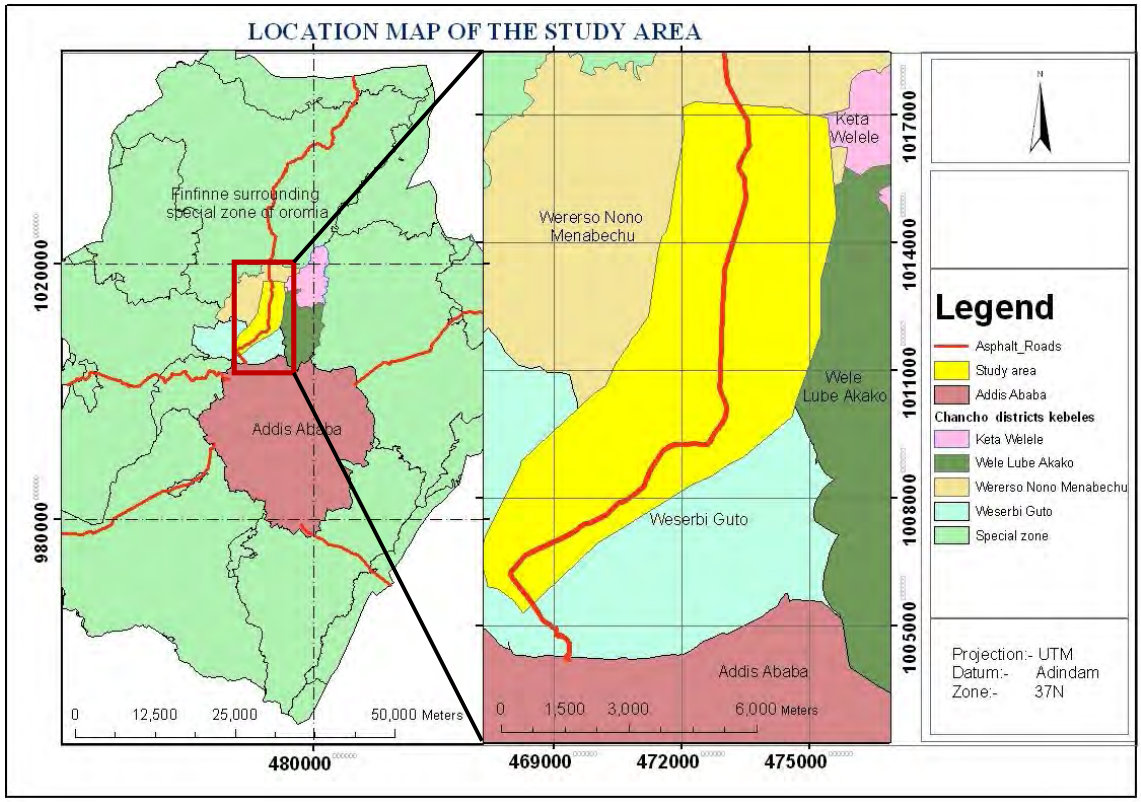

Figure 4.1 Location map (source: Own computation)

4.1.2 Topography

4.1.2.1 Elevation Range

One of the important aspects of the study area is the landscape as it influences the land use planning and implementation. The topography of the area varies from chains of mountains around Entoto ridge in the south to plain lands in the East, North-west, and north. The average elevation in the town is 2600m above mean sea level. The altitude of the study area generally dropdown south-north direction from 2800m to 2500m above mean sea level. The peak altitude of the area is 2800m at Entoto ridges and the lowest is 2500m to the north fringe of the study area. The minute elevation difference with in the whole area contributes a lot for water logging as most of the area is possibly classified as plain area. See the map below for detail information.

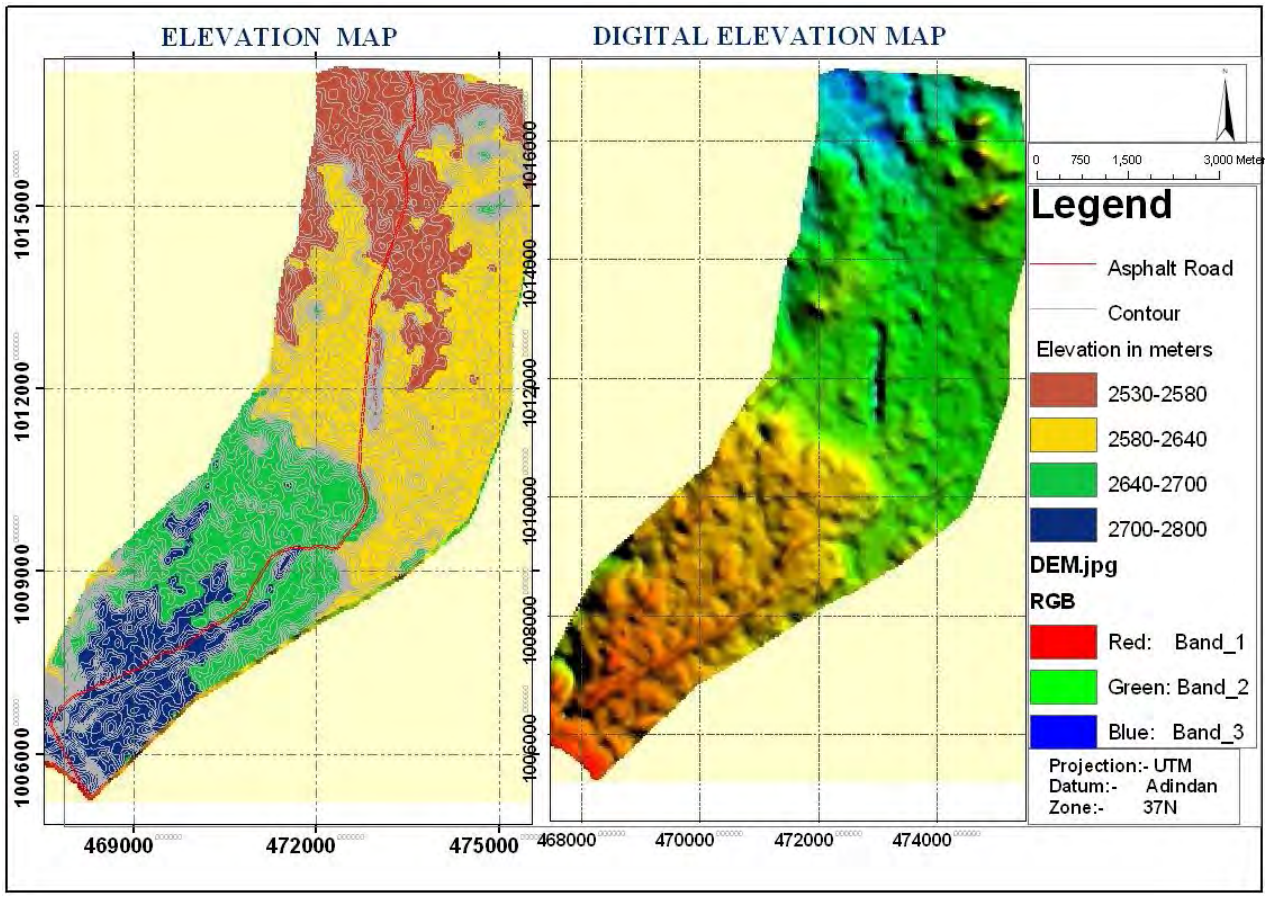

Figure 4.2 Elevation and Digital elevation model map (source: Own computation)

Based on the above figure 4.2, the elevation range between 2580m to 2640m is the dominant class in the study area which accounts about 39.6%. The range of altitude that found in the category of 2640m to 2700m is the second larger class followed by ranges of 2530m to 2580m and 2700m to 2800m which accounts about 21.28% and 14.85% respectively. Generally, the dominant elevation range in the study areas is the middle class altitude (2580m-2640m), where the existing settlement of the town lies.

4.1.2.2 Slope

In the study area the slope is also another topographical aspect that influences the land use planning and implementation. The steepest slope in the area is situated in the elevation range of 2640m to 2800m almost around the southern ridge of Entoto and north-eastern fringes. By implication high run off and lateral erosion is high in these areas compared to the gentle slope locations. The gentle slope lies mostly in the central part of the study area within 2580m to 2700m altitude where existing built up lies. The flat area of the Town found in the altitude of less than 2580m in the east and north-west of the study area. This area is one of the likely water logging area at the rainy season and potential grazing land at dry season. Generally, the town is marked by a slope of less than 29 percent (See figure 4.3).

Based on the figure 4.3 below, the larger area of the town has a slope range between 2 to 15 % which accounts about 41.06% of the study area. This range is very important for most developments mainly housing, commerce, administration, Industry and others. The second larger area is found within the slope range of 0 to 2 % which accounts about 37.22% and not suitable for most developments as it may be flood prone areas. The small part of the study area is found within the range of greater than 20% constituting 4.86% that may also not capable for most developments as high runoff and land slide may be expected in this area. Therefore, these unsuitable slope classes for development may be suitable for conservation purposes. The rest of the study area is lies on the slope range of 15% to 20% which is moderate for the development (Figure 4.3).

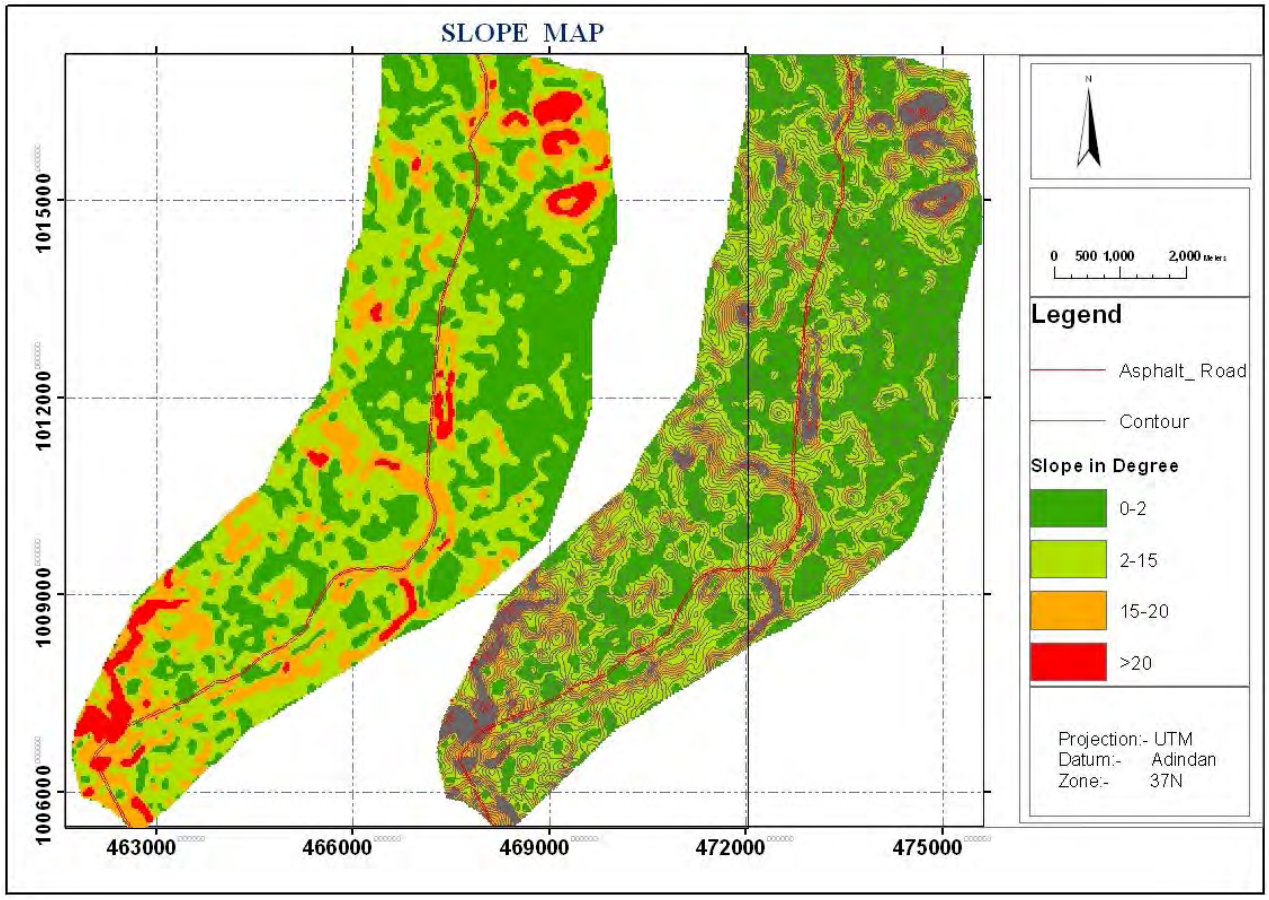

Figure 4.3 Slope map with and without contour (source: Own computation)

4.1.3 Geology and Soil

4.1.3.1 Geology

The geological setting of the study area is generally classified in to two major groups; namely, Tertiary Volcanics (Plateau Basalts) and Quaternary units (Rift Volcanics and Sediments). The classification is based on age of eruptions, special distribution, and mode of occurrences.

Tertiary Plateau Basalts are part of the Trap-Series volcanic products consisting huge accumulation of basaltic rocks with minor silicic intercalations, whereas the Quaternary Rift Volcanics and sediments comprise variety of rock units (both acidic and basic) associated to the formation of the Main Rift System during the Quaternary Period. However, each of them has sub-divisions; whereby Tertiary Volcanics (Plateau Basalts) consists of Aiba Basalt, Alaji Basalt and Chancho Basalt on the other hand Quaternary units (Rift Volcanics and Sediments) comprises Adama Group and Entoto Silicics.

Alaji Basalt situated in gently undulating lands and at surfaces where usually covered by relatively thick soil in plain areas of the study area. Weathered material of the unit virtually looks like volcanic ash of light gray to white and fine-grained soft matrix, with sub rounded weathering remnant boulders of the basalt, which exhibits white weathering. Alaji Basalt (ptb2) directly overlies the Aiba Basalt (Ptb1), which in turn is overlain by Chancho Basalts (Ptb3) of younger volcanisms. This unit covers large proportion of the total area of the study area and quarrying activities is undertaken on it.

Aiba basalt occurs on the northern part of the study area. The unit underlies younger volcanic products mapped in this work as Alaji Basalt (Ptb2) and Chancho Basalt (Ptb3), with rare basic tuff inter layering at top. This unit is characterized by its homogenous in composition and range of thickness from 200 to 600 meters. it is the second larger portion in the study area next to Alaji Basalt.

Chancho Basalt (ptb3) is other basaltic unit that accumulated Up to 200m thick, mapped in the study area. The unit is situated as a patch occupying small proportion as per the total area, to the northeast of the study area.

Adama Group in general consists of fiamme ignimbrites of light greenish gray to reddish brown varieties, and unwelded tuffs. The unit also uncomformably overlies faulted blocks of Plateau Basalt Formations of Tertiary Volcanics in areas along the Rift Shoulder and it covers relatively small part of the study area.

Entoto Silicics is situated in the southern fringe of the study area arround the Mountain Chain of Entoto that surrounds Finfinne City from northwestern, northern and northeastern directions. And the unit covers the least proportion of the study area, it lies up to 200m thick and it is either overlies or cuts trough Chancho Basalts and in turn is overlain by younger ignimbrites of Adama Group. See figure 4.4 for detailed information.

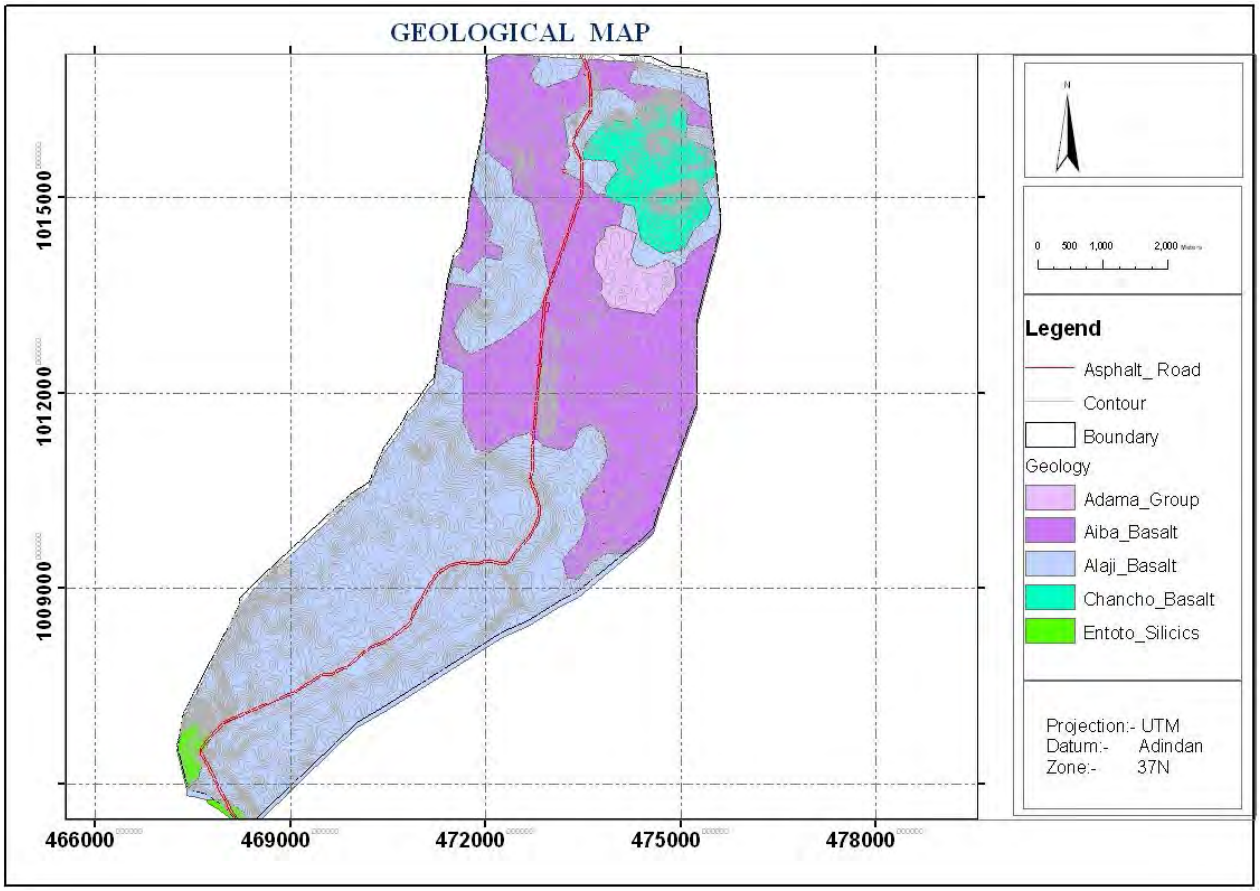

Figure 4.4 Geological map (source: Modified from OWWDSE, 2011)

Based on the above figure 4.4, the dominant geological component in the study area is Alaji_Basalt which accounts about 56.5%. Aiba_ basalt is the second dominant component which covers about 33.7% of the study area. The rest of the area is covered by Chancho_basalt, Adama_group and Entoto_silicics.

4.1.3.1 Soil

Soils are the world's natural resource and a soil map is a spatial representation of these resources. Therefore, soil map is fundamental and should be the starting point when planning every type of land use. In the study area there are four major types of soil which are stated below.

Cambisols are soils with initial stage of soil formation or weakly developed soils relating to their parent material. Beginning transformation of soil material is evident from weak, mostly brownish discoloration and/or structure formation below the surface horizon. The cambisol in the study

area is found distributively in limited places. The soil texture is loamy to clay and identified on undulating to rolling plateaus in the study area with stony phase and limited in depth.

Leptosols are soils with an incomplete solum and/or without clearly expressed morphological features. They are particularly common in hilly to mountainous area of the southern fringe of the study area and it covers a small proportion of the area.

Luvisols are soils whose dominant characteristic is a marked textural differentiation within the soil profile, with the surface horizon being depleted of clay and with accumulation of clay in a subsurface. Normally, it is not present as individual particles but is clustered to aggregates that consist wholly of clay or of a mixture of clay and other mineral and/or organic soil material. Luvisols have typically a brown to dark brown surface horizon over a reddish brown to strong brown. As you can observe from the map the large proportion of the study area is occupied by this type of soil particularly the central part of the Town where the existing built up area is lied.

Vertisols are soils having, after the upper 20 cm have been mixed, 30 percent or clay in all horizons to a depth of at least 50 cm. In the study area vertisols are found almost to the southeastern direction associated with Luvisol and Leptosol (See figure 4.5).

Based on the figure 4.5 below, the dominant soil type in the study area is Luvisol which covers about 84%. The rest of the area is covered by Vertisol, Leptosol, and Cambisol constituting about 6%, 5.2% and 4.8% respectively.

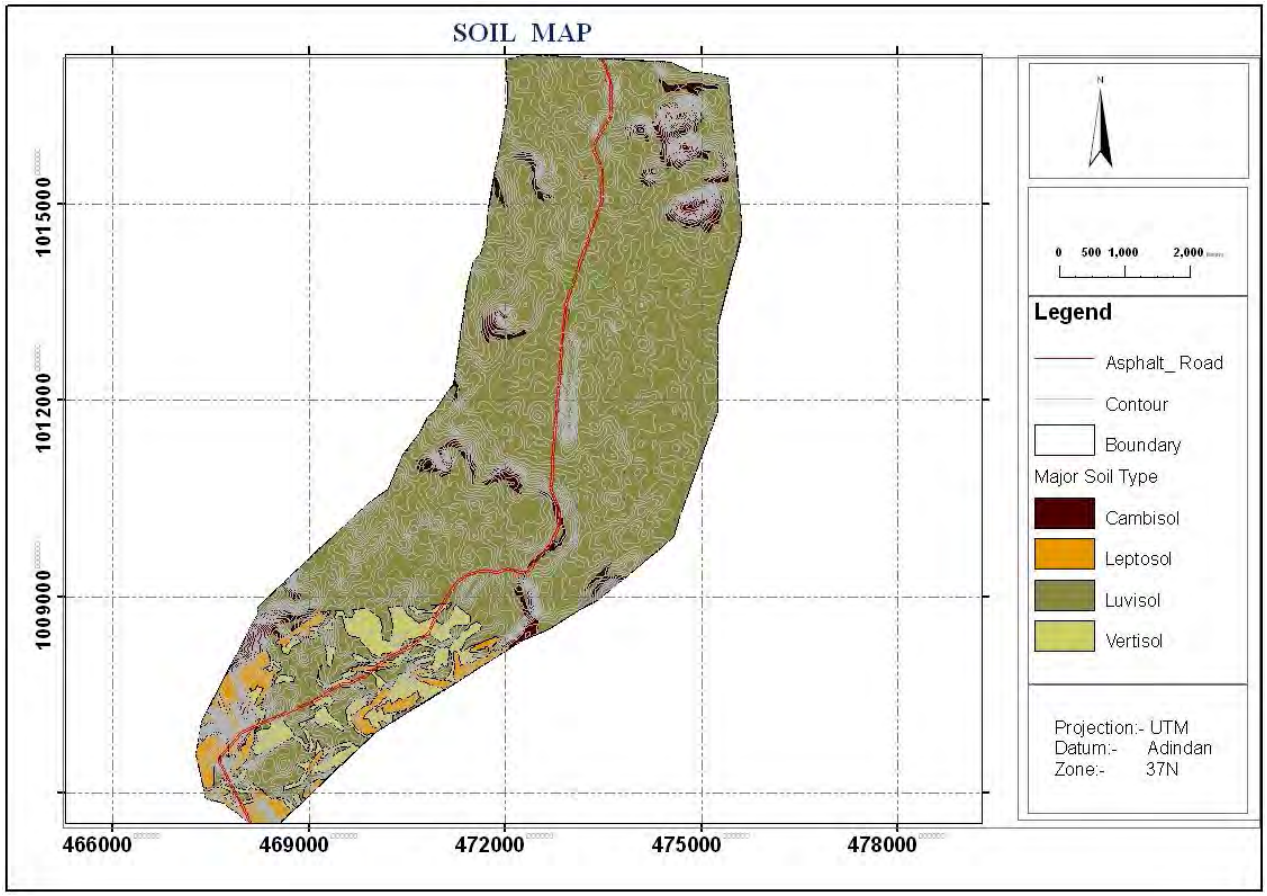

Figure 4.5 Soil map (Source: modified from OWWDSE, 2011)

4.1.4 Climate

Climate influences the physical and cultural environments, the types of vegetation and crops to be grown, the land use patterns and ultimately the economy. Therefore, in the land use planning and implementation evaluation, climatic variables should be considered as an analytic land qualities/ or land characteristics.

Globally the climatic condition of the project area is part of the tropical humid climatic region, which is locally classified as dega agro-climatic zone. The area receives a minimum rainfall of 780mm and maximum of 1390mm in the year 1996-1999 E.C, on the average the area practiced the annual rainfall of 1085mm (from Sululta satellite station). On the other hand, the maximum temperature is 16^{o}c and the minimum is 11^{o}c. thus the area experienced the typical temperature of 16^{o}c. which is distinguished by cool sub-humid and high rain fall. It also characterized by its alternating wet and dry season, that determined largely by the annual movements. The one which

is across the country of equatorial low pressure zones were caused by the convergence of the dry north-easterly winds and with moist winds of the south- easterly or south westerly origin.

In the study area, from October to February when the Northeasterly winds persist long period, the dry weather are experienced. Between February and the ends of April the weather become more unsettled and a convergence of moist southeasterly air stream causes light rains-commonly referred to the "Belge Rains". The dominant rain fall is occurring between June to September when moist winds from the Atlantic and Indian oceans converge over the Ethiopian high lands. Thus, rainfall intensity is high during this period and runoff and erosion would be very high, unless different soil and water conservation structure are implemented.

It is obvious that temperature decreases as one move from lower altitude to higher altitude. In the study area, as Entoto is found at higher elevation (above 2700m msl) and the center of the town is located relatively at lower altitude (about 2580m msl) so the maximum temperature records are lower for Entoto area and higher for the area near to the center of Sululta town.

4.1.5 Water Bodies

4.1.5.1 Drainage System and Wetland

A drainage system describes the way of streams that feed other larger streams and rivers branch off in different directions. Thus, major drainage pattern in the study area can be described as streams and rivers, in which the Streams tend to from about 3 major rivers in the area. These are Dima, Orgogo and Billo rivers, as most areas of the town is flat and the rivers transient through it are narrow in width and shallow in depth, they are over flooded. In addition, they also filled with wastes discharged in to it by different units. These in turn aggravated the river pollution and unpleasant odor that prohibited the dwellers to get the benefits that the resource gives.

There are also seasonal wetlands that situated mostly in the East and northwest of the Abyssinia water factory in the town. The wetland contributes a lot of environmental benefits like run off reduction, ground water recharge, waste water purification, and home for a variety of birds' life. However, these benefits are not considered by the town administration and local dweller thus the current condition of the resource is not seems under consideration. In general, the streams, rivers and wetlands have economical, social and environmental benefits for societies. By creating artificial lakes, streams and fountains for recreation, storage of water for fishing, and for planting,

particularly in the study town it is largely used for domestic purposes like drinking, cooking and washing in addition with construction purposes (see figure 4.6).

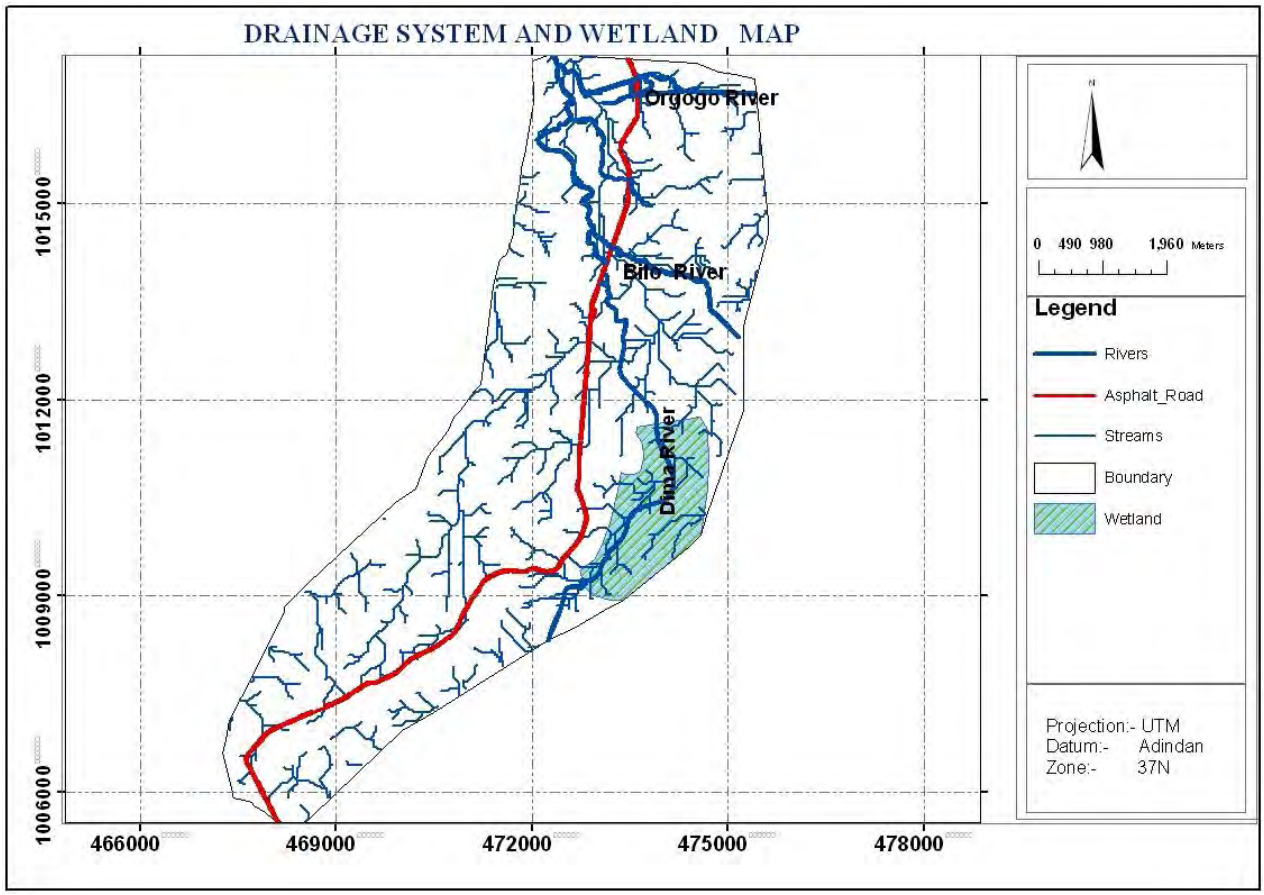

Figure 4.6 Drainage system and wetland map (source: Own computation)

4.1.5.2 Ground Water

According to the geological well data and study done, groundwater is known to be found in the range of 10 to 15 l/sec and the potential aquifer is found after 280m depth with in Scoriacous basalt (OUPI, 2006).

Spring is a concentrated discharge of groundwater appearing at the ground surface as a current of flowing water (Todd, 1980). With this understanding the springs of the study area are generally classified under depression springs. These springs are found commonly in recharge zone area near Entoto ridge. Most of them are emerging at the foot of associated slope. In the study town, low discharge springs and seasonal springs are common along the eastern and northeastern ridges of the catchment and it only yields about 0.5l/sec (OUPI, 2006).

It was also known that in the central part of the river catchments the springs have no flow during dry period because of the lowering of the water table. During very dry condition; most of them are left as tangent pond. In the western part of the catchment in relative to the eastern part springs are potential with yield variation from 0.2 to 1.2 l/sec (OUPI, 2006).

In general, the springs show yield variation because of the rain fall variation. As mentioned already, the catchment get recharge mainly from direct precipitation and reflects shallow groundwater circulation due to the shallow depth rock weathering and fracturing.

4.2 Biological Characters of the Study Area

4.2.1 Flora and Fauna

Analysis of flora and fauna is another important aspect that has been considered in environmental planning and management. The major forest base of Sululta town is Entoto ridge area that is extended up to the jurisdictional boundary of Addis Ababa. In the study area, the vegetation cover is mostly dense Eucalyptus tree that is associated with few Acacia tree, scattered bushes and minor other kinds of plants. The northern plain part of the study area is mainly covered with grass (pastureland) and alternating crops with few scattered trees. Almost the whole escarpment of this area is fully covered with Eucalyptus trees, which are also seen around homesteads.

The larger proportion of the planted eucalyptus forest in area belongs to Addis-Beha fuel wood project in addition with one cooperative forest and the homestead and bushes. Presently, the eucalyptus trees of Addis Beha that are found in the boundary of Sululta town are administered under the town. Generally, the most common vegetation species in the study area are Eucalyptus Globules, Juniporous procera, paynus pachula, Accacia abbyssinica, and Olea Africana.

The interviewers stated that, originally, the project area was known to harbor various wild animals including: Spotted/ hyenas, common jackal, mongoose, vervet monkey, mole rat, civet, wild cut etc. But today these animals are not commonly seen in the area. These may resulted from the absence of national parks, game reserves and sanctuaries, and reserved areas for wild life conservation in the study area. According to some dwellers, now a day wild animals like hyena, rabbit, pig and fox are rarely found in the study area, mainly around the boundaries of Entoto and

weserbi. In addition, solon birds and some other types are viewed around weserbi, Entoto ridge and in the region of the wetland that found to the east of the study area (See the plates below).

Figure 4.7 Plates showing flora and fauna (source: Own photograph)

4.2.2 Ecosystem Services

Ecosystem Services are the process by which the environment provides resources that we often take for granted such as clean water, timber, and habitat for fisheries, and pollination of native and agricultural fields. In this regard, whether we find ourselves in the town or rural areas, the Ecosystem in which humans live provide goods and services that are very familiar to us. In here, services that an Ecosystem can provide are to moderate weather extremes and their impacts,

disperse seeds, mitigate drought and floods, and protect people from the sun's harmful ultraviolet rays. Moreover, it will help to cycle and move nutrients, protect stream and rivers from erosion, detoxify and decompose wastes, and control agricultural pests. In addition, it also generates and preserves soils and renews their fertility, contribute to climate stability, purify the air and water, and pollinate crops and vegetation.

4.3 Socio-Economic Characters of the Study Area

4.3.1 Naming of the Town

Information about the exact time and condition of coining and naming of "sululta" has been difficult and needs further investigation. However, there are two major oral traditions for the name Sululta. The first one, there are those who argue that the name belongs from one of the Tulama Oromo clan conquering the area for agricultural and strategic purpose. Whereas the others argue that the name of Sululta is related with its scenery. As early Oromos appreciate nature, it was believed that this area was named as Sulula by early Oromo settlers in expressing their appreciation for the greenness and plainness of the area. This expression was largely supported by poems of early elders of the area. For many the name Sululta came from Oromiffa word Sulula, meaning lowland and plain land that has associated with attractive landscape.

4.3.2 Demographic Characteristics

Demographic study is the major and fundamental component in designing and undertaking development strategies. Actual demographic and population studies represent the starting point for planning at all scales. It helps, as an example in land use planning, deciding the total land requirements and a basis for allocating land between various computing uses such as housing, shopping, and education and health services.

The national population and housing census conducted in 1994 puts the population of Sululta town as 1271. Whereas, the national population and housing census conducted in 2007 shows that the total population in the town as 12,452. This is less than the figure provided by OUPI in 2007 which is 14,000. From these two national censuses, it is possible to calculate the observed population by computing the growth rate of the town exponentially. Hence, Sululta town population is forecasted for the planning year with the consideration of the two CSA base

population data of 1994(1271) and 2007(12452). Thus, the growth rate from the two years population data were calculated and it could be 17, from which the total population from 2012 to 2022 was projected by the researcher (See figure 4.8 below).

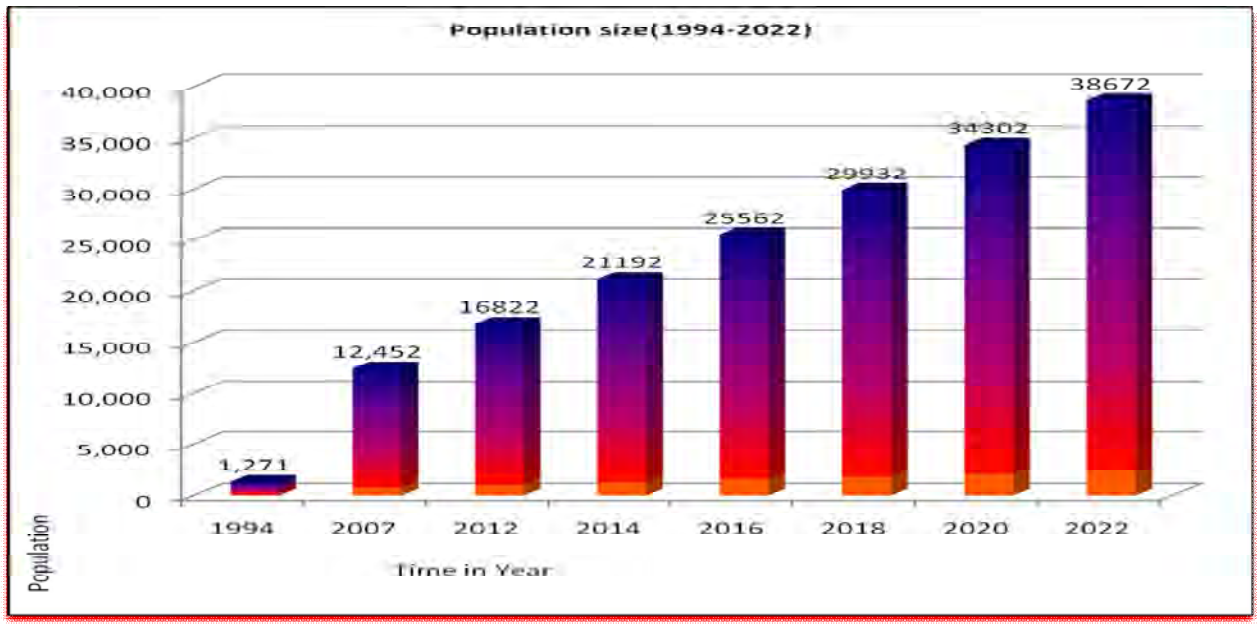

Figure 4.8 Population of the study area computed from CSA, 1994 and 2007

4.3.2. 1 Population Composition

The composition of age of a particular's society is a very critical component of Land use planning. Specifically; in Land Use Planning Study, it will facilitate and enable to predict what will be the future demand and development activity. The more the young generation, as an example, the higher the future land demand for different activities. Hence, aiming to plan the environmental land use pattern of the study area, the research tried to divide respondents' age structure into nine different categories. As the table below shows, the age structure is relatively distributed modestly to the different categories (See table 4.1).

Table 4.1 Population in age group

Age group	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	>or=60
Male	62	74	90	92	84	38	33	37	19	19	13	13	27
Female	73	64	92	92	75	53	38	29	29	20	32	22	53
Total	135	138	182	184	159	91	71	66	48	39	45	35	78

Source: CSA 1994

According to CSA 1994 the population size of the town is 1271 of which (47.1%) male and (52. 9%) female. From the table above the number of population aged from 0-14 are children-economically dependent population, those accounts about 455(35.8%) and those found in active work force age from 15-64 accounts about 773(60.9%). Whereas those that found above 65 ages constitute only 43(3.3%).

Concerning the ethnic composition of the town, Oromos are the original and dominant settlers that take the lion's share of more than 85%. Whereas, Amaharas were later settlers by different pulling factors in the town from other parts of the country and rarely found only sharing 11.6%. The rest population size in terms of ethnic composition in the town was shared by Sodo guraghie, Siltie, Agew and Afar. Another concern of demographic study is religious composition which has a vital role in determining the different land use patterns, like social amenities, worship places, cemeteries, and other major land use and infrastructural amenities. In this regard about 85.9% of the religion in the town is Orthodox Christian followed by Protestant Christian accounting about 10.5% and the rest are shared by Muslim, Waqefata and others.

4.3.2.2 Population Dynamics

Population dynamics refers to the numbers of births, deaths, immigrants, and emigrants over the specified time interval that determines the change in population size. As the country develops from primarily agricultural to industrial economy and urbanization is going on, large scale of migration from rural to urban takes place. The growth rate of urban areas is typically double the pace of overall population increase during this process. Sululta is the one where high rate of population growth is observed as a result of different pushing factors. Mainly better standard of living, job opportunity and poverty alleviation, despite the serious problems of overcrowding,

sub-standard housing, crime and burden for the government to manage and fairly allocate the resource.

Based on the table 4.6 below out of the total population number of the town, about 38.5% are migrants from other areas. From this about 12 % were from urban areas while 26.5% were from countryside. Therefore, most of the migrant population of the town is from rural areas.

Table 4.2 Population migration

Sex	Number	Area of previous residence			
		Non-migrants	Migrants	urban	rural
Male	599	372	227	-	-
Female	672	410	262	-	-
Total	1271	782	489	152	337

Source: CSA, 1994

4.3.3 Economy of the Town

The major economic bases of the town are industrial development, private investment, urban agriculture, commercial activities, and micro and small enterprise development.

While the town is less potential for industrial development, it is possibly yet at its infancy stage. The existing limited manufacturing industries are largely concentrated in northern fringe and those that are under construction where concentrated in the center of the town. Most of the existing industries are Agro-processing industries, mainly dairy farm and tanneries that create job opportunity for significant number of peoples.

The next economic base of the town is private investment. The main private investment areas in the town are trade, industry, social service and agro-processing. Thus, they may be considered as engine of economic growth due to the fact that private investment play indispensable role in reducing poverty by creating jobs and increasing purchasing power of the poor. It is also the main source of tax revenues, contributing to public funding for health, education, and other services.

Urban agriculture is also the economic base of the town and characterized by closeness to markets, high competition for land, limited space, use of urban resources such as organic solid

wastes and water, low degree of farmer organization, mainly perishable products, high degree of specialization, to name a few.

Urban Agricultural is a widely practiced activity that is taken as a means of livelihood for many in the town. It is an important income supplement for urban families and it is an integral component of urban economic and ecological systems. It comprises a diversity of agricultural production systems in and around the town often specialized in perishable products, such as, milk, eggs and meat. The fodder of animals is also another agricultural product in the town that serves as economic source for many dwellers.

Formal and Informal trade activities are another most important form of trade activities in town. The livelihood of significant number dwellers directly and indirectly depends on these activities that involve the transaction of highly diversified agricultural and industrial commodities raging from light consumer goods to higher order /capital goods. Thus, the sector plays an important role in employment creation and poverty alleviation by providing incomes to unskilled and semi skilled workers who otherwise would be unemployed.

The small business sector is also seen as an important force to generate employment and more equitable income distribution, to activate competition, exploit niche markets, enhance productivity and technical change, and through all of these stimulate economic development.

Tourism is again another significant economic potential of the town, particularly concerning Solon birds observed in waserbi and Entoto ridges and forests. There are also other bird's species which lives around the wetland of the study area. Therefore, these areas can be conserved for the attraction of tourists for bird watching, protection of soil erosion, forest and water conservation, and for overall management of natural resources of the area.

4.3.4 Land Use/ Cover

Land use/cover is an important aspect for modeling and understanding the earth as a system and is a key input for planning and management activities. It goes without saying that informed Structure planning promotes sustainable development and use of the natural resources. The land use/cover of the study area constitutes settlement, bush and shrub land, cultivated land, flower farm, open grass land, plantation forest and wood land. These are also shown on the map below

for further evaluation of land use plan and implementation of the study area. The components of the land use/cover of the study area are also assessed in the figure 4.9 below.

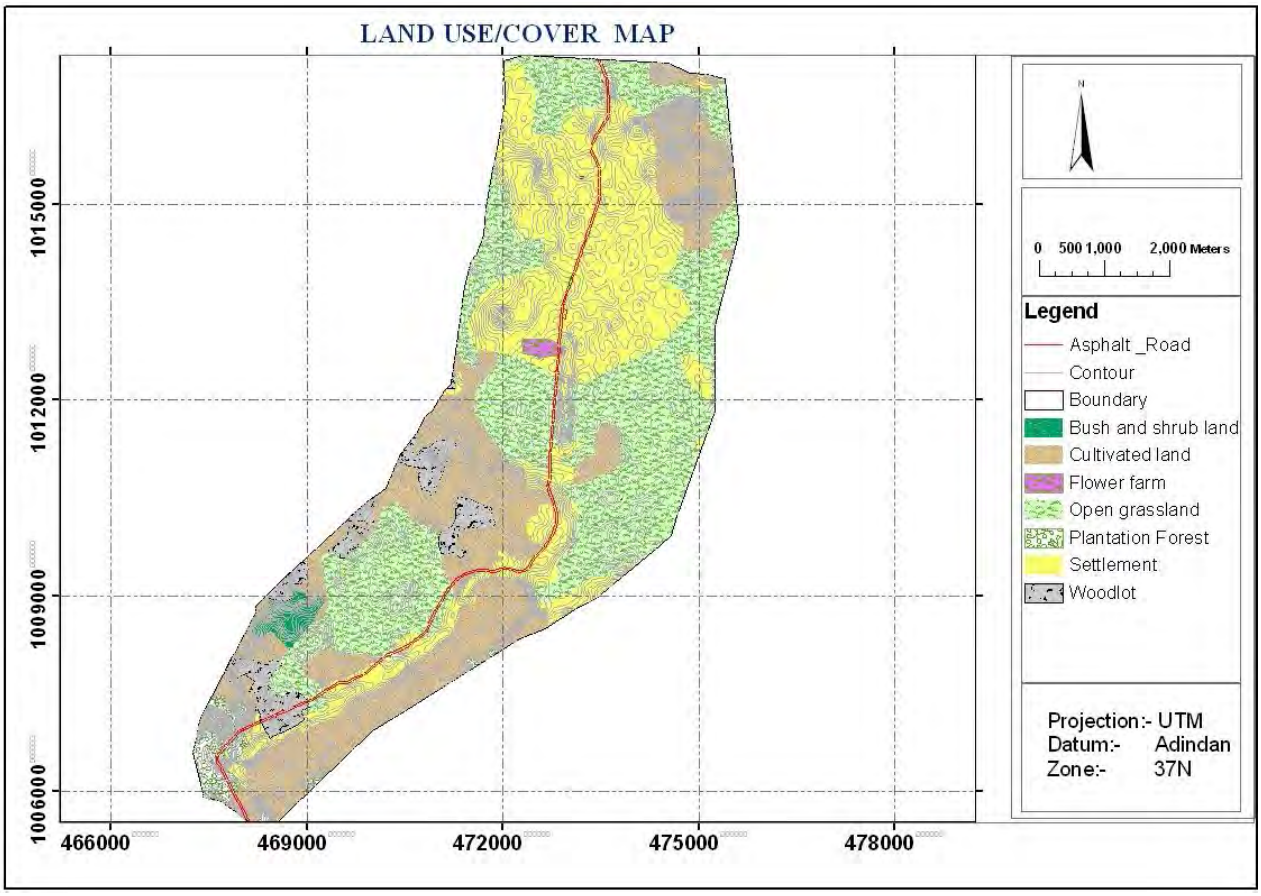

Figure 4.9 Land use/cover map (source: Own computation)

Based on the figure 4.9 above the dominant land use/cover in the study area is open grass land which accounts about 36.57% of the total land use/cover. Settlement is the second larger land use/cover of the study area which accounts about 30.56% followed by cultivated land taking about 26.93% and wood land that constitute about 4.12%. The rest land uses/cover of the study area has been occupied by plantation forest and flower farm.

4.3.5 Structure Plan

The 2006 structure plan of Sululta town was prepared by the Oromia Urban Planning Institute (OUPI), for 10year planning period and for a population of 22,374. During this period the population of the town was 14,000 (OUPI, 2006). The dominant land use type during this planning period was the urban greenery. The next land use categories were the residence followed

by transport and road network. This structure plan had brought a model for the town's development. The structure plan expansion areas followed the main road of Addis Ababa- Bahir Dar, in the direction of Addis Ababa town linearly.

In general, the existing structure plan of the study area is composed of different proposed land uses like administration, commerce, residence, manufacturing and storage, Transport and Road network, reserved area, urban greenery and social services. The plan covers an area of 4470.55 hectares within its delineated boundary and the plan is as shown below with little modification in converting from AutoCAD file to GIS file to easily analyze it (See table 4.3 and figure 4.10).

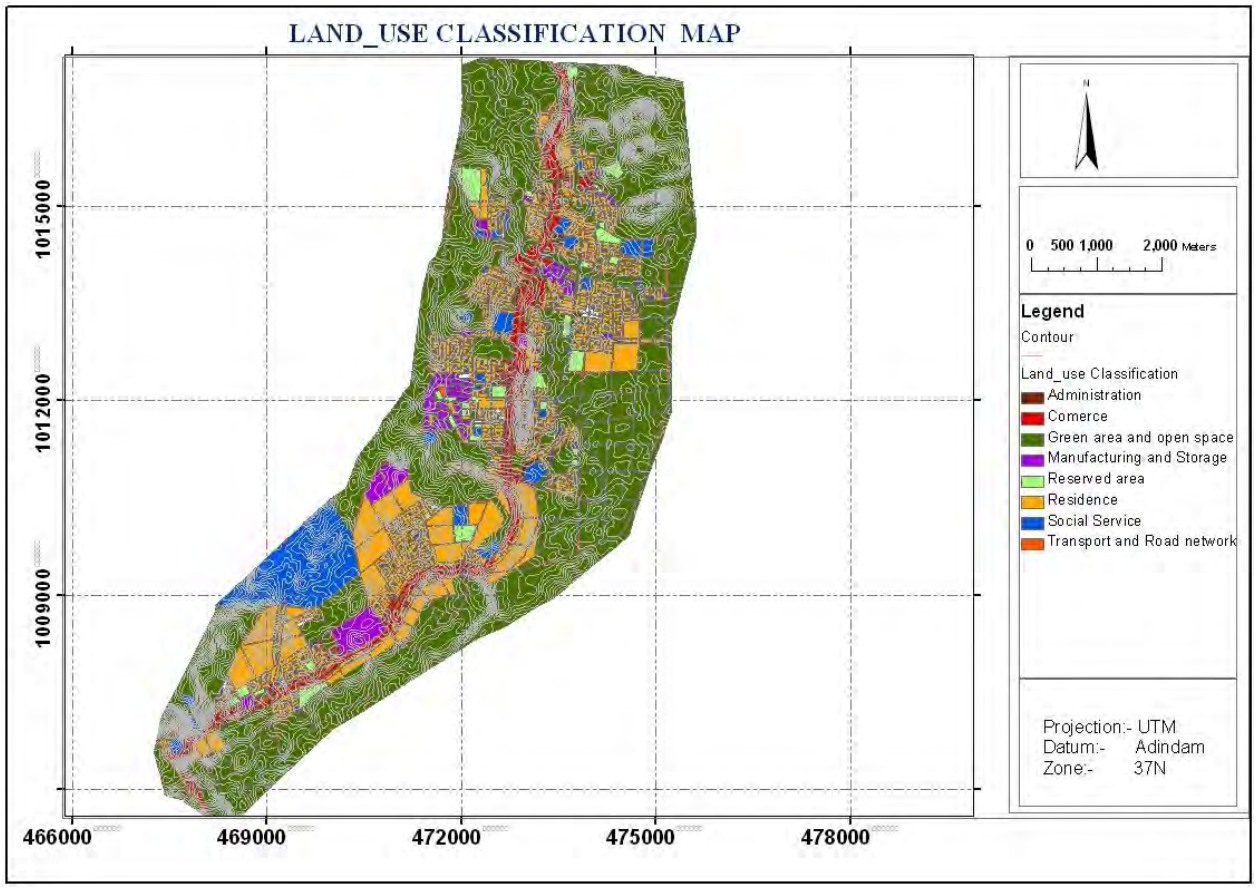

Figure 4.10 Existing structure plan of Sululta town (source: OUPI, 2006)

Table 4.3 Structure plan, area coverage in hectares and percentage

No	Land use Type	Area in hectares	Area in percentage
1	Administration	6.67	0.15%
2	Commerce	189.86	4.25%
3	Urban greenery	2473.68	55.33%
4	Manufacturing and storage	121.18	2.71%
5	Reserved area	89.03	2%
6	Residence	750.72	16.79%
7	Social service	267.38	5.98%
8	Transport and road network	572.03	12.79%
9	Total	4470.55	100%

Source: OUPI, 2006

Based on the table 4.3 and figure 4.10 above the dominant land use in the study area is urban greenery which accounts 55.33% of the total land use. These land use composed of recreation area, neighborhood open space, urban agriculture, forest, buffer zones, road side greens, squares, and grazing land. Residence is the second larger land use in the area which accounts for about 16.79 % followed by transport and road network taking about 12.79% and social service constitute about 5.98%. The rest land uses have been occupied by commerce, manufacturing and storage, reserved area, and administration.

4.3.6 Road network

The proposed road network on the structure plan consists of different road type based on their width and functions. These are Arterial, sub-arterial, Collector, and local/feeder roads and cover about 572 hectares of the study area. The detail arrangement of each road type has shown in the following map (See figure 4.11 below).

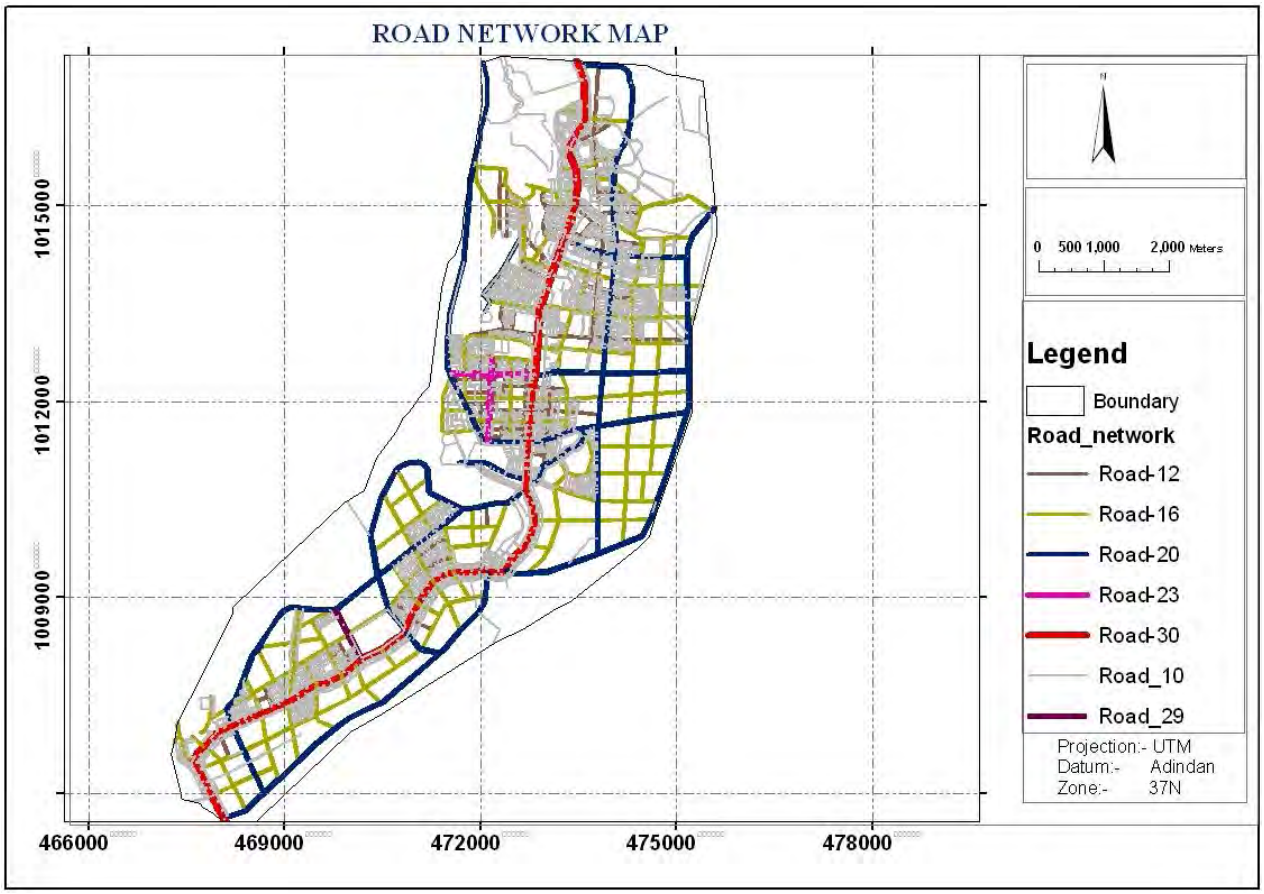

Figure 4.11 Map of the proposed Road network (source: Modified from OUPI, 2006)

CHAPTER FIVE

5. PROBLEM IDENTIFICATION AND SUITABILITY ANALYSIS

5.1 MAJOR PROBLEMS

5.1.1 Problems Related to Plan Preparation

Land use planning is a system of representing the different function of lands in a given area. Some of these functions are housing, commerce, manufacturing and storage, transportation and road network, reserved area, urban greenery, etc. Thus, the structure plan of the study area has proposed part of these functions. Therefore the preparation situation of the structure plan components will be discussed below.

5.1.1.1 Plan Boundary

It is obvious that the shape of the town has negative and positive impact on the infrastructure, service and utility development. If the town has compact morphology, it is cost effective to deliver services, infrastructure, and utilities for the town whereas for the elongated shape of the town, it is challenging for the town administration to undergone these basic developments.

The shape of a town can be evaluated by using different compactness indices such as Length-breadth index and other methods in order to know whether a certain town and /or influence area has compact morphology or elongated in its shape.

To determine the shape of sululta town weather it is compact morphology or elongated, it is analyzed using length-breath ratio which is computed as:

- L-B ratio: length of long axis/ length of short axis of an area.
- Long axis: a line joining the farthest points on the boundary in a straight line
- Short axis: The longest line perpendicular to the long axis between two other points on the boundary.

Therefore, the long and short axis measured from the structure plan of sululta town is 14km and 4km respectively. Hence the computed result is about 3.5 indicating that this town has a relatively

elongated shape. This implies the town is developing length wise with short breadth. In addition, it is observed that the development in the town is along the road Addis Ababa to Bahir Dar and the development at the south part of the town is very random and sporadically flourished, these are may be as a result of two potential factors. The primary factor is road access that attracts the development along it and the other is Addis Ababa city which has a great potential to attract the developments in the town to the direction of its location.

Generally this kind of shape and development has negative impact on socio-economic and environmental values, mainly, on solid waste management, Infrastructure, services and utility development. For example to foster environmental quality of the town, solid waste management is should be undertaken in the town however for this kind of town shape and development it is difficult and expensive to manage. Moreover, the development of infrastructure, service and utilities has considerable impact on socio-economy of the town.

In this research, to take corrective action up on the shape of the town, there are two challenging aspects. The main aspect that challenges the town to take action on compaction is socio-economic aspect that caused by destruction of the sporadically flourished development. The other aspect is environmental and socio-economic that resulted from extra expanding of the town breadth to bring compact morphology.

Moreover since there is no extra land demand by the town administration at the moment, the action may have worthless and considerable impact on the environment as urbanization converts the pervious to impervious and waste cleansing to waste generating environments. In addition, these may have also considerable socio-economic impact as it needs the delivery of infrastructure, service and utilities within the expanded administrative boundary that may be beyond the capacity of the town administration (See figure 5.1).

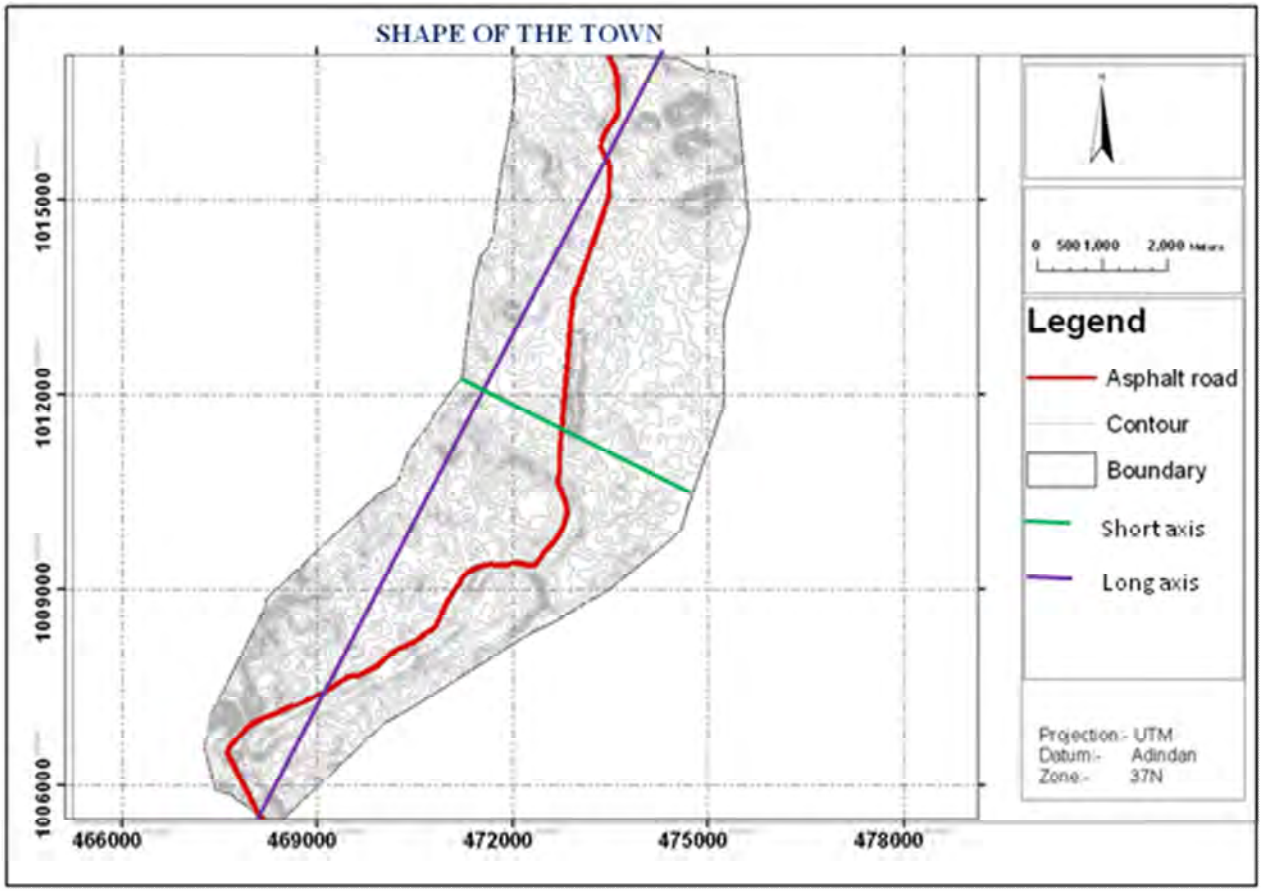

Figure 5.1 Shape of the plan boundary (source: OUPI, 2006)

5.1.1.2 Housing

Here by the study area, Sululta town is the second urban grade level in Oromia Regional State. Therefore, the standard of housing unit for this grade level is 50-60% (FUPI, 2006). However on the structure plan the housing plan component as stated in 3.3.3 accounts about 23% of the total study area below the standard. This may resulted because of the natural setting of the town as it is mostly constraint for this kind of development rather for conservation.

The standard (FUPI, 2006) also states, a green or buffer zone of at least 100m should be preserved between housing areas and heavy industries, depots, and waste disposal site. In addition, a quarry site should be rehabilitated for at least five years before it is supplied for housing development. Also, housing areas should be planned and developed in areas where the slope is between 2-15% (FUPI, 2006). However, on some areas of the study, the proposed

residence contradicts this condition. For example, there is no buffer zone between proposed residence and industrial areas.

Furthermore, most of the proposed areas of the housing unit areas lie on the slope less than 2% that may be prohibited for this use. Thus, most of the settlement in Sululta is developed on relatively flat land; significant proportion of the town is affected by water bogging. Part of the housing unit is also proposed on environmentally sensitive area mainly wetland which founds to the east and west part of the town. The wetland in the area may have environmental benefits like water purification, ground water recharge, climate moderation, runoff reduction and habitat for many lives. However, the land use is unsuitably proposed on the area, limiting the above benefits that the town can get from the wetland (See figure 5.2).

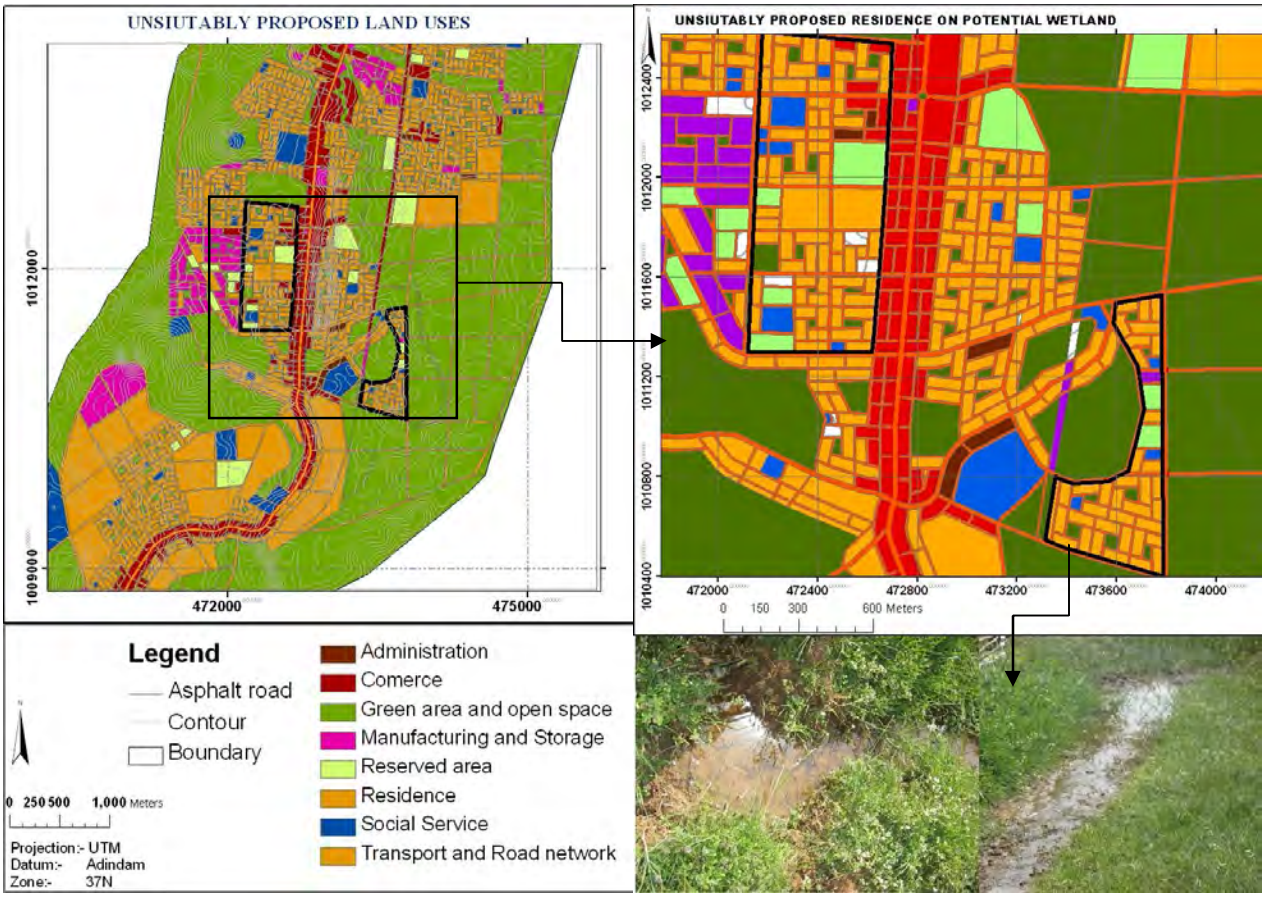

Figure 5.2 Settlement proposed on wetland (source: Own computation)

5.1.1.3 Commerce

The proposed commerce on the structural plan of the town was also has some considerable short falls. Particularly the proposal has significant impact on the environment as it proposed on the wetland that found to the west of the Abyssinia water factory in the study area. The interviewer and the group discussion argued that the proposal were better if it was reserved as wetland or recreation. Thus, it fosters the environmental quality and socio-economic benefits in the town (See figure 5.3).

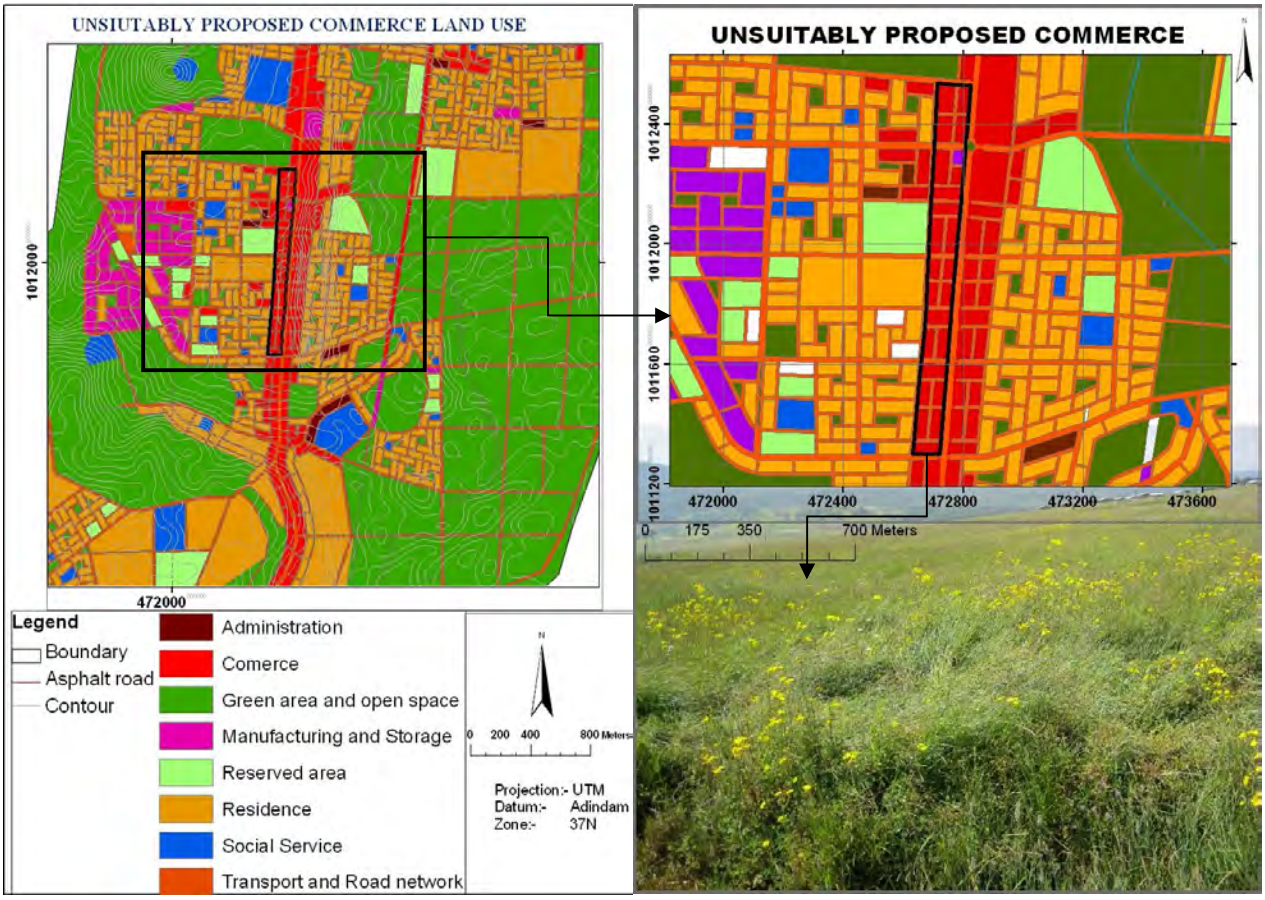

Figure 5.3 Proposed Commerce on wetland (source: Own computation)

5.1.1.4 Manufacturing and Storage

Sululta is less favourable place for industrial development. However, the evaluation of different parts of Sululta for industrial development shows, the existing old town of Sululta is relatively better area for industrial development, which currently occupied by the existing Housing and other uses (OWWSDE, 2011). Thus, even though the proposed industrial areas in the town

accounts about 2.71% of the total land use and these may be below the standard of second urban grade level of Oromia Regional State that is 10-15% (FUPI, 2006), the structure plan limited the percentage of the use depending on the suitability of the town for the development.

The manufacturing and storage proposed in the town was located at four different places and the one located in the middle of the town does not consider the concept of land use planning. Because, the proposed industrial area is less suitable for industrial development as it is very close to rivers and streams. In addition it is incompatibly proposed with other land uses like settlement and commerce. Moreover, the fact that the location of the town itself is on the upper stream of the zone, it will be difficult to protect rivers and streams from contamination. Hence, it is important to gradually convert the existing industrial development to non- pollutant agro-based industry and prohibit new heavy industrial development in the area (See figure 5.4).

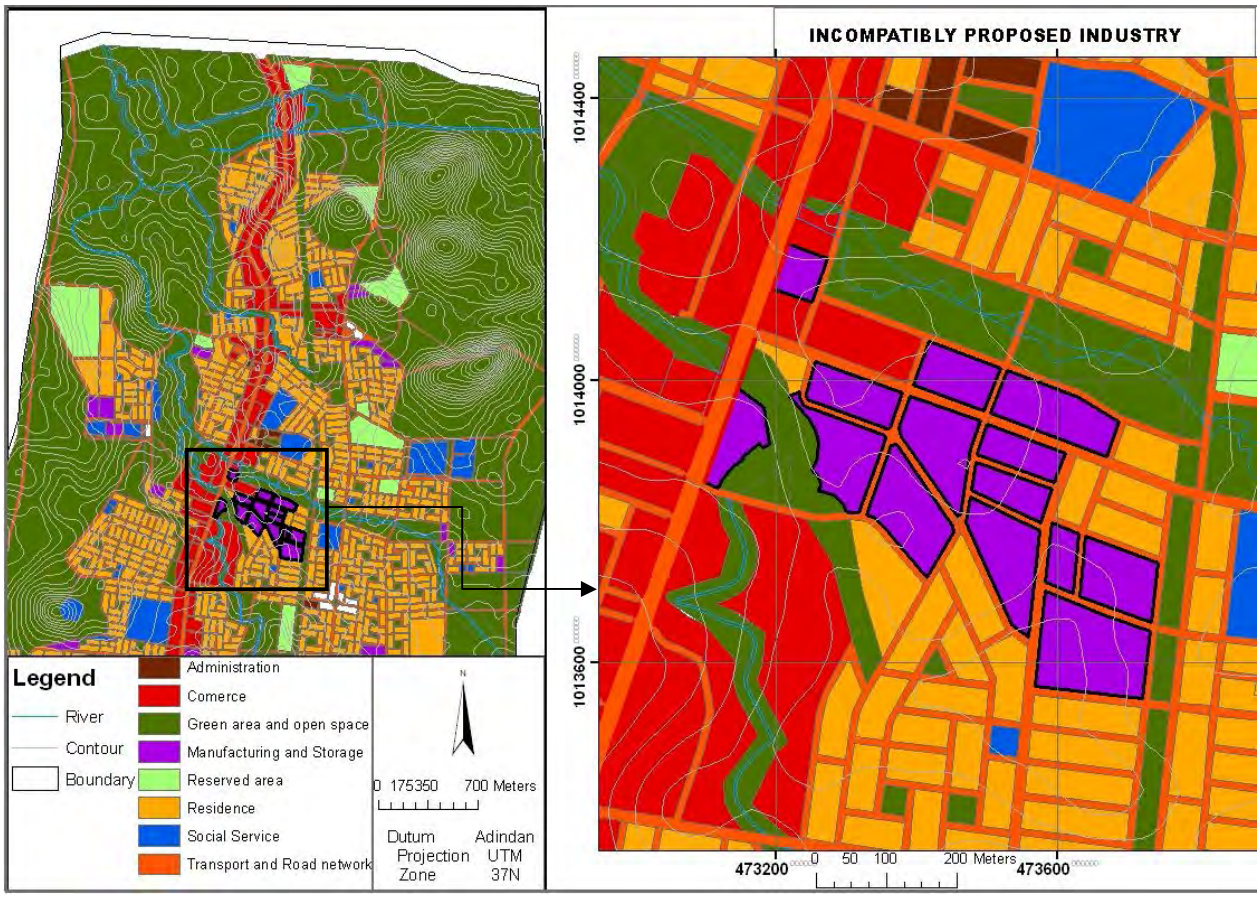

Figure 5.4 Incompatibly proposed industry (source: Own computation)

5.1.1.5 Urban Greenery

The proposed urban greenery in the town including urban agriculture, grazing land, recreation, forest, buffer zones, water body and etc. accounts about 55.33% of the study area. Therefore, the proposal of the component accounts more than twice the standard of structure plan 15-20% (FUPI, 2006). The reason behind the proposal were most of the areas have natural constraint that forbid the development and encourage conservation.

In addition, the town has great potential and suitable for green area like urban agriculture, recreation, wetland and forest around Entoto ridge. Also the abundance of slope less than 2% and greater than 20%, in the study area obliges to compromise the standard. However, the short come of the proposal were urban agriculture that incompatibly proposed on existing wetland, found to the east of the study area. Moreover the existing quarry site was proposed by the urban green mainly forest, that may be better if it was proposed as reserved area till it is rehabilitated.
In the town one of the potential water resources is wetlands that found in east and west part of the town. In addition it is bare fact that wetland can give a lot of environmental benefits mainly as habitat for many life, flood reduction, waste water purification, ground water recharge and others. However, in the prepared Structure plan nothing was dealt about the seasonal wetland of the town, as the study may be ether didn't consider the different seasons of the year in the planning concept or closely discuss with the local residents about the changes made with the seasonal change.

Generally, the proposal of urban greens on the structure plan has some limitations. These are the proposal of urban agriculture on the wetland area, forest on quarry operation site, and inability of the plan preparation team to consider the potential wetland in the town are the short comes of the structure plan concerning urban greens. See figure 5.5 for detail information.

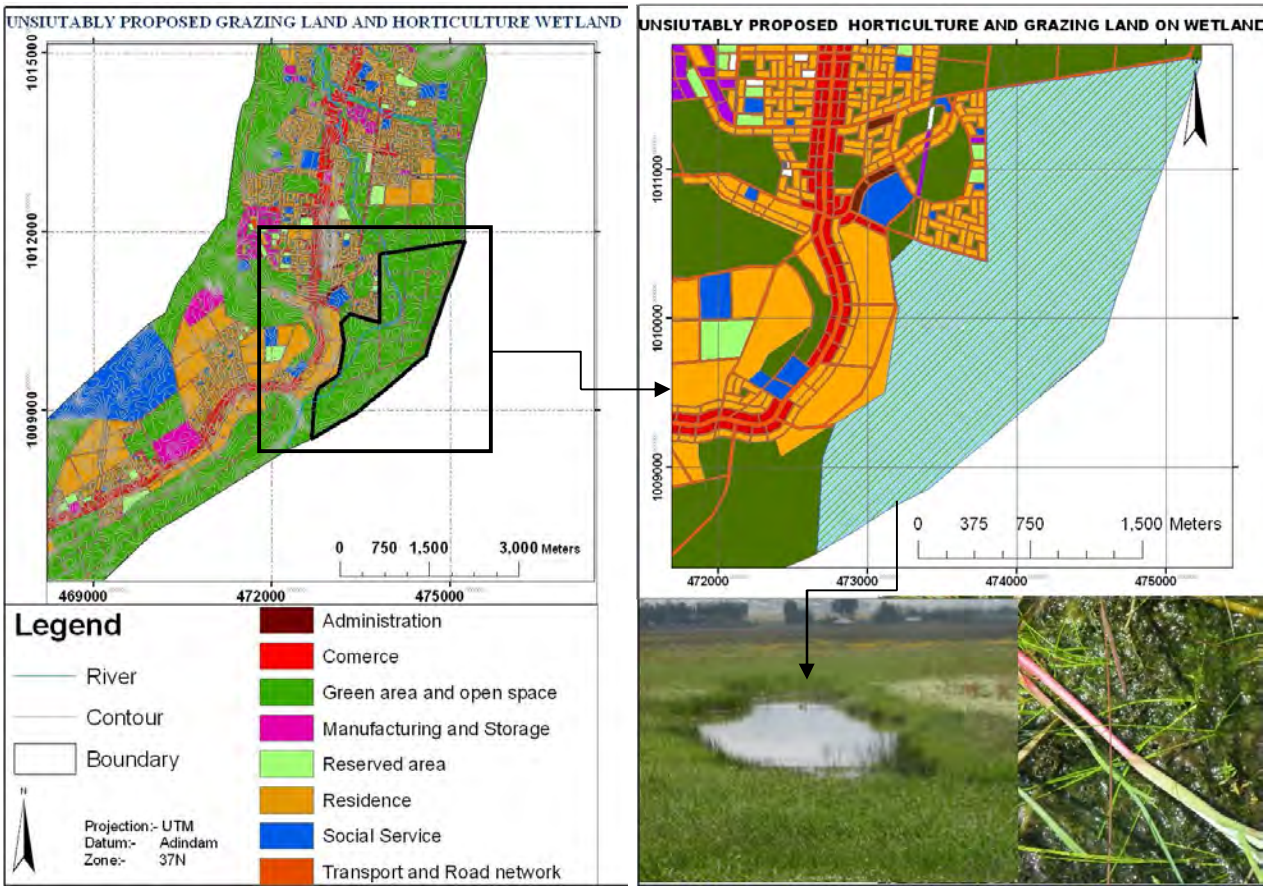

Figure 5.5 Urban agriculture proposed on wetland (source: Own computation)

4.1.1.6 Transport and Road Network

The proposal of the transport and road network can not coincide with the concept of structure plan. The spatial proposal of the component seems development plan as it proposed all local/feeder roads in the town whereas the socio-economic study deals as structure plan. Thus, the researcher challenged to compare the proposal of the component with the standard of the structural plan.

However, what is tried to analyze here is the transport and road network, infrastructure, and utilities including those details of the local/feeder roads proposed as development plan accounts about 12.79% that is below the standard sated for structure plan 15-25%. On the other hand the natural constraint of the study area for development also contributes to compromise the standard.

In addition what is observed from the structure plan of the town is that the component is proposed as a grid network on the potential wetland that found to the east of the study area. These may result two challenges to the town administration. The primary challenge is the wetland may be lost as the road network converts the pervious wetland that serves as waste purification in to impervious one that facilitates the discharge of waste in to the wetland. The other challenge is economical challenge as construction of the road network on this wetland requires high cost that is beyond the financial capacity of the town administration (See figure 5.6).

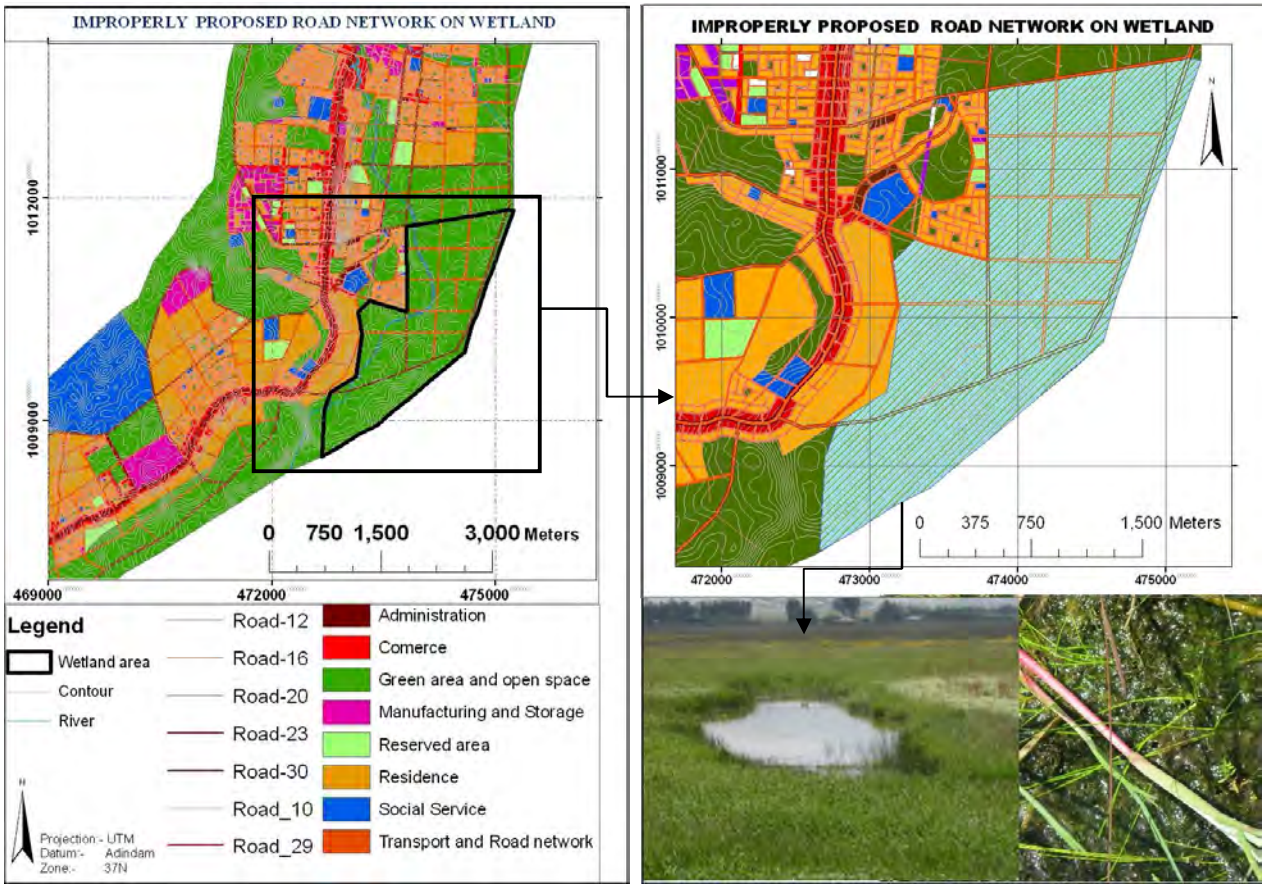

Figure 5.6 Road network proposed on wetland (source: Own computation)

5.1.1.7 Municipal Function

5.1.1.7.1 Solid Waste Dump Site/Landfill

Solid waste dump site is one of the environmental component that the planning process should pay due attention. Similar to most towns of the country, there is no proper solid waste dump site in Sululta town. Thus, how the dump site is approached in the planning process is not rational. Hereby the standard set to propose the dump site by many scholars' are within a slope of 0-5 %, and minimum altitudinal range in relative to the town and others. However in the planning process the standards are not considered as the proposal of the dump site is on the slope greater than 15% and on high altitudinal range in relative to the existing area of the town. These resulted; the site is not yet implemented in the intended place in the town and all or most of the generated waste remains elsewhere in the town and at transfer stations.

In waste management scenario, transfer stations must be considered in the planning approach. Then the wastes are collected from the transfer point and convey it to the final disposal site. Thus, where the transfer stations should and how the transfer stations are managed is well covered in the planning process of the Structure plan of the Town.

Hazardous wastes are ending up with municipal wastes elsewhere in the town or at the dump site, but municipal solid wastes are not supposed to be disposed off together with hazardous wastes. In this regard, the plan has not considered and studied in the ways how hazardous wastes generated from industries and health centers can be collected, transported, and disposed off at a separate site away from the residential areas with the main objective of protecting the dwellers and the ambient environment.

Street waste is directly related with the aesthetic appearance of the town as well as sanitation. However, special attention has not been paid how street cleaning services undergoing in the planning process of the structure plan. As a result, the streets in the town where dumped by the wastes generated from day to day however there are no street swappers to take action on the street wastes that clearly distort the image of the town. Therefore how the street sanitation should undergo requires planning intervention (See figure 5.7).

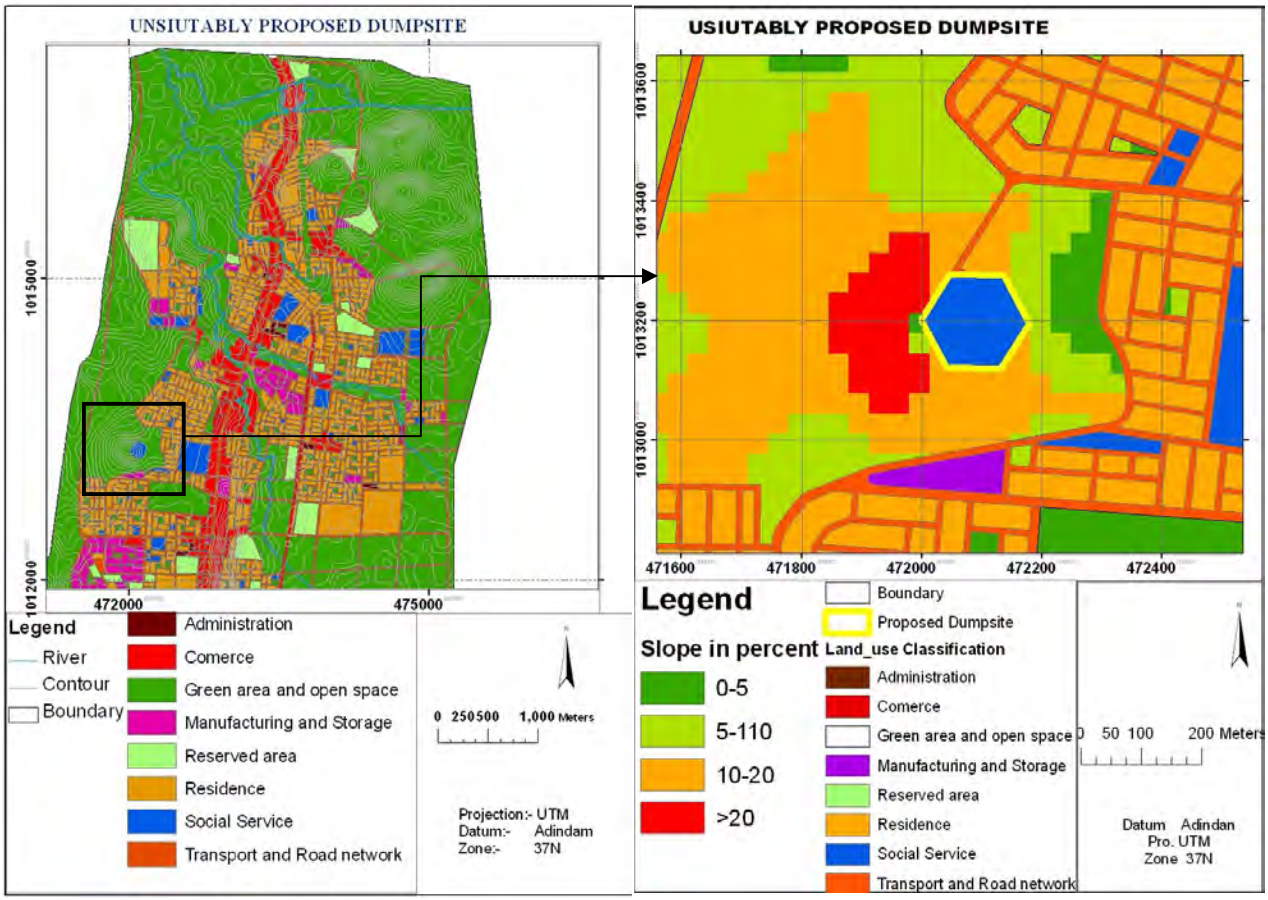

Figure 5.7 Unsuitably proposed landfill site (source: Own computation)

5.1.1.7.2 Liquid Waste

Liquid wastes generated from industries, residential units, commercial units and others also adversely affect the environment if proper planning solution is not given in many towns. Hereby in the study area a detail study of liquid waste is covered on socio-economic report of the structure plan whereas the spatial proposal didn't proposed the site for treatment plant that challenges the town administration to manage the liquid wastes in the town. Thus, the problem is intensified as most of the housing unit's luck toilet facility and septic tank. Because of this, majorities of the population in the town defecate in pit latrines, open space, and gullies.

Moreover, the generated liquid wastes may also drain in to nearby rivers, open space, wetland, and streets causing water pollution and offensive odor in the environment. Therefore proper recommendation to create community awareness toward toilet facility and septic tank and spatial solution is needed for liquid waste dump site to properly manage the wastes.

5.1.1.7.3 Municipal Abattoir

The existing municipal abattoir in the town is incompatibly on operation with the other existing land uses that violets the planning criteria's and principles. Thus, though the planning team recommended some guide lines for the proposal of the site mainly:

- The abattoir should be located in the periphery of the town
- It should not be located close to settlements
- It is preferable if the slope is about 5%
- It should not be near latrines or any other waste disposal system
- It should be 2km away from any ranch boundary and sources of water supply.

Thus, the spatial proposal of the abattoir didn't consider the criteria and no planning solution is given for the aggravated problem. Therefore the abattoir is yet located in between the settlements, where slope is greater than 5%, in tangent with solid waste transfer stations, and in close proximity to the ranch area and water resources that requires urgent planning interventions. Otherwise the difficulty may be multiplying itself for further adverse effect of the environment in the project town (See figure 5.8).

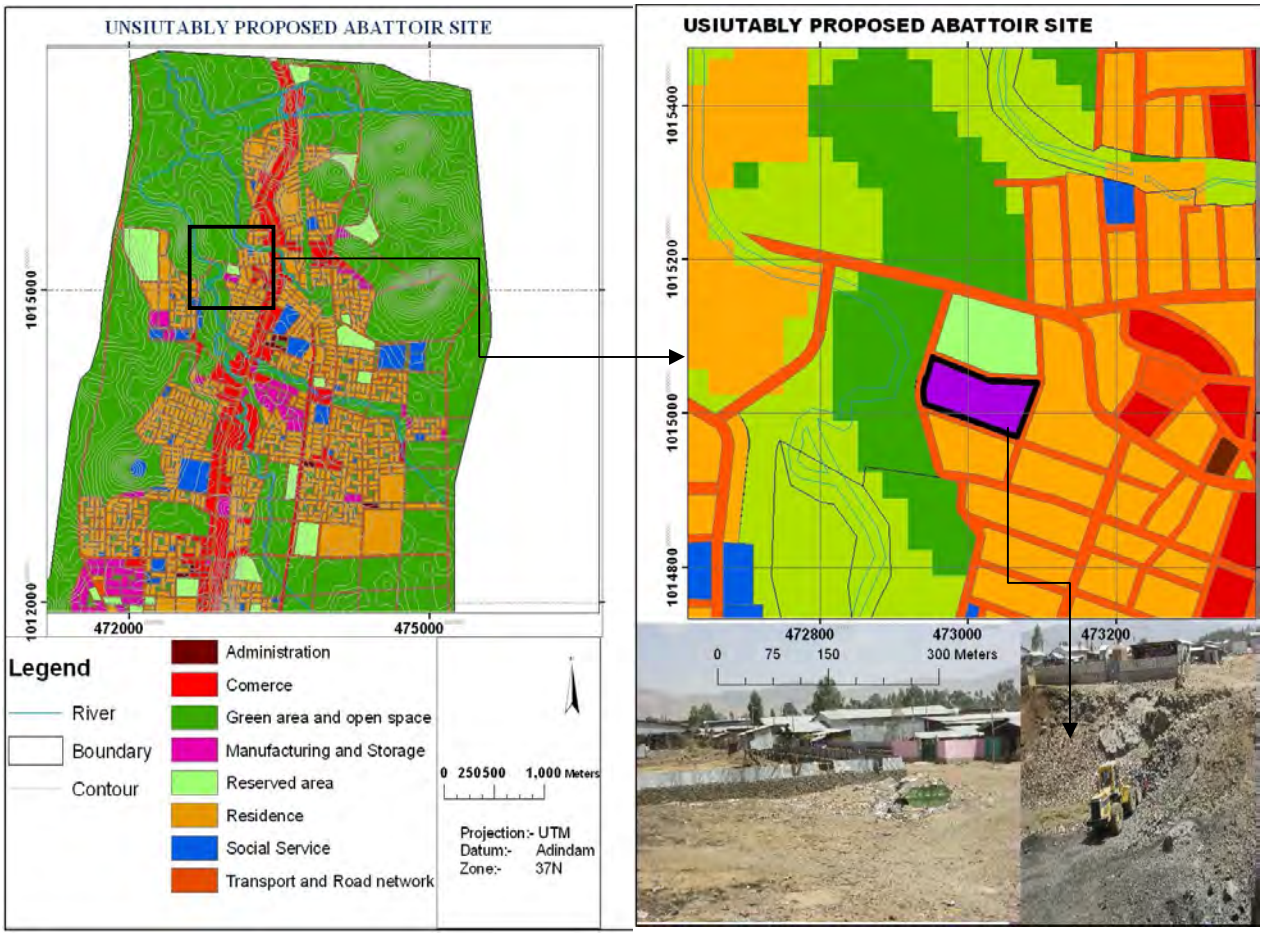

Figure 5. 8 Unsuitably proposed abattoir site (source: Own computation)

5.1.1.8 Summary of the Problems Related to Plan Preparation

Even though the structure plan have been prepared as per the standard, guideline, principles and norms of the plan, some conflicting areas of the land use at the preparation period are identified. Therefore, the major conflict areas of the structure plan and the land suitability study has identified below (See table 5.1 and figure 5.9).

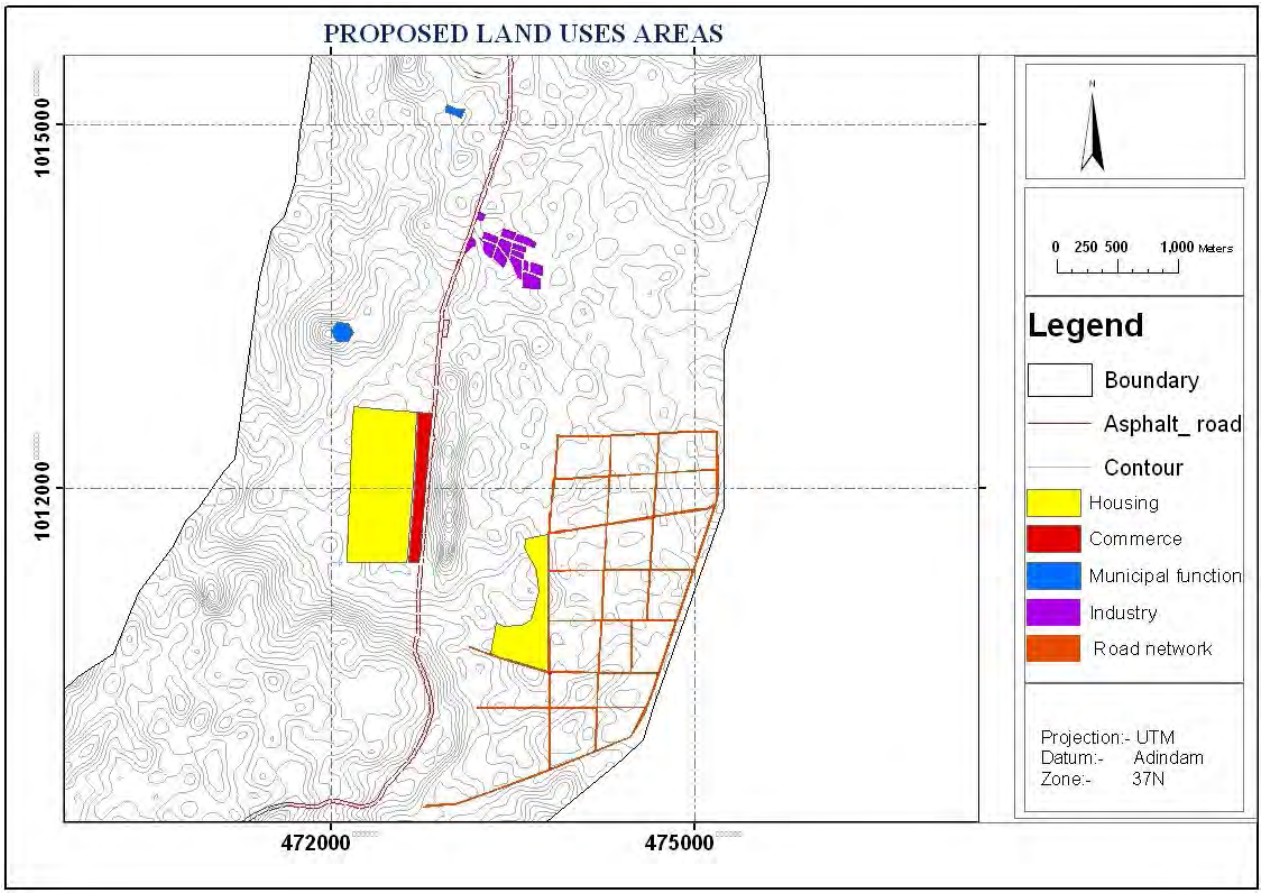

Figure 5.9 Summary maps of the problems during plan preparation (source: Own computation)

Table 5.1Summary of conflicted land use areas in hectares

Unsuitably and icompatibly proposed Land use type	Area in hectares
Housing	88.56ha
Manufacturing and storage	11.87ha
Commerce	11.69 ha
Transport and road network	37ha
Municipal function	3 ha

Source: Own computation

4.1.9 Reason for the Problems

In the land use planning of the study area, even though the preparation of the plan has the lion shares, some of the external and internal factors contributed for the short falls of the planning approaches have been observed.

The external factors affecting the quality of the plan specifically the environmental plan units are lack of community, investors and private participation as well as with shortage of commitment of officials. These resulted in a limited level of awareness that leads to unrealized plan execution. In addition, Interest conflict among primary stake holders like community, investors, religious and others was also resulted in giving biased data that directly has been affect the quality of the prepared structure plan of the town.

Moreover, the internal factors that cast a shadow image on the quality of the Structure plan were the experience and skill gap of the plan preparation team that caused for the proposal of existing quarry site for grazing land, existing wetland for settlement and road network, dump site on slope greater than 20% and high altitude where not suitable for the intended use. On the other hand, as most scholars assured, land use planning needs multi professional that mainly affected the quality of the Structure plan. However, it is observed that there is shortage of multi professional particularly environmental planner and related fields while the town plan has been prepared. These resulted, possibly less consideration have been given to the environmental components during plan preparation.

The typical example is Aluminium factory that proposed in tangent with residential, flower farm and around riverbanks. This affects the environment mainly through river pollution, air pollution and unpleasant odors that severely affecting the health of dwellers and sustainability of the resources. Besides, the seasonal wetland found in the east and west direction of Abyssinia water factory, were proposed for residential with road network and other land uses unsuitably.

5.1.2 Problems Related to Plan Implementation

Very fast rate of urbanization is exacerbating social, economic, and environmental problems already found in many urban centers of developing countries including Ethiopia. The adverse impacts of urbanization on the project town will be severe particularly in the residential areas of low income groups, and on the rivers crossing the town. Therefore, comprehensive urban planning in general and, urban environment planning and management in particular is inevitable.

Accordingly, it is quite imperative to study the existing complex environmental problems of the town provoked by problems of plan implementation. Thus, main environmental issues i.e. urban greenery, water resources, quarrying, pollution, waste and their impacts on urban environment are discussed briefly.

5.1.2.1 Urban Greenery

In most towns of the country the consideration given to the provision and development of urban green is minimal. This shows the ineffectiveness of plan implementation to preserve green areas. The study area is one of the towns of the country where this problem is intensified. Therefore, the accordingly implementation of urban greens in the study town that consists of all kinds of public parks, neighborhood greens, street side greens, woodlands/forests and open spaces, institutional and private green gardens, and urban agriculture are assessed. .

5.1.2.1.1 Existing Situation of Urban Green Areas in the Town

The share of urban green area on the Structure plan is quite enough as per the standard set by FUPI 2006, which is (15-20%) of the total land use. But, in the past years, even though the Town has preserved some green areas in implementing the land use plan (2006), the provision and development of green area in the town has left back. In addition, some of the proposed land use green areas are reclaimed for settlements. Therefore, there are no designed and properly organized community/public urban green areas in the town. Moreover, during field observation the researcher has identified Green areas that are implemented according to the plan, those that are deviated and yet not implemented. The location and existing condition of green areas of the town presented in the map below (See figure 5.10).

5.1.2.1.2 Public Parks

There are diverse and suitable open lands that are preserved on the land use plan for the development of public parks. However, still there is no functional public park employed in the town. In addition, the town has great potential areas with varied topographical and functional environments. These include the wetlands that serve as habitat for different kinds of birds in the eastern part of the town. The wetland may also provide economical and environmental value through tourist attraction and habitat for many lives respectively, if it will be conserved and developed as a public park.

Hilly areas in the southern, western and north eastern part of the town, heap of hilly areas in the western part where know quarrying activities is taking place may also used to view the top view of the town are among important potential areas to be developed as public parks. Hence, the town administration has to take consideration of public park development to gain economical, social and environmental benefits (Figure 5.10).

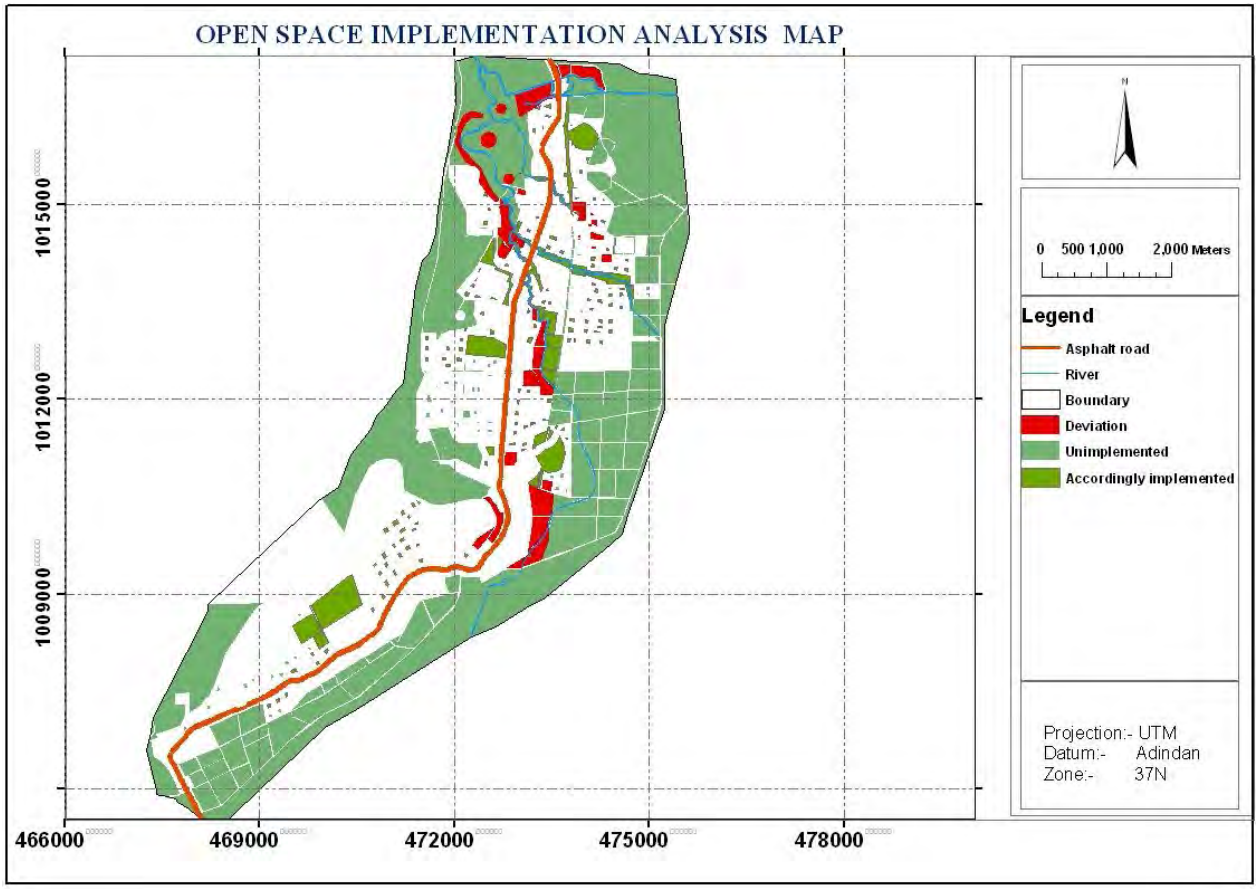

Figure 5.10 Implementation status of urban greens (source: Own computation)

5.1.2.1.3 Neighborhood Green Area

Although there are different open spaces preserved through the town, there is no properly developed neighborhood green area in the residential areas. Some of the existing recreations which serve as neighborhood greenery have been reclaimed for other purposes, particularly settlements. In addition, the existing neighborhood open spaces lack fences, green trees/vegetations, play facilities, walkways, seats, shelters/sheds, etc. Therefore, there are no properly managed neighborhood green areas implemented in the town. This calls urgent attention in the area to work on it (See figure 5.11).

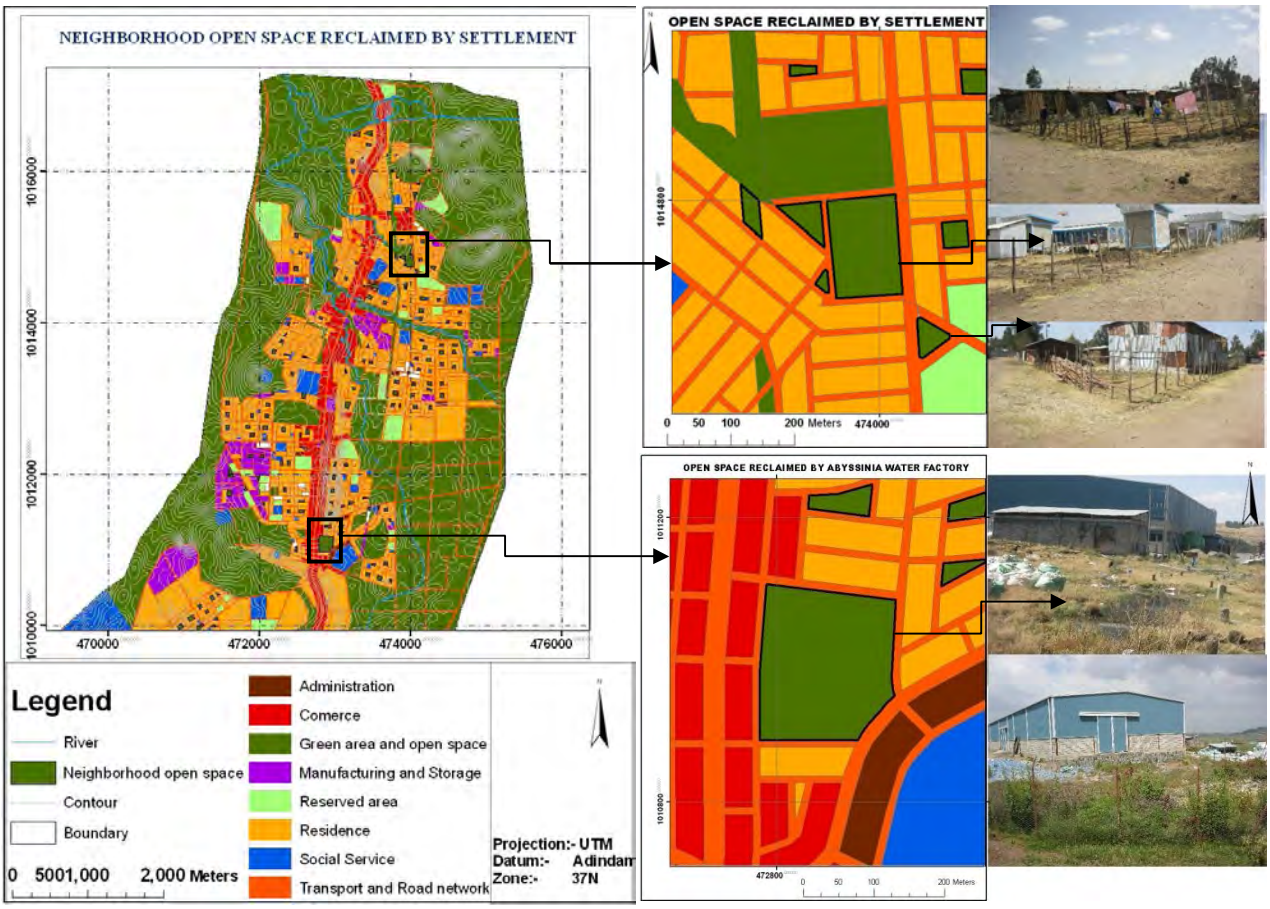

Figure 5.11 Neighborhood open space reclaimed by settlement (source: Own computation)

5.1.2.1.4 Urban Agriculture

Crop production, horticulture, and livestock rearing activities are taking place inside the town and in periphery parts of the town. Livestock production mainly dairy farm takes the most proportion of agriculture in the town. Horticulture found in the east and west part of the town is also an urban agriculture taking place. The town has the following natural potential for urban agriculture.

- Geographical location of the town for national and international market.
- Availability of potential ample land for dairy investment
- Suitable climate and environmental condition of the rural hinterlands for agriculture.

Even though the town has agricultural potential as a result of the mentioned above factors the implementation of the activities in the town has some limitation. Mostly, as the investment of dairy farm is going on, issues need to be covered prier to investment such as EIA and suitability of land use in the area is left back. The location of these investments is almost near to the riverbank and local residents so that their waste is directed to the rivers. These aggravate the pollution of rivers and offensive odor that adversely affect the residents in the nearby and downstream.

The dairy farm owned by Dame in the north western part of the town is typical example, polluting the Orgogo River by discharging wastes directly to it (See figure 5.12). In addition, the unpleasant odor emitted by the farm can harm the health of local residents. Generally, mixed agriculture is not considered in the urban agriculture development in the town.

Therefore, the major planning components with respect to encouraging urban agriculture are promoting mixed agriculture should be reconsidered in view of the above fact., for example encouraging horticultural development along the riverbanks and encouraging livestock development in the peripheries.

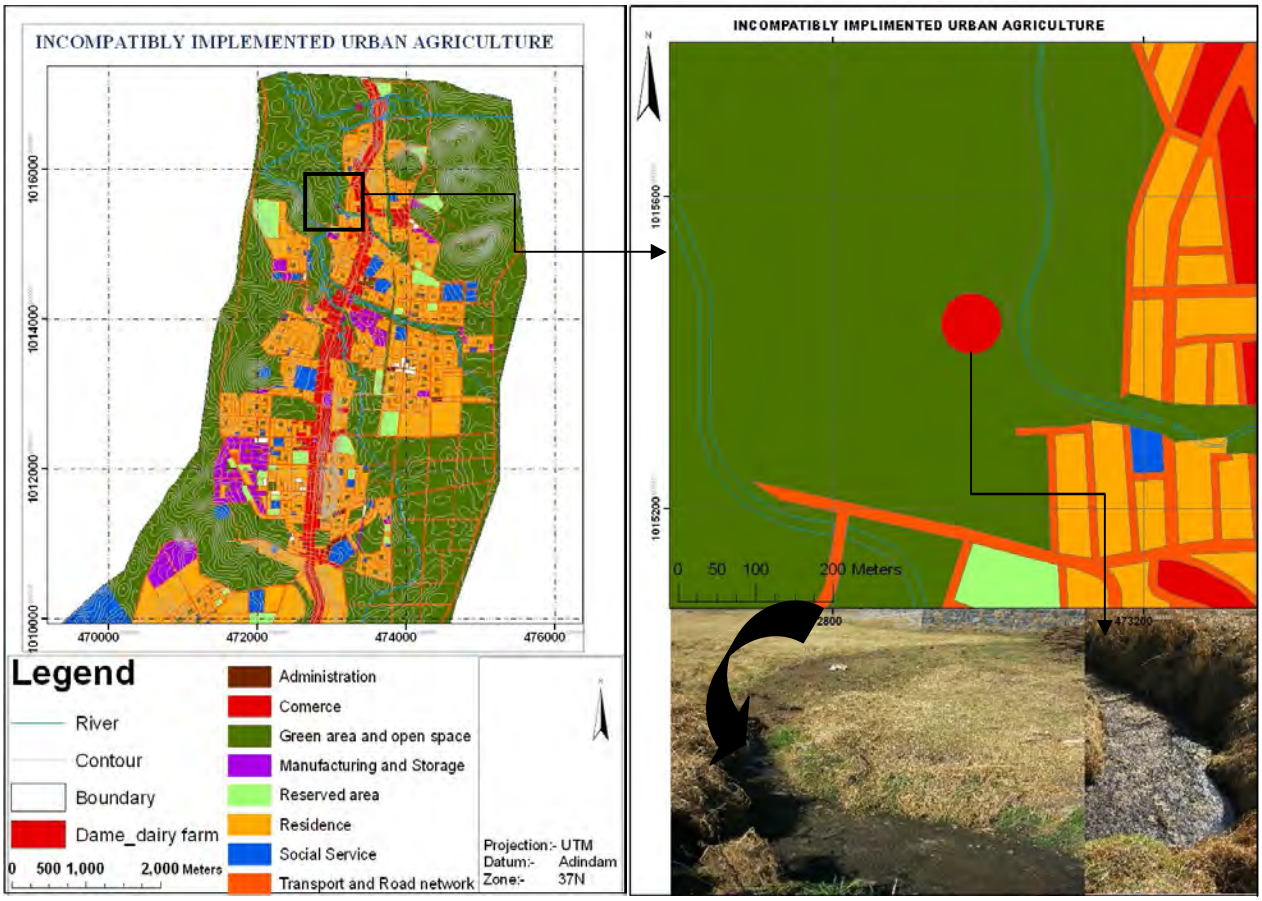

Figure 5.12 Improper implementation of urban agriculture (source: Own computation)

5.1.2.1.5 Road Side Green Area

These include green spaces and trees/vegetations along the right-of-ways of roads, boulevards and roundabouts /squares. In the project town there are no road side green area developed yet. Therefore, the implementation of the road side green area is almost not under consideration, so that, it is possible to say the development and provision of this green area is marginalized. As a result, policy frame work, proper design and management, awareness of the concerned body to implement the development of road side green area in the town are required.

5.1.2.1.6 Forest Bushes/Shrubs and Grasses

The vegetation cover in the town is concentrated in the mountain side of Entoto where Eucalyptus tree is associated with few acacia tree together with scattered bushes and minor other kinds of plants. Most of the existing trees which are eucalyptus are owned by the government (Addis Baha Firewood Project) and individuals in the past are mainly found scattered in the areas.

Presently, the Eucalyptus tree that is found in the boundary of Sululta town is administered by Sululta municipality. The majority of the man made vegetations are eucalyptus species which have high demand for construction purposes; but they have less environmental significance. So, it requires gradual replacement of eucalyptus trees by indigenous one to enhance the environmental importance of the vegetation.

The northern, eastern and some parts of the western plains in the fringes of the town are mainly covered with grasses (pasture land) and alternative crops with few scattered trees. Though the town has potential by grasses (pasture land) that serve as fodder from local level to international like Djibouti, the condition is not seem sustainable.

As, some industrial units, residential units, commercial units and investments discharge their wastes and chemicals directly to this area, these may accelerate the extinction of the potential. In addition, the units also discharged to the wetlands, rivers and marshy areas found in the town that indirectly influence the existence of the grasses as they would share polluted water and soil to grow up. The typical example that potentially destroying the grasses is Ethio-China Tannery that found in the northern fringes of the town. From this view, pollution mitigation and conservation measures have to be taken by concerned body to sustainably get the benefits from the potential grasses in the town. See the figure below.

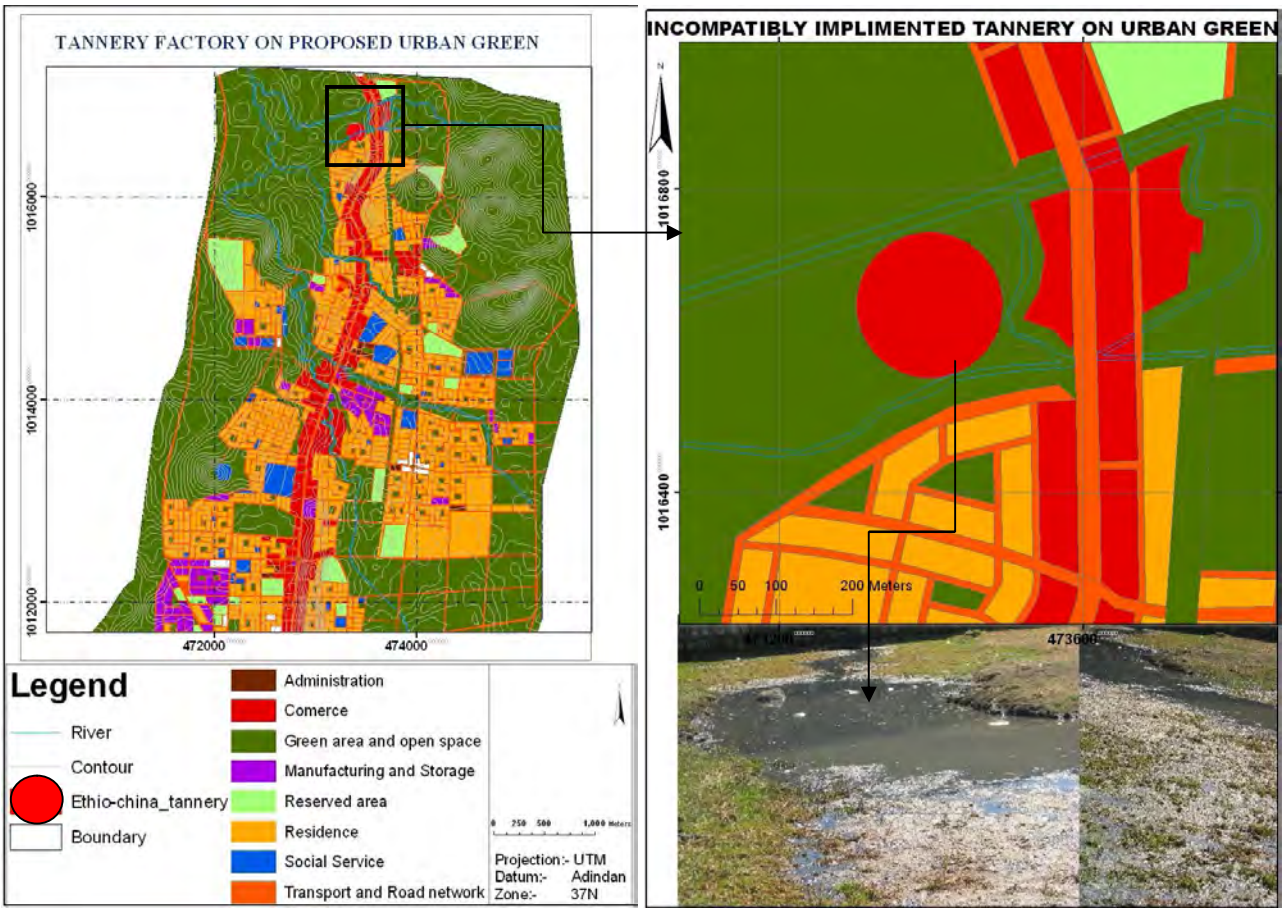

Figure 5.13 Tannery implemented on urban green (source: Own computation)

5.1.2.1.7 Wetland

The seasonal wetlands in the town are located in the eastern fringe and western part of the town in front of the Abyssinia water factory. It is obvious that wetland provides a lot of environmental benefits mainly, water purification, flood reduction, carbon suck up, run off reduction, ground water recharge and others. Moreover, the wetlands in the project town directly serve as habitat for many birds' species and indirectly for fodder production through ground water recharging that used in dissolving the nutrition needed to grow.

In the current condition, the wet land found in the project town is being reclaiming by settlements, investments and other type of land uses in disruptive to its natural environmental and economical benefits. In addition to these, municipal, industrial and dairy farm wastes are discharged in to the wetlands through natural or manmade canals. Erosion or the physical removal of parts of the surface/farm lands, dissolved plant nutrients, fertilizer, pesticide/herbicide, etc flow

directly to the wetland. Accordingly, the wetland is gradually filled with sediments and, dissolved organic and inorganic nutrients which have adverse effects on aquatic life, i.e. eutrification.

The reason that intensifies the problem are the low level of awareness of the community, investors, government officials and other stake holders in relation to the environmental benefits of the wetland. In addition, the natural topography of the wetland might also aggravate the problem as it located at the lower slope and elevation relative to the town. These, puts the existence of it and the organisms living dependently on it at risk.

Therefore, in order to gain sustainably the environmental and economical benefits of the wetlands in the town drainage canals should not be directed to it without treatment, strong mitigation and conservation measures should be taken. Observe the figure below

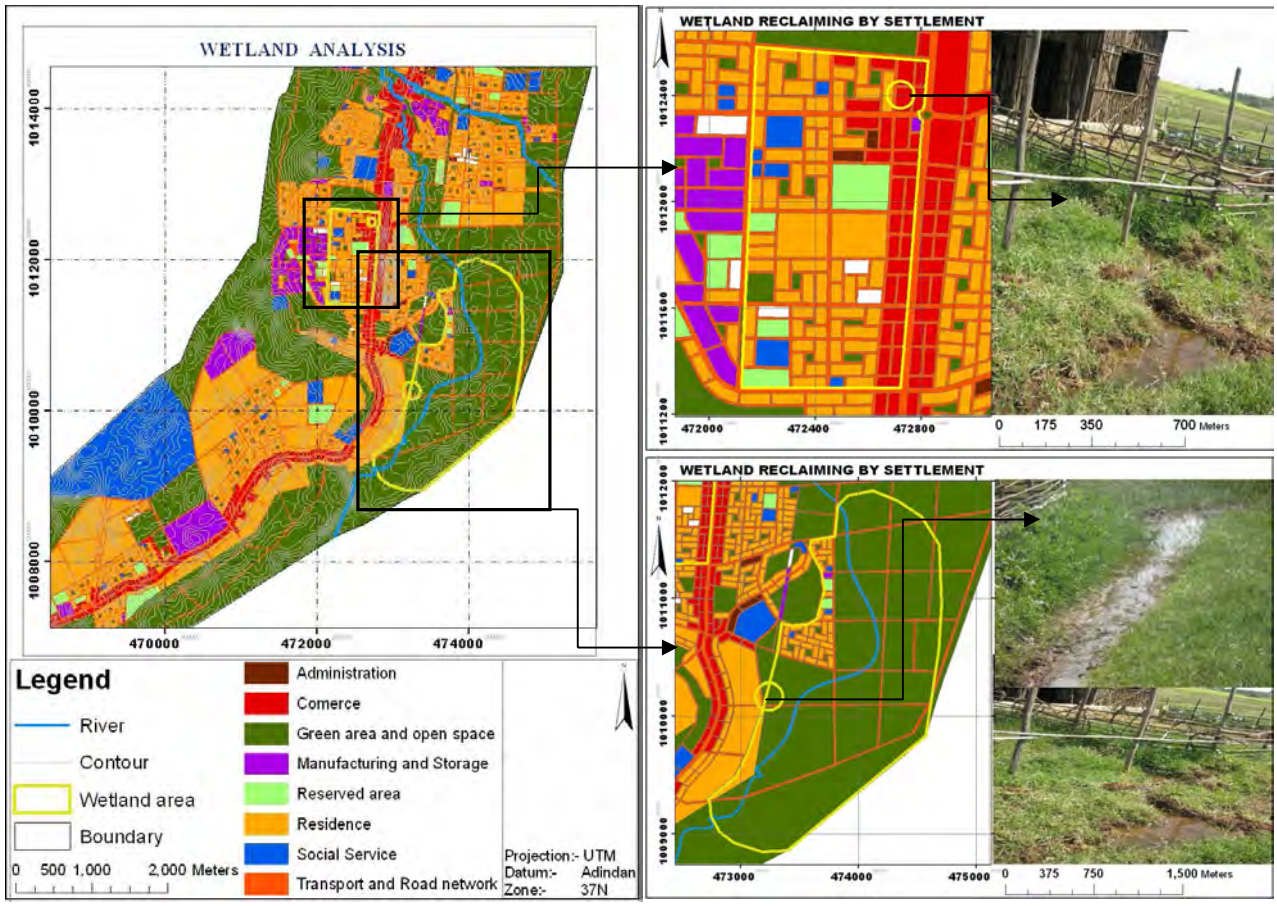

Figure 5.14 Wetland Analysis map (source: Own computation)

5.1.2.2 Waste Management

One of the major environmental problems of urban centers is waste generated by different activities. Inappropriate waste management in urban centers can impede urban development opportunities by destructing image of the town/city, posing threats to human health, and diverting limited resources to unproductive uses.

Improper waste management practice, lack of proper waste collection vehicles for solid and liquid wastes, and limited public and community toilets, etc forced the people to dispose their wastes in any open fields. Moreover, most of the municipal solid waste is dumped on land in an uncontrolled manner. These dumps make very uneconomical use of space, allow free access to waste pickers, animals and flies, and often produce irritating odor and unpleasant scenery.
Generally speaking, the existing condition of waste management in the project town is not satisfactory. Thus, it calls for comprehensive and appropriate waste management strategy to improve what is observed nowadays. Appropriate regulations, laws and their implementation based on integrated waste management practices especially at community level and at private industries are most important issues to be taken into consideration to improve the current situation.

5.1.2.2.1. Solid Waste

Like most other urban centers in the country, there is no adequately organized solid waste management program in Sululta town. Solid waste management is therefore one of the issues for which the Municipality should give due attention.

A. Types and Sources of Solid Wastes

The main sources of solid wastes in the town are household, commercial, institutional, industrial, construction and demolition wastes, and street sweepings. Though the proportion and composition are not accurately known, the main sources of municipal solid wastes are households (residential units), commercial establishments, and industries. However, residential unit/house hold solid wastes account the higher proportion and followed by the others.

Based on per capita solid waste generation rate for developing countries, which was estimated to be 0.5 kg /day/person (S.C. Santra, 2001), in July 2012, the amount of municipal solid waste generated in the project town is calculated as 8,411kg /day or 31.5 m^3/day. This figure is expected to increases to 19336kg/day or 71.61 m^3 / day by 2022.

Table 5.2 Projected per capital solid waste generation

Year	Population	solid waste generated/kg/day	m^3/day	m^3/year	Required containers	Trips/vehicle/day	No. of Trucks
July 2012	16,822	8,411	31.15	11,337.54	4($8m^3$) 6 ($6m^3$)	4 6	1* 2
July 2016	25,562	12,781	47.34	17,290.94	6 ($8m^3$) 8($6m^3$)	6 8	2 2
July 2022	38,672	19,336	71.61	26,155.55	9($8m^3$) 12($6m^3$)	9 12	2 3

Source: Own computation

Source: Owen computation based on projected CSA 1994 and 2007 population data

- converted by assuming specific weight of 270 kg/m^3 (uncompacted density)
- Number of required trucks assuming 5 trips per vehicle /day

By taking specific weight of 270kg/m^3 (adopted from AA City) by 2022, nearly 71.61 m^3 solid wastes per day will be produced. Thus, to transport and dispose this waste on the average about 9 trips using $8m^3$ or 12 trips using $6m^3$ vehicles per day are required. Moreover, about one or two truck is required know and three trucks by 2022 assuming five trips per vehicle /day. However, the municipality currently has no dump truck for this purpose. This means there is an acute shortage of lifter dump trucks for existing and future solid waste collection demand that needs attention.

B. Waste Composition

The composition solid waste in the town is assumed to be food and vegetable wastes, ash, paper, plastics including plastics, glasses, clothes, grass, bone, etc. Hence, the composition of the existing solid waste in the town is assumed to be more of organic which has high economic significance. It is estimated that about 60-80% of the municipal waste is organic which can be great potential for compost preparation. However, the proportion of plastic materials (festal, bottles, shoe, etc), which have short and long term environmental impacts is relatively high, and requires immediate intervention.

C. Solid Waste Storage

All solid wastes generated from different sources are not stored in standardized/authorized municipal containers. Most of the residents store solid wastes either within their own compounds using simple containers or dispose haphazardly into open spaces and bushes, along streets sides, gullies, drainage canals, railway sides, etc. similarly, commercial establishments, governmental and non governmental institutions, industries, etc do not have their own proper solid waste storages.

During field visit, it is observed indiscriminate disposal of solid wastes are in the bridges of Dima River, which is located near Sululta Palace Resort Hotel, the old market area, between Sululta Abattoir and local residents and behind Ethio-Iran Almunium P.L.C. Such indiscriminate disposal of solid wastes create unattractive urban scenery and it is potentially causes of health problems since solid wastes make offensive smell, attract disease vectors and pests (flies, mosquitoes and rodents) and pollute both surface and ground water bodies . Besides, solid wastes block drainage canals, culverts and natural water ways (See the Figure 5.15). As a result, the municipality has to work to curb the adverse effect of improper solid waste storage. Observe the figure below.

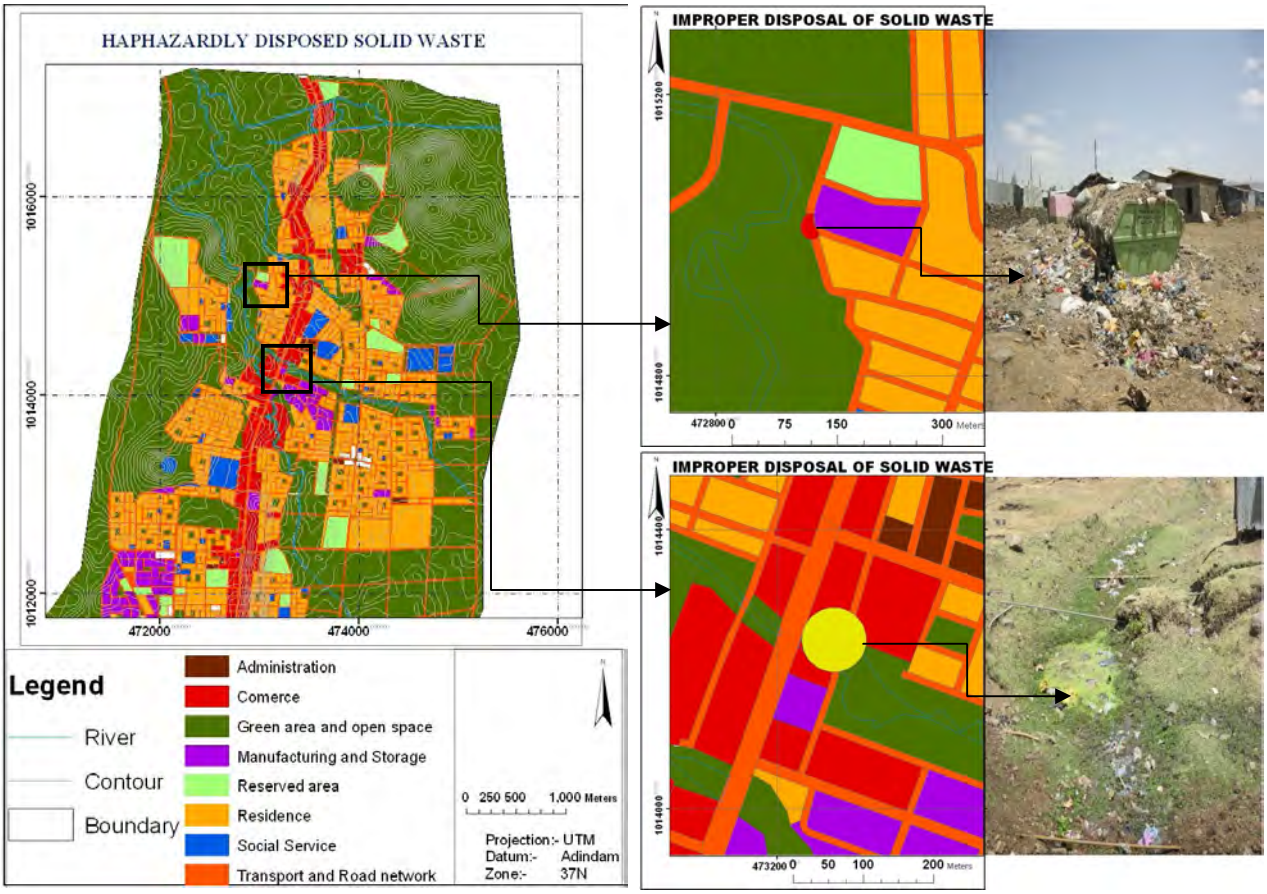

Figure 5.15 improper disposal of solid waste (source: Own computation)

D. Collection and Transportation

In regard to solid waste collection system, the municipality has a limited number of containers and there is no organized labor to collect the waste from household or blocks to the containers, As a result, the wastes are disposed elsewhere and the containers are not filled for several days. Currently, the municipality has no official dump trucks for the activities; the collection has conducted randomly by the truck that are assigned for other task. So, the dump trucks are not giving regular services adequately because of continuous malfunctioning. Moreover, the trucks have also used to transport other municipal works. Therefore, solid waste collection system has interrupted frequently and the collection coverage is not adequate so that the municipality have to work on it.

E. Solid Waste Dump Site

Regarding waste disposal site, the municipality has one newly constructed open dump site around Orgogo River behind Dame dairy farm to the north western part of the town. The dump site was constructed haphazardly in unsuitable place where not proposed by the Structure plan of the town. Therefore, it may affect the environment and the health of the local community in different ways.

As, the slope at which it was constructed declined down to the Orgogo River, the solid waste is directly discharging the river by percolation and surface run off, particularly at summer season. In addition, the dump site, Dame Dairy Farm and quarry site are incompatibly tangent at a point. Moreover, it affects the surrounding areas (especially areas opposite to the prevailing wind direction) by unpleasant smell, dust particles and smoke.

Solid wastes from Ethio-China Tannery, some from the municipality and other sources are simply dumped in the open field near the dump site, as it is not accessible for the dump truck to dump it inside. Thus, it attracts scavenging animals such as dogs, birds, etc. during a daytime and, hyena and other scavengers during the night. Consecutively these are vectors that spread disease to human being to treat life.

The site also lacks appropriate fence and site management. Most of the disposed refuses especially residue of the tannery industry, paper, bones and plastic materials are seen scatted around the dump site, affecting the aesthetic image of the town. Generally, the location is not compatible with the existing and future land uses. As a result, the dump site needs immediate attention of the municipality, prior to it causes adverse effect on the environment and local community (observe figure 5.16).

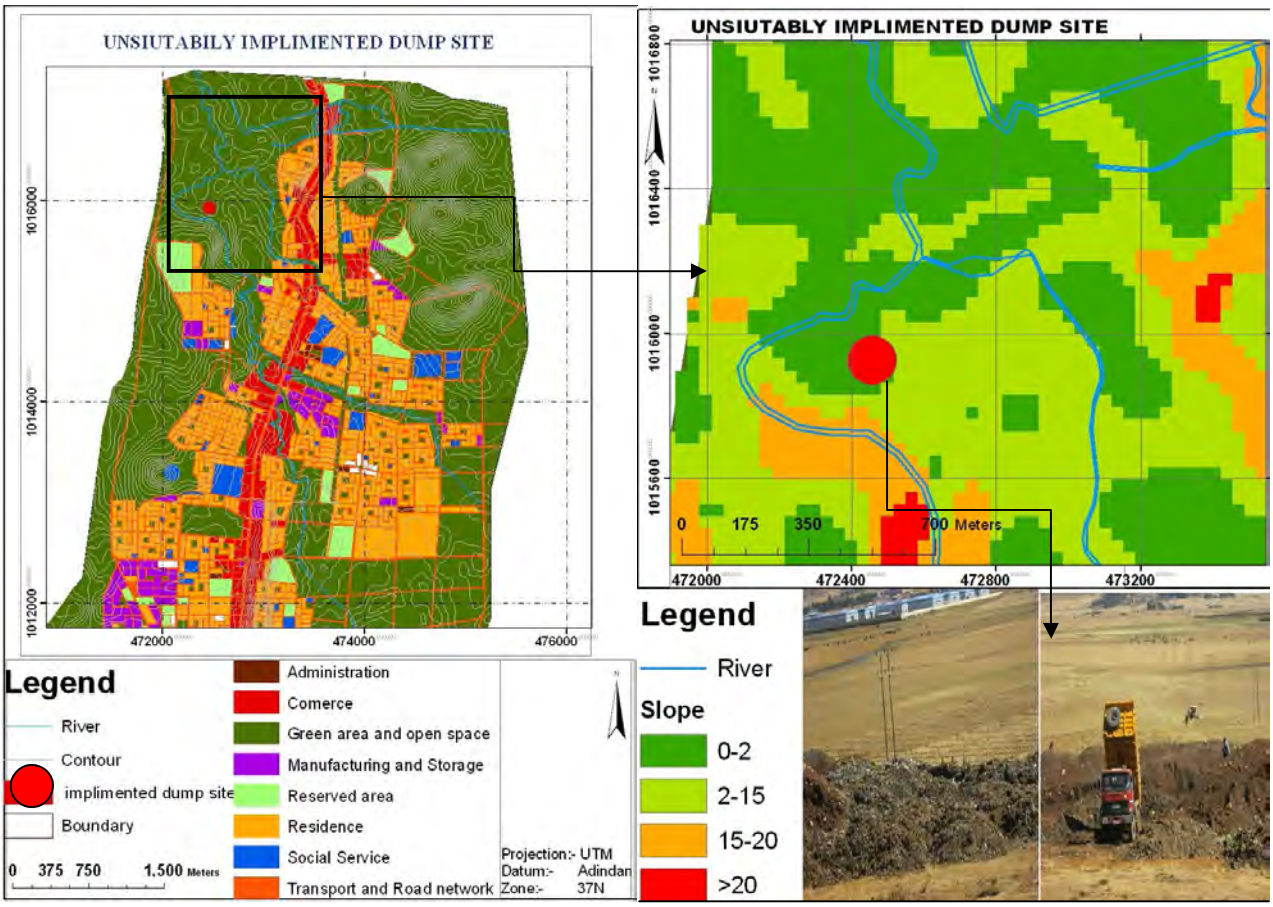

Figure 5.16 Improper implementation of solid waste dump site (source: Own computation)

5.1.2.2.2 Liquid Waste

The disposal of liquid waste (sewage) such as drain cleaning (waste water), human urine and defecation, and the effluent from domestic animals, commercial and industrial effluents are the major problems of urban centers of Ethiopia. Sululta town is among the towns which are affected by these problems.

According to the 2007 population and housing, census, about 45.3% of the housing units in the town did not have any toilet facilities and only 1.9% of the total housing units are connected to private and shared flush toilet facilities. Moreover, nearly 47.6% of the housing units have private and shared pit latrine. So, this show larger proportion of the housing units in the town does not have toilet facility that leads the majorities of the population in the project town urinates and defecates in pit latrines, open spaces, gullies, etc. The reasons may vary from low awareness level

to less income, thus worsen sanitation facility. Besides, liquid wastes generated from industries, dwelling and commercial housing units drain into nearby rivers, open space, and streets. This has resulted in contamination of surface and ground water (observe figure 5.17) .

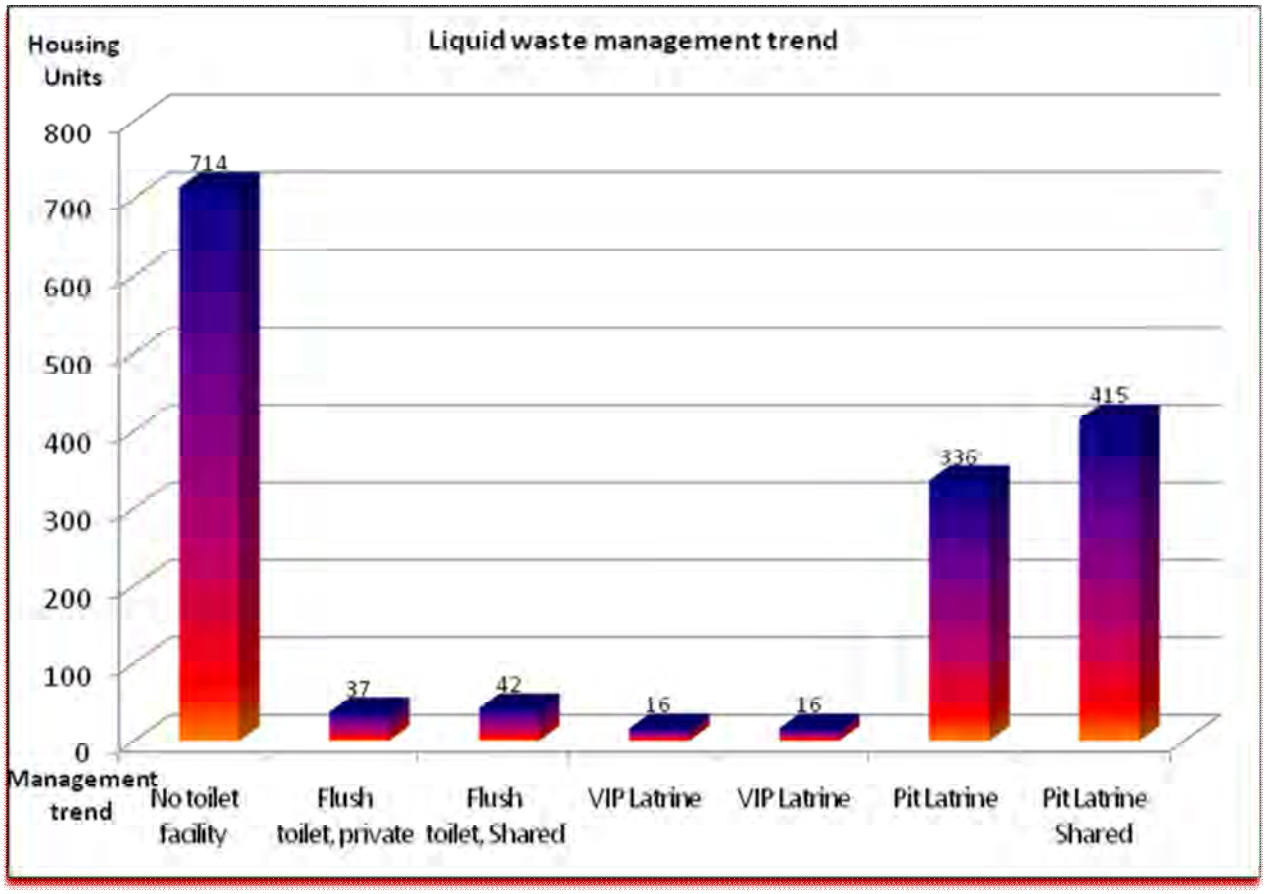

Figure 5.17 Liquid waste management trends of the town (source: CSA, 2007)

On the other hands, liquid wastes generated from industries and other enterprises also drain in to the nearby stream/rivers. For example, liquid waste generated from Sululta abattoir is directly drained in to Orgogo River and causing acute river and environmental pollution. Similarly, Ethio-China Tannery, Ethio-Iran Aluminum Factory and Abysinia Water Factory discharge liquid waste containing Soda ash and different chemicals to Bilo, Orgogo and Dima rivers respectively. The data collected by field observation and interview stated that the waste discharged to these rivers by the factories can adversely affecting the health of the primary users. Particularly, losses of life are intensified on the animals like cattle, sheep, horse and others as they regularly consume polluted water and fodder. Injury of skin while washing by the water and unpleasant odor is also aggravated affecting the local residents.

In general, most of commercial and other establishments use rivers/streams as natural canal/sewerage due to absence of septic tank and adequate sewerage system in the town. As specified in the table above the widespread means of disposing urine and excrement in the project town is pit latrine system, which usually contaminates surface and ground water. Thus, environmental pollution in general and rivers/streams contamination in particular has become serious problem of the town that requires urgent planning intervention (See figure 5.18).

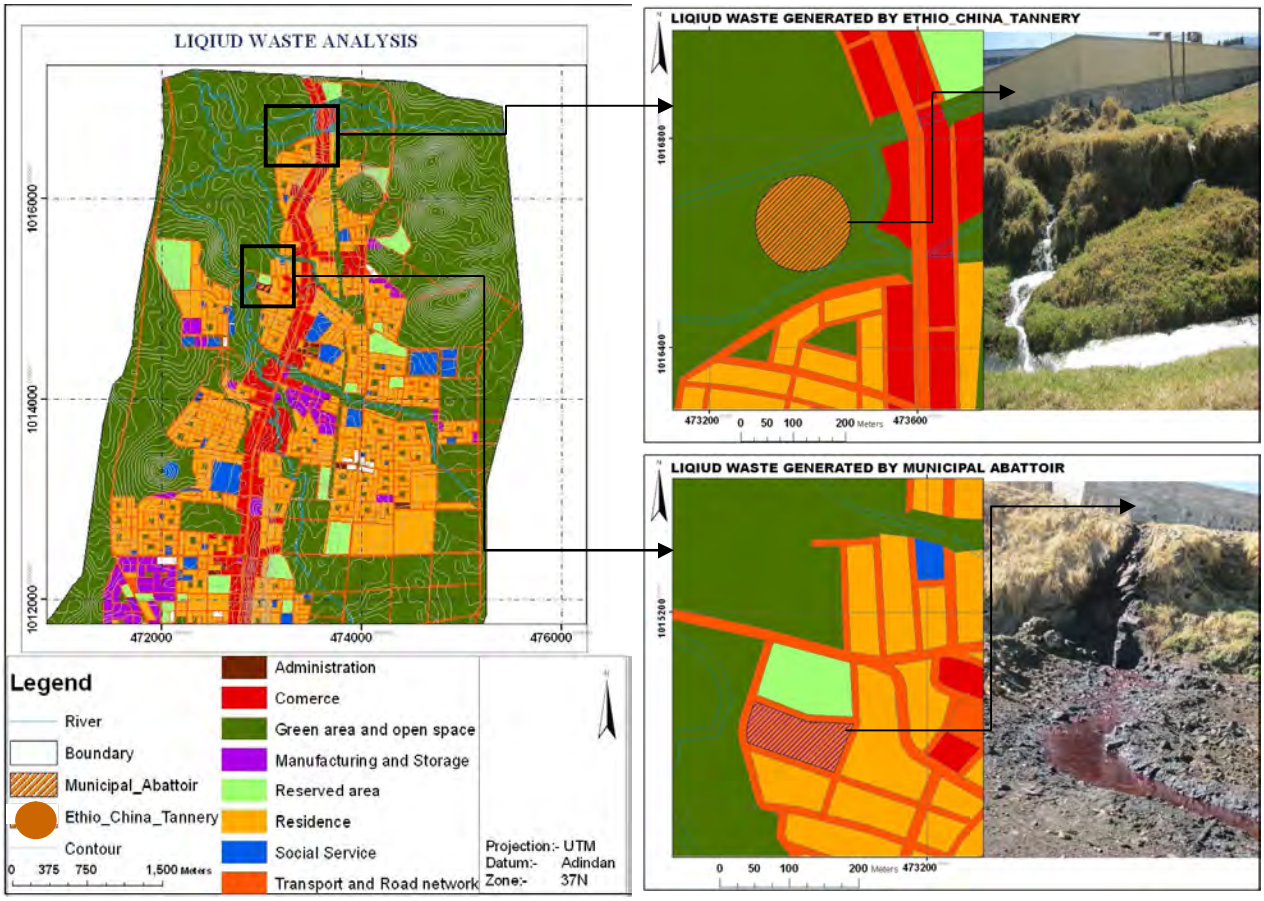

Figure 5.18 Improper management of liquid waste (source: Own computation)

5.1.2.3 Municipal Abattoir

There is one old abattoir owned by Sululta Abattoir Association PLC located in the Northwest of Sululta Town Administration at about 100m from the centre of the town. The location is not suitable site since it is surrounded by the settlement and where quarrying activity taking place which contaminate the meat and nearby water resource particularly Orgogo and Dima river.

Currently, about 95 cattle and 35 sheep and goat are slaughtered on average per day on non-fasting days.

As regard to waste management, even though there is solid waste disposal site employed in the town by the municipality, it is not adequately managed. Solid wastes are discarded as refuse in and outside the fence. Moreover, scattered bones and hairs are more observed in the surrounding environment within 100m radius from the abattoir.

On the other hands, liquid wastes also disposed in to open field in and outside of the fence. There is also manmade canal directed from the abattoir to the Orgogo River. The liquid wastes containing blood, infected liver and kidney from the abattoir directly discharged to the river via the canal.

Generally solid and liquid wastes generated from the abattoir are not properly managed, treated and separated. Therefore, they are polluting the surrounding environment particularly the nearby rivers which in turn affects the health of the users that requires immediate solution (See figure 5.20).

5.1.2.4 Quarrying Activity

Quarrying is mainly associated with rock quarrying in the town and taking place in most areas of the project town. The rock type that are commonly quarried include basalt and trachyte(ignimbrite). Trachyte/ Ignimbrite quarrying in the town have been carried out to depths greater than maximum permitted for artisan miners in the mining proclamation No. 52/1993. The proclamation forbids all tunneling and other underground work greater than 15m in depth. There is also different mining proclamation and mining operation regulation in place to govern mining procedures. For example presenting the EIA and feasibility reports by miners before a mining license is issued is the expected one. Another important provision is the enforcement of the extractors to rehabilitate the mined area after the mining operation is complete.

However, the miners in the town have no legal issued license as they engaged in the activities and they have little awareness about the adverse effects of quarrying on the environment. In addition to this, the reluctance and low level of knowledge of the town administration to enforce the rule and regulation of quarrying activities aggravates the environmental problems.

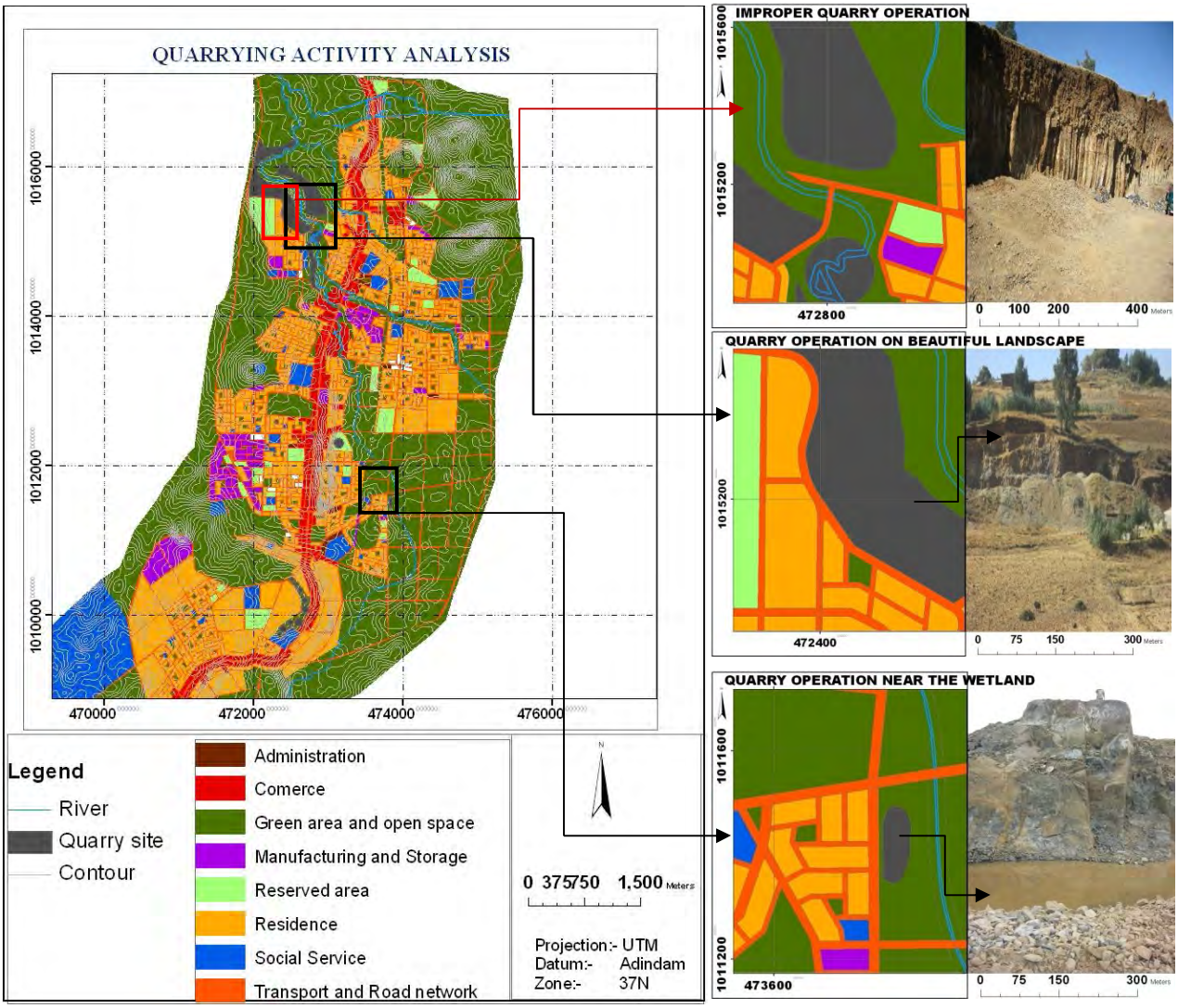

Figure 5.19 Quarrying activity analysis map (source: Own computation)

This may results, wide ranges of potential environmental impact, caused by quarry operation in the project town. Mainly, landscape change, change to the visual scene, erosion, habitat loss, loss of flora and fauna and stability problem, noise, vibration, dust, security problem, effect on the amount and quality of water, high traffic and waste materials are the common problems resulted by quarry operation in the town.

As most of the quarry sites are located at the foot of scattered mountain picks in the project town, where the raw materials are easily accessible, the Mountains are changing in to artificial caves, ponds, and cliffs. These are going to be a manmade barrier between the town and its rural

hinterlands. Moreover, the safety of the workers at the quarry site is not in a good condition, most of the time the workers are vulnerable to rock slide and machine cut that results loss of life or hand-cap and injury. There are also problem of water ponds in the quarry which is creating conductive environment for breading of insects. Thus, necessary conservation measures should be made on the quarried areas and the law and regulation of quarrying activities should be implemented for the future carrier (See figure 5.19 above).

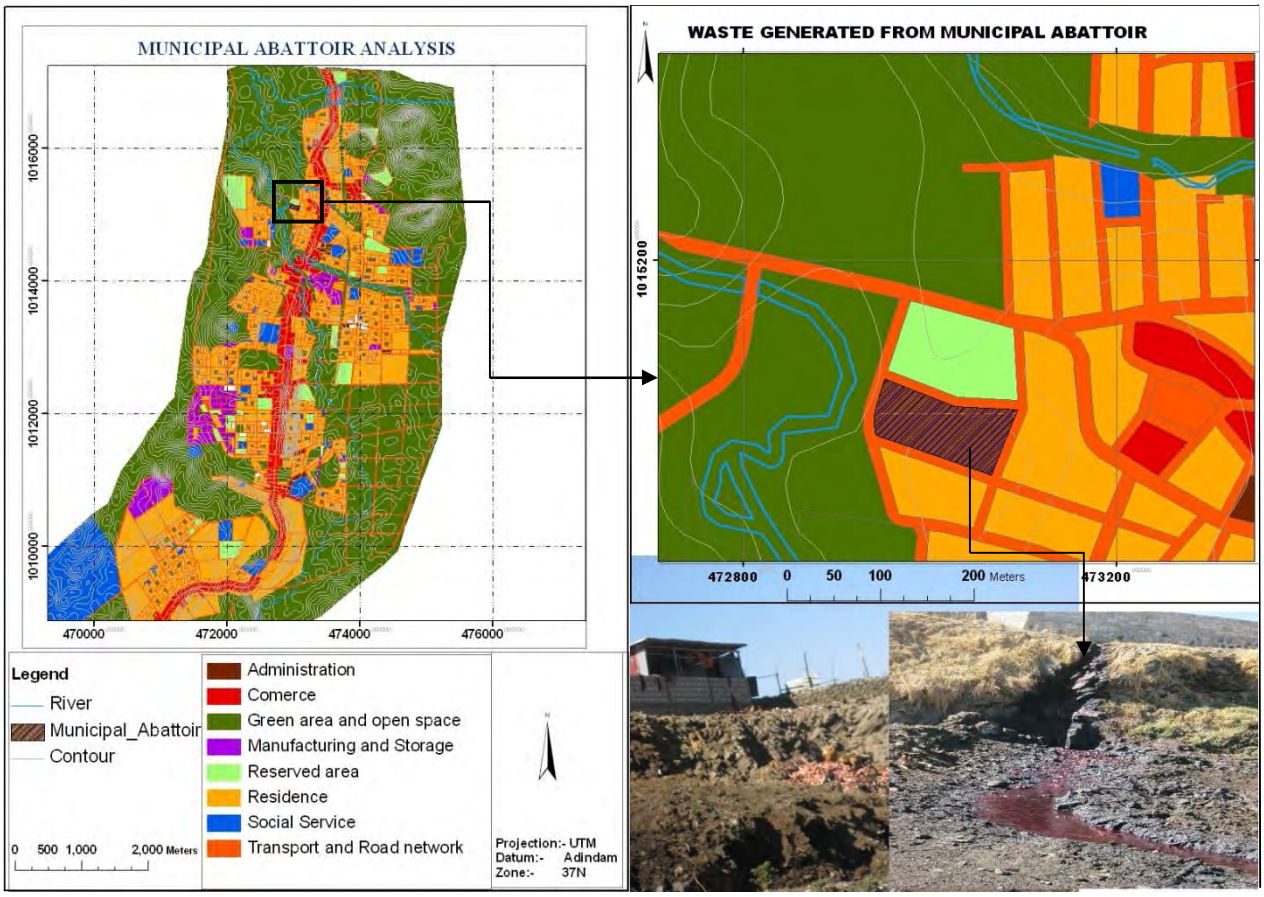

Figure 5.20 Municipal abattoir analysis map (source: Own computation)

5.1.2.5 Major Environmental Pollution

As clearly described above, major areas of the project town environment are exposed to pollution related to the waste generated due to different factors. The inadequate planning and implementation of the land use plan, and inadequate basic infrastructures provisions in the Town such as access roads, sanitary facilities, and low level of environmental awareness of the

community have made most parts of the town highly polluted and unsuitable for the inhabitants to live.

Moreover, unplanned distribution of manufacturing industries, agro-processing industries and dairy farms, etc, and their poor waste management systems exacerbate environmental pollution of the town. Currently the big challenge is, therefore, how to minimize all pollutants that have adverse effect on image of the town and human health, and renovate the quality of the urban environment.

The major environmental pollutants of the project town i.e., air pollution, water pollution, soil/land pollution, and noise pollution would be discussed briefly in the subsequent paragraphs.

5.1.2.5.1 Air Pollution

Considering that the main objective of the thesis is to evaluate the planning and implementation of the land use plan in the town with respect to environmental issues, the researcher concerned with outdoor air pollution as its effect is directly related to land use. The main sources of air pollution in the town are particulates from intensive quarrying activities, chemicals from industries, unpleasant odor from dairy farming, abattoir, household and institutional wastes. Particulates that arises as a result of crushing of the stone while quarrying activities is taking place pollutes the air in the town that in turn cause the environment of the town uncomfortable for the living inhabitants.

On the other hands, the most cause of air pollution in the town is unpleasant odour from manufacturing industries like Ethio-China Tannery industry; Indian Bottle Factory and Ethio-Iran Aluminum factory. These factories emit their particulate in to the air, polluting the local environment and cast a shadow on the quality of the environment.
Additionally, stench/irritating odor emitted from tanneries, abattoirs, dairy farms, and informal solid and liquid disposals are also serious causes of outdoor air pollution in the town. The dairy farms and tanneries don't emit only stench smell but also release fur, quill and dust particles in to their surroundings that degrades the environmental quality and images of the town. Therefore, these activities require short and long term interventions.

Thus, to alleviate the existing air pollution and related problems, measures such as expanding green areas, improving waste management practices of industries, dairy and poultry farms, paving the main and secondary streets, covering tertiary and local roads by cobblestone, burning of solid wastes in safe way, etc are possible remedies (See figure 5.21).

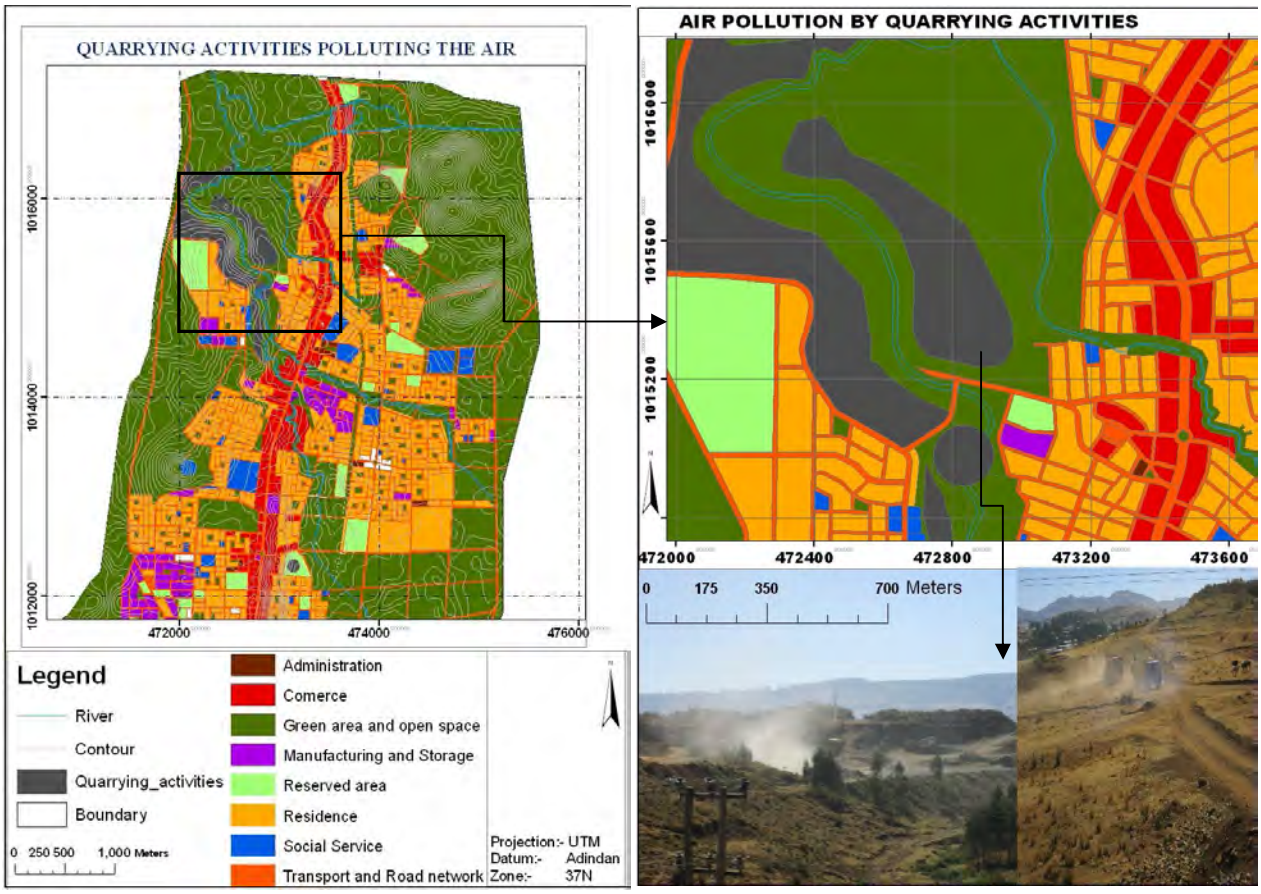

Figure 5.21 Map of air pollution (source: Own computation)

5.1.2.5.2 Water Pollution

The rapid urbanization and industrialization witnessed during recent years along with poor waste management and incompatible land use allocation in the Town has posed pollution hazard on surface and groundwater. The problem is further exacerbated by the low level of awareness of the private investors as well as the community about waste management as well as the reluctance, insufficient man power and skill of the municipal officials to enforce relevant laws and regulations. Thus, surface and ground water bodies of the town are vulnerable to pollution.

Both seasonal and perennial rivers cross the town starting from south eastern and flowing to the north western of the project town. With regard to pollution, seasonal rivers Bilo and Dima are crossing the town east to west through the central part of the town. They are highly affected by polluted municipal effluents and polluted urban run-off discharged in to the rivers through natural and manmade canals.. Moreover, agricultural chemicals (fertilizer, pesticide/herbicide, etc) also affect the river through run-off.

The discharge of untreated effluents and wastewater from industries that are built alongside the rivers, households, and institutions are the main sources of water pollution. Industrial wastewater is the primary causes of water pollution, followed by domestic wastewater and human excreta in the town. Thus, wastes generated from domestic and industrial activities are the main threats to cause surface and ground water pollution.

Pollution as a result of China Tannery, Indian bottle factory, Abyssinia water factory and Ethio-Iran aluminum factories in the town causes adverse effect on the health, and quality of the environment. Mainly, as the wastes that compose hazards chemicals discharged haphazardly on the surface and rivers by these factories without any treatment, health of organisms is threatened.

The users of this polluted water for different purposes like drinking, washing and for house hold activities, loss their healthy. And even the adverse impact of this pollution goes beyond ecological footprint up to 10km downstream. Therefore, there should be proper protection and conservation of the rivers from both urban and agricultural pollutions (See figure 5.22).

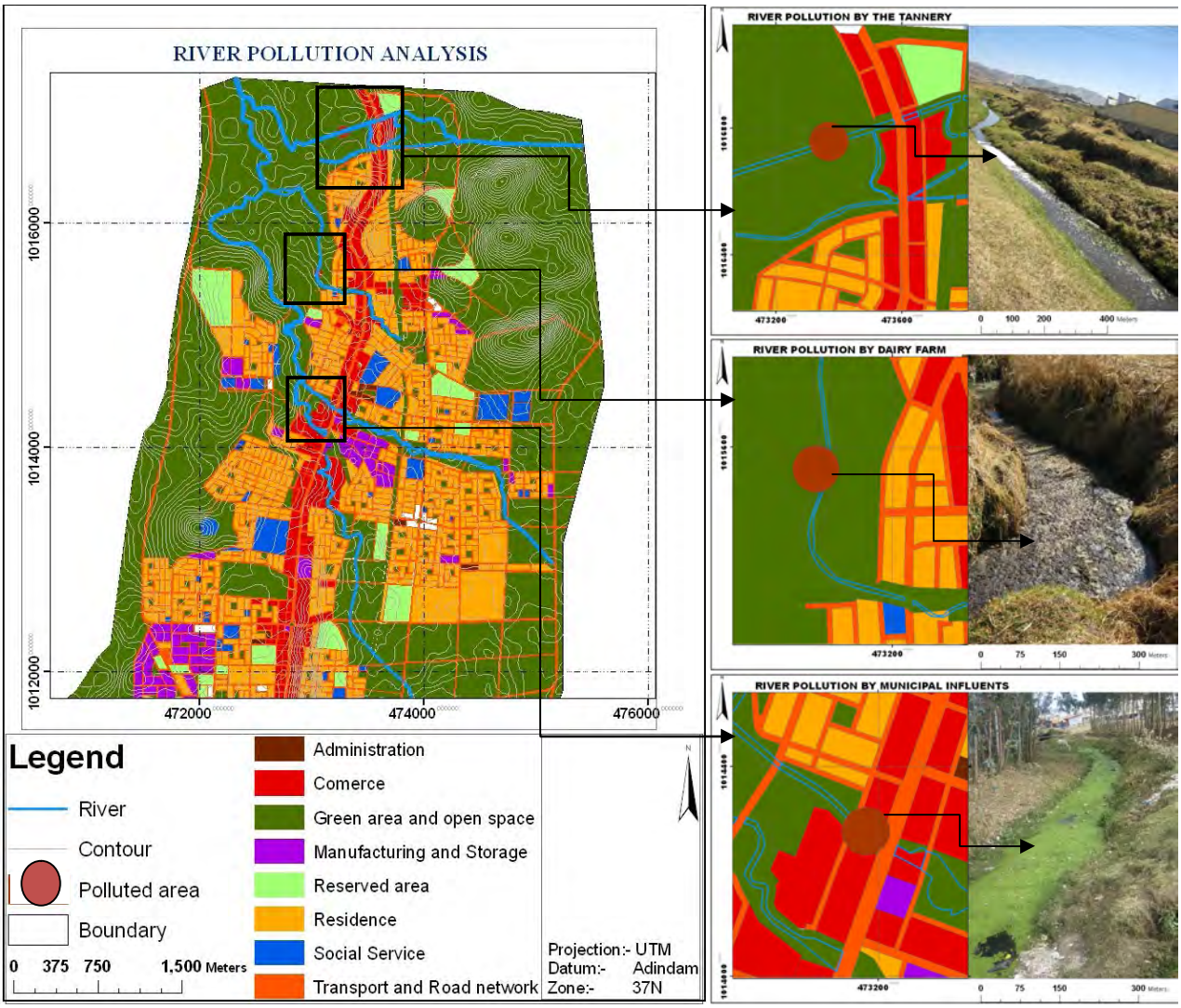

Figure 5.22 River pollution analysis map (source: Own computation)

5.1.2.5.3 Noise Pollution

In Sululta town, noise pollution is related to machinery crushing stone in the quarry site, trucks for transportation of crushed stone, trucks in the main road, Abyssinia water factory, and other different sources. However, the main source of noise pollution in the town is associated with quarrying activities taking place in most part of the town, mainly the western part. Therefore, residential zones and other sound sensitive functions and the quarrying activities should not be located close to each other. Moreover, planting dense vegetation in the town substantially reduce noise pollution from different sources.

5.1.2.5.4. Soil /Land pollution

Soil degradation is decline (deterioration) in the quality of soil resources due to both natural processes and human interference. Because of deforestation and sheet and gully erosion sloppy areas are highly deteriorated. Particularly the southern part around Entoto ridge, streams, and tributaries of the town is under severe gully erosion. Moreover, the informal disposal of municipal, industrial, institutional and other solid wastes such as glasses, plastic materials, demolished materials, chemical substances, corroded metals, etc in already urbanized and peri-urbanized land areas have adversely affected the natural soil formation process. The liquid wastes percolating in to the soil from these sources are also negatively affecting it.

Generally, the soil/land in town and the surrounding areas are under serious environmental stress. Thus, integrated environmental protection and conservation measures should be taken in order to bring about livable and sustainable urban environment (See figure 5.23).

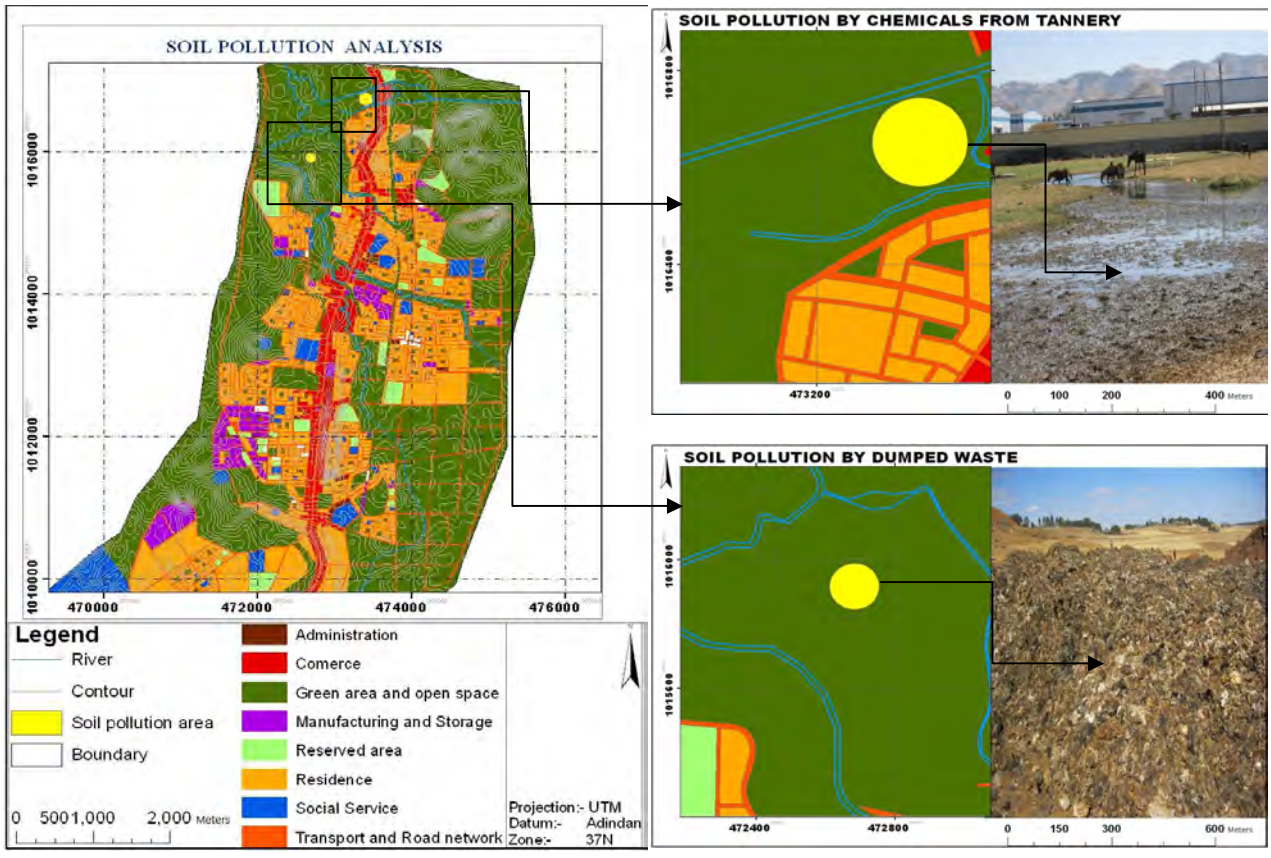

Figure 5.23 Soil/Land pollution analysis map (source: Own computation)

5.1.2.6 Summary of the Problem Related to Plan Implementation

The other factor that contributes to the incompatible land uses in the town were wrongly implemented land uses resulted by lack of skill capacity, commitment, personal interest and enforcement from the highly authorized body. In addition lack of institutional, financial, implementation tools and limited capacity of the town administration aggravated the issues in the project area. Almost all of the functional industries implemented in the town were random and violating the structure plan of the town. Most of the factories are implemented where the development plan has been proposed for green area, commercial, residential and reserved areas.

The typical examples are Ethio-China Tannery employed in the area where proposed for green area on the structure plan and Ethio-Indian Bottle Factory on proposed reserved area. The other industrial areas that found under construction in between Ethio-Iran Aluminum Factory and Abyssinia Water Factory were implemented on the areas proposed for commerce.

The other land use that incompatibly implemented in the town was solid waste dump site. The town administration was employed the dump site where quarry site and Orgogo river are found in the southern and northern direction of the site respectively. In addition, the slope and elevation of the area is also not suitable for use. As the dump site is open dump located at the high altitude, it may accelerate unpleasant odor at the distant. The slope of the area is also gentle slope that allows the waste in the dump site being easily percolate and discharge to nearby land and Orgogo River.

Thus, the combined effect of the incompatibly and unsuitably implemented land uses can adversely affecting the environment through pollution of water, land and air by releasing unpleasant odor that makes life harsh in the town if solution is not given in the near feature with its other impacts.

The other shortfall of the plan implementation observed in the town were, some areas of urban greens were converted to settlement and the other part are also using for quarry operation. These may contribute to the distortion of the aesthetical values in the town and aggravated environmental problems like landslide, soil erosion, and flooding. Therefore to reverse the impact, planning solution is required to enhance the provision and development of urban greens (See table 5.3 and figure 5.24).

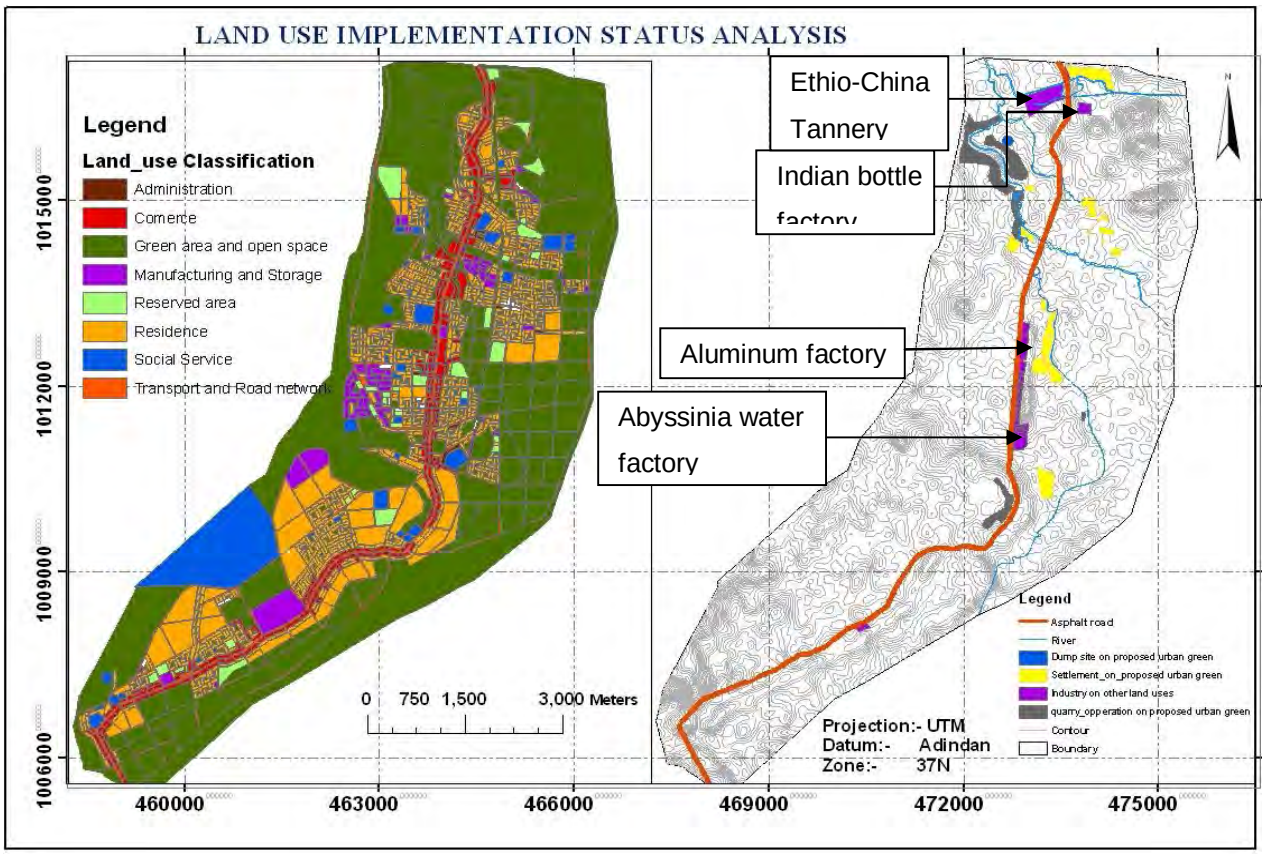

Figure 5.24 Summary of the implementation analysis map (source: Own computation)

Table 5.3 Summary of the implementation analysis.

Diverted from land use	**Diverted to land use**	**Area in hectares**
Urban green	Housing and commerce	100ha
Urban green, Housing, reserved area and Commerce	Industry	45.79ha
Urban green	Quarry operation and dump site	70 ha
Urban green	Road network	30ha
Total		245.79 ha

Source: Own computation

5.1.2.7 Contributing Factors for the Failure of Plan Implementation

Factors contributed for the failures of the expected environmental plans to be implemented in accordance with the Structure plan can also be seen from Policy related, implementation tools/materials, skilled man power, and commitment of officials of the municipality, Institutional, and Financial aspects.

5.1.2.7.1 Policy Related

The low level of awareness of decision makers, the absence of policy and its enforcement on waste management, the lack of approval on air pollutant emission standards, lack of strong enforcement to connect polluting industries to sewer systems are the existing factors that hinders the implementation.

5.1.2.7.2 Implementation Instruments

There are instruments that contribute a lot for the action to be realized in implementing the land use plan. Particularly, software's and equipments are the major ones that may influence the implementation process in the study area. As Information from interview and group discussion with the town officials shows, the unavailability of tools is one factor contributing for the deviations of land uses during implementation. Namely, surveying equipments like GPS and total station in addition with Auto CAD and GIS software's are the typical examples that not common in the study town. Thus, the absence of these instruments were hinders the land use plan implementation process in the town.

5.1.2.7.3 Skilled Man Power

The information from officials of the municipality and the existing data show that the total number of current employees in the town is less than half of the required. This reveals that the existing employees are expected to work the jobs of other employees in addition to their work. These may result, inefficiency of the workers to implement the plan. Furthermore, none of the employees are not environmental related professionals in the study area. This shows that there is high shortage of skilled man power in the area causing difficulties for the achievement of expected outcome in implementing the environmental plan components.

5.1.2.7.4 Commitment of Officials

Even though there is some considerable reason that the officials has justified to give attention on the enforcement and follow up of the issues related to plan implementation, information from respondents shows, the officials are not well committed. Therefore, the reluctance of the officials contributes to the acceleration of environmental issues in the town; mainly inappropriate drainage system, incompatible dumpsites, abattoir and some other environment related issues are the main problems intensified as a result.

5.1.2.7.5 Community Awareness

Although the town administration has made minor community awareness, majority of the society are still at low level awareness about the issues of environment in the town. On other hand, the intensified problem by itself adds up the awareness of the community as everybody starts to think over the problem to be saved from being negatively affected. For example the interviews and group discussion made with the dwellers agree that, wastes from Ethio-China Tannery has adversely affected local society since more animals life is threaten and skin injury caused while using the polluted water in addition with fodder for their animals is dried by the chemicals from the Tannery. These creates a lot of awareness among the community from local to national as the affected societies rise their voice on the issues to be solved starting from town administration to the regional government of Oromia and the medias. However, the dwellers were concluded that, still not to the required level they need, thus the concerned body has to work on it.

5.2 LAND USE SUITABILITY ANALYSIS

The use of GIS software for land suitability analysis is crucial. A GIS- based land suitability analysis requires that the site selection criteria should be identified and integrated into a GIS database in the form of map layers with associated attributes. Consequently, a set of criteria for various uses for site selection will be identified based on literature review and relevant experts' opinion. Virtually all the selection criteria identified are geographic in nature in the sense that they can be referenced to a particular location.

The various data sources (mapped data available in GIS, and CAD) used to generate map layer based on the criteria. These map layers, with their attribute data, are used to delineate areas which are environmentally potential and/or sensitive with site suitability model, the implementation of which on Arc GIS Version 9.3 yielded suitable sites for various uses.

Different physical, biological and socio-economic factor maps are created to run the land use suitability analysis in this study. Here by the factor maps are used to show the land suitability of different areas of the town for the intended use. In this analysis the category of the physical factor maps are valued from 1 to 4 representing least, low, medium and high suitability respectively and the rate of influence of each map is also assigned based on its percent of concern over the other maps to analyze the suitability of the land use. Whereas the category of the bio-socio-economic factor maps are valued 1 and 4 where 1 represents not suitable and 4 represents suitable and their rate of influence of each map is also assigned accordingly.

5.2.1 Landfill Site Suitability Analysis

Several countries have put in place rules to follow when selecting suitable sites for sanitary landfills. The following are the factors that several researchers have used to determine the suitability of the land fill sites. The factor maps are suitable for the landfill if it obeyed the following points used by several researchers and (FUPI, 2006).

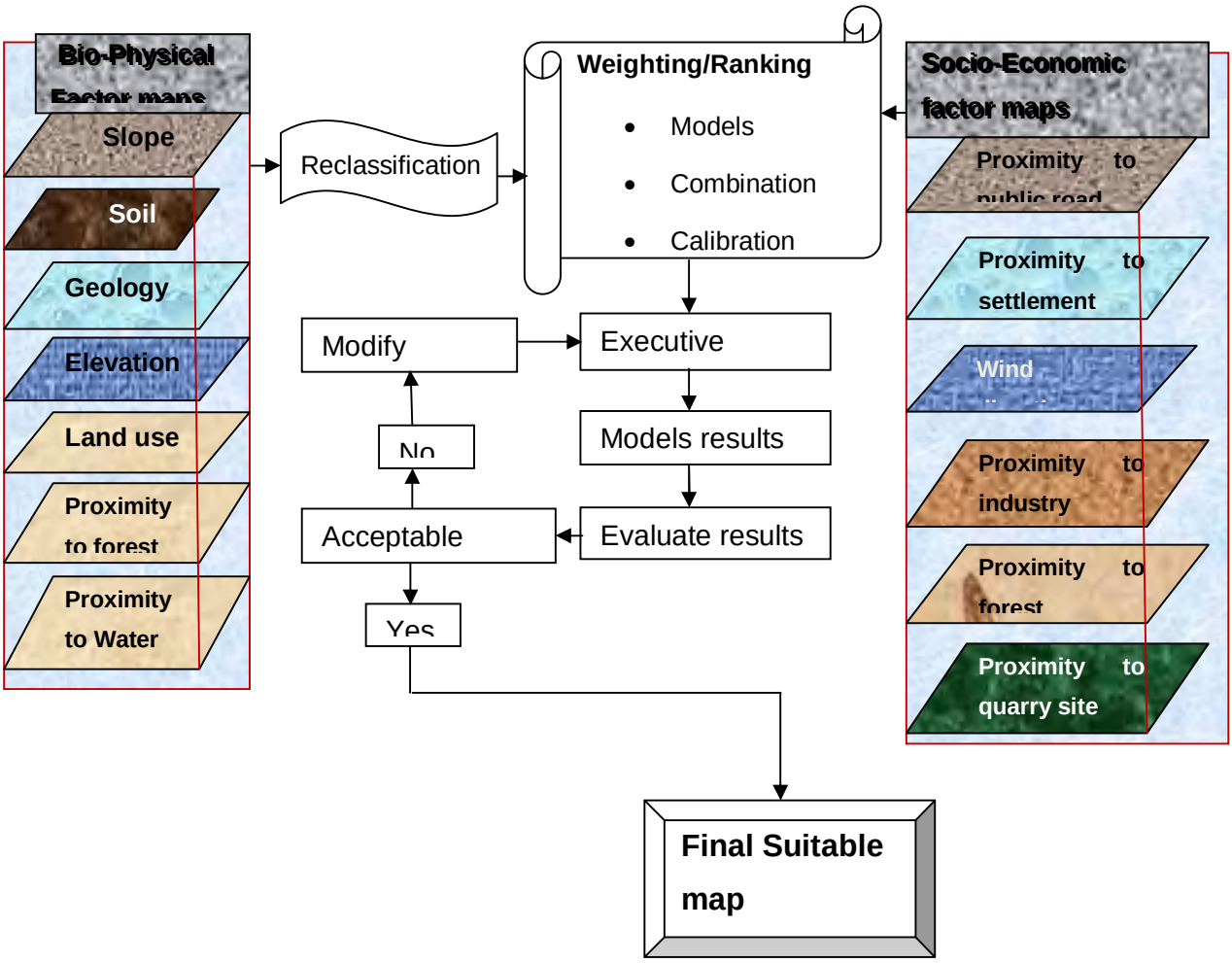

Figure 5.25 Work flow of landfill site suitability analysis (source: Own computation)

Based on the above guide line and work flow the following factors maps are weighted and ranked to undertake multi criteria analysis (table 5.4).

No	Criteria	Category	Suitability	Ranking score	Influence/Weight (%)
1	Slope Based on Percent	0-5% 6-10% 11-20% >20%	High Medium Low Least	(4) (3) (2) (1)	15

2	Soil Based On degree of permeability	Vertisol Cambisol Leptosol Luvisol	High Medium Low Least	(4) (3) (2) (1)	10
3	Elevation(in meter)	2530-2580 2581-2640 2641-2700 2701-2800	High Medium Low Least	(4) (3) (2) (1)	5
4	Geology based on stability and fracturing	Entoto silicics Aiba basalt Alaji basalt Adama group Chanco basalt	High Medium Low Least	(5) (4) (3) (2) (1)	10
5	proximity to public roads	Greater than 100m Less than 100m	Suitable Not suitable	(4) (1)	10
6	Proximity to industrial development	Greater than 200m Less than 200m	Suitable Not suitable	(4) (1)	10
7	Proximity to settlement	Greater than 200m Less than 200m	Suitable Not suitable	(4) (1)	10
8	Proximity to surface water	Greater than 200m Less than 200m	Suitable Not suitable	(4) (1)	10
9	Proximity to existing forest area	Greater than 200m Less than 200m	Suitable Not suitable	(4) (1)	10
10	Proximity to quarry site on operation	Greater than 200m Less than 200m	Suitable Not suitable	(4) (1)	10
11	Direction of wind belowing	East-western Other direction	Suitable Not suitable	(4) (1)	considered

Table 5.4 Factor maps ranked for dump site suitability analysis (source: Own computation)

Based on the above criteria the Bio-Physical factor maps are computed and converted to raster that in turn reclassified to run multi criteria analysis. Thus to analyze the landfill suitability, the Bio-Physical factor maps used were slope, soil, geology, altitude, forest and water bodies are organized as follows (see figure 5.26) .

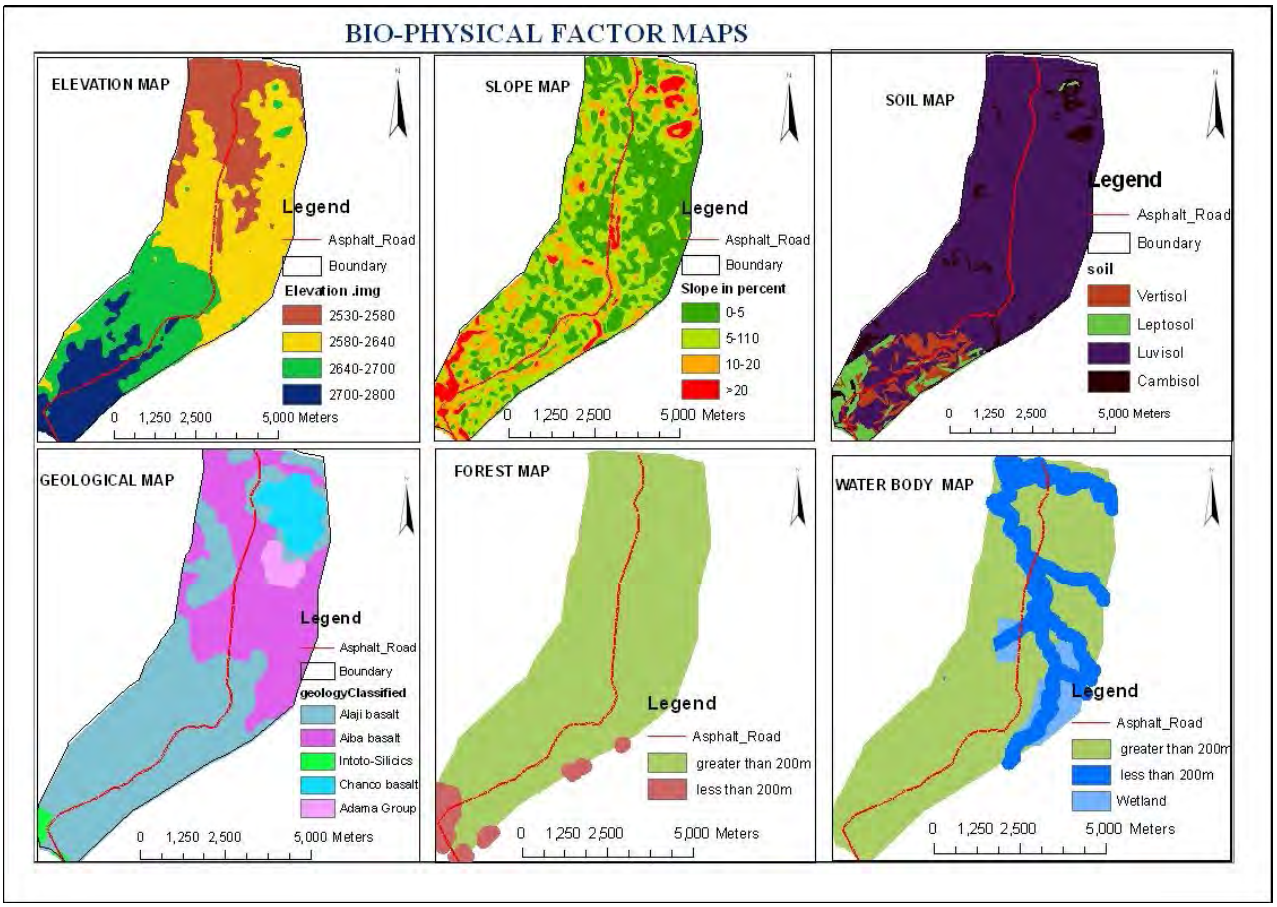

Figure 5.26 Bio-Physical factor maps for dump site analysis(source: Own computation)

In addition to the Bio-physical factor maps, socio-economic factor maps are also computed and converted in to raster that in turn reclassified to run multi criteria analysis. Thus, to analyze the landfill suitability analysis the factor maps are considered mostly as per their proximities to settlement, public road network, quarry site and industrial areas. Hereby, the proximity that indicates less than 100m to the public road and less than 200m to the other factors shows not suitable for the landfill site whereas the proximity that indicates greater than 100m from the public road and greater than 200m from the other factors shows suitable for the intended use and they are organized as follows (figure 5.27). Moreover, as the wind direction in the town is East-

western direction, it is suitable for the use if the site is situated in the west, North-west and South-west peripheries of the town. The map of Socio-economic factors is presented below.

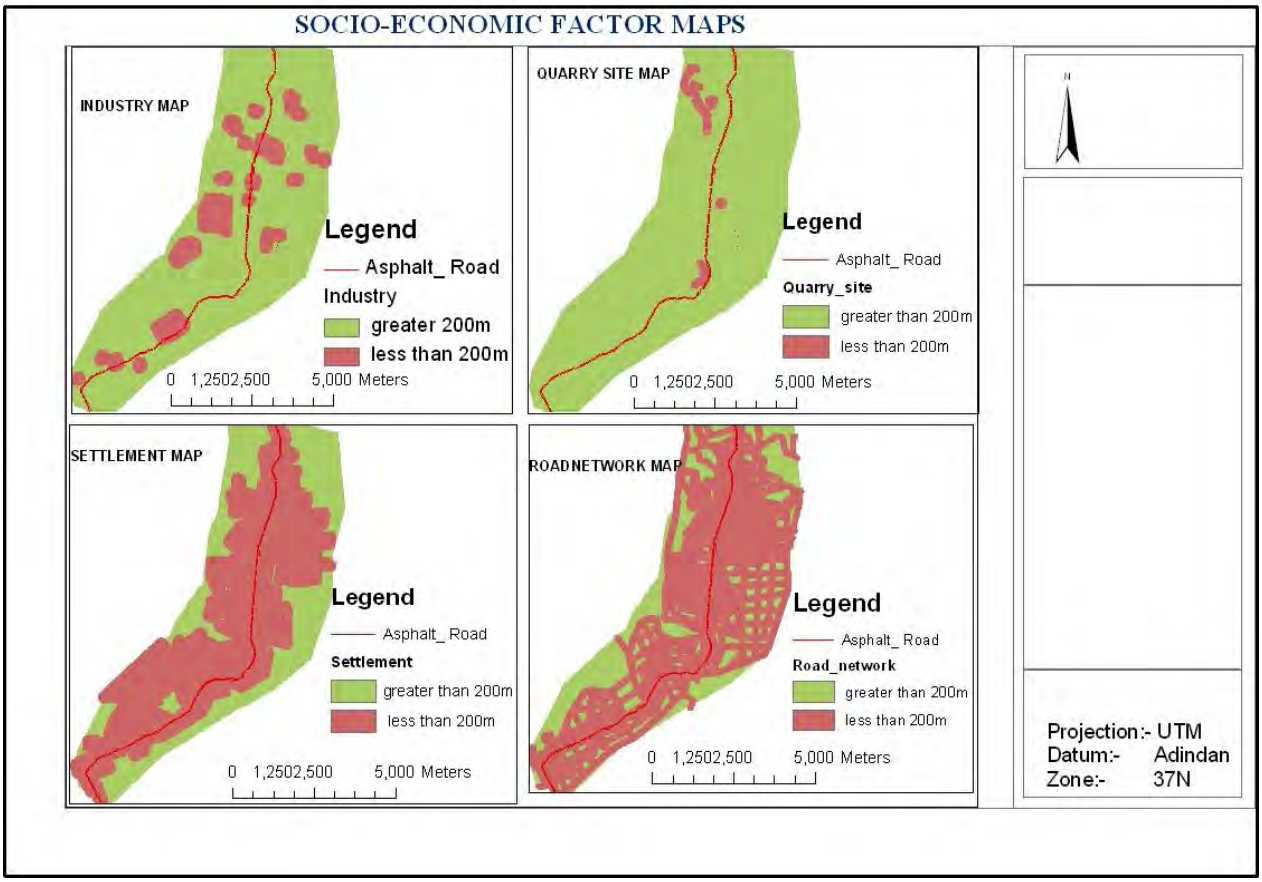

Figure 5.27 Socio-economic factor maps (source: Own computation)

Based on the above Bio-physical and Socio-economic factor maps the land suitability map for landfill site is computed through calibrating, combining, buffering, overlaying, validating, and running raster calculation to execute models. The executed model results in turn evaluated to be accepted for the final suitable land use, thus the concluded appropriate land map for the use looks as follows (figure 5.28)

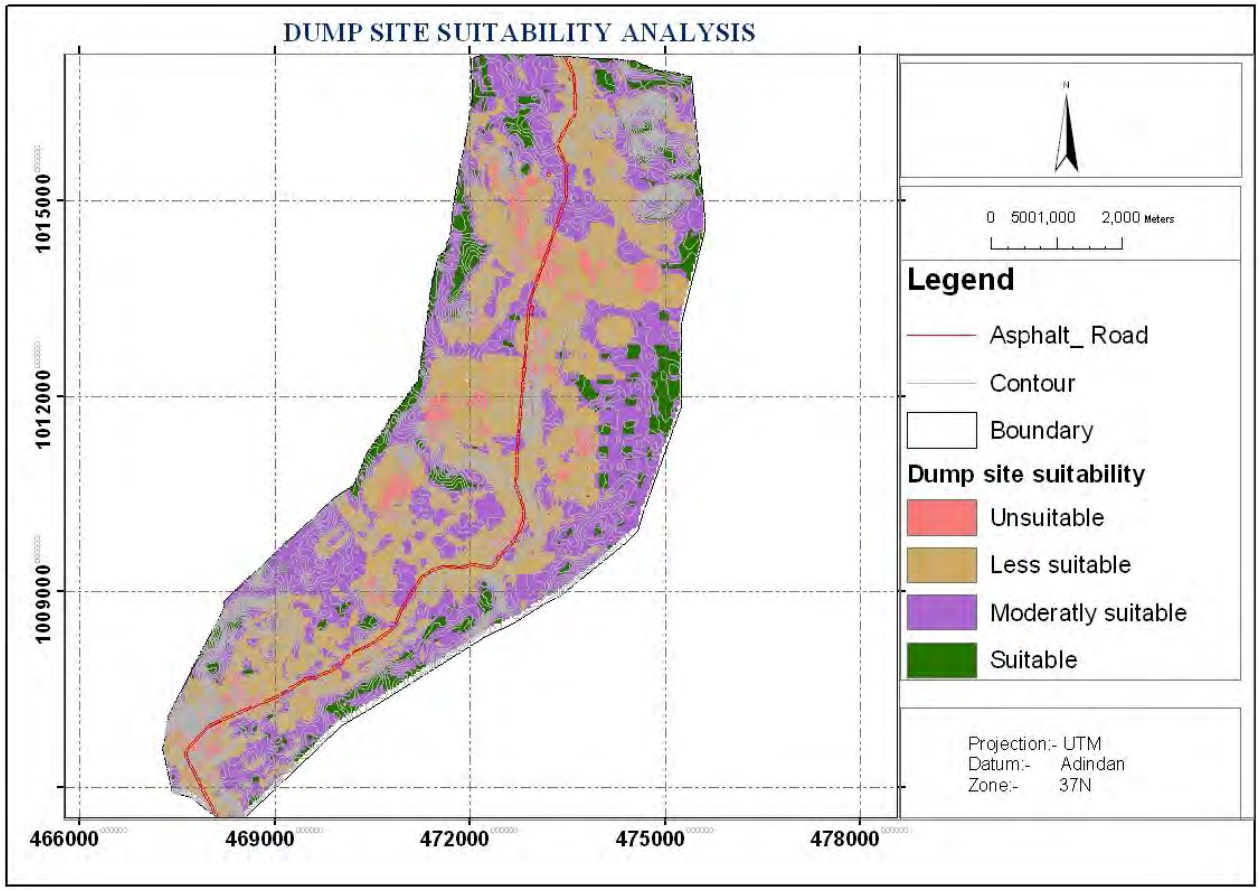

Figure 5.28 Suitability map of dump site(source: Own computation)

Based on the above analyzed map, the areas marked by the green are suitable areas for landfill site. Whereas, the areas that falls under light yellow and purple color is least and not suitable for the intended use. However the suitable areas of the analysis are also considered in views of the wind direction. As the wind direction of the town is east-western the suitable areas that found to the west is selected as most suitable in relative to the other to curb the adverse environmental impact on the study area.

5.2.2 Conservation Suitability Analysis

Suitability analysis for conservation is generated by reversing suitability analysis for development. This is because, the preparation of suitability map for development is based on a thorough consideration of the natural environment i.e. water, soil, natural slope, and vegetation. However these natural resources should be conserved and development activities shall be placed away from them in the conservation suitability analysis. Thus, areas suitable for development

should be concentrated at bare land whereas areas suitable for conservation should be buffer zones, forested, degraded/ deforested/ areas, water resource areas, water logging areas and steeply slopes. Therefore site suitability map layers for conservation has been developed and ranked as follows.

Table 5.5 Factor maps ranked for conservation suitability analysis

No	Criteria	Category	Suitability	Ranking score	Weight (%)
1	Slope Based on Percent	0-2% 3-15% 16-20% >20%	High Least Low High	(3) (1) (2) (4)	20
2	Soil Based On degree of permeability	Vertisol Cambisol Leptosol Luvisol	Least Low Medium High	(1) (2) (3) (4)	10
3	Geology based on stability and fracturing	Entoto silicics Aiba basalt Alaji basalt Adama group Chanco basalt	High Medium Low Least	(1) (2) (3) (4) (5)	10
4	Water resource	Water resource areas Off water resource area	Suitable Unsuitable	(4) (1)	20
5	Existing forest	Existing forest area Off existing forest area	Suitable Unsuitable	(4) (1)	20
6	Quarry site	Quarry site on operation Off quarry site operation	Suitable Unsuitable	(4) (1)	20

Source: Own computation

Based on the table above the factored map layers are slope, soil, geology, land use/cover, water resource areas, existing forest areas and quarry sites. Thus these factor maps are overlaid and analyzed via multi criterion analysis to compute the areas suitable for conservation (figure 5.29).

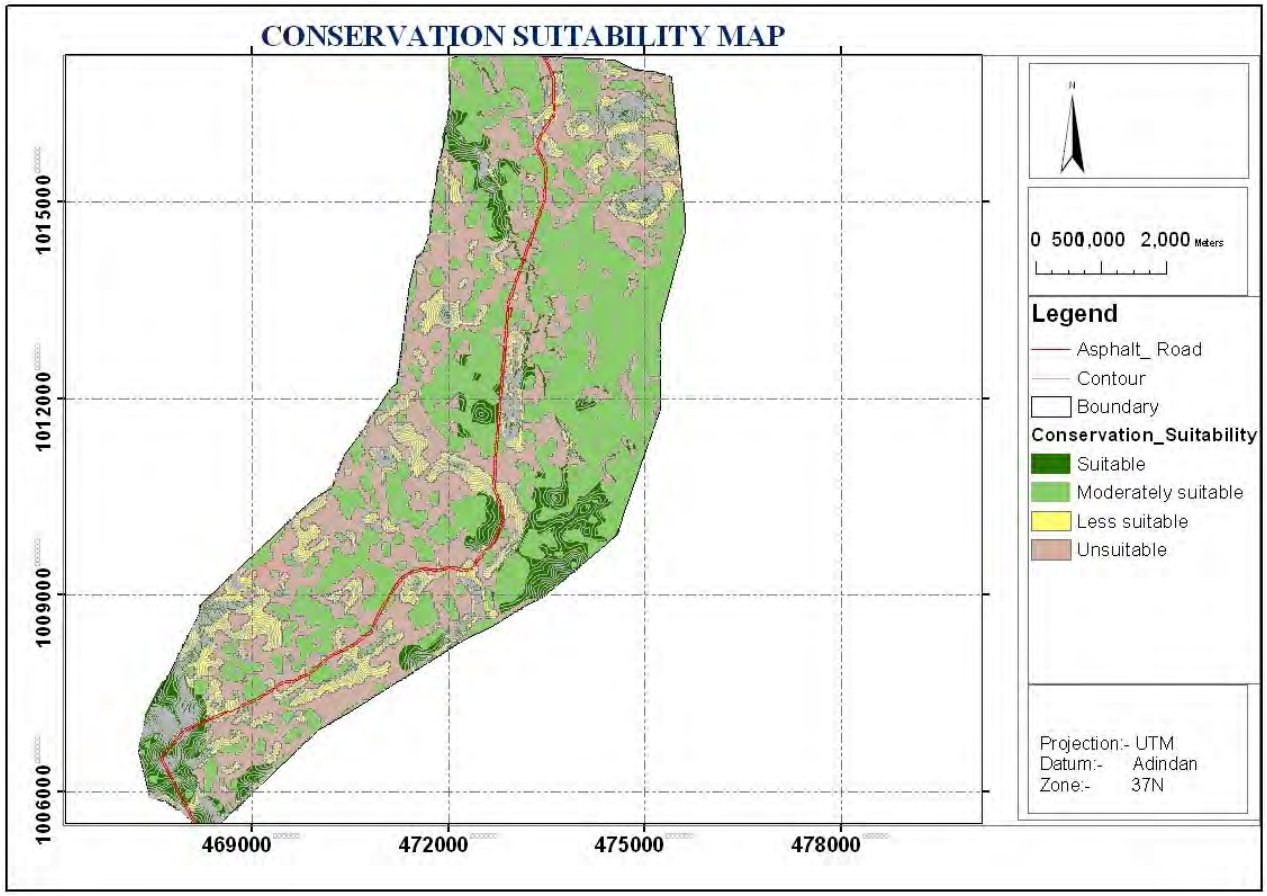

Figure 5.29 Suitability map of conservation area (source: Own computation)

Based on the map above, the most environmental sensitive areas are most suitable for conservation as marked by dark green color. Consecutively, major areas of the study fall under moderately suitable for conservation which is marked by light green on the map. However considerable areas manifested with light yellow and soapstone Dust are less suitable and not suitable for conservation purpose.

5.2.3 Industrial Area Suitability Analysis

Developmental suitability may be defined as the "fitness" of a given tract of land for a well-defined use (Steiner, 1983). The procedure for land suitability analysis for the industrial development relied on GIS based raster calculation of the factor maps on this thesis. Thus, the intensity or importances of the particular maps are verified. Accordingly, Geology map, surface water map, slope map, land use/cover map, soil map, proximity to high ways and wind direction

were used to generate the suitability map. Each map has been factored and weighted as follows (table 5.6).

Table 5.6 Factor maps ranked for industrial area suitability analysis

No	Criteria	Category	Suitability	Ranking score	Weight (%)
1	Slope Based on Percent	0-2% 3-15% 16-20% >20%	low High Low Least	(2) (4) (3) (1)	20
2	Soil Based On degree of permeability	Vertisol Cambisol Leptosol Luvisol	High Medium Low Least	(4) (3) (2) (1)	15
3	Geology based on stability and fracturing	Entoto silicics Aiba basalt Alaji basalt Adama group Chanco basalt	High Medium Low Least Least	(5) (4) (3) (2) (1)	15
4	Proximity to settlement	Greater than 200m Less than 200m	Suitable Not suitable	(4) (1)	15
5	Proximity to surface Water	Greater than 100m Less than 100m	Suitable Not suitable	(4) (1)	20
6	Proximity to high way	Greater than 500m Less than 500m	Suitable Not suitable	(4) (1)	15
7	Wind direction	East-western Other direction	Suitable Not suitable	(4) (1)	Considered

Source: Own computation

Based on the table above the factored map layers are slope, soil, Geology, Land use/cover, proximity to water resource, high way and wind direction. Thus these factor maps are overlaid

and analyzed via multi criterion analysis to compute the areas suitable for industrial development. Therefore the result of the analysis is presented as follows (figure 5.30).

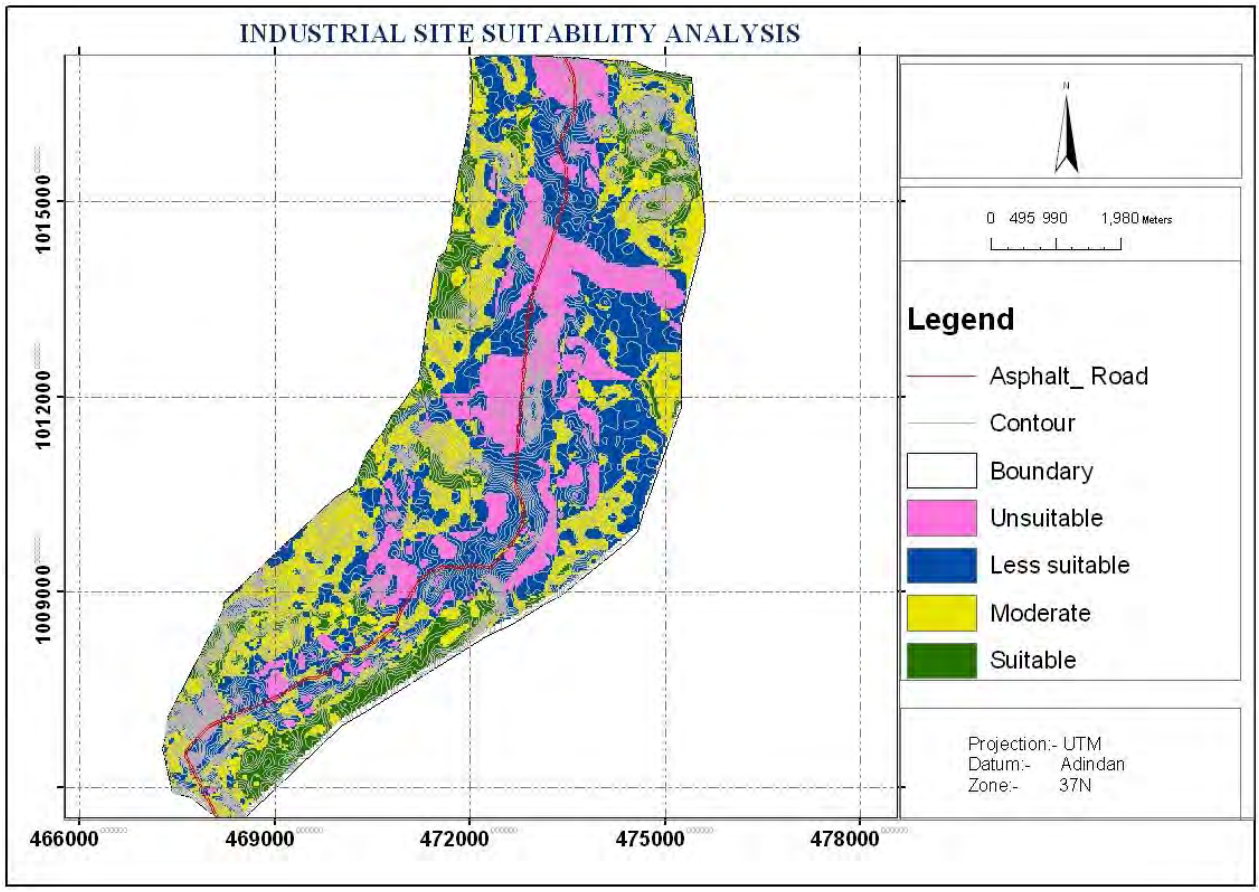

Figure 5.30 Suitability map of industrial area (source: Own computation)

Based on the map above, the suitable areas for industrial development are marked by green color. However, wind direction were also considered as another factor, thus as the wind direction of the town is east-western direction, suitable areas that found to the western peripheries of the town were finally selected for the development. Consecutively, the considerable areas of the study fall under moderately suitable for the development which is marked by yellow color on the map. However the other areas that manifested by pink and pink color are less and not suitable for the industrial development.

CHAPTER SIX

6. INTERVENTION AREAS AND THE PROPOSAL

6.1 Major Intervention Areas

The analysis and findings of the study depicts that structure plan of Sululta town needs proper intervention. Based on the theories, principles and experiences of environmental land use planning, existing condition of the town (physical, Biological, and Socio-economic condition), needs of the town administration and town community, proper environmental land use planning intervention is required for the town.

Based on the result of Analysis, the proposed solid waste landfill site was in unsuitable place, as it proposed on slope greater than 15% and relatively on high altitude (discussed under 5.1.1.7.1). Moreover, the town administration implemented the land fill site at another place away from the proposed one that also unsuitable area for the use, affecting the environment (discussed under 5.1.2.2.1E). The abattoir site in the town was also proposed incompatibly with other land uses and its implementation is degrading the environment (discussed under 5.1.1.7.3) and (discussed under 5.1.2.3). The other intervention area is industrial site that proposed incompatibly in between residents and on river banks (discussed under 5.1.1.4). The implementation of the industrial area in some places was also violating the proposal.

The urban green plan component particularly the neighborhood open spaces are reclaimed by different development mainly housing (discussed under 5.1.2.1.3). In addition, the existing Wetland in the town was not considered in the land use planning, thus it proposed for land uses like residence, road network, commerce and urban agriculture needs intervention. Quarrying activities is also extensively taking place in the town however the planning approach proposed the area for urban green and the implementation is also not in safe way, thus it requires intervention.

Therefore the spatial intervention has given attention to revision and land use proposal of land fill site, abattoir site, industrial areas, urban greens, environmental sensitive areas and other land uses related to environment. In general, these are among some of the areas on which the intervention was made and the proposal is presented as follows.

6.2 Planning Proposal

Based on the identified environmental problems and analyzed land use suitability, the following land use proposal has been made for intervention areas of the study. Hereby about 55.3% of urban green is proposed including forest area, recreation, buffer zones, environmental sensitive area, road side green, water bodies and squares in the former plan. However, in this study about 46.4% of Green area of the total land use is proposed excluding wetland. Thus, still the proposal of the land use accounts the maximum percentage. These is due to the town has great potential for recreation in addition with most areas of the town are unsuitable for development but for conservation purposes that should included in to urban green land uses. This may be important to get the ecological, economical and environmental benefits for the study area.

Moreover industrial areas that are undeveloped and found incompatibly in the center of the town and riverbanks are evicted and relocated based on the analysis made. The residence, commerce, urban agriculture and road network land uses proposed on the wetland area are also evicted and relocated accordingly. The other land use proposal concerns quarry site on operation that was proposed as urban green on the former plan, now proposed for reserved area so as to use for other development after rehabilitation. Finally, the proposal is concerned with the landfill and abattoir site that was proposed unsuitably and incompatibly on the former plan. Thus, in this study the site for the land fill and abattoir are proposed based on the suitability analysis made. In general the following proposals have been made for the study area.

Considering the planning period which ends by 2022 and amount of waste generated per day, about 11.7ha of land is proposed for solid waste dump site to serve until the end of this planning period that generates 71.61m^3 per day. In addition, about 2ha of land is proposed for abattoir enabling about 100-150 cattle and 50-300 goats and sheep slaughtering per day and about 320.2 ha of land is also reserved as wetland in the proposal

The other land uses that the proposal deals with were housing 70ha, commerce 12.5ha, and industry 10.67ha of land were evicted from their unsuitable and incompatible proposed areas and relocated to the suitable site. Moreover, the road network that was proposed on wetland were also evicted from it. The quarry site that was proposed for urban green was also proposed for reserved

area in this study. In general the summery of the proposal in comparison with the former one has been presented on the table (6.1) and figure (6.1), (6.2) and (6.3) below.

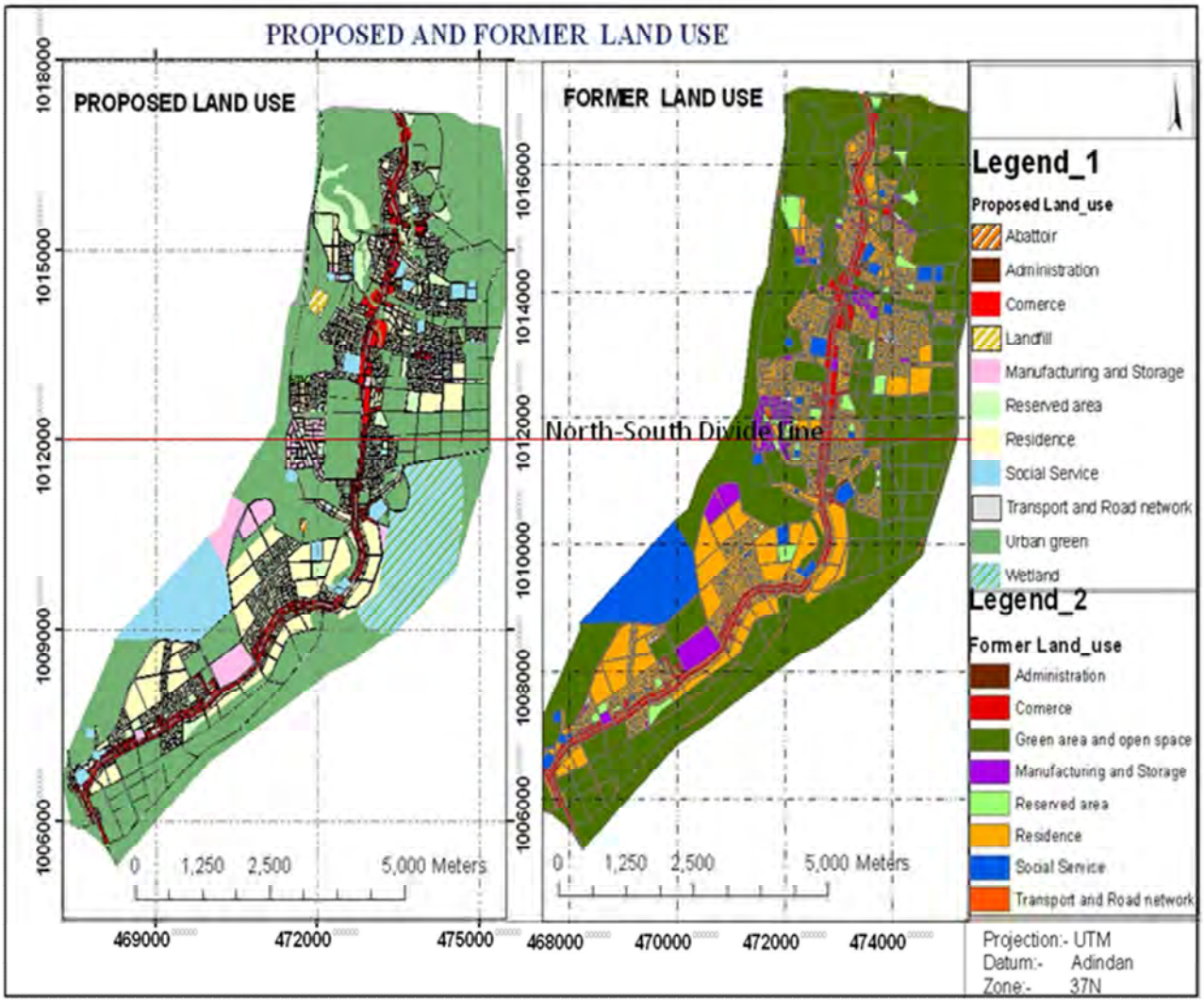

Figure 6.1 Proposed and former land use plan

Land use type	Former land use in hec.	Former land use in %	Proposed land use hec.	Proposed land use in %
Residence	750.72	16.79%	856	19%
Commerce	189.86	4.25%	177.36	4%
Manufacturing and storage	121.18	2.71%	144	3.2%
Administrative	6.67	0.15%	6.6	.15%
Urban green	2473.68	55.33%	2080	46.4%
Reserved area	89.03	2%	153.7	3.2%
Social service	267.38	5.98%	259	5.6%
Transport and road network	572.03	12.79%	516.3	11.5%
Wetland	Included under social services	-	320.6	7%
Land fill site	Included under social services	-	11.7	.24%
Slaughter houses	Included under social services	-	2.1	.04%
Total	4470.55	100%	4470.5	100%

Table 6.1 Former and proposed land use in hectares and percentage

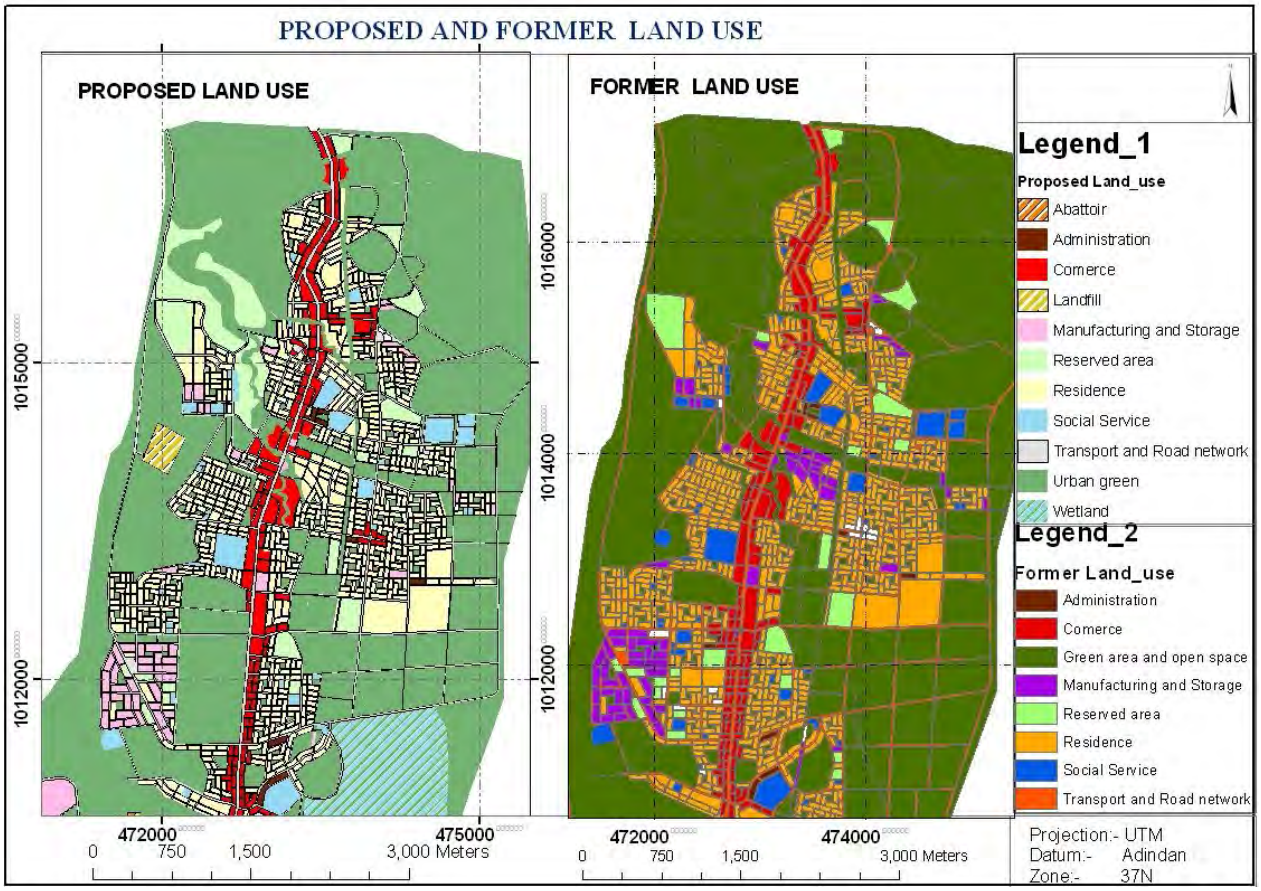

Figure 6.2 North part of the former and proposed land use plan

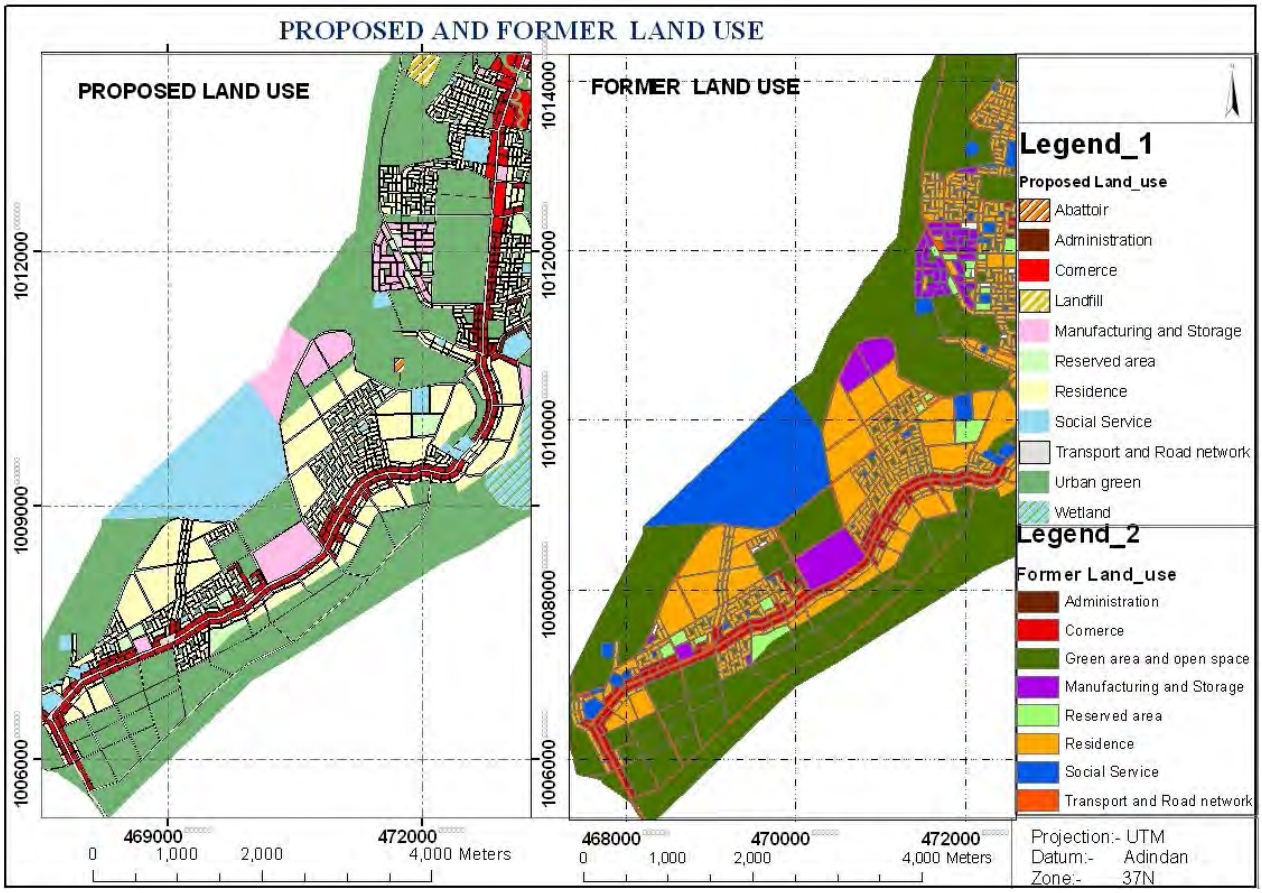

Figure6.3 South part of the former and proposed land use plan

CHAPTER SEVEN

7. CONCLUSION AND RECOMMENDATION

7.1 Conclusion

The Evaluation of land use planning and implementation with respect to environmental issues were evaluated in the study area. Thus, the researcher concluded that the land use planning and its implementation were ineffective as a result of internal and external contributing factors. In the preparation of the structure plan of the town, there are internal and external factors that contributed to the infectiveness of the plan. The external factors affecting the quality of the plan specifically the environmental plan are lack of public participation as well as shortage of the commitment of officials. Moreover, the internal factors that cast a shadow image on the quality of the Structure plan were the experience and disciplinary gap of the plan preparation team.

In addition the effectiveness of the plan implementation were also affected by factors like lack of policy and commitment of officials, shortage of implementation tools, skilled man power, and community awareness.

In general, the infective land use planning and implementation resulted by the factors that in turn results unhealthy natural environment in the town via various development activities such abattoirs, industries, housing, quarrying activities, etc. Moreover, insufficient urban greenery, land and soil degradation, poor solid and liquid waste management, noise and poor air quality, poor sanitation infrastructures and poor environmental management has led to several social and health problems, environmental pollution, and poor urban image.

6.2 Recommendation

In line with the findings of the evaluation of land use planning and implementation with respect to selective environmental issues the following recommendations are presented:

- Public participation should be employed in land use planning and implementation.
- Required disciplinary should be incorporated in land use planning team.
- On job training should be employed to capacitate the experts and officials concerning land use planning and implementation as well as implementation tools like GPS, Total station and software's such as GIS and AutoCAD should be fulfilled for the experts.

- Develop and apply appropriate policy, rules and regulation in land use planning and implementation with commitment of officials to enforce it.
- Conserve environmental sensitive areas like forests, wetland, catchments of water bodies and areas with slope greater than 20% as well as restrict pollutant activities with buffer zone and public awareness.
- Promote environmental friendly waste management system by employing involvement of private sectors and 3R (reduce, reuse and recycle) as well as 'polluters pay principle';
- Enforce industrial developers to conduct EIA and construct treatment plant with implementation to manage the waste generated before affecting the natural environment based on EIA recommendation.
- Relocate incompatibly and unsuitably implemented land uses based on the analysis result.
- Rock mining should be undertaken based on EIA study and proclamation No.52/1993 that forbids the activities within a depth of greater than 15m.
- The town administration and concerned body should follow up the development of land uses and enforce the developers to run according to the norms, principles, rules and regulation of the recommended plan.

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APPENDIXES

Appendix-1

Structure plan component	Small & Medium towns	Large towns	Cities	Metropolitans
Housing	55-70	50-60	45-50	40-45
Business and commerce/ Centers and market places	5-10	5-10	10-20	10-20
Public facilities, cultural, archeological sites and special functions	5-10	5-10	10-20	10-20
Manufacturing and storage	5-10	10-15	10-15	10-20
Infrastructure, utilities and Transportation	15-25	15-25	15-25	15-25
Open spaces and environmental sensitive areas (parks, urban agriculture, recreation, mineral resources)	15-20	15-20	15-20	15-20

Structure plan standards (FUPI, 2006)

Appendix-2

No	Container Size and type	Maximum Catchment area (ha)	Maximum Catchment population (HH)	Maximum Catchment radius (meters)	Assumed emptying interval (days)
	1.1m3	1.25	60	65	5
	8 m3	3.15	150	100	8

Solid Waste Container Provision Standard (FUPI, 2006)

Appendix-3

Area exclusion criteria applicable worldwide	
Aspect	Criteria
Transport	More than 2 km from a suitable main road Uneconomical travel distance
Natural conditions	Flood plains or areas liable to flooding Extreme morphology (steep slopes liable to landslips
Land use	Designated groundwater recharge Incompatible future land use designations Within a military exclusion zone
Public acceptability	Within 200 m of existing residential development
Safety	Within 5 km of an airport runway in the direction of approach and take-off Area of former military activity Within a microwave transmitter exclusion zone Within a safe buffer distance (say 100 m)from an existing or planned quarry Areas known to contain collapsing soils

Selection criteria for solid waste disposal sites (FUPI, 2012)

Appendix-4

I. Checklist Questioner for government sectoral offices

1. How do you evaluate the land use proposal and the implementation status of Green Areas and Open Spaces in the town?

A _____

B _____

C_____

2. Could you think that the land use plan adopted in the year 2007 have incorporated enough green areas and open spaces for the Town.

3. What benefits do you think are obtained from the existing green areas of the town?

4. What environmental, social and economical benefits can a Town get from preserved green area and open space?

Environmental benefits_____

Social benefits_____

Economicbenefits_____

5. would the existing green areas and open spaces in the town are uniformly distributed within the town?

6. Please mention the activities made and the expected outcome achieved with respect to the green area and open space development and preservation in the Town.

A _____

B_____

C_____

7. Please mention the activities carried out to phase out the eucalyptus tree production around the chains of Intoto Mountains and areas where exceeding 20% slope and replant the area with indigenous trees.

A _____

B_____

C_____

8. With respect to identifying conservation areas for future recreational, development, urban agriculture, etc., please point out the activities performed and the result achieved by your Town Administration.

A _____

B_____

C_____

9. In line with urban agriculture in the Town, please mention the activities performed to:

A. Promote mixed agriculture in the Town

B. Encourage horticultural development along riverbanks

C**.** Livestock production in the peripheries

10. Is there any problems do you think are emerged/ faced due to shortage or lack of green areas and open spaces in the town?

A _____

B_____

C_____

11. What activities are conducted to raise the awareness level of the public on personal hygiene and house hold cleanness in line with solid waste management?

A _____

B_____

C_____

12. What are the trends of solid waste collection techniques & available resources in the last five years in the town?

Type of collection	No of containers	No of trucks	No of workers	
			Professional	Non -professional

13. What are the trends of solid waste collection techniques & available resources currently present in the town?

Type of collection	No of containers	No of trucks	No of workers	
			Professional	Non -professional

14. Are there waste management regulations at the town level to encourage the involvement of interested stakeholders in the area?

15. Are there any decentralization level of waste collection system to lower administrative level, i.e. sub-town and Kebeles?

16. Are there the involvement of the private sectors and any contributions made on solid waste management in the Town?

17. Is there an existing enforcement policy in the town about the self-treatment of wastes by complex buildings, industrial plants, and other similar units?

18. In the past five years, how many of the established industries have waste treatment plant and not.

A. No of industries that have treatment plant_____

B. No of industries that not have treatment plant _____

19. Please list out the number, type and location of mining activities taking place in the last five years (2007-2011) in the town.

A. Number of mining activities_____

B. Type of mining activities_____

C. Location of mining activities_____

20. Has any adverse impact been occurred on the environment including local residents while quarrying activities is undertaken in the Town in the year (2007-2011)?

What are the main problems that are intensified in the last five years?

A. Dust fall out	D. Noise	G. Psychological problem
B. Security problem	E. Water pollution	H. Land stability problem
C. Visual impact	F. Vibration	I. Destruction of household material

21. Had you take any measure to minimize the problems concerning mining issues in the town?

A. The existing rules & regulations used.

B. The application of environmental friendly mining techniques used

C. The activities carried out in the past five years in the Town to restore and reclaim excavated sites

22. What are the potential water resources you have in your town?

A. Surface water

B. Ground water

23. How do you see the quality of water resource in your Town in the last five years?

A. Increasing

B. Decreasing

C. Remain the same

24. How do you see the quantity/volume of water resource in your Town in the last five years?

A. Increasing

B. Decreasing

C. Remain the same

25. Is there any adverse environmental impact that provoked by water pollution in the past five years?

26. Could you specify the source and location of pollutants of water resources in you Town?

A. Sources of pollutants

B. Location of pollutants

27. What mitigation and conservation measures you take as a town administration concerning water resource pollution in your town in the past five years?

7. Please specify if you have any regulation that you have used to enforce to control the pollution of water resources in the last five years in your town

A. _____

B. _____

C._____

Appendix-5

II. Checklist Questioner for urban dwellers

1. Have you ever worried for the existence/necessity of green areas and open spaces in your town?

2. How do you see the size (proportion) of green areas and open spaces in your town?

A. It is increasing from time to time

B. It is decreasing from time to time

C. It is the same all the time

3. Which benefits do you think are obtained from the existing green areas of the town?

A. Recreation.

B. Community Integration

C. Moderation of Climatic Extremes

E. Noise Mitigation

F. Wildlife Habitats

5. How do you generally observe the development and preservation of green areas and open spaces in the town?

6. Have you ever worried about the adverse effect of solid and liquid wastes on environmental, social and economical values in your town?

7. How do you observe the generation rate of solid and liquid wastes at different levels in your town?

A. It is increasing from time to time

B. It is decreasing from time to time

C. It is the same all the time

8. Do you think that the waste management system is employed in line with the increasing of the waste generation rate in the Town?

9. Could the distribution of the containers and trucks available in sub- parts and kebeles of the town to collect the generated wastes?

10. What problems do you think are emerged/ faced due to improper waste management system in the town?

11. Could you sense any pollution in your town?

12. What are the pollutions do you think are adversely affecting the environment in the Town?

A. Sound pollution D. Air pollution

B. Water pollution E. Land pollution

C. Noise pollution

13. Is there any source and type of pollution that you know in the last five years in your town?

A. Source of pollution_____

B. Type of pollution_____

14. Have you ever worried about the adverse effect of mining activities on the natural environmental, social and security of the society in your town?

15. Has any adverse impact been occurred on the environment including local residents while quarrying activities is undertaken in the Town in the year (2007-2011)?

16. What are the main problems that are intensified in the last five years?

A. Dust fall out D. Noise G. Psychological problem

B. Security problem E. Water pollution H. Land stability problem

C. Visual impact F. Vibration

17. Do you have any information about the quality and quantity of water resources in your Town in the last five years?

18. How do you see the quality of water resources in the past five years in your Town?

A. Increasing

B. Decreasing

C. Remain the same

19. How do you see the quantity/volume of water resources in the past five years in your Town?

A. Increasing

B. Decreasing

C. Remain the same

20. What environmental impacts are prevailed as a result of water pollution in your town five years ago?

A. Climate change

B. shortage of drinking water

C. Drought

21. Please could you specify the source and location of the pollutants of water resources in the town for the last five years?

A. Source of pollutants

B. Location of pollutants

22. Are there any mitigation and conservation measures undertaken up on the pollution of water resources that you know in the last five years?

Contacted respondents from gov't sectoral offices			**Contacted urban dwellers**	
Zelalem Tadesa	Land Administration		Gezagn Shifera	Urban dweller
Mitiku Tola	expert		Belexe Leta	Urban dweller
Mesfin Wendimsishaw	expert		Abraham Demise	Urban dweller
Ashenaf Tsegaye	Development base manager		Alemu Gutema	Urban dweller
Girma Dechasa	expert		Abebe Seboka	Urban dweller
Tamiru Aredo	Beautification and greenery manager		Asefa Lema	Urban dweller
Lula Jamal	expert		Malase Demise	Urban dweller
Tashoma Galan	expert		Tesfaye Belacho	Urban dweller
Siyum Hailu	Mayor		Selemon Adugna	Urban dweller
Ishete Debela	Town manager		Zewedu Bekela	Urban dweller

Tsegaye Lema	expert		Dejene Fikadu	Urban dweller
Simirat Tamiru	expert		Tesfaye Gudeta	Urban dweller
Habtamu Ketema	expert		Girma Telila	Urban dweller
Wekgari Gurmesa	expert		Girma Hunde	Urban dweller
Birhanu Abeba	expert		Dame Haile	Urban dweller
Indale Haile	expert			
Getinet Akililu	expert			
Azeb Asefa	expert			
Yared Girma	Owner process			

Appendex-6

III. Checklist Questioner FGD

1. What are the major environmental problems intensified in the town?
2. What the major social and environmental problems aggravated as a result of last plan preparation and implementation?
3. What are the conflicts happening related with land use in the town?
4. What are the social and environmental problems resulted because of industrial development in the town?
5. How do you observe the waste management system in the town?
6. What information do you have concerning quarrying activities in the town? Is there any social and environmental problems as a result?
7. How do you see the existence, provision and development of urban greens in the town?

FGD Divisions

Crew-1 Kebele 01		Crew-2 kebele 02		Crew-3 Kebele 03
Ejere Mariyam		Abebe Dechassa		Alemu Gutema
Tsegaye Alamu		Nuguse Malase		Asrat Ejere
Daraje Lema		Tolasa Megarsa		Tarafa Biranu
Tafasa Urge		Asefa Fikadu		Diriba Dinku
Taganu Dame		Desalegn Geleta		
		Tulu Abdi		

Dozi Malase		Mitiku Tola
Gamada Guta		Azeb Asefa
Biranu Warku		Almaz Lulu
Daba Robi		Tashoma Galan
Lencho Tola		Yared Girma
Galana Bikila		Dadi Girma

Crew-4 Kebele 04 Crew-5 town administration

Appendix-7

FGD with gov't sectoral experts

Interview with the expert

Interview with the land Ad.

FGD with kebele 01

Interview with the dwellers

FGD with kebele 02

FGD with kebele 03

Interview with the mayor

FGD with kebele 04