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Building Ethiopia Since 1954

Enhancing Green Infrastructure of Addis Ababa Through the Reclamation of Derelict Land: *The Case of 'Bole-Qatla'.*

Thesis submitted to School of Graduate Studies of Addis Ababa University in the partial fulfillment of the requirements for the degree of Master of Science in Environmental Planning and Landscape Design.

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These 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 perceptions and practice submitted in partial fulfilment of the requirements for the Degree of Masters of Science (Environmental Planning and Landscape Design) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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By: **Amanuel Atlabachew**

Date: April**, 2018**

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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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Confirmation

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

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List of Acronym

AACRDA	Addis Ababa City Road Authority
AAEPA	Addis Ababa city Environmental Protection Authority
AAHDPO	Addis Ababa Housing Development Project Office
AASHDE	Addis Ababa saving house development program
ACSI.SC	Addis Credit and Saving Institution Share Company
AAWSA	Addis Ababa city Water and Sewerage Authority
AMSL	Above mean sea level
BWUD	Bureau of Works and Urban Development
CSA	Central Statistical Authority
ECBP	Engineering Capacity Building Program
EEPA	Ethiopian Environmental Protection Authority
ESIA	Environmental and Social Impact Assessment
FAR	Floor area ratio
GDP	Gross Domestic Product
GIS	Geographic Information System
GRED	Grand Ethiopian Renaissance Dam
LDP	Local Development Plan
LFP	labor force participation rates
LULC	Land use land cover
MSE	Micro and Small-Scale Industries
MoUDH	Ministry of Urban Development and Housing
NLUD	National Land Use Database
ORAAMP	Office for the Revision of Addis Ababa Master Plan
UN-HABITAT	United Nations Human Settlement Program

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Gedaliah!

Abstract

The urban population is expected to grow exponentially which impacts the livability, sustainability and future construction of urban settlements. Following that land is being developed faster today than ever before. This accelerated consumption and the resulting fragmentation of open land are the primary conservation challenges facing today. The reclamation of urban derelict land, subsequently is not gaining attention especially on government owned quarries in Addis Ababa.

Therefore, this study sheds light on the reclamation of derelict land to enhance green infrastructure coverage development of Addis Ababa the case taken on 'Bole-Qatla' neighborhood'. The research seeks to study the general status of the area, answer the quarry LULC (land use/ land cover) change during the years and to examine the integration as well as disorder of green infrastructure with the future mid-density development, and adjoining uses for transformation of the site. The main considerations for selecting the study area is that the government is undertaking a project without ESIA (environmental and social impact assessment) study and reclamation plan. In addition, it is an active quarry project which is allocated on a working landscape with inadequate social and physical infrastructure and a proposed site for future medium-density residential neighborhood. Meanwhile, the study used both primary and secondary data sources that are collected using field survey, interview and questioner. Moreover, the type of methodology used to conduct the research is an explanatory and descriptive method. The explanatory method is used to understand derelict land reclamation approaches with their respective advantages and disadvantages related to the character of the site and available resources while the descriptive method is to describe the overall state of affairs as it exists on the study area at the time of the study. Systematic random sampling which is a probability sampling method and purposive or judgmental method of non-probability sampling has been employed in this research.

The results from the analyzed case study area showed that quarrying has led to a significant change on landscape and land cover. Negative landscape changes due to presence of abandoned quarry pits and pour overburden material management along with lack of quarry restoration and management plan, degraded the land. The study also revealed that the government-owned quarry, 'Bole-Qatla' is neither managed nor administered by mining and reclamation plan. In addition, the working and built environment is using wider area than the natural area.

Finally, the study recommends physical design proposals to reclaim the site and make ready to transform to medium density residential development at micro level to enhance green infrastructure. Also, endorses that governmental bureaus to work in cooperation for common goal, ensure environmentally friendly and livable mid density neighborhood. Moreover, awareness creation program, immediate preparation and implementation of environmental social Impact assessment as well as administration and reclamation plan are necessary for the proper reclamation of the site.

***Key word** – Derelict Land, Green Infrastructure, Quarry Reclamation, Urban Ecosystem, Buffer, Addis Ababa.*

CHAPTER I: INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Background of the Study

The urban population is expected to grow from 3.6 billion today, roughly half of the entire population, to nearly 7 billion by 2050. These growth expectations raise questions concerning livability, sustainability and future construction of urban settlements (WHO, UN-HABITAT, 2010).

Various organizations have presented their concern that the inevitable demand for urban space will increase tensions for developable land and push boundaries of traditional city planning. Developable land is getting scarce and with the expectations of the urban population in the future, natural land resources are running out (WHO, UN-HABITAT, 2010).

Derelict land is land which has been so damaged by development, that it is incapable of development for beneficial use without rehabilitation. In addition, the land must currently not be used for the purpose for which it is held or a use acceptable in the local plan. It has also been suggested that, land also qualifies as derelict if it has unresolved previous use which could constrain future development (The Scottish Government, 2013). According to the National Land Use Database (NLUD) in the UK, derelict land is another side of “previously developed” and hence “available for development” land, even “Land so damaged by previous industrial or other development that it is incapable of beneficial use without treatment” (Kamvasinou, 2011).

Quarrying is an ancient practice, dating back at least to the Stone Age (Langdon, 1988). Although stone was needed to create tools such as knifes, axes, hammers, and arrows, as well as for construction (Tandy, 1975), extraction was on a relatively small scale. The uses of stone for present-day industrial applications such as in the construction of roads and manufacture of cement means that exploitation is now undertaken on a much larger scale. Quarrying continues to be carried out because of the economic importance of the minerals extracted from below the earth surface. In turn, this extraction has the potential to have a devastating impact on the environment (I. Ashmole, 2008).

Quarrying nowadays takes place under strict rules and regulations as well as through self-policing by mineral extraction companies (Langer, 2001). This control on the industry will help to reduce the disturbance of land as well as ensuring that disturbed land is reclaimed (Cripps, 2004). The implementation of these rules and regulations has not been studied on government-owned quarries in Addis Ababa. Reclamation is a process of returning a disturbed piece of land to a productive state (Down, 1978). The land could be reclaimed in order to accommodate its original

use or any other type of use suitable for the existing conditions (economic, socio-cultural and physical) status (Walton, 2004).

Addis Ababa has a number of quarries which are used to support the construction industry. These quarries are owned and administered by both the government and private individuals and companies. The government-owned quarries in the city are recently used for the production of dimension stones and further for cobblestone production. Dimension stone is a collective term for various natural stones used for structural or decorative purposes in construction and monumental applications (Merke G, 2000).

Quarrying of dimension stone still only accounts for under 0.5%of worldwide quarrying tonnages (Montani, 2007). With sand, gravel, aggregate, and limestone for cement accounting for most of the remaining volume. In terms of value, however, the industry is an important one, with the total value chain estimated at over US$ 60 billion worldwide.

However, the project operation in government-owned quarries with respect to the reclamation approach has not been studied. Further, from the reclamation scheme, the use of land and integration of quarries with their surrounding areas and uses has not been a focus of study. Following high land value in Addis Ababa, mining areas are planned for low and mid-density housing developments like of 'Bole Qatla'. Therefore, the major intention of the paper is intensifying the reclamation of quarries that should excide beyond just rally for the ecosystem but support the upcoming development.

1.2 Problem Statement

The urban environment has distinctive biophysical features in relation to surrounding rural areas. These include an altered energy exchange creating an urban heat island, and changes to hydrology such as increased surface runoff of rainwater (S.E. GILL). Such changes are, in part, a result of the altered surface cover of the urban area. For example, less vegetated surfaces lead to a decrease in evaporative cooling, an increase in surface sealing results in increased surface runoff. Climate change will amplify these distinctive features. Derelict lands like abandoned quarries are one of the elements for causing the above effects.

Exhausted quarries in most cities become abandoned and wasteland after they depleted. The overburden materials stripped are not properly kept and protected for green infrastructure development. Soil erosion and land degradation, diversion of natural river water flow, a poor practice of rehabilitation and deforestation of the indigenous trees were recognized (Berie, 2013). Quarrying strips off minerals in the topsoil that is necessary for any ecosystem to thrive in a given

area leaving the landscape bare and degraded. When human activities leave the land bare, it becomes difficult for plants, insects and the ecosystem at large to be sustainable. Other negative influences on mining are air pollution, stagnant waters, pollution of water tables and streams killing all aquatic organisms (Mwangi, 2015).

Ethiopia is going under a number of mega projects and infrastructure developments (Bertelsmann Stiftung, 2016). Similarly, in the capital Addis Ababa, a number of infrastructure developments are taking place. The required construction materials for these developments are collected mainly from the city and neighboring Oromia towns (AAPA, 2012). The city administration has also own and administers stone quarries that are used for processing cobblestones which are used for the construction of different roads in the city.

Different engagement with derelict lands for mining or processing of cobblestone have a considerable impact on land, water, air and biological resources, if the operation and post-operation issues are not handled properly. Even though the impact is part of the environmental and social price, it bears for the benefits of mineral consumption; the unregulated destruction of the natural environment is not compatible with sustainable development (Nyakeniga, 2009).

Similarly, the residents and workers around the quarry sites are being seen as out of the context. Many people are employed by quarrying practices, therefore an elimination of the quarrying industry to transform into mass housing development would result in the loss of jobs for countless families within the area and the city as a whole.

The study area is one of the most potential quarry sites of the city that create large job opportunity by cobblestone production for road pavement. However, it is observed that various environmental problems, such as the excavated site which is abandoned and left as a wasteland, the overburden materials that are improperly dumped for future rehabilitation, eroded soil and degraded land exist. These derelict lands can be reclaimed and used to improve the city wide urban green infrastructure coverage.

The quarry site in the study area have great problem characterized by lack of mining plan, ecological considerations, inadequate quarrying process and rehabilitation planning, technical and policy enforcement barriers, which significantly aggravate the degradation of the environment and socio-economic development endeavors of the area. The site is also planned for the construction of mid-density residential use in the Structure Plan of Addis Ababa City, 2017 for the next 25 years which implies the future integration of the site with neighboring blocks and uses are not properly treated. It is difficult to take a green infrastructure development nor sustainable

mitigation measure without detail investigation of the impact. Therefore, it needs conducting research on the site to identify the degree of impacts and to take remedial measures. Hence, this study seeks to investigate the impacts of stone quarrying on the physical as well as the socio-economic environment and seeks possible ways to reclaim the derelict land for green infrastructure development at microscale level based on the analysis on the case study area.

1.3 Purpose of the Study

The purpose of this study is to enhance green infrastructure of Addis Ababa through the reclamation of derelict land: *The Case of 'Bole-Qatla'.*

Thus, the following research question are the focus areas of the paper.

- How is the 'Bole Qatla' quarry area residents and quarry workers socioeconomic and environment condition?
- How does the quarry change the land use/ land cover (LULC) of 'Bole Qatla'?
- How is the integration and disorder of the 'Bole Qatla' area green infrastructure with the future mid-density development, and adjoining land uses?
- How can the 'Bole Qatla' derelict land can be developed to enhance the city green infrastructure?

1.4 Scope of the Study

This research has thematic, spatial and temporal scopes. The thematic scope incorporates the general quarrying processes. Correspondingly challenges of quarry areas related to socio-economic issues regarding impacts on livelihood, income and economic benefit to the local community. As well as examining the factors, extent and patterns of land use and land cover changes, along with environmental resource degradation. Also, evaluation of the green infrastructure development and its integration with the future medium density housing on the site.

The Spatial Scope is limited to Addis Ababa city specifically inspected on Bole sub-city, Woreda 10 commonly known as 'Bole Qatla'. The study area covers a total of 107 hectares of land. On the site agriculture, mining and cobblestone production takes place. Even though the site is located in Bole sub-city according to the quarry production processes it is managed and administered under Yeka Sub-city micro and small-scale industries bureau/ cobblestone production sub-office. The temporal scope of the research extends from 2007 up to 2017.

1.5 Significance of the Study

Examining quarry and mining sites and development of rehabilitation techniques to reclaim the land will help for the health and safety of neighboring residents and communities. The city administration also defines other quarry areas for the construction of medium-density residential neighborhoods, so that this manuscript will help to deal with these sites too. Also, the quarry on which the study performed is owned and administered by the government (Addis Ababa City Administration). Following that, it will be an important document for government officials, Non-Governmental Organizations (NGOs), the community, environmental advocators and others. Furthermore, it also gives recommendations and planning solution of reclaiming for mining and quarry pits that are found within the vicinity and out of cities. It also enriches the knowledge for the academia. In addition, this study is expected to motivate other scholars to do similar research in Addis Ababa and other cities of Ethiopia and Africa at large to contribute for solving comparable problems.

1.6 Limitation to the Study

This research has faced a number of limitations. The major ones are a shortage of materials for literature review, lack of proper documentation on mined resource amount. Lack of updated terrain map of the study area due to expensive surveying cost and lack of official's willingness was a limitation. Also, government future policies regarding the housing project, cobblestone production or quarry management can influence the research either ways. Furthermore, the different planning and administrations like MoUDH and AAEPA were reluctant to provide the required data for this study.

1.7 Organization of the Research

The thesis is organized into five chapters. The first chapter is the introductory section which depicts the overview of the research where background, statement of study problem, research objectives, questions, scope, limitation and methodology are included. On the methodology section research type, design, sampling methods with data analysis and presentation method is discussed.

The second chapter is the review of relevant literature on the topics of quarrying. Highlights about the theoretical and analytical framework relevant to the study in which the topics of quarry landscape elements, reclamation techniques with their respective advantage and disadvantages, and sustainability issues are treated. Also, a relevant case study on housing development on reclaimed derelict land is presented and discussed.

The third chapter consists of description of the study area. The history, location, topography, and land use of the study area is discussed. The fourth chapter deals with the presentation, discussion of results and finally conclusion are drawn. Data collected from different sources by different ways are computed and elaborated. The last chapter, chapter five present recommendations and planning proposals.

CHAPTER II: LITERATURE REVIEW

Mines produce a variety of minerals, metals, and aggregates that are used in everyday products and in the construction of buildings, roads, and bridges. (Tom Daniels and Katherine Daniels, 2003). There are a number of ways to treat and improve quarries. Following that, this section mainly deals with the story of how quarry works, quarry landscape elements, environmental impact of quarry operation and abandoned quarry reclamation.

2.1 Definition of Terminologies

Several terms used in the restoration literature have subtle but important differences (SER, 2002).

- **Derelict land** is land (with or without buildings) which has been so damaged by development or use that it is incapable of being developed for beneficial use without rehabilitation, and which is not being used for either the purpose for which it is held or for a use acceptable in a local plan. Once again there are exceptions, including operational sites where rehabilitation would not be possible or appropriate within five years, and land which is derelict through natural causes and which appears to have blended into the landscape (e.g. neglected woodland, farmland, marshes, mudflats, quarries etc.). All sites where contamination is known or suspected are classed as derelict (Edinburgh's environment state of the environment audit , 2009).
- **Green Infrastructure (GI)** stands to improve quality of life in many ways, through its environmental, social and economic credentials, based on the multifunctional use of natural capital. Potentially a very valuable policy tool, GI's multifunctionality could contribute to the achievement of a number of policy aims and fulfil the needs of a variety of stakeholder groups (Science for environment Policy, 2012).
- **Reclamation** provides stabilization of terrain, public safety, aesthetic improvement, and return of the land to productive use. This process mainly tries to improve an area for a better living and working space. This method mainly uses for treating brown and derelict lands. (e.g., mined land reclamation) (Walton, 2004).
- **Rehabilitation** emphasizes reparation of ecosystem processes and services. Unlike restoration this process does not concern with the previous status of the area. It tries to improve the current states of the area to a better ecosystem services and their successive processes (e.g., reforestation).
- **Restoration** aims to reestablish preexisting biotic integrity in terms of species composition and community structure. It undergoes by understanding the previous level of fauna and

flora diversity with their versatile interaction primarily, and an intervention that tries to recreate the previous biotic integrity (Montani, 2007).

2.2. Green Infrastructure

The concept of Green Infrastructure has been introduced to upgrade urban green space systems as a coherent planning entity (Sandström 2002). It can be considered to comprise of all natural, semi-natural and artificial networks of multifunctional ecological systems within, around and between urban areas, at all spatial scales. The concept of Green Infrastructure emphasizes the quality as well as quantity of urban and peri-urban green spaces (Turner 1996; Rudlin and Falk 1999), their multifunctional role (Sandström 2002), and the importance of interconnections between habitats (van der Ryn and Cowan 1996). If a Green Infrastructure is proactively planned, developed, and maintained it has the potential to guide urban development by providing a framework for economic growth and nature conservation (Walmsley 2006; Schrijnen 138 2000; van der Ryn and Cowan 1996). Such a planned approach would offer many opportunities for integration between urban development, nature conservation and public health promotion.

Green Infrastructure can be broadly defined as a strategically planned network of high quality natural and semi-natural areas with other environmental features, which is designed and managed to deliver a wide range of ecosystem services and protect biodiversity in both rural and urban settings.

More specifically GI, being a spatial structure providing benefits from nature to people, aims to enhance nature's ability to deliver multiple valuable ecosystem goods and services, such as clean air or water.

This will in turn:

- Foster a better quality of life and human well-being, for instance by providing a high-quality environment in which to live and work.
- Improve biodiversity, for instance by reconnecting isolated nature areas and increasing the mobility of wildlife across the wider landscape.
- Protect us against climate change and other environmental disasters, for instance by alleviating floods, storing carbon or preventing soil erosion.
- Encourage a smarter, more integrated approach to development which ensures that urban limited space is utilised in as efficient and coherent a way as possible.

One of the key attractions of GI is its ability to perform several functions in the same spatial area. In contrast to most 'Grey' infrastructures, which usually have only one single objective, GI is

multifunctional which means it can promote win-win solutions or ‘small loss-big gain’ combinations that deliver benefits to a wide range of stakeholders as well as to the public at large. However, for this to happen, the ecosystem must be in a healthy condition.

Green Infrastructure encourages a more sustainable and resource efficient development process. It can act as a catalyst to economic growth by attracting inward investments and generating employment, reducing environmental costs and providing health benefits amongst others. Experience has shown that investing in Green Infrastructure can contribute to the recovery of economy by fostering innovative approaches and creating new green businesses in Europe. Green jobs already represent around 5% of the job market. GI can also support different EU and nationally driven policies and actions, including those in the fields of agriculture and rural development, forestry, biodiversity, water, climate change, green growth, transport and energy, sustainable urban development, health and spatial planning.

Contents of Green Infrastructure

Green Infrastructure is made up of a wide range of different environmental features which can operate at different scales, from small linear features such as hedgerows or fish ladders or green roofs to entire functional ecosystems, such as intact floodplain forests, peatlands or free-flowing rivers. Each one of these elements can contribute to GI in urban, peri-urban and rural areas, inside and outside protected areas.

It is important however to be aware that not all green spaces or environmental features necessarily qualify to be part of GI. In addition to being of high quality they must also form an integral part of an interconnected GI network and be capable of delivering more than simply ‘a green space’. An urban park inside a city, for instance, might well be considered an integral part of Green Infrastructure if it acts as a cool air corridor, absorbs excess water run-off and offers an attractive outdoor area for recreation and wildlife. On the other hand, a patch of uniform grass that contains no other environmental features is unlikely to qualify as GI.

2.3 Derelict Land Reclamation

Reclamation is a process that involves creation of appropriate landform to support any envisaged post mineral extraction after-use, and creation of appropriate surfaces for the establishment of vegetation. The success of any reclamation scheme is aided by proper implementation of these two processes. The importance of adequate planning for both the extraction and reclamation processes during the planning stages of a quarry cannot be overemphasized (Darmer, 1992).

Well planned sites can lead to fine landscapes, examples of which include the Norfolk Broads, Eden project in Cornwall, the National Water Sports Centre at Holm Pierrepoint, Nottingham, Grays quarry in Essex, and many other magnificent sites across the world (Bradshaw, 1984).

Planning for reclamation takes into account a number of factors. They include the public's preference for the type of after-use, the intended final grade of the site, depth of the extraction pit, whether extraction was wet or dry, availability of fill material, soil characteristics, availability of topsoil, quarry setting, cost, availability of technical expertise, character of the surrounding landscape, and land ownership. These have an influence on the type and choice of reclamation techniques that can be applied as well as the final appearance of the reclaimed quarry landscape (Land Use Consultants, 1992). When designing new landscapes, reclamation schemes should follow applied theories and principles of landscape design. More importantly, designs must also follow theories and principles specifically relevant to the intended after-use of a site for reclamation to be successful. All this has to be done within the sphere of acceptable and recommended technical requirements for the intended after-use (Moffat, 1994).

The reclamation techniques described in this literature review have been developed and refined to better achieve functional, aesthetically pleasing (Lange, 2012), and sustainable post mineral extraction landscapes. They can be used independently or by combining techniques to prevent monotony in the landform of the final landscape. The success of these techniques lays partly, but more importantly, on the proper management of all processes that precede reclamation (Wolf, 1980). These include site clearing (vegetation removal), stripping of topsoil and subsoil, and the removal of overburden and its storage on or off site. The mitigation of visual impacts during operation is also an important aspect, which can be tailored to build up to the final reclamation scheme. The extraction of the mineral will need to follow a predetermined layout from which a landscape reclamation scheme was based.

However, because of the long-life span of quarries and other related factors, it is not always possible to ascertain that the post extraction land use and the reclamation scheme that was envisioned during the initial stages of quarry planning will be implemented. Sometimes change is unavoidable, and in most situations, it has resulted in outstanding reclamation schemes. The need for change could be caused by a number of factors, including improvements in reclamation technologies, improvement in technical knowledge, changes in extraction technologies, change in planning policy, and sociological factors (Environment, 1995). Any diversion in any of these processes from a pre-planned path and design will have to be reconciled with the reclamation scheme. For this reason, legislation should allow and encourages operators to periodically review

their reclamation schemes throughout the operation to ensure relevance (Environment, 1995).

2.4 Quarry Landscape Elements

There are two major elements that are of importance in quarry reclamation: landform and vegetation (Cripps, 2004). They are the most important aspects that drive the success of quarry reclamation. Plate 1 illustrates how different aspects of landform and vegetation can contribute to this success. It is important that attention is given to the design of the landform at the onset as a foundation for all other elements that will make up the reclaimed landscape (Nicolau, 2003).

Expensive as landform design undertaking might be, it is crucial, because besides being the foundation, it is what people will be seeing in the period before vegetation establishes and matures (Nicolau, 2003).

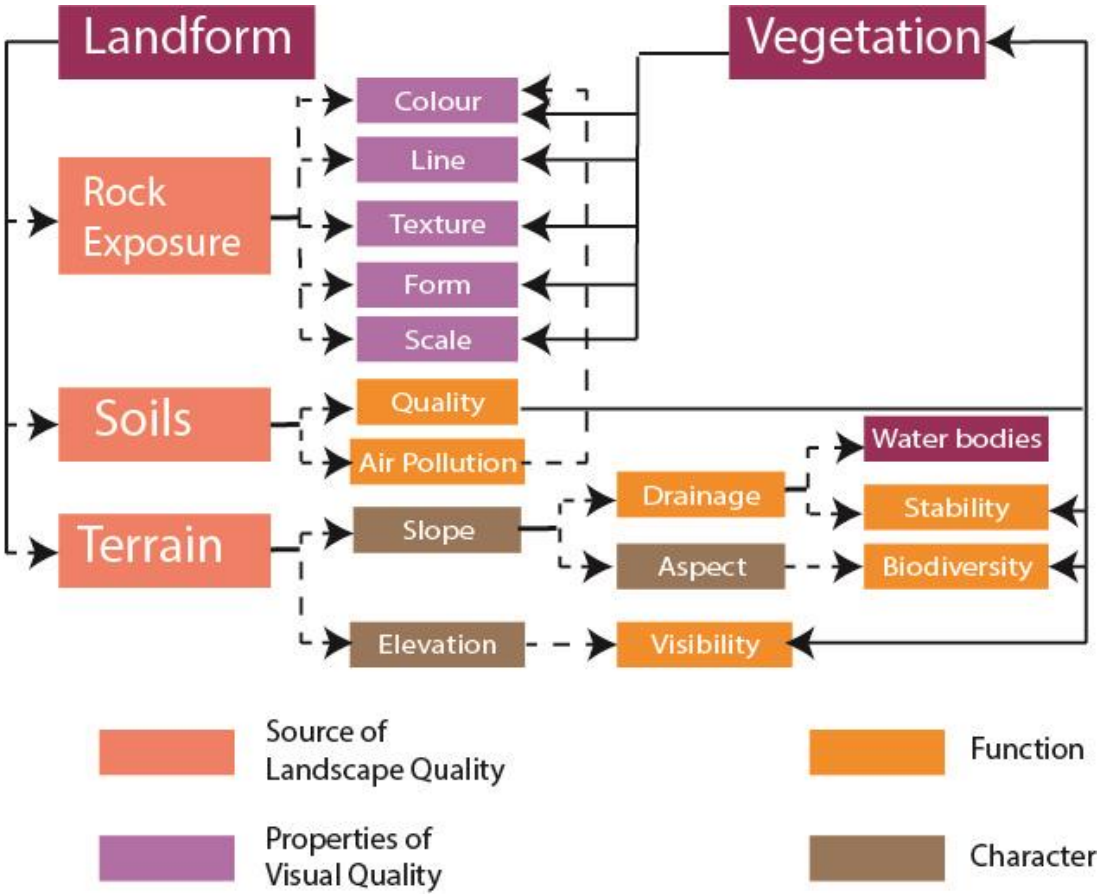

Plate 1 An illustration of how landform and vegetation contribute to environmental quality in quarry reclamation.

Source: Quarry Reclamation in England: A Review of Techniques.

2.4.1 Quarry Landform

Most quarries have three main components that make up a quarry landform. They all require different treatments during reclamation. These are the quarry floor, face, and bench. In many situations, the quarry floor becomes the focus for any intended after-use. It can either be flooded or dry depending on the depth of the water table and depth of extraction (Department of Environment, 1989). It can also be ripped to develop a suitable planting surface for vegetation establishment. Quarry faces have crevices that attract a variety of plant and animal species and can present an invaluable ecosystem with the least disturbed plant and wildlife habitats (Yundt, 2002). Because of their heights and steep slopes (Table 1), quarry faces also attract activities such as rock climbing (Land Use Consultants, 1992a). Benches on the other hand can be used to provide access to different parts of the quarry for reclamation management, as well as for recreational purposes where public access is allowed.

Overall, there is a great potential for treating all these sections of a quarry to attain a wide range of landscapes and facilities for both environmental and social benefits. In a spectrum of after-uses of quarries worldwide, there is on one end, landscapes that are purely natural with very little or no human activity like Miller's Dale Quarry (plat 3) in the Peak District, England, to highly urban, high-tech, and on the other highly used human centered areas, such as the Songjiang hotel in China (plat 2).

Table 1 A range of dimensions of quarry components cited from different articles

Components	Dimensions
Face Slope	70 - 90 ^{o}
Overall Slope	45 - 60 ^{o}
Quarry Face height	10 – 20m
Bench Width	7 – 15m

Source: Land Use Consultants, 1992a; Walton et al., 2004; Cripps et al., 2004.

Plate 2 Millers dale quarry

Source: Thwaites, 2008.

Plate 3 Songjiang hotel

Source: Welch, 2015.

Of the three main components of a quarry landform, benches and faces, which make up the quarry wall, present the most challenge in the reclamation process. This is so because of the safety and visual quality challenges they present. They also cause contrast in form and color spelling between the quarry landform and the undisturbed landscape around quarries. The earth surface of a natural landscape is usually dominated by vertical structure in the form of vegetation, whereas horizontal lines caused by the edges of quarry faces dominate the quarry wall. This causes the quarry landscape to fall out of place with its context (Cripps, 2004). Different authors have provided guidelines on the application of different techniques that can minimize these differences and help blend the quarry landscape with its surroundings (Allington, 2008).

2.4.2 Vegetation

Quarries are “hostile environments” for plant establishment (Wheater and Cullen, 1997). This is mainly because of poor soils, unavailability of topsoil, steep slopes, and size of the quarries. Even though it might be available in small amounts at the end of mineral extraction (Escalante-Montanez, 2005), topsoil is a very important factor in the success of vegetation establishment in any reclamation schemes (Defra, 2009). Because of its importance, sometimes it has to be imported from outside the reclamation area (Land Use Consultants, 1992a), or engineered onsite

from soil forming substances. Although they come at a cost, these soils do not always produce desired character of vegetation at their new sites because of their quality (Bradshaw, 1984). This is especially so for limestone quarry sites. Soils that lays above limestone mineral are alkaline and are referred to as calcareous soils. They support calcareous vegetation, which is characterized by grassland with sparse woodlands. The use of highly nutritious soils on these sites may therefore produce vegetation that is out of place with that in its surroundings (Riley, 2003). One of the techniques applied in the industry is to mix the topsoil with limestone dust to mimic the highly alkaline calcareous soils.

2.5 Techniques of Quarry Reclamation

There are several techniques that may be applied to reduce the visual impact of quarries and provide potential for the creation of biodiversity. The major techniques are the creation of rollover slopes, backfilling, bench planting, and restoration blasting (Walton, 2004).

The success of both natural recovery and other schemes, benefit from the use of local soil. Often the success of reclamation schemes can be greatly enhanced by the use of combinations of techniques, sometimes selectively, to address different challenges and achieve an intended outcome. The choice of any one or a combination of the techniques is dependent on the following factors:

- The intended after use of the site,
- The character of the surrounding landscape,
- Availability of topsoil,
- Availability of fill material,
- The cost of using any particular technique,
- The significance and character of the regional landscape,
- The intended final grade of the site,
- Availability of technical expertise.

2.5.1 Rollover Slopes

This method involves tipping and pushing material over the top edge of the quarry and spreading it on the underlying benches creating gentle slopes over quarry faces (plate 4). (Walton, 2004), observed that in about half the cases, rollover slopes proved to be a successful technique. It is often used in highly visible parts of a quarry, although because of the smoothness of the surfaces the landform may not look or behave like the natural landforms (Wheater and Cullen, 1997). Natural topography tends to have uneven slopes with depressions and knolls which create

different microclimatic conditions and soil moisture conditions throughout the landform ((Cripps, 2004), (Anon., 2010)). This provides an opportunity for a number of different plant species to establish naturally in the different portions of the reclaimed quarry (Nicolau, 2003).

Advantages.

- The presence of fill material provides an opportunity for vegetation establishment.
- The covering of quarry walls reduces the potential for rock falls which provide safe conditions and opportunities for public access.

Disadvantages.

- The techniques could require a lot of soil or other fill materials which might need to be sourced externally.
- This technique may result in the presence of steep slopes which may limit the options for after-uses of the site. The slopes could also make access to the upper parts of a quarry for planting and maintenance very difficult (Down, 1978).
- The covering of rock faces reduces establishment of biodiversity on rock crevices. It also removes industrial archaeological interests of a site.
- There is a high potential for soil erosion and mudslides especially during rainy seasons and before vegetation is established.

Plate4 An example of rollover slopes being formed at the Hope Cement Works, Hope, Derbyshire, England. The technique was used in a progressive reclamation scheme to cover a number of benches where extraction has ceased.

2.5.2 Backfilling

Backfilling is the process of partly or completely filling a quarry void with soil, soil forming materials, and/or waste rock in order to restore the original grade (Haywood, 1979) or create a new landform (Plate 5). It has been used widely to restore sites where coal has been extracted using open-casting methods.

Plate 5An example of rollover slopes being formed at the Hope Cement Works, Hope, Derbyshire, England. The technique was used in a progressive reclamation scheme to cover a number of benches where extraction has ceased.

Source: Holme Hall Quarry, Stainton, Maltby, Rotherham.

The site was designed and developed to accommodate an agricultural after-use. This method is dependent on the availability of a significant amount of backfill material either onsite or from external sources, and the cost of acquisition and transportation could become limiting factors. However, such schemes have been used in other locations where the void has been used to dispose of domestic and other wastes. Depending upon the nature of the waste, a lining and leachate capturing system might be required to prevent pollution to local surface and groundwater resources.

Advantages.

- This technique covers rock faces and as such removes any potential for rock falls.
- Where the amount of fill material is sufficient, the original topography can be recreated providing an opportunity to revert the site to its original functions.
- Vegetation can be established anywhere on the site after the landform has been crafted.
- Selective backfilling can be used to expose rock faces with geological or archaeological

interest or to expose areas with potential to be wildlife and plant habitats (Plate 5) (Cerver, 1995).

Disadvantages.

- Depending on the slopes created, materials used and environmental conditions, there is potential for soil erosion and other forms of instabilities to occur.
- Very large volumes of fill material are required. As generally the material may need to be sourced externally, it is likely to be costly to implement. Some quarry operators have employed what can be called 'fill material transfer strategy' to undertake backfilling. By extracting mineral from two or more adjacent sites, overburden, waste, and topsoil from two sites can be used to restore one pit, while rock extraction occurs in the other (Plate. 7). This can also be beneficial in preventing double handling of materials.
- The high likelihood of settlement due to the self-weight and moisture induced densification that occurs after tipping of fill material which would limit the options for after-uses. This possibility can be minimized by compacting the fill as it is placed.
- The creation of smooth soil slopes lacks the unevenness of natural ground, where this contributes a diverse and robust ecology.
- When backfilling a wet excavation (those below the water table), there is a potential of contaminating underground water. It is therefore very important that materials used in such situations are not contaminated or toxic, (Down, 1978).

Plate 6 limestone Quarry reclaimed by Backfilling at Dirt Low rake

On the above plate, a small section of a quarry face was left exposed to display a piece of industrial archaeology after backfilling a limestone quarry at Dirt Low rake, Hope, Derbyshire, England.

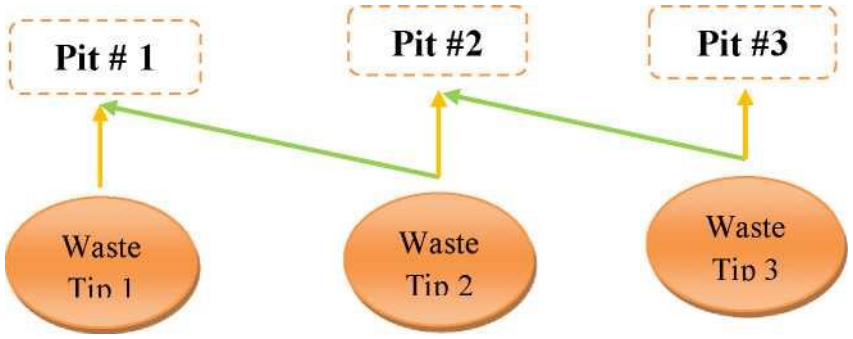

Plate 7 An illustration of the fill transfer strategy

According to the above plate Pit #1 to be reclaimed using fill material from Pit #1 and Pit #2, Pit #2 to be reclaimed using fill material from Pit #2 and Pit #3. The reclamation options for Pit #3 are more limited because of the small amount of fill material left over. Material may have to be sourced externally to back-fill Pit #3.

2.5.3 Bench Planting

This involves placing soil and waste material on benches to create a planting surface (Land Use Consultants, 1992a) (Plate 8). The material covers only a small portion of the rock face. The main purpose is to enable establishment of vegetation on the benches which could eventually conceal the rock faces. In view of the limited space usually available on benches and the stability of the soil, the soil thickness is liable to be insufficient to establish a significant amount of vegetation. Normally large deep-rooted trees cannot be use but with the right type of plants, this technique can minimize the amount of exposed rock face.

Plate 8 An example of bench planting at Dene quarry, Cornford, Derbyshire, England.

Advantage.

- A relatively small amount of fill material is required for this technique.
- When a diverse variety of vegetation of different sizes is established on the benches, rock faces could be hidden from view thus improving the visual qualities of the site.
- Important plant and wildlife habitats within the quarry can be preserved. The crevices on quarry wall creates different microclimatic conditions, suitable for different species.

Disadvantages.

- Depending on the depth of the soil material placed on the benches, some deep rooting plants may be precluded.
- There is a high possibility of rock falls from the exposed rock faces which could render a site unsafe for public use. Such problems may require use of rock fall preventative or protective measures.
- Access to benches might be difficult and specialized equipment might be required for placing and spreading the soil on the upper benches.

2.5.4 Restoration Blasting

Restoration blasting is a technique that was developed and tested by a group of researchers from the Limestone Research Group (Yundt, 2002). The intention was to use the final phase of blasting of the quarry faces to simulate landforms found in a locality. Despite the fact that this technique was tested on limestone quarries, it also has potential to be used in the reclamation of other types

of hard-rock quarries (Cripps, 2004), although modifications may be required for the technique to be applied to areas with different landforms and geology (Yundt, 2002).

Plate 9An example of a natural Dale side. Great Rocks dale, Buxton, Derbyshire, England

Source: (Gunn et al, 1992).

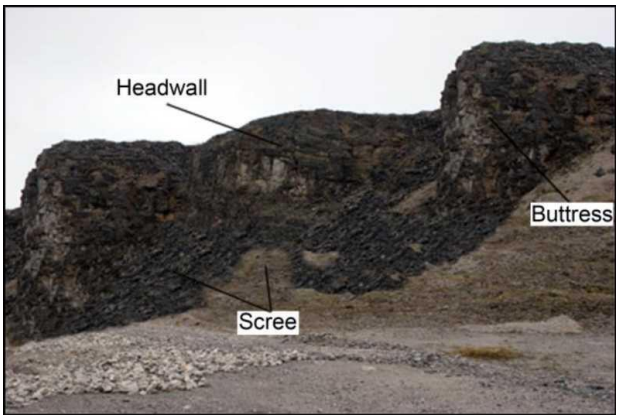

Plate 10An example of a quarry wall that has been reclaimed using restoration blasting.

Source: (Cripps et al., 2007; Gunn et al, 1992).

Advantages.

- Blasting design can be tailored to replicate existing landforms, in order to blend the quarry with the surrounding landscape.
- The scree blast piles created as part of the restoration blasting process can be used as substrate for vegetation establishment (Gunn, 1992).
- The technique reduces the overall slope of the quarry walls where it has been applied.

Disadvantages.

- This is a highly technical undertaking which requires specialized blasting and geotechnical expertise. Sourcing the necessary experts and the equipment could be costly and would have a bearing on the total cost of reclamation. Selective application of the technique could help reduce such costs. It can be focused on the most visually intrusive parts of the quarry (Gunn, 1992).
- The quarry wall and buttresses are liable to be unstable, posing safety risks for land-users.
- Soil erosion might occur on the screen blast slopes especially when they have been top dressed with soil for vegetation establishment.
- Scree blast piles alone may not be sufficient for the establishment of vegetation, especially shallow rooting grasses.

2.5.5 Natural Recovery

Natural recovery is a process in which re-vegetation relies on the presence of seeds and roots in the soils or are transported from adjacent land by natural processes. It happens through different stages referred to as primary and secondary succession (Davis, 1985). It could be applied on quarries that went through normal closure requirements. Contention and therefore avoidance of such an undertaking is caused by the duration with which this process produces acceptable landscapes (Plate 12). In most cases, the site characteristics, especially the soil conditions, slows down growth and sometimes “maintains the site in arrested successional stages” (Novak, 2006).

Plate 11 An example of a quarry site that underwent natural recovery. The site exhibits high biodiversity (Hope cement Works, Hope, Derbyshire).

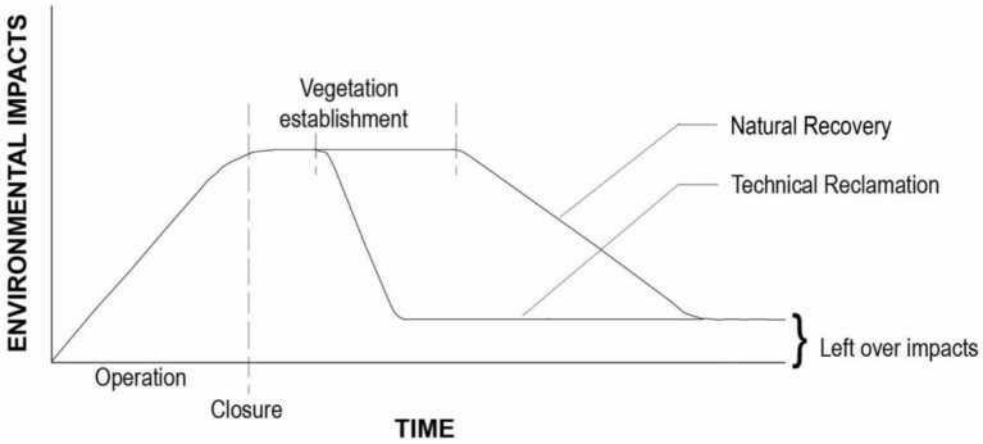

Plate 12 An illustration of the extent of environmental impacts over time

As the above plate shows the environmental impact over time after different reclamation interventions undertaken verses natural recovery. Generally, it takes longer for environmental impacts to decrease under natural recovery than it does under technical reclamation. It also shows that there will always be left-over impacts regardless of the type of reclamation interventions.

Advantages.

- There is a high possibility of establishing highly diverse sustainable ecosystems that is adapted to the adverse conditions of the quarry landscape over time.
- It has a low cost of implementation.
- There is no specialized expertise such as blasting, plants selection and planting, landscape design, and management required.

Disadvantages.

Depending on the availability of a seed bank and quality soils, it may take a long time for the vegetation to become established. Until vegetation becomes established, there could be problems with soil gullying and instability if slopes are not stabilized.

2.6 Case Study: Quarry Falls

Once quarries depleted of their desired resources, they are frequently abandoned. The majority of quarries are located fairly close to urban environments due to the expense of transporting raw materials into the city for industrial use in buildings and roads. As a result, inhabitants of neighborhoods near quarries are subjected to air pollution from dust, noise pollution from trucks and machinery, and the destruction of what may have once been a beautiful landscape.

While quarrying can be a negative industry for society and for the environment, the necessity of quarrying is undeniable. In order for human civilization to continue as it has since the industrial revolution, we need the retrieval of resources from quarries in order to create our homes' foundations, transportation structures with cement, concrete, asphalt, and crushed stone, and other industrial uses such as abrasives, binders, additives, and roofing. Therefore, in order to remedy the negative effects of quarrying, we must use the resource depleted spaces for other practices once the quarries cease being operational. The potential transformation of quarry sites into a variety of sustainable uses would not only remedy the negative effects of quarrying, but could create sites of greater social, environmental and economic capacity.

Location and Purpose

Located in the center of San Diego, California, this quarry had served as the major stone and concrete source for construction projects in the region for the last 70 years, including the downtown baseball stadium of the San Diego Padres and airport runways. As of 2008, when the quarry was depleted of its resources, developers proposed a plan to restore the site into a mixed-use housing district including multi-family housing units, retail shops and commercial office space, interchangeably referred to as Quarry Falls or Civita—a name that blends civic with vitality.

Plate 13Regional Map of Quarry Falls

Source: Quarry Falls Specific Plan 2008

Issues Prior to Redevelopment

There are several surrounding neighborhoods in San Diego, that are subjected to the noise, air, and water pollution as a result of the operational quarry. Since the quarry is unsightly for nearby residents, property values in the area are low and complaints are high. The land has allegedly sunken 61 meters from its original level.

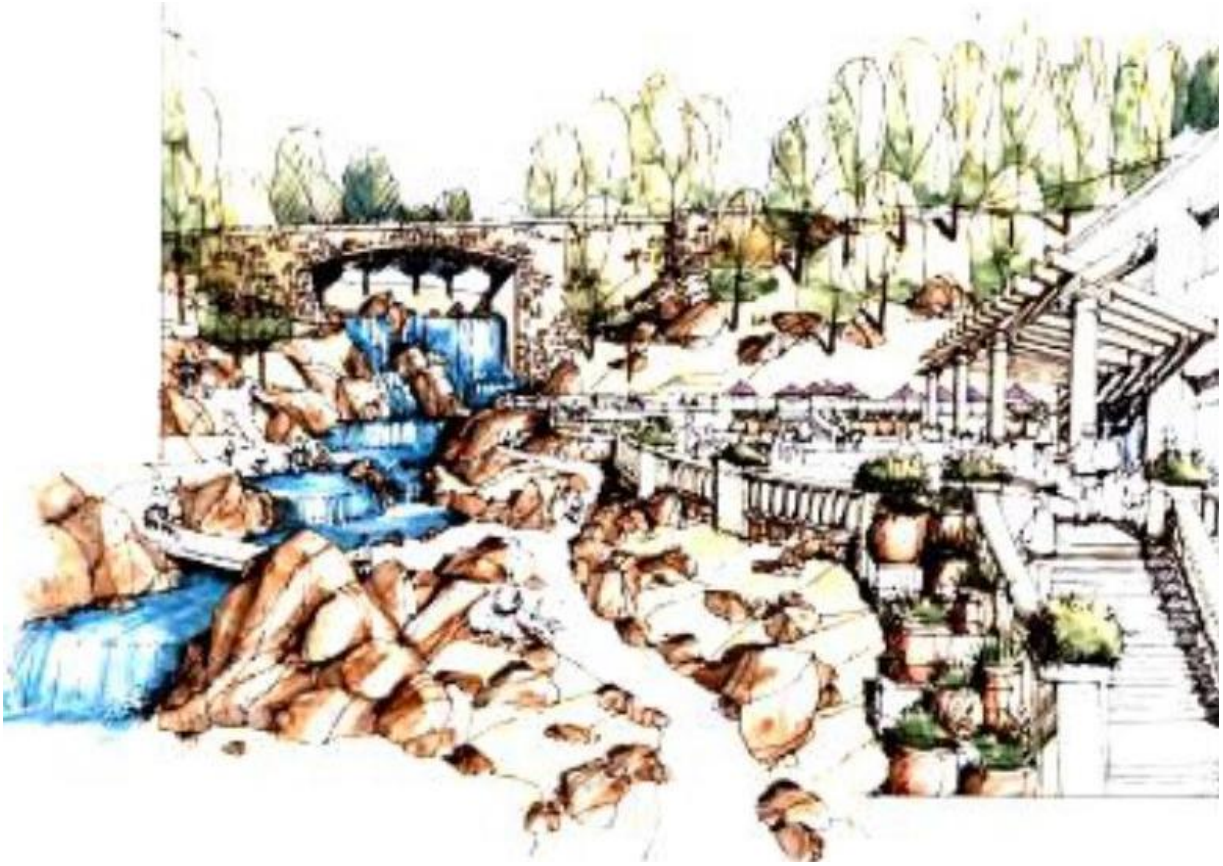

Plate 14Plan of the Quarry Falls Recreation Center

Source: Quarry Falls Specific Plan, 2008

Funding

The large-scale plan was proposed and accepted in 2008, but due to the housing market crash, construction did not begin until 2010 and is projected to continue for the next 15 years. The adoption of the Quarry Falls specific plan by the San Diego City Council establishes the city's official development policy for Quarry Falls. The quarry has been owned by the Grant family since the late 1920s and was taken over by the Corky Mc Millin Companies of San Diego contracting company and the Sudberry Properties development agency. The budgeted $1.5 billion project is said to be financed from construction loans through local banks that had been lenders for Sudberry projects.

Features

The Quarry Falls plan features 91 hectares or 225.0 acres planned development located within the city limits of the City of San Diego. Organized around an expansive system of terraced parks and urban open space, the Specific Plan's various land uses are combined to allow optimal

integration of a variety of housing types; a mixed-use area, with neighborhood, community and lifestyle retail commercial uses; and office/business parks linked together by a functional and efficient network of pedestrian trails and sidewalks, bicycle paths and vehicular circulation. Quarry Falls will include 15 hectares or 37 acres of parks and trails, 4,780 living units, a self-sustaining community with an elementary school and shops, trolleys that connect to public transit, large waterfalls, and an emphasis on sustainability, energy efficiency and recycling.

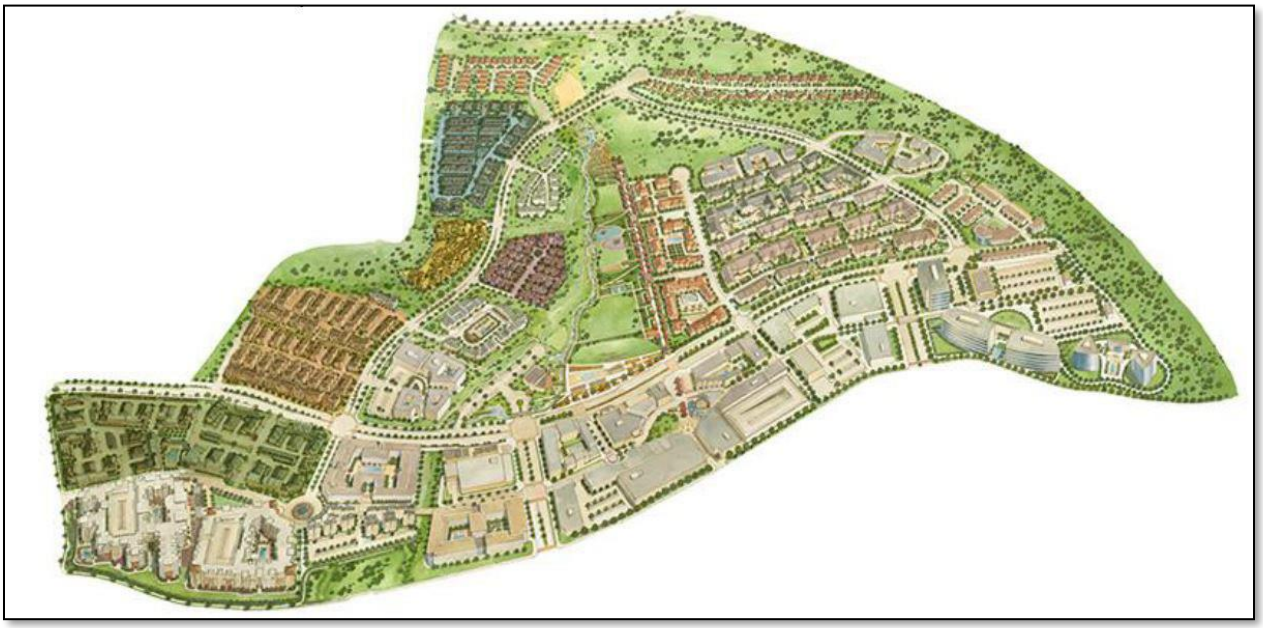

Plate 15 Aerial Map of Completed Plan for Quarry Falls.

Source: Quarry Falls Specific Plan, 2008

Benefits

The benefits of Quarry Falls are only speculative at this time, but it is projected that, once completed, the project will turn the area into a thriving center of residential, retail, office and business space. The current living member of the Grant family was determined not to let the quarry, which is on the National Register of Historic Places, be turned into yet another shopping mall. This project has helped provide jobs to many of the construction workers who lost their jobs in the 2008 market crash and will hopefully stimulate the local economy by attracting tourists and inspiring similar projects elsewhere. The desire to incorporate sustainable practices in the area is one to be admired and replicated.

Drawbacks

The cost of the project is very high at $1.5 billion, and the project is a long-term endeavor that may cause discomfort and other unpleasant consequences for nearby residents who are subjected to construction drawbacks until completion. Since the quarry has dropped some 61 meters from its original level, there is also the issue of drainage from the district. However, with the creation of so employment opportunities, living and business spaces, as well as a remedy for the negative environmental and aesthetic impacts, the costs and temporary discomfort resulting from the project are soon to be outweighed.

Public Response

The first housing units went up for sale in early 2012 and have had a very positive response. While living spaces are costly to purchase or lease, the district has been granted many awards for its creation of a smart energy community, including acknowledgments such as the 2010 Outstanding Planning, Leadership, and Service Award from the San Diego Chapter of the American Planning Association, as well as the 2009 Governor's Environmental and Economic Leadership Award given by Governor Arnold Schwarzenegger. As the project continues to grow and parks are completed, the public response is expected to be even more positive.

Chapter III: RESEARCH METHODS AND MATERIALS

3.1 Description of the Study Area

This portion of the paper gives information on the history and naming of the study area, 'Bole-Qatla'. Furthermore, the geographical location of the site is described and adjoining establishments have also been incorporated to give an overall clue about the site. The issues raised in the topography of the site also reveal that its topography is dynamic due to the quarry activity. Finally, the land use of the site in the previous and current city-wide master plans presented, besides the current detail land use have thoroughly been discussed.

3.1.1 History and Naming of the Study Area

The area has no clearly written history study so this information is compiled by asking open-ended questions of the site elderly dweller's. According to Mr. Alemu Yadeta and Mr. Anbesse Feyessa, both born and raised on the site stated, displaced people due to different reasons come from a deferent place such as Lemi, Kunta and Meri since 1985 GC. After the settlement of the displaced, the immigration to site was minimum and only these dwellers continue their lively hood. Since then the neighborhood residents leaved peacefully, respecting one another. The term Qatla means a living place for people living as one heart for one vision. All of the inhabitants used to be farmers. They cultivate Teff, wheat and sorghum in the area. This enables them to cover their subsistence demand and sell it to generate an income.

3.1.2 Location of the Study Area

The study area is located in the far eastern part of the city (Plate 16), Bole sub-city, Woreda 10, commonly called Bole Qatela. It is located at a distance of 8.30km from the nearest urban center "Megenagna". The site location is situated at 8°59'N Latitude and 38°52' Longitude. It covers 106.9 hectare or 1069000 m^2 area of land.

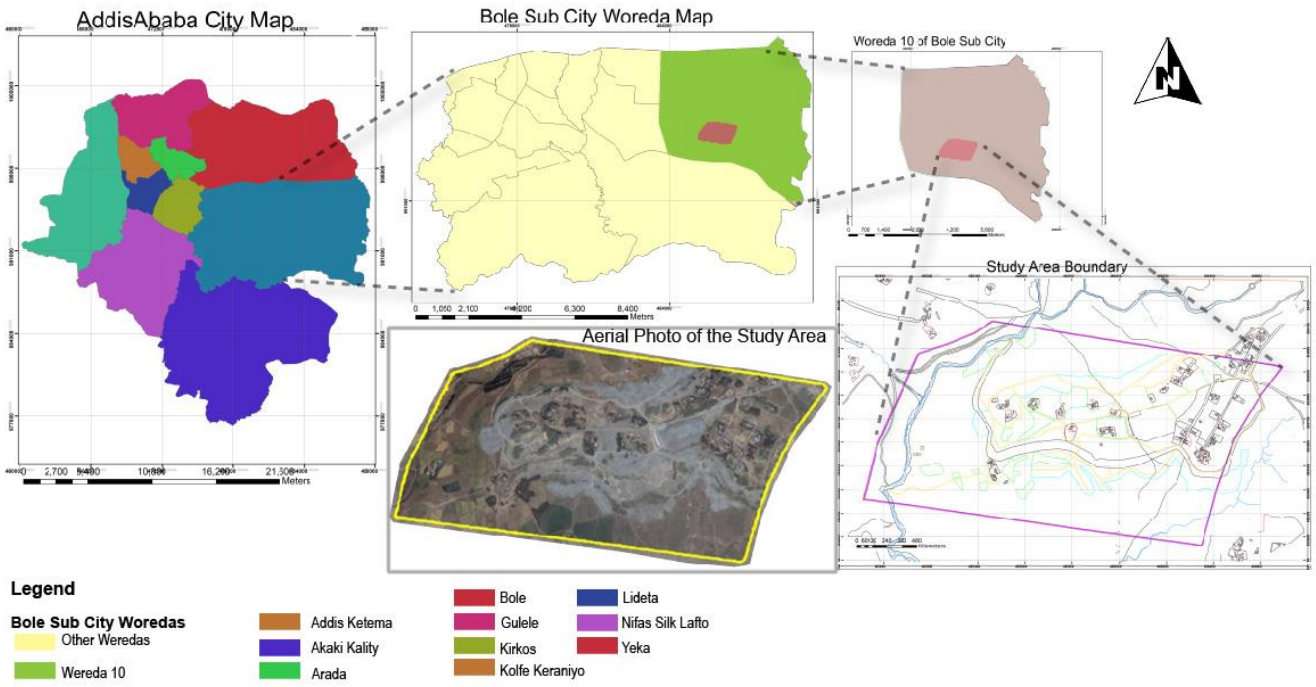

Plate 16Location map of the study area

3.1.3 Topography of the Study Area

As it is shown on plate 17 the area has a wide slope variation. The range exceeds from 0 - 78 % slope and an altitude difference of 71 meters. The minimum elevation is along the Beshale River, which is 2280m above mean sea level (a.m.s.l) and the highest elevation lays at the right top corner of the site in the residential areas, which is 2351m (a.m.s.l). The western border of the site bounded by Beshale River following that the slope of high steepness is located in the area. On the top, right corner and the center of the site has a genteel slope of 0-4%. This slope variation of the site has a direct impact on the land use and housing scheme of the site before the quarry had started. Land with gentle slope mostly used for residential use and the rest used for agriculture, grazing land and open space. Correspondingly, every water drops flowing through the neighborhood can drain towards the Beshale River or other small tributaries.

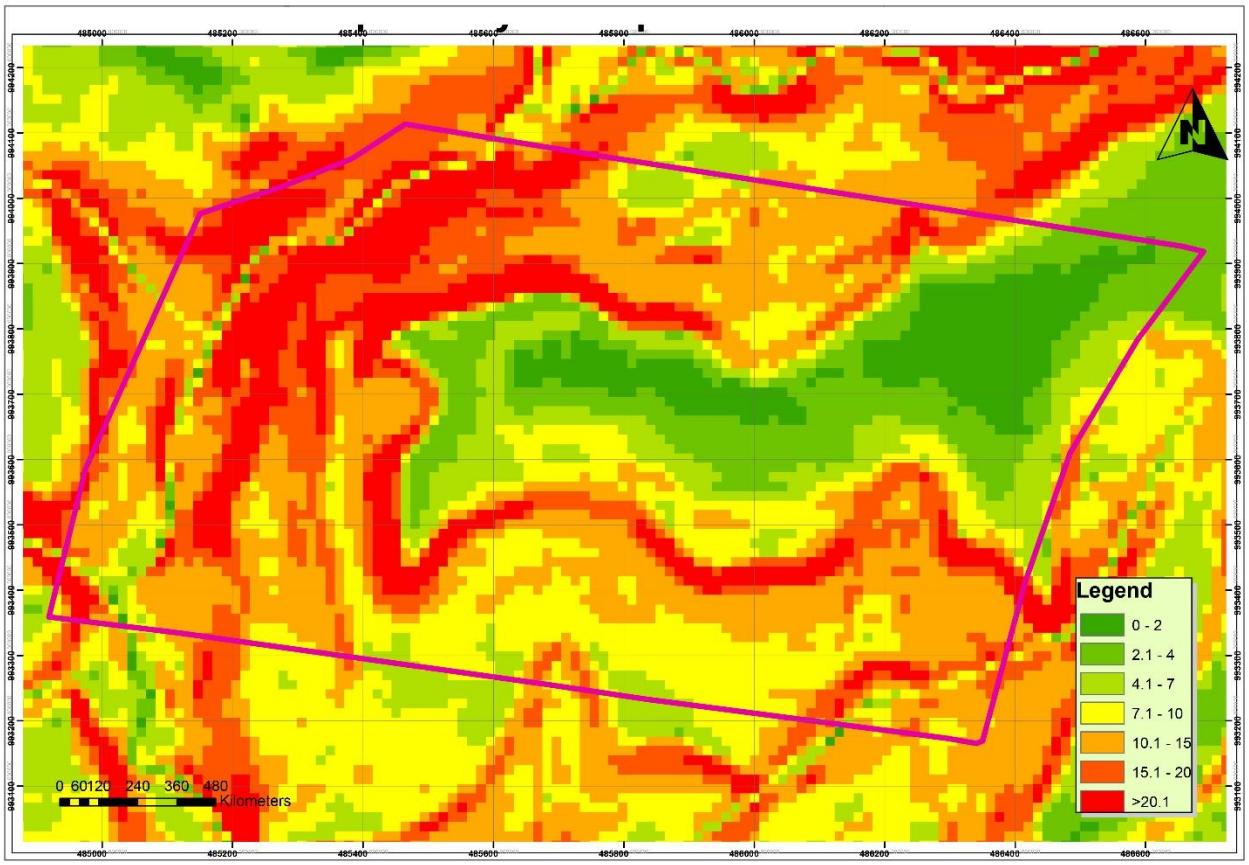

Plate 17 Slope analysis map of the study area.

N.B: the slope analysis map does not show the topographic change due to the quarry on the site

3.1.4 Geology of the Study Area

The bedrock geology of Ethiopia embraces a great variety of rock types within a wide age range (Mengesh, 1996:). Precambrian metamorphic and igneous rocks cover 23% of the country and include some of the most interesting building stone sources, such as marbles, granitoids and soapstone. Thick successions of Paleozoic and Mesozoic sediments (25%) overlie the Precambrian. These include building stone quality limestones and sandstones. A large part of the country is covered by Tertiary and Quaternary volcanic rocks (44%), and in these areas, basalts, tuffs and ignimbrites are extensively used for local housing and construction (Haileyesus Walle, 2000).

A number of small quarries are worked in the vicinity of the capital (plate 18), mainly by hand, using simple tools. The ignimbrites are somewhat harder to work than the tuffs, and therefore more commonly used for rubble than ashlars. Due to their softness, such rocks are, however, not very suitable for use as paving stone and stairs.

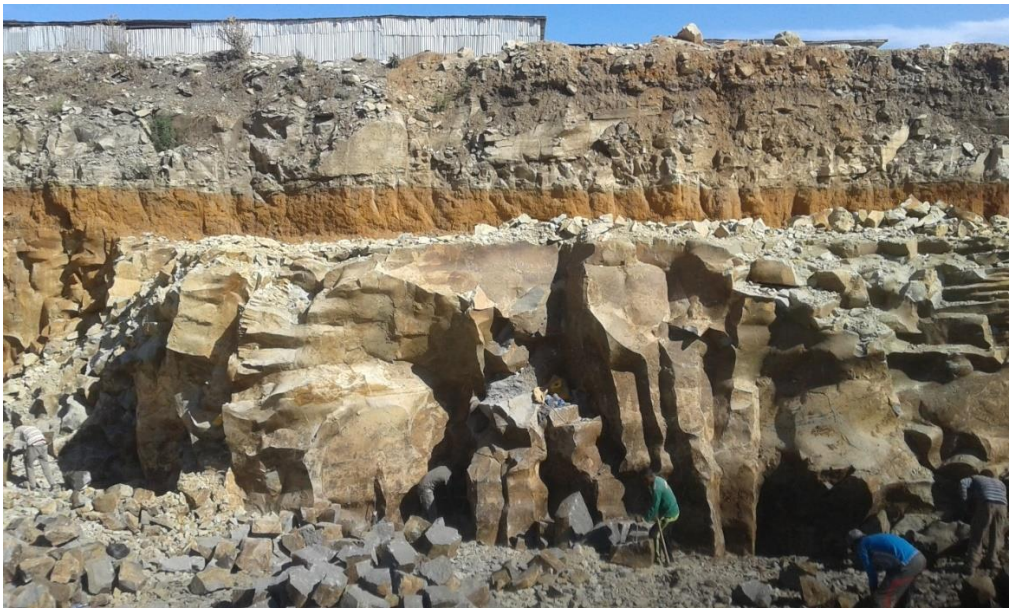

Plate 18 Bole Qatla Ignimbrite Quarry

Source: field photograph, 2017.

Tuffs and ignimbrite deposits are also exploited at several other places in the country. For instance, the famous, rock-hewn churches of Lalibela are carved in soft tuffs, and these rocks have also been employed more recently for local construction in the area. In general, due to its tuff as well as ignimbrite nature and mass existence of those rock types are found in most part of quarry sites that used for extraction of construction materials.

3.1.5 Land Use of the Study Area

Land use involves the management and modification of natural environment or wilderness into built environment such as settlements, neighborhoods and semi-natural habitats such as arable fields, pastures and managed woods. It also has been defined as "the total of arrangements, activities and inputs that people undertake in a certain land cover type (Peter, 2002). The major land use categories are Residential, Commercial, Mixed Use, Services, Administration, Manufacturing and storage, Recreational, Open Space, Forest and others.

A. Land Use of the Study Area on Structural Plans of Addis Ababa

The two consecutive structural plans of the city classified the site for similar purpose. The 2002, structural plan (plate 19&20) define the study area for proposed mixed-use of residential use. The rivers that define the left border of the site and the other, that touches the right bottom corner are expected to be buffered. On the other sides of the site, 30m width of sub-arterial street bound or/and defines the site. Also, a 30m width of sub-arterial street bisects the site from north to south.

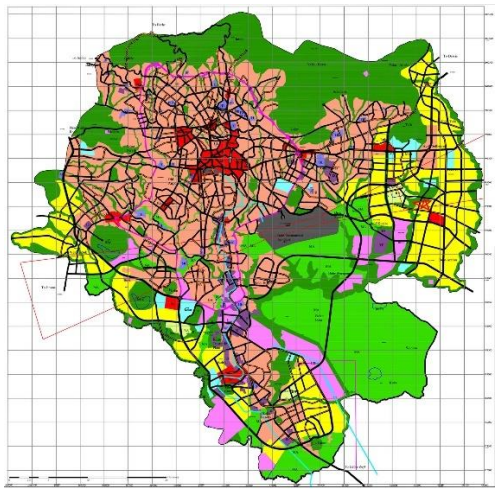

Plate 19 Addis Ababa Structural plan, Land use map (2002)

Source: A.A Structural Plan of, 2002

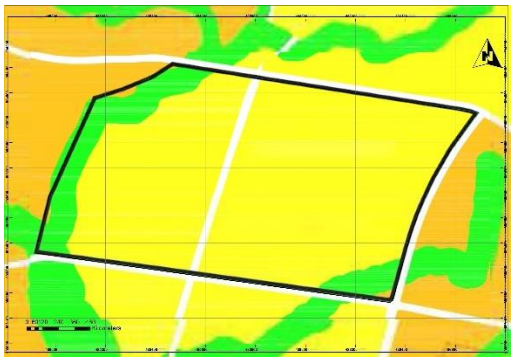

Plate 20General Land use map of the study area (2002)

Source: Extracted from A.A Structural Plan of 2002

The 2017 structural plan defines the area for medium and low density mixed residence (Plate 21 & 22). Besides that, it tries to integrate services from the proposed local development plan and neighborhood design of the area. Following that six woreda level playing ground fields, one health center and one high school are proposed on the site.

The structural plans state not permitted uses within the area to mix with. This are industries, manufacturing and storage that require more than 500m^2 areas; military establishments or prison; waste treatment plants and landfill sites; services like stadiums, slaughterhouses, festival sites and cemeteries. Mining and quarry are also unacceptable uses/ activities within the area.

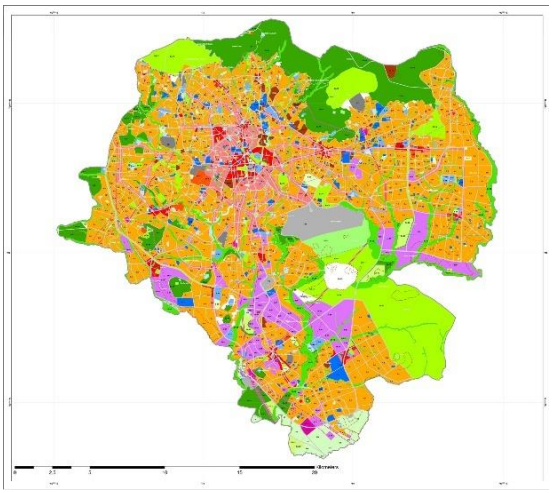

Plate 21Addis Ababa Structural plan, Land use map (2017).

Source: A.A Structural Plan of 2017

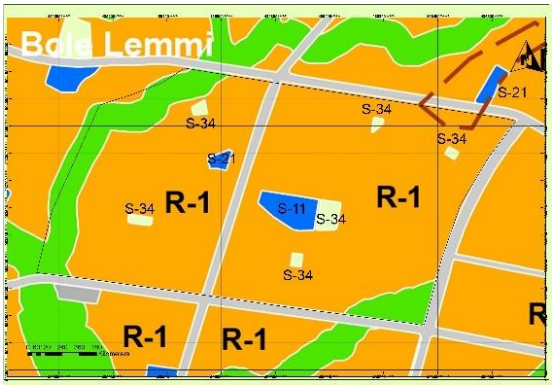

Plate 22 General Land use map of the study area (2017)

Source: Extracted from A.A Structural Plan of 2017

B. Land Use of the Study Area

The World Bank Group define, land use planning as a process by which a society, through its institutions, decides where, within its territory, different socioeconomic activities such as agriculture, housing, industry, recreation, and commerce should take place. This includes protecting well-defined areas from development due to environmental, cultural, historical, or similar reasons, and establishing provisions that control the nature of development activities (World Bank, 2012). The majority of quarries are located fairly close to urban environments due to the expense of transporting raw materials into the city for industrial use in buildings and roads. As a result, inhabitants of neighborhoods near quarries are subjected to air pollution from dust, noise pollution from trucks and machinery, and the destruction of what may have once been a beautiful landscape. Not only do quarries often negatively impact those who live nearby, but they often leave residual negative impacts on the environment.

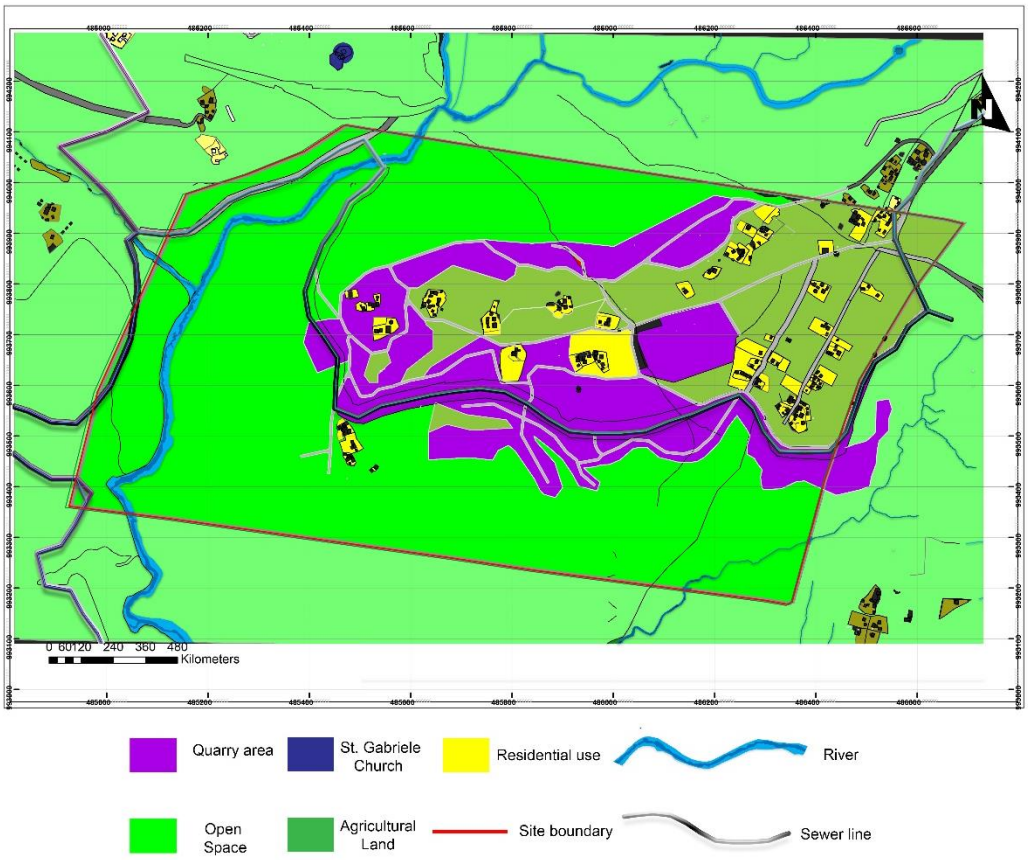

Plate 23 Land use of 'Bole Qatla' Quarry.

Land use of the Bole Qatla at the time of this study, it is different from the structural and master plan discussed above. The area dominated by quarry activity and that comes with it. The quarry area (Plate 23) use for cobblestone production outdoor sitting place for chiselers and next to that abandoned quarry pits. The quarry is gradually consuming larger territories and exposing the residential uses for difficult situation. The residential households incorporate a mixed use of commercial use and agriculture. The commerce is by selling food, drink and small goods for quarry workers. Consequently, river and sewer line cross the site. The sewer line was constructed before the site start quarrying (Plate 24). This continuous quarrying process is exposing and cracking the sewer line. This is creating air and water pollution on the area. The area has a surface water potential that flows to the south part of the site. Three small tributaries meet on the site. These rivers on the site are polluted by the mud and sand sediment from the quarry.

Plate 24Constructed sewer line at Bole Qatla Quarry area exposed by quarrying

The agricultural and open spaces beyond the quarry are serving for different purposes. The agricultural areas use for the cultivation of Teff, wheat and sorghum in the area. Due to unsustainable water provision activities, this activity is highly dependent on seasonal rain. Agricultural activities such as plowing, harvesting and also storing takes place within the area and in some cases in their residence. Difficult places for agricultural activity are left open for grazing land.

3.2 Research Methods and Materials

Research Methodology is the path to find answers to a research questions. It is a practical step through which a researcher must pass in his/her research journey in order to find answers to his/her research questions (Kumar, 2005). This section describes how the research set criteria for selection of the study area, research methods, data collection methods and instruments, also the analysis and presentation methods.

3.2.1 Considerations for Selection of the Study Area

Bole Qatla area is selected as a case study area, the reason for selecting this area is to study the mining area overall character. Following the cobblestone production on the area any resolution has environmental, social and economic implication. Due to the intention to develop the area for medium density development the quarry reclamation is mandatory. Following that this research

focus on quarry reclamation approach. Moreover, the following considerations were taken for the selection of the study area:

- Governments' approach to medium-density housing development projects without ESIA (environmental and social impact assessment) study and reclamation plan.
- An area with inadequate social and physical infrastructure.
- Quarry project located at the periphery of the city, on a working landscape (agricultural fields).
- Active quarry with ongoing mining process.
- The presence of proposed, medium-density residential neighborhood design for the area.

3.2.2 Research Type

The research used both qualitative and quantitative research types. The Quantitative Research is used to study the area by quantifying the problem by way of generating numerical data or data that can be transformed into usable statistics.

The qualitative research, is used to gain an understanding of underlying reasons, opinions, and motivations. It uses to collect information related to the households, quarry workers and environmental study of the case study. Regarding the households housing ownership, occupation, social safety and security type of data are gathered. Regarding the quarry workers data like sex and age distribution, place of origin, employment and livelihood strategies, social impact of quarrying are gathered. On the other hand, concerning the environment of the study area, air and surface water pollution related data is collected. These data use to provide insights into the problem and help to develop ideas for potential quantitative data.

3.2.3 Research Design

The research design is needed because it facilitates the smooth flow of the various research operations, thereby making research as efficient as possible yielding maximal information with minimal expenditure of effort, time and money (Kothari, 1985). The research uses Descriptive and Explanatory research.

The Descriptive method includes surveys and fact-finding inquiries of different kinds. The major purpose of the descriptive method for this research was to describe the overall state of affairs as it exists at the case study (Bole Qatla quarry area). Moreover, it is also used to describe various facts that are related to the physical, environmental and socioeconomic character of the area. So as to plan and manage quarry reclamation proses.

The Explanatory method is used to understand derelict land reclamation approaches and techniques with their respective advantages and disadvantages related to the character of the site and available resources so as to plan and manage quarry reclamation proses.

3.2.4 Conceptual Approach of the Research

The conceptual approach of the research is organized in three parts.

Part I-Contextual Background: it contains framing and organizing the research. From stated research problem, research objectives are driven.

Part II-Theoretical Background: literature review covering important aspects on quarry operation, reclamation techniques, and landscape elements according to different authors are reviewed. Also, a case study area where a quarry is being reclaimed for a mixed-use housing district including multi -family housing is presented.

Part-III-Presentation, Discussion, Conclusion and Recommendation:

The case study area collected data (both primary and secondary) and interpretation pertaining to is done in this part of the research. Findings on the subject matter, conclusion drawn up, recommendation is given and design proposal is offered.

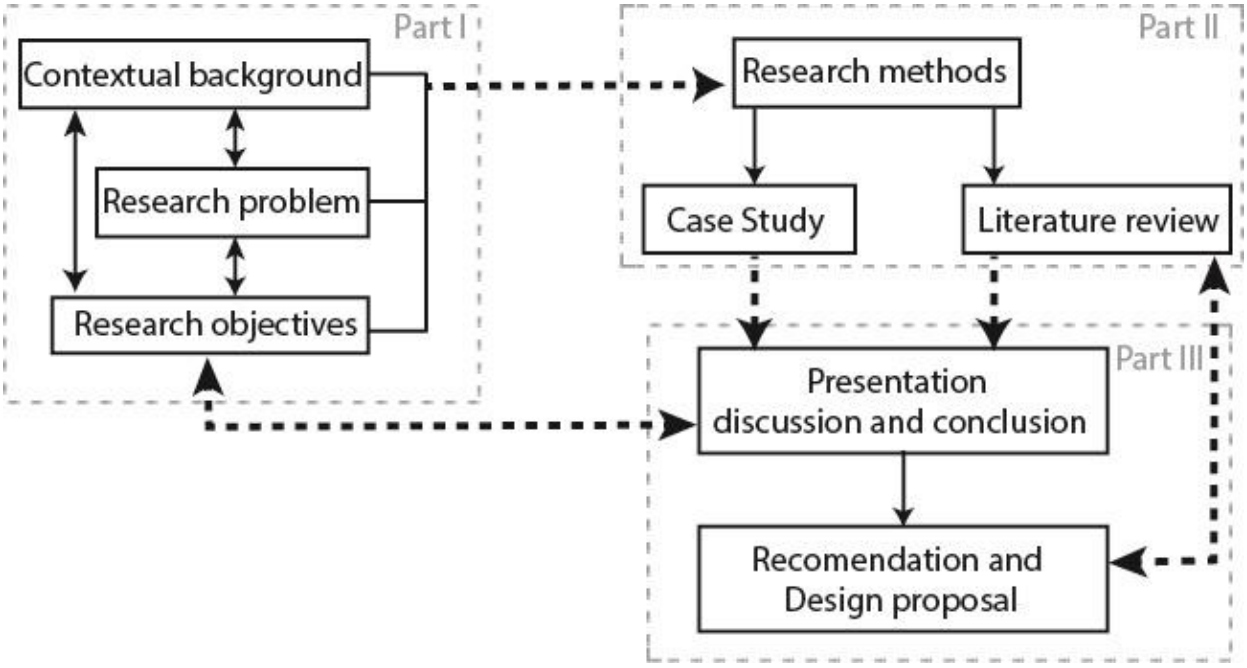

Plate 25 Research Design Diagram

3.2.5 Data Types and Sources

The study used both primary and secondary data sources. The primary data were collected from the local residents, key informants, Bole Qatla Cobblestone Enterprises, Small and Microscale Enterprises of Stone Chiselers and Smashers, Addis Credit and Saving Institution Share Company (ACSI.SC), Bureau of Works and Urban Development (BWUD), Addis Ababa Environmental Protection Authority and Land Development and Urban Renewal Offices of Bole Sub-city. Moreover, field observations were also another data that has been taken as a primary data.

The secondary data has been obtained from the various policy documents, legislation, urban development plans, strategy documents, different official documents, project documents and other relevant published documents appropriate for the issue under study. Moreover, up-to-date version of Google earth map, soft copy base maps, statistical data from governmental and non-governmental organizations and reliable websites are used. Also, elderly residing on the area were informally interviewed about the history of the study area. Each of the sources are acknowledged and cited accordingly.

3.2.6 Data Collection Techniques

The research has scavenged different types of data from different sources. Each type of data has collection methodology. These different data sources and their respective collection method and instruments are illustrated below. As a data collection method field survey, interviews and questioners had been directed to officials and professionals to study issues relevant to the research.

Field survey

The field survey was conducted according to the objectives by using the 2011updated GIS base map of Addis Ababa, prepared checklists (Annex 3 & 4) and camera. The base map used to understand the current status of the area. The checklist includes issues like physical elements, different land uses, available environmental elements, vegetation types and cover. The camera is used to take pictures.

In addition, general field observations have also been undertaken to assess the current status of the area with respect to preparation of land for quarrying and production process. Also, non-participant direct observation and participant observation methods have used.

Interview

It has been conducted to understand the general way of Bole Qatla quarry operation. The interviews comprised of both close ended and open-ended questions. Also, used to study its effect on the environmental, social and economic aspect of the surrounding area. Similarly, data related to the current and future functional integration of the quarry with the surrounding area in terms of land uses and services collected by interviewing four professionals. Also, qualitative approaches, such as informal discussions with professionals, planners and administrative officials were also used.

Information from Addis Lone and Saving Institute, Bureau of Works and Urban Development (BWUD), Urban Planning Institute and Environmental Protection Team at sub-city and city level had been used. Correspondingly some possible suggestions in the view of professionals and residents to improve the quarry operation and rehabilitation of the area is collected. Also, more formal approaches through in-depth interview method is used.

Questionnaires

It was administered by using structured and non-structured questioners to guide data collection. The structured questioner used to collect data from stone cutters, smashers (Annex 2) and residents (Annex 1). On the other hand, non-structured questioner used to collect data from cobblestone enterprises, small and micro-enterprises of stone cutters and smashers. This use to identify relevant data that can achieve the objectives.

3.2.7 Sampling Techniques

The research used both probability and non-probability sampling methods. From the probability sampling method, the study used systematic random sampling. This sampling method, was used to choose potential households on the study area from which the data is to be collected. These households serve as a residence and in some case mixed use of residence with either agriculture or pity trade. Some of the residents still rare cattle, few poses agricultural lands in close proximity out of the site.

From the non-probability sampling method, purposive or judgmental sampling and convenient sampling method has been employed. These methods are used based on the characteristics of a population and the objective of the study. Purposive sampling method used to select the study area of this research (Bole Qatla) and to select quarry workers.

3.2.8 Sampling Frame

A sampling frame should ideally contain a complete, up-to-date list of all those that comprise the population for research (Denscombe, 2010). The sample information on this research specifically the households' data has been obtained from Bole-Qatla housing local Development plan and neighborhood design final report 2015. Also, the 2011 Addis Ababa city GIS database is referred. Following that the sample frame gained from the document is cross checked by site visit. More importantly, the existing private and rented households as well as quarry workers on the study area were taken as frames for the samples.

3.2.9 Sample Size

To set a sample size of the study, the Addis Ababa city wide structural plan and local development plan preparation preliminary study sample size is referred. Depending on size of data sources, the data collection can cover the whole population or be limited to representative samples. If the data source is small, better to take the whole population and in case of big data source, sample approach is preferable (Ministry of Work and Urban Development, Federal Urban Planing Institute, 2006).

The above plans take a 20% and 100% sample size respectively. Following that considering the character of the study this research chooses a 50% sample size. The base for randomizing has been carried out according to the sample frame. Thus, from the total of 72 households that are found within the site, 36 housing units had been taken as a representative of the total and to be studied for this paper.

The selection of households is based on the condition, purpose of the research and the potential neighborhood problems witnessed in the area. Sample household selection was by referring households that share common border and located in close proximity with abandoned and active quarry pits. Also, households that has economic ties with the quarry by selling local beverages and/or birr, renting houses for small shops and hotels. The potential neighborhood problems refer households with inadequate social and physical infrastructures such as potable water, and electricity.-Since households situated in the area experience different spatial, social and economic problems which bear a critical component of sustainable development.

3.2.10 Data Analysis and Presentation Technique

The qualitative and quantitative data collected from primary and secondary data sources were analyzed and presented. Qualitative data from interviews, document survey and field observation were operationalized by qualitative analysis method in order to analyze the current situations. The

data were analyzed by computer aided applications. Thus, Microsoft Excel for preparing charts, graphs and tables, Adobe Photoshop and illustrator used for doing graphical presentation and illustration, likewise AutoCAD is used. Furthermore, the spatial analyses were conducted by using Arc GIS 10.3 (Geographic Information System) analytical tool. The different pictures of the site that are obtained during the field survey are presented according to the point discussed.

3.2.11 Maps Source

The research used maps from different sources. Such as the 2012 Office for the Revision of Addis Ababa Master Plan (ORAAMP) and 2017 structural plan of Addis Ababa, prepared by the Addis Ababa City Planning Project Office and 2011updated GIS line map of the city was used for studying the site and also to extract the contour line of the study area. Furthermore, Arial pictures and Google earth images are also used to analyze the physical status and evolution of the site regarding LULC (land use landcover) change by processing it with ArcGIS Software version 10.3.1.

Chapter IV: RESULT AND DISCUSSION

In this section, based on the information gathered by using questionnaire, interview and field survey from quarry administrators, workers and local resident's descriptive analysis was employed. Furthermore, other key informants: AAEPA, Environmental Protection Office of Bole and Yeka Sub Cities, Land Development and Urban Renewal Offices of Bole Sub-city, Woreda 10 provided important data through interview and questioner.

4.1 Socioeconomic and Environmental Status of 'Bole Qatla' Quarry Site.

4.1.1 Socioeconomic Characteristics

This portion of the paper explores the general status of the 'Bole Qatla' quarry area along with socioeconomic status. The demographic and socioeconomic characteristics of the respondents refer household information, education attainment, income status with social safety and security. On the other hand, the socio-economic status of quarry workers is discussed.

4.1.1.1 Socioeconomic Characteristics of the Household Respondents

This sub title discusses the general information of the household living around the quarry resulted from the sampled household survey. Which include sex, age, year of residence in the study area; their educational attainment and socioeconomic status of the residents around the quarry.

- **Household Size, Marital Status and Residence Year of Local Dwellings**

The household size of the respondents, enquired to know the number of persons living together in a single house on the study area. The question about marital status of the respondents, was asked to know the household head status whether they are single, married, divorced or widowed. The question about the average year of residence in the area was included in the household survey to know for how long they spent in the place. The community around the quarry is commonly living in a rural way of living.

The average household size of the area is higher than the city, the Bole sub-city and even the woreda. Which is 4.1, 3.85 and 3.87 respectively according to 2007 CSA. The site household size is 7.59 from the total household survey 40.3% of them possess 6 to 7 household members, and the remaining 59.7% has more than or equal to 8 household members. Referring marital status of respondents 61% are married and 10% are widowed. There are neither single nor divorced household heads.

Also, referring year of residence within the area more than 73% are born and raised on the site. Following that 26.4% of the respondents stayed ten to 20 years. Neither new comers with less

than ten years period nor dwellers with 20 to 30 years of residence period are present within the area. Correspondingly by referring the family size of respondents, they have big family size. Households with a family size 6 to 8 are 40.3% and households with more than eight members are 59.7%. Households with a family size of five or less are not found by this study. Generally, the site is characterized by larger family size, that build strong social attachment within the years.

- **Housing Ownership and Use Data**

Housing ownership and use data of sample HH is summarized below. The data focus on the ownership of households and purpose or special use of the household. The ownership data help to know the households' tenure on the area whether they are rental, kebele or privately owned. On the other hand, the use of households refers whether they are pure residence, commercial, agriculture or a mixed use of either of the uses.

Table 2Respondent's household purpose of housing

Purpose of Housing	Frequency	Percent
Pure residence	3	9
Commercial	0	0
Agriculture + Residence + Commerce	13	36
Agriculture + Residence	10	27
Commercial + Residence	10	27
Total	36	100

Table 2 shows the purpose of the sample households, 36% use for a mixed use of agriculture, residence and commerce. The agriculture activity includes animal husbandry and urban agriculture. The commercial activities are small hotels, small shops and local liquor stores that provide services for the quarry workers. Supplementary, 27% of the households are used for a mixed use of residence with agriculture. Similarly, the additional 27% of the households are a mixed use of residence with commercial activity. the remaining 9% are pure residence.

Plate 26Residential houses in the area

Source: field photograph, 2017

The mixed use of residence with agriculture units also used as a storage unit of straw for livestock and a place of different household activities (plate 28) the harvested agricultural products.

- **Principal Occupation and Income**

This section summarizes the economic status of the household respondents in the study area. From the HH sample, the productive family member per household is 1.86. Considering the household size of 7.9, its noticeable that the dependency level is high.

The occupation of residents is mostly dependent on the skill and assets they have especially agricultural land. From the sample survey 73% of the households used to have an agricultural land in their neighborhood. Following the expansion of the quarry the government took the land by paying a compensation fee depending on the area of land they have. These respondents are not involved in agricultural activity currently. Similarly, 13% of the respondents still poses an agricultural land around the area and 14% were not having an agricultural land at all, these households are mostly subtenant.

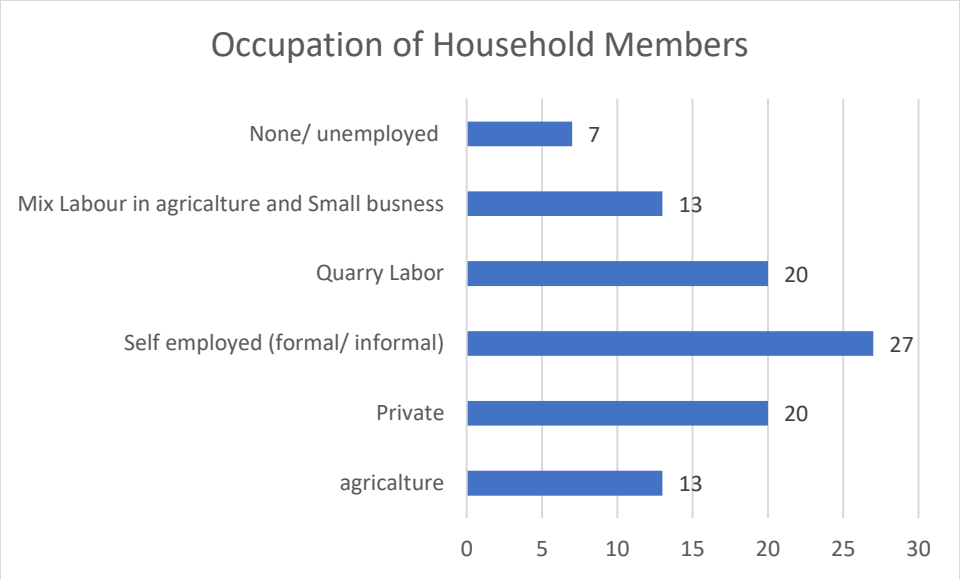

Plate 27 Occupation of Household Members (%)

Referring the economic status of the respondents they were requested about the occupation of the productive family members. The livelihood means data of respondents shows that 27% of the respondents involve in self-employed jobs both formal and informal. These activities include labor works, selling local drinks and alcoholic beverages and other informal conditional works. Following that 20% of the respondents involve in private work and additional 20% of the respondents involve in quarry and cobblestone production work on the area. Subsequent, 13% of the respondents engage in agriculture and additional 13% engage in small business in addition to the agricultural activity. The remaining 7% are unemployed. From the data, it can be seen around 26% still engage in directly or indirectly with agriculture. The quarry also opens a business opportunity to do either small trading or rent houses for these purposes.

The household survey result on the economic status regarding their monthly income. It implied that 57% of the households has an income of one to two thousand birr, 29% are having an income of three thousand five hundred to five thousand. The remaining 14% has an income of two thousand to three thousand five hundred.

Social Safety and Security of the Neighborhood

The respondents were asked about the social safety and security of the neighborhood by referring to the current neighborhood structure with quarry domination as compared with the previous working landscape dominating environment. Regarding the current social safety and security threatening problems the respondents prioritize their problems. According to the data gathered (table 3) land/ house tenure and fear of eviction took the first two highest 32% and 28%

respectively. Following that joblessness is considered the third by 16% concerning point regarding social safety and security. Sound pollution, safety and security is considered as 12% and finally Violence, crime and theft 12%.

Table 3 Social safety and security problems of the neighborhood

Social Safety and Security Problems	Percentage
land/ house tenure	32%
fear of eviction	28%
joblessness	16%
Sound pollution, lack of safety and security	12%
Violence, crime and theft	12%

The agricultural and residential area is taken by the quarry for the extraction of minerals. The agricultural area was taken officially by the government by paying compensation payment for the local farmers. The residential plots of dwellers within the quarry are evicted on the time of these study. Following the above reason, the local dwellers lack guarantee for their land/ house tenure and consequently there is a growing fear of eviction from the area. Almost all of the local dwellers on the area used to gate their livelihood income and subsistence product from agriculture, it's almost the only skill they have. Following that they are facing difficulty to start new careers on other job opportunities, the ones tried are working on labor intensive works such as a daily laborer and quarry worker. As 4 (11%) of respondents mentioned that the study area before the quarry started operation, used to be so quite with no fear of theft nor crime. These days the situation has changed, pollutions of sound from the quarry operation, air pollution from the broken sewer line and dust particles from the quarry production is affecting the dwellers.

Following the quarry and the change that come with it changed a number of things within the area; among this the immigration of quarry workers and petty traders is one. According to key informant's statement conflicts used to happen between quarry workers and local community, but currently there is almost no conflict or arguments. At the beginning of the coble stone production program the government was engaged in organizing homeless from the street for cobblestone production. It's called a Renaissance Project. Following background of these participants some conflicts and disagreements were happening with the local residents. After that, due to government effort to improve their social interaction there is good relation with the local residents.

4.1.1.2 Socioeconomic Status of Quarry Workers

This sub title discusses the general information of the quarry workers in the study area resulted from the sampled 48 quarry workers survey, 4 professionals interview and viewed different documents. That socioeconomic status of quarry workers include sex, age, place of origin; economic status, income, and national contribution. Besides, its social impacts are studied in this section.

- **Sex and Age Distribution**

The labor market for male and female Ethiopian youth drastically differs from each other. Generally, labor force participation rates (LFP) is higher for men than for women. In 2005, 79 percent of Ethiopian women between the ages of 15 and 29 were participating in the labor force whereas 86 percent of Ethiopian men between the ages of 15 and 29 were participating in the labor force. For men, this was a slight decrease from 87 percent participation in 1999 whereas for women this was an increase from 75 % in 1999. The differences are even more pronounced when we look at employment and unemployment rates. Male youth had an employment to population ratio of 83 percent and an unemployment rate of 4 percent, compared to the employment to population ratio for female youth of 71 percent and an unemployment rate of 11 percent (Tekleselassie, 2012).

The main differences in labor market outcomes between youth and the national average are driven by differences in outcomes by gender. This is true for both rural and urban areas. The differences in labor market outcomes for men and women is not unique to Ethiopia. In general, men have more employment opportunities than women. Women have less access to education, formal sector employment, social security, and government employment programs (Todaro, 2008).

Table 4 Respondent's age group.

Age group	Frequency	Percent (%)
18-25	29	60.4
26-33	13	27.1
34-41	4	8.3
42-50	2	4.2
Total	48	100

Like any other labor-intensive sectors all working age groups and both sexes were engaged in stone quarrying. While due to the nature of the work that needs energetic working people mostly

youths and men are involved in the stone quarrying and coble production activities. From the data analysis, some specific type of activities such as stone hammering from the natural deposit and loading it for transportation are 100% male dominant activities. Regarding coble stone production 17.5% of the quarry workers were females and the rest 82.5% were males. Correspondingly, 60.4% and 27.1% of cobblestone workers are in the age of 18-25 and 26-33, respectively. Similarly, 8.3% of them are between 34-41, whereas the age beyond 42 were only 4.2% which was under age category of 42 to 50. The above data point toward youths as the dominant employee of quarry works and cobble production.

- **Place of Origin**

The study area is not used as a shelter or living place for the quarry workers, except for the local residents that engage in the production. Following that the quarry workers are located in adjacent villages or different part of the city. Though the presence of the light rail way transport in close proximity for the site offers wider alternative. Interviewed quarry workers revealed that 94% of the quarry workers were migrants from different regions of the country. These migrants came to the city by different puling and pushing factors. The puling factors may have environmental, social, economic and political bases. It can be for seeking opportunity, safety, stability and freedom. The pushing factors are poverty, disaster and unemployment (Anon., 2017).

Though, the influx of this migrant labor may understandably have a significant positive and negative impact on local social structures as well as economy. From the open-ended questionnaire, the local dwelling respondent said that, the existence of the quarry site close to the communities' village created market opportunity for house renting aimed for shops, small liquor stores, tools welders and food items selling positively and them able to transform them to urban economic activities.

- **Quarrying as a Source of Employment and Livelihood Strategies**

Unemployment rates are rather high, estimated at between 15% and 25% of the labor force, with young people disproportionately affected in Ethiopia (Bertelsmann Stiftung, 2016). Labor intensive job opportunities like quarrying can create substantial job opportunity. Following that the government is providing land, trainings, and other important facilities. Subsequently according to the data gathered through questionnaires shows that 100% of the sample population considered the sector as a primary livelihood strategy and take the job as a full-time. Even though, they consider it as a full-time job it gives them time freedom, workers can do the job either for the

whole day or for a certain period of time per day though, there income depends on their production.

The quarry production on the area has management rules to lead the production and manage the quarries. Among this, a person quite engaging in cobblestone production is not allowed to return buck to the project. Due to this reason quarry workers have an alternative to work or leave for good. According to the data gathered by questionnaires shows that 60% of the respondents worked for more than three years and 40% of the respondents work for 1-2 years period of time. Subsequently the respondents' response implies 59% engage on stone quarrying sector by following their relatives and friends. The remaining 41% respondents engage and work by themselves.

- **Better Income**

Ethiopia is the second-most populous country in Sub-Saharan Africa *(plate 28)* with a population of 99.4 million, and population growth rate of 2.5% in 2015 (worldbank, 2017). The country's per capita income of $590 *(plate 29)* is substantially lower than the regional average as stated on Gross National Income, Atlas Method and coted on (worldbank, 2017). The government aspires to reach lower-middle income status over the next decade. Driven by this ambition the government is working to create jobs for unemployed and jobless. Among this cobblestone production is one.

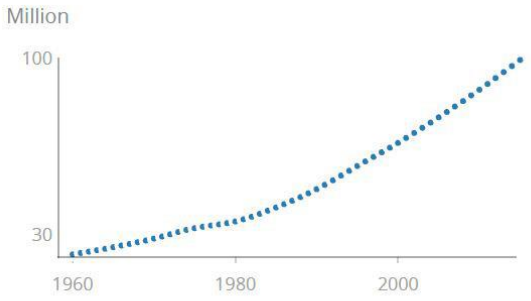

Plate 28Total Population of Ethiopia

Source: (worldbank, 2017)

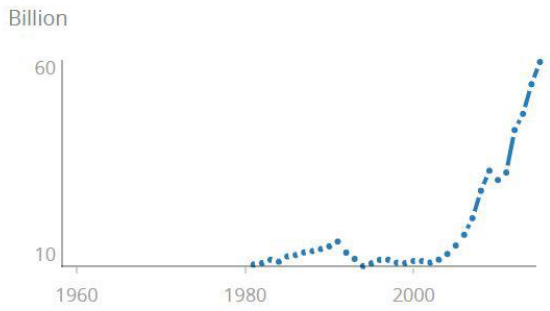

Plate 29 GDP of Ethiopia (US$)

Source: (worldbank, 2017)

As a labor, intensive work quarrying creates substantial job opportunities in many countries. Similarly, the Government of Ethiopia identified it as one of livelihood strategies and facilitates the availing resources of land, credit, tools, trainings and information to those who wants to engaged in the sector (Zelalem, 2016). Following the initiation of the cobblestone production project by the

ECBP, Engineering Capacity Building Program (Tekleselassie, 2012) It created job opportunity for a number of people to generate an income.

As the respondents pointed out income of cobblestone production is directly related with the number of cobblestones produced per day. According to the data amount of cobblestone production rate has direct relation with gender. In average male quarry workers can produce 150 to 210 pieces, also female ones produce 100 to 130 pieces per day.

Quarry workers income is directly related with their production rate, quantity and quality. These products are supplied to AARA, after evaluated according to their standard. The bureau purchases one piece of cobblestone by three birrs. Correspondingly the males get a daily average income of birr 510 and females 330 birr daily.

The cobblestone project has also shows improvement on quarry workers life regarding income increment, update in their marital status and quality of life. 43% of the respondents point out that the cobblestone project improved their livelihood income and 48% of the respondents witnessed an improvement on their quality of life. The remaining 9% of the respondents' got married after they started the job. The respondents have no children to confirm improvement/ change in their children education status.

Table 5 Respondent's cobblestone production amount, income and status change

Quarry workers Sex	Cobblestone Production (piece/ day)	Income (birr/ day)	Average monthly income (Birr)
Male	150-210	450-630	15,300
Female	100-130	300-390	9,900

Status Change	Frequency	Percent %
income	21	43
Marital status	4	9
quality of life	43	48

- **Contribution to Local Economy**

While economic growth is good for job creation, it is important that growth occurs in sectors that have the potential to absorb labor at a large scale. Some sectors and activities are more employment-intensive than others. As Basnett and Sen stated identifies an extensive body of evidence which suggest that growth in manufacturing and services have particularly positive impact on employment. The cobblestone production processes fall in services category due to its

use for infrastructure/ road construction. The impact of GDP growth on employment in agriculture is found to be limited overall, while value-added growth agriculture sector has relatively a larger impact on employment. For textiles, the body of evidence was low, but the studies suggest that growth positively contributed to job creation. For agri-business/food processing, the authors find a positive impact of growth on employment.

The Bole Qatla Quarry, according to the 2013 project report; it has more than 534 unions of chiselers that shape the stones in to cobbles, 62 unions of quarry workers that extract the stones from their natural deposit and some unions of stone loaders. Following the job character and circulation of money (Table 5) in the sector the government set a money saving mechanism for quarry workers as long as they persist in their activity. The saving is obligatory; they are expected to save 40% from their income. The saving is done by Addis Credit and Saving Institution Share Company (ACSI.SC). All the quarry workers have a saving account for saving. The quarries will be able to use their money by the time they live the sector or plan to start other jobs individually or in collaboration.

Therefore, high level of labor intensive projects like the cobblestone production project can make a positive transformation that extend from individual to nationwide GDP. This role can develop individual saving habit and improve living condition of workers. Thus, the saving practice in the sector has been contributing to personal finance; money used to purchase stocks, put in an investment fund or used to buy any asset. In the national scale, it increases the amount of fixed capital available, which contributes to economic growth. Moreover, the saving practice that done by quarry workers contributes to a national saving growth rate broadly as well as the national contribution for the construction of GRED.

4.1.1.3 Social Impacts of Quarrying

Hazardous working and living conditions for, quarrying, cobble chiseling works and surrounding residences are exposed to a high incidence of fatal occupational diseases such as silicosis, tuberculosis and lack of safety (Zelalem, 2016). Derelict lands impose problems for those living and working around it. The workers will face different none transmitted and pollution caused diseases. The residential areas around the quarry also face the consequences according to their proximity and their way of living.

According to the respondents' reply and critical site visit the quarry workers and cobblestone chiselers have faced problems. The problems happen with the respective production process that extends from the extraction of the mineral to final finishing work. The quarry works carry very heavy weights during loading. Also, during cobblestone production the chiselers sit outdoor for a

long time, this expose them to direct sun light consequently increase the body water demand. Due to absence of potable water in the area quarries are exposed to kidney problems. Correspondingly, anemia, visual difficulties and common cold are also common problems. The continuous quarry production sound is also causing hearing difficulties for workers working for more than two years and above. Due to the above reasons, some workers consider it as a transitional work to other preferred or their desired job.

Plate 30 Houses at the edge of abandoned quarry

As stated above the surrounding residences are also the one facing this problem (plate 32). According to the site character a number of residential units are located within the quarry so these houses suffer the consequences by active and abandoned quarries around them. The quarry administration set a regulation to live an offset distance that band quarry for two meters from the fences and thirty meters from the get of residential houses. Unfortunately, these laws are not neither protecting the local dwellers nor being respected properly so they are facing the consequences. The problems are regarding cattle death, and children's falling over cliffs. So far one girl fell and broke her hand, also four cattle's and two calves died by falling on to the abandoned and active quarries.

4.1.2 Environmental Status and Quarrying in the Study Area

This sub title discusses the general information of the physical environment and quarrying process of the study area. The physical environment studied concerning with the waste accumulation and disposal practice, air and surface water pollution of the study area in relation to the mining practice is discussed. Consequently, the quarrying process along with its management practice and physical environment of the site.

4. 1.2.1 Waste Accumulation and Inappropriate Disposal

Derelict lands create a large variety of wastes that need to be treated accordingly. Quarries specifically create a variety of wastes at every step of the processes. The steps can extend from exposing the target mineral up too production of the final output. The waste has a potential of adverse environmental impacts and health threats from solid waste has increased (National

Center for Biotechnology Information, 2017). According to the tangible situation on the Bole Qatla we can classify the wastes in to two according to source of waste production as, the quarry and the residencies around it.

The waste produced by the quarry has also varieties. At the beginning of the processes, large quantity of overburden material on the top is required to be removed to extract the target mineral. This pile of soil, stones and overburden materials are dumped within the site carelessly without proper management. As shown on the picture (Plate 31 a & b) the overburden material is accumulated over the surface without proper management or an intention of reclaiming the quarry.

Plate 31Overburden material within the quarry

a) b)

It is estimated that the overburden waste materials have an average depth of 3 meters and total areas of the abandoned quarry site is estimated to be 41 hectares (0.411km^2) (411,000m^2). Therefore, the volume (V) of overburden material is calculated as:

Volume = Total area of the abandoned quarry sites in the study area X average depth of the topsoil with volcanic tuff materials

$$V=0.411km^2 * 3m=1,233,000m^3$$

With a rough estimation, an overburden material of 1,233,000m^3 is left unmanaged and carelessly deposited within the site. Besides the overburden materials other broken stones are produced as a byproduct during the cobblestone production. The amount of usable pebble depends on the kind and character of the stone. On average from one-meter cube of dimension stone a maximum of 75 to 80 % could be used for cobblestone formation, while the rest 20 to 25 % are left as waste (Zelalem, 2016).

Considering the above information, the site has been quarried for the past five to six years, following that it has created a large amount of withdrawal as a waste or by product. Unlike the overburden material the withdrawal is not dumped or stored on the site; its sold for different construction projects of roads and buildings. This will also impose difficulties on the reclamation processes.

4. 1.2.2 Air and Surface Water Pollution

Quarrying is necessary to provide much of the materials used in traditional hard flooring, such as granite, limestone, marble, sandstone, slate and even just clay to make ceramic tiles (Hsin-Yi Cohen BSc, 2017). However, like many other man-made activities, quarrying causes a significant impact on the environment. This extraction, storing and transportation to the required location methods gives rise to noise pollution, air pollution, surface and ground water pollution, damage to biodiversity and habitat destruction.

Surface Water

Surface bodies of water had been long associates of mining right from the inception (Karmakar, 2012). On one hand, such water bodies pose threats of flood to mine workings and on the other hand pumped out water from the mines when discharged into surface water may cause dreadful pollution. This is true for opencast and underground mines equally.

The Bole-Qatla quarry site as shown on the slope analysis it is located-on top of a hill. Following excavation on the area it alters the natural surface water flow besides that the rainfall on the area creates vulnerability to erosion of surface soil, pollute and create stagnant water bodies in the area. The stagnant water is being a mosquito breeding location for spreading of malaria. This creates a difficult situation for both residential houses in the area and also the development that comes along with the quarry. Besides, the stagnant water is creating difficult situation even for the mining processes. In order to mitigate this problem, the mining committee built a number of ditches (plate 32 a) besides that they also use water pumps to remove water from mining pits plate 32 b). Consequently, due to the erosion of the dumped excavated topsoil and overburden materials it will be washed away during rainy season and causes the increased turbidity and pollution of neighboring rivers.

a) Open ditches on the quarry for channeling surface water

b) Stagnant water sucked by pump

c) Disposed waste on river basin.

d) river basin on the dry sissonnes

Plate 32 Mining activities within the study area

Source: field photograph, 2016 and 2017.

The excavated topsoil and other wastes in the study area were eroded by the surface water to downstream and contaminate the river plate 32 b). As we can see in the figure, the two pictures (plate 32 c & d) show the same river in different time, the polluted river image Figure 4.4 c) was

captured on June 2017 and the clean river image plate 34 d) was taken on April 2016. This river starts from upstream ponds and they are relatively clean revers of Addis.

Ground water

Ground water flows into the mine workings as soon as excavations or removal of burden material are made either on surface or below ground, due to natural flow through pores and permeable zones (Karmakar, 2012). Turbulent flow occurs in the joints, cracks and crevices connecting the mine-workings to water sources like water logged old workings, aquitards or surface bodies of water. Quantum of natural ground water inflow for a specific place may be estimated on the basis of thorough study of hydrological parameters of the media through which ground water movement occurs. This in turn, would include topographical study, delineation of catchment areas, rainfall humidity, air temperature variation etc.

According to the key informants from the field survey there were three water pounds that are used for supplying potable water and other uses. These ponds were used to satisfy the community demand, that are living around the area. Through time due to the mining processes the sewer line going within the site has been cracked and a sewer spill. This pollutes the ponds. Considering the fact, the site has no potable water lines; the community is facing difficulties to get clean water.

Another impact of stone quarrying in the area mainly in shallow quarries is air pollution. High level of dust particles is present in the area, and can be blown by wind, due to heavy tracks and lories. Its impact on the surrounding residents extends from difficulties to dry wet clothes outdoor too facing respiratory organs related diseases.

4.1.2.3 Quarry Products of Bole Qatla Area

From Bole Qatla Quarry site materials like ignimbrite. natural aggregates and others are extracted. These minerals have their own use depending on the character of the specific product. The major products are cobblestone, big stone, curve stone, construction aggregates and production byproducts. The character and use of each of the products are discussed below.

Cobblestone

It is one of the major finished products of Qatla quarry (plate 34). Cobblestone is a natural building material based on cobble-sized stones and is used for paving roads and streets (plate 33). It is chiseled stone with a dimension of (10X10X10) cm with a flat narrow edge to provide an even paved surface.

Plate 33 Paving roads and streets by Cobblestone

Source: field photograph 2017, Lafto woreda 01.

Plate 34 Pile of chiseled cobblestones at Bole Qatla Quarry

Source: field photograph, 2017.

Curb Stone

It's a chiseled stone with a dimension of (20X40X10) cm (plate 36). as the name employed its used for defining or setting a cobblestone paved road layout at the right and left side. It is flat stones with a narrow edge (plate 35).

Plate 35 Defined road sides by curve stone

Source: field photograph Lafto woreda 01, 2017.

Plate 36 Pile of curve Stones

Source: field photograph, 2017.

Big Stone

Like the rest of the products it's chiseled with a dimension of (15X17X10) cm (plate 38). it defines the starting and the finishing line of the cobblestone pavement at the cross section of the road. Also, it's used at the transition of pavement from the cobblestone to the other kind of pavements like gravel and asphalt (plate 37).

Plate 37 Defined road side by big stones

Source: field photograph 2017, Lafto woreda 12.

Plate 38 Pile of big stones

Source: field photograph 2017.

Aggregates and Byproducts

This are the byproducts or residue of the cobblestone, big stone and curve stone production as well as those products that does not meet AARA standard for road construction. The AARA standard refers the dimension and texture/ smoothness of the products. These products sold out as a selected material to different construction sites after crashed and broken down for the desired use.

Like most dimensional stone production in Ethiopia, the Bole Qatla quarry is fully operated by using manual labor-intensive tools. Starting from the mineral extraction up to final chiseling work. Even though the tools vary depending on the level of production and personal quarry workers preference. These tools are different types of hammers and chisels. The tools are made by simple local metal workers. Following that these workers are located themselves on the quarry. The cobblestone production has also opened a job opportunity for these people.

4.2 Land Use/ Land Cover Change of the Study Area

Different studies related to land use and land cover (LULC) of an area consider the area population to be served, the natural environmental condition like topography, slope, soil and ground water tables, the types of material used to distribute the facilities, the safety for reduction of damages on materials and the environmental impacts and health issues of the dwellers. This portion of the paper explores the land use and land cover (LULC) of Bole Qatla area by using detail land use map of the area and two Land Sat images to study its gradual change.

4.2.1 Existing Land Use of the Study Area

The environment is made up of three main land uses natural areas, working landscapes and built environments (Randolphy, 2009). Natural areas are that provide environmental services, including wildlife habitats, wetlands, water supplies, most coastal and riparian regions, national and state parks, and wilderness areas; natural areas that also contain lands that pose environmental constraints, such as natural hazards, including floodplains and landslide areas. Working landscapes, include farms, rangelands, forests, mines, and recreation areas, that provide jobs and contribute to the health of rural economies. Built environments of cities, suburbs, and towns that involve the design, sitting, and type of buildings, transportation systems, sewer and water facilities, and public spaces and parklands. Land uses interact with one another affect a place's appearance, size, functioning, and environmental quality. Deciding how, when, and where these land uses should or should not change is the primary challenge of environmental planning.

Assessment of the existing land uses of the study area is the key part of this study. The following land use landcover were obtained based on the spatial data analysis. The data were supported by taking pictures and observations. Also Interviewing and conduct informal meetings, had been carried out. The land use and land cover percentage and the area coverage of each land category were derived from Addis Ababa base map which is updated and examined by field survey during the study.

Natural areas of the site include Beshale River and open spaces, these covers 9.2% of the site. Also working landscapes including abandoned and active mining pits, patches of eucalyptus plantation, grazing and agricultural land, and cobblestone production/ chiseling areas. The above working landscapes cover 79.8% of the site. Consequently, the built environment which is incorporated by the road network, quarry products storage, residential and mixed uses, this category covers the remaining 11.7% of the site. As we can see from the above data, working landscape is dominant as compared to the natural area and built environment.

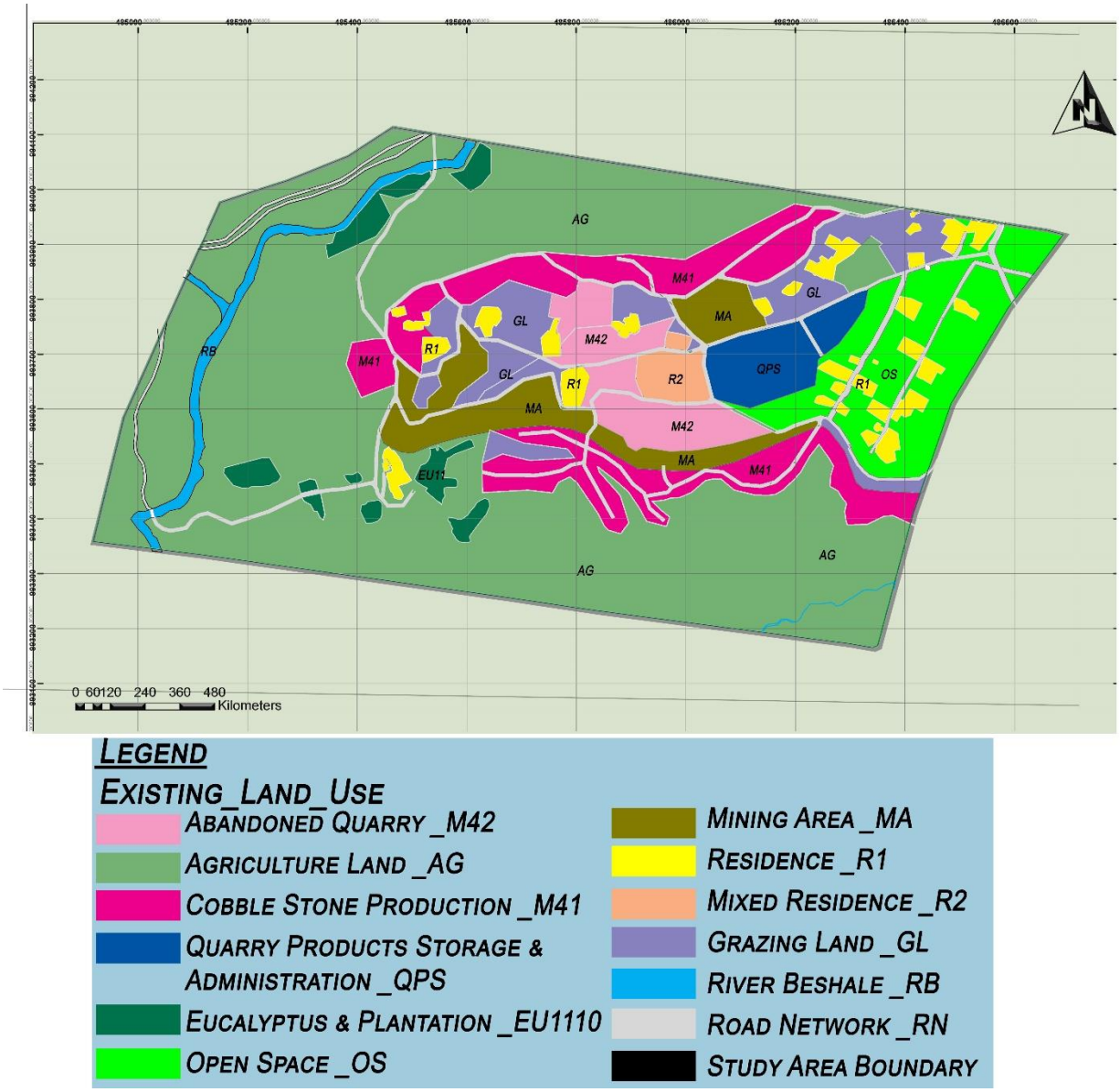

Plate 39Existing land use map of the study area

Land use map (plate 39) of the study area shows detailed land uses with their amalgamation and distribution. Thus, it has resulted twelve land use and land cover classes (see the Table 6).

Table 6 Computed land use land coverage of the study area.

Land use/Land cover	Code	Hectare	%
Agriculture land	AG	56.9	53.2
Quarry area	Q	23	21.6
Cobble Stone Production area	M41	10.3	9.7
Mining area	MA	5.6	5.2
Abandoned quarry	M42	4.3	4
Quarry Products Storage and Administration	QPS	2.8	2.7
Open space	OS	8	7.5
Grazing land	GL	5.8	5.4
Road	RN	4.3	4
Residence	R1	3.5	3.2
Plantation (Eucalyptus)	EU1110	2.5	2.3
River (Beshale river)	RB	1.8	1.7
Mixed residence	R2	1.1	1.1
Total Area		106.9	100

The agricultural land produces serials like Teff, wheat and sorghum frequently. It is administered via old farming activity by the native site inhabitant's. The cobblestone production areas use for chiseling and shaping the dimension stones to produce cobblestones, big stones and curve stones. Most of these areas ones used as mining areas, by the time they become depleted they serve as chiseling area.

Neighborhood open spaces in the site are located at the right top corner of the site. This open space used by the local communities as a grazing land and as straw storing field. The central and north-western part of the site are either active, abandoned or storage of quarry products. Once they are depleted they either use as coble stone production/ chiseling areas or abandon irresponsibly. The residential units, are privately owned by the native site residents. Some are rented for small local bar and restaurants. The quarry products storage and administration located at the center of the quarry. As the name implies, different offices such as AARA, sub-city & woreda MSE, labor unions bureaus and other offices are located.

The compatibility issues are viewed regarding land use and it's environmental and/or landscape compatibility. The land use incompatibility is seen with reference to the mining pits with its adjacent residential houses i.e. residential and quarry practice. The conflict of these areas lays on lack of safety due to high proximity. The environmental incompatibility is viewed against the

mining area poor waste management regarding air, water and sound pollution. The burden materials are dumped on the abandoned quarries irresponsibly. Consequently, polluted waters are also discharged to the neighboring river.

4.2.2 Trend and Rate of Land Use and Land Cover Change

The study area gradual land use land coverage changes during the past ten years have been studied. For this purpose, two Land Sat images were used. Image classification of 2007 and 2017 has resulted six categories of land use and land cover classes in the study. This are bare land, forest, agricultural land, grass land, built up area and river. Table 7 elaborates the above categories classification scheme regarding the land use land cover.

Table 7 Land covers Classification Scheme

Land Cover Class	Description
Bare Land	Areas characterized by bare rock, bare lands (exposed soil and rock), Quarries/Strip Mines/Gravel Pits - Areas of extractive mining activities with significant surface and abandoned quarry site.
Agricultural Land	Is land devoted to agriculture, the systematic and production of crops that is land being tilled.
Grass Land	This land cover includes grazing areas dominantly covered with grasses.
Built Up Area	It is the carpet area covered by considerable constructed materials. (e.g. concrete and mud buildings, etc.). These are residential and mixed-use buildings.
Forest	Areas characterized by dominant vegetation cover (It can be natural and plantation; tree canopy have considerable percent of the cover).
River	Natural flowing watercourse, freshwater, flowing across or through the site.

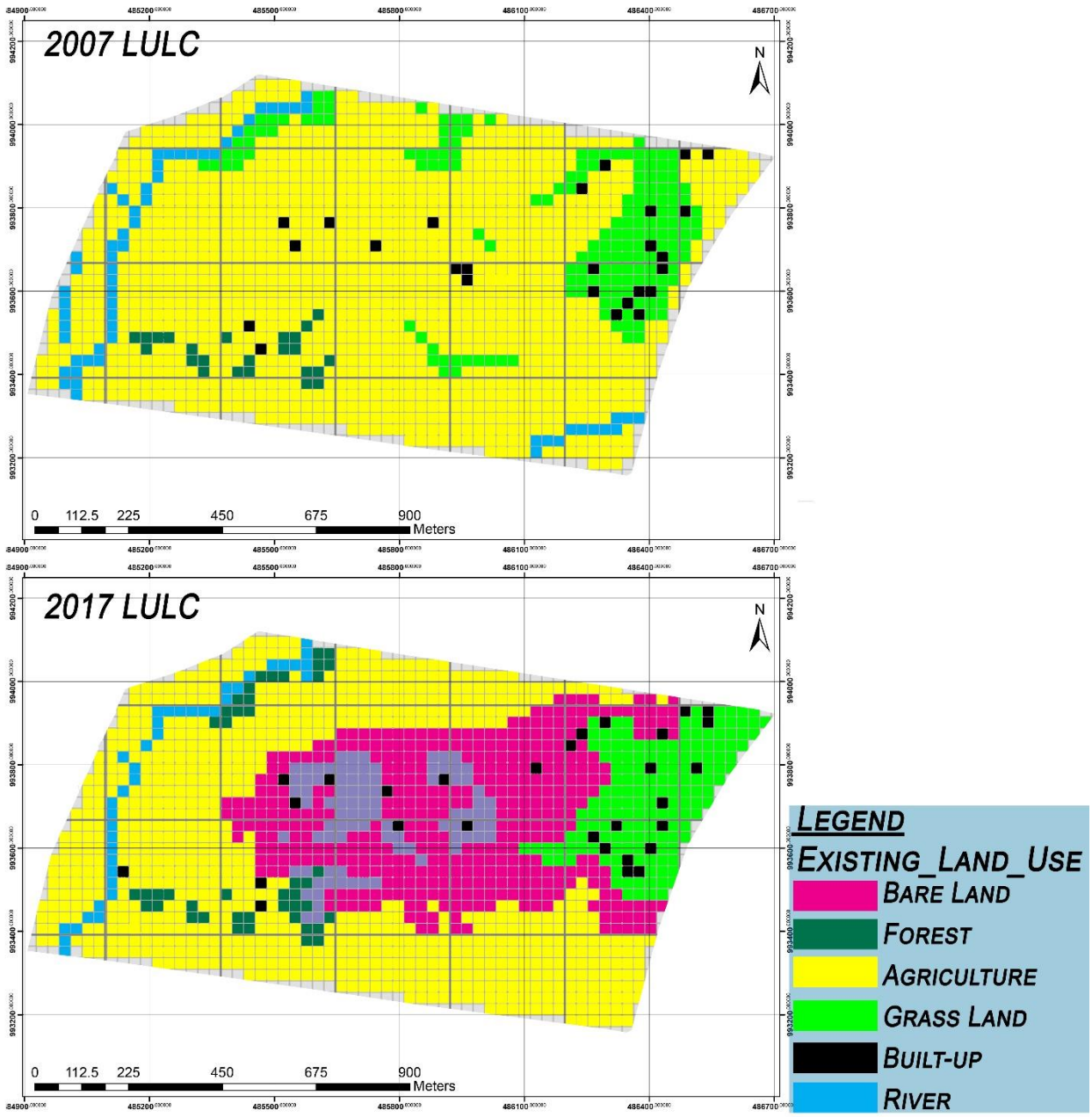

Plate 40Land Use and Land Cover Change Map during 2007 &2017.

The following results were obtained based on the analyzed map (plate 40), in 2007 there were no quarry strips, mines and pits. Agricultural land was dominant it covers more than 85% of the whole area. Grass land is the second dominant land use which takes 8.7%. Built up areas, forest cover and river cover 5.5% of the area. Generally, at time of 2007 the green and blue infrastructures were dominant with minimum and null built up areas and bare land respectively.

Table 8Area Statistics and Percentage Change with Rate of LULC

LULC Type	Base Year 2007		2017		Change Between 2007-2017	
	Area in Hectare	%	Area in Hectare	%	Change in Area	Rate of Change (%)
Bare Land	0.0	0.0	29.2	27.3	29.2	27.3
Forest	1.4	1.3	2.6	2.4	1.2	1.1
Agriculture	91.7	85.8	56.9	53.2	-34.8	-32.6
Grass Land	9.3	8.7	13.8	12.9	4.5	4.2
Built-Up	2.0	1.9	2.7	2.5	0.6	0.6
River	2.5	2.3	1.8	1.7	-0.6	-0.6
Total	**106.9**	**100.0**	**106.9**	**100.0**	**0.0**	**0.0**

According to the 2017 analyzed satellite image some land use land covers show dramatic increment even though agricultural land still takes dominant land cover, 53.2%. Bare land and grass land show increment 27.3% and 12.9% respectively. Following the mining practice on the area fragmented lands converted to open/ grass land. Also following the change in topography of the site and the neighboring area due to the mining and different construction, the water flow is also changed. This lead to the decreasing of rivers, 1.7%.

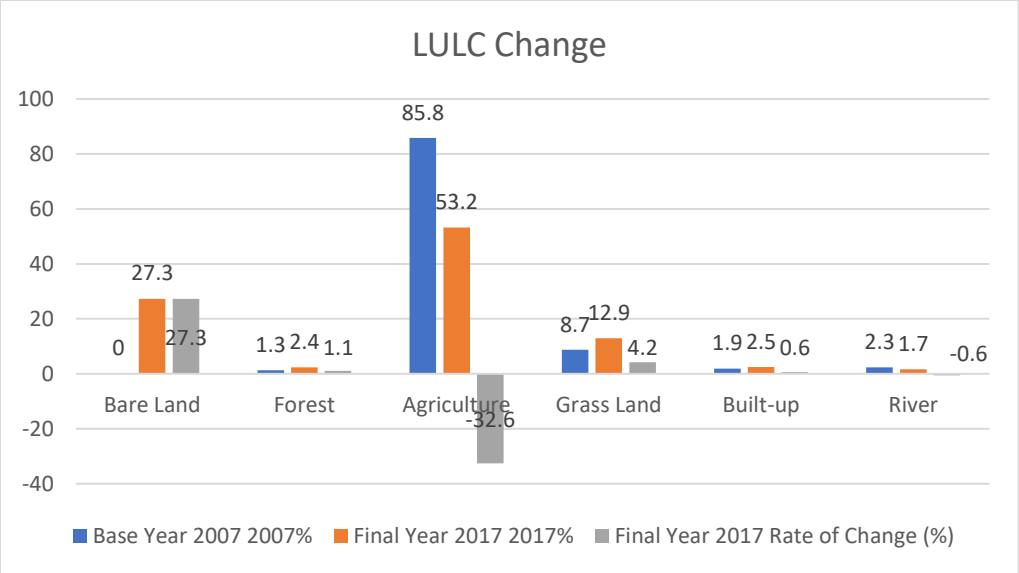

Plate 41Land Use and Land Cover Change over the study period

4.3 Local Development Plan and Neighborhood Design Of 'Bole Qatla'

Housing considered as the major development task to reduce urban poverty and improve the lives of slum dwellers and to bring sustainable socio-economic transformation. Addis Ababa has some 337,700 houses backlog to satisfy the housing needs of its residents and most of the houses in the city are either too old or without necessary living facilities. According to research conducted by city Administration as part of the five-year strategic plan, states more than 25% of the house lack toilets,26% of them do not have kitchen and more than 30% of them are very narrow-sized with no partitions. To alleviate this problems Addis Ababa city Administration launched a huge housing development project in 2005. Since 2005 about 78,000 condominium houses have been constructed and allocated for the residents of Addis Ababa. (A.A City Administration).

To solve the housing problem Addis Ababa the City Administration sets strategic plan along with the nationwide housing development project. From the national housing construction plan of the year 2013-2018 half which is 200,000 is planned to build in Addis Ababa.

Along with different institutions and bureaus that work to meet the above goal, The Addis Ababa City Plan Institute plan and Design Preparation bureau play a designing role. Following that the bureau prepared a high-density neighborhood design that consists 20/80 and 40/60 housings along with different services for Bole Qatla area.

The site used to be an agricultural land for Tefe, wheat and other serials. Due to high deposit of stone resource under the site, it changed to a stone quarry area. On the site, different MSE (micro and small-scale industries) work as a stone aggregate and coble stone production. This activity gradually started to cover wider area, also leave deep gorges, escarpments and burrow a depth of 10-15m. This practice forced a revision of the previously prepared locale development plan of the area.

4.3.1 The Bole – Qatla Local Development Plan and Neighborhood Plan.

The 2013 local development plan of Bole – Qatla was prepared by Addis Ababa City Administration City Planning Institute, in collaboration with Yeha Architects Plc and Pace Consulting Architects and Engineers Plc on May 2015. This plan developed conceptual plan, following that strategies, road network and land use plans are driven. This section reviewed this local development plan and neighborhood plan.

4.3.1.1 Design Strategies and Concept

The aim of the project is to create environmentally, socially and economically sustainable neighborhood. The Strategies are to facilitation for pedestrian friendly, comfortable and safe

neighborhood. This is planned to be achieved by integrating services located at the center of the site and surrounding the open space around it. This open space is created by defining steep cliffs and stone extraction pits that are created by the quarry, can be used as a long green strip.

Regarding the mix of different income groups on the area it's planned to create integration among them. This is driven by creating a mixed-use development and services allocation with their linkage. The proposed services in the area are located either inside the core circle or linked to it. So, by locating different services at the center, it will improve the integration of different income households HH.

Minimizing the segregation/ separation among the site by the arterial street and the cliff by providing pedestrian under pass under the 30m arterial street that bisect the site longitudinally. The different quarry areas especially the abysm will use as topsoil dumping area during construction. This contribute for improving the terrain and to support the idea of creating green area. Following that the green network use for linking the neighborhood. Land for private developers is allocated along the northern and southern roads of the site. Consequently, an urban agriculture is proposed next to the river benches for onsite relocation.

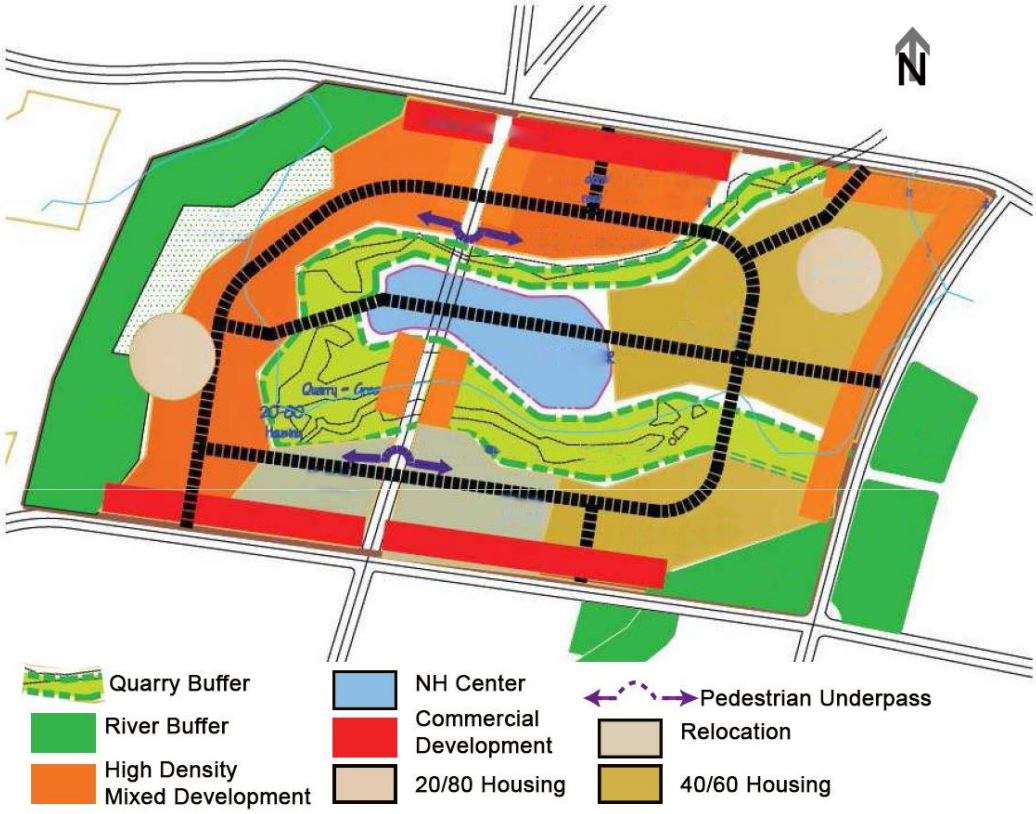

Plate 42 Proposal Design Concept

Source: Bole Qatla Local Development Plan and Neighborhood Design, April 2015.

4.3.1.2 Road Network

The road network of the local development plan, has considered topography, standard of the city (concerning width, and hierarchy,) and the character of the area regarding the abandoned mining area. The road network is designed in a way to minimize steepness of the road.

As the rules and regulations of master plan, local development plan and neighborhood plan preparation standards stated, the gap between consecutive local roads meeting the arterial roads is respected. Also, the standard of road network coverage in peripheral area as of Qatla, it is fifteen to twenty-five presents over the total area. By considering the high cost of vehicular road construction on the old mining area, pedestrian road is proposed within it to enhance and strength the linkage. Also, the standard road spacing will create difficulty for pedestrian extended linkage, so pedestrian only networks are planned in the design. The overall road layout is networked and interlocked by creating loop around the neighborhood

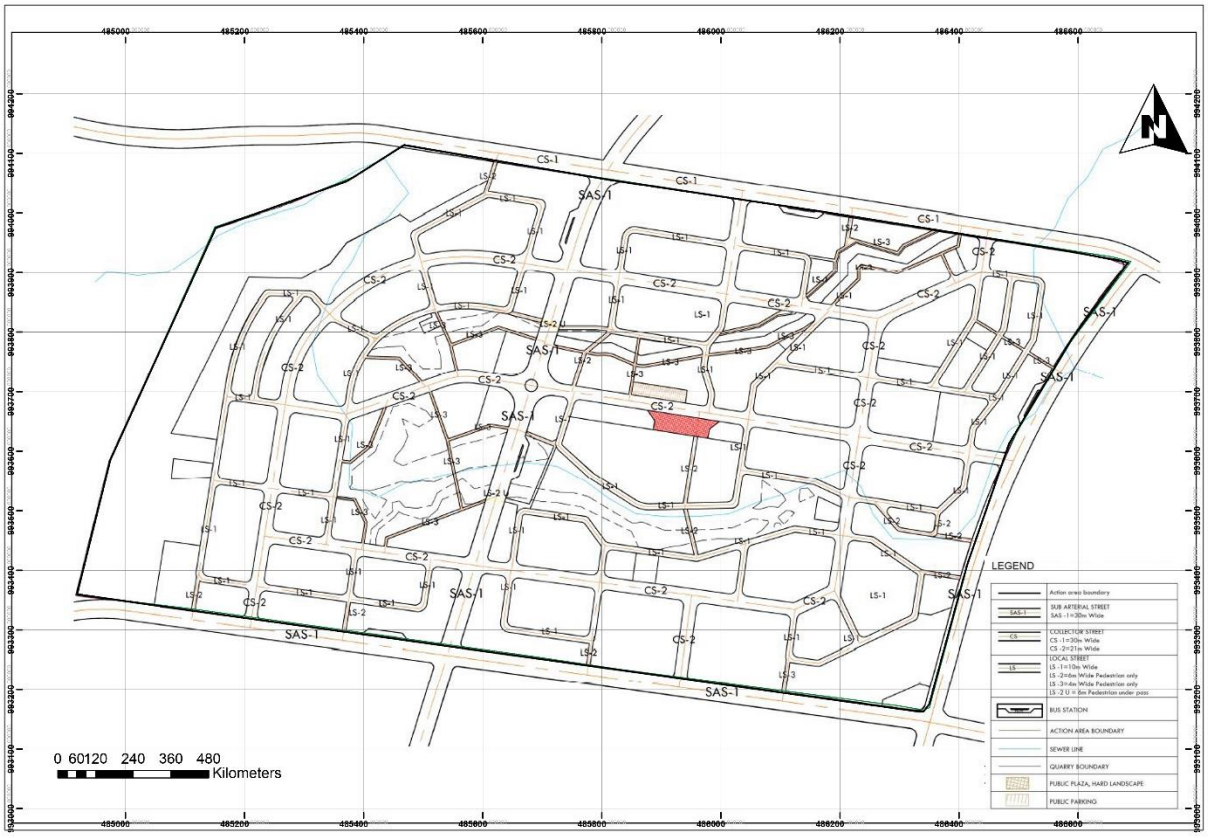

Plate 43 Road network

Source: Bole Qatla Local Development Plan and Neighborhood Design, April 2015.

4.3.1.3 Land Use Plan

The land use plan was prepared by bearing in mind different considerations. Such as standards of road networks and river buffer areas, land use and housing mix. Also, strategies developed from smart neighborhood and new urbanism principle are considered.

Regarding land use mix of services, it contains different land uses such as commercial, mixed uses and housing programs are included. This movement is very use full for the creation of an adverse and active neighborhood. In addition, the community including living in the lease area, demand of service and recreation such as cinema, hotel, and other services will be provided by private investors/ developers. Also, the urban agriculture in the site will create job opportunity for the relocated people and subsequently it provides fresh and cheap food source for the dwellers.

The variety of different housing is mixed in the area. Such as 20/80, 40/60, private houses and those developed by investors. This will help to encourage social integration and promote diversified city. The mining area which covered around 3.1% of the total area, is covered with green frame work regarding the intention of environmental reclamation and also considering its use regarding combating flood in the future. From this green area 25 percent can be used for any needed service.

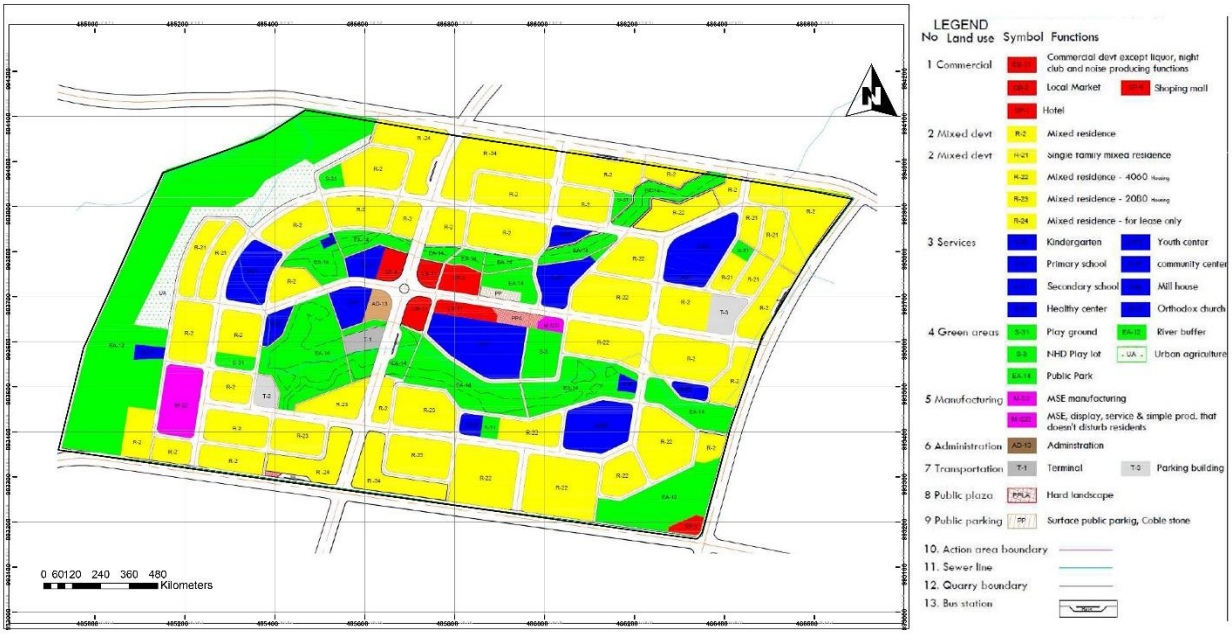

Plate 44 Land Use Plan

Source: Bole Qatla Local Development Plan and Neighborhood Design, April 2015.

Table 9 Proposed land use of the site compared with ORAAMP standard

No	Land use	Required	Proposed	
		%	Area/ ha	%
1	Residence, mixed residence and commerce	55 -575	42.96	53%
2	Services	5-10	8.5	10.5%
3	Manufacturing	5-10	4.24	5%
4	Recreation, and green areas	10-15	3.4	4%
5	Roads (local access and collector streets)	15-25	21.9	27%

Source: Bole Qatla Local Development Plan and Neighborhood Design, April 2015.

River side green buffer and quarry region green area are not included in the calculation of recreational green areas.

The design is expected to incorporate a minimum of 9,720 households. From these a total governmental built condominium houses within the project is: 2,310. For mixed use and commercial uses a FAR ratio of 1:7 unit and an area of 100m^2/HH is considered.

Table 10 Propose households Type and number

No.	Types of houses	The total amount of houses
1	20/80 house	760
2	40/60 house	1,666
3	Houses in mixed use (60%)	9,385
4	Single households' residential units	88
	Total	11,883

Source: Bole Qatla Local Development Plan and Neighborhood Design, April 2015.

4.3.1.4 Waste Management Plan

Like in many developing cities a rapid population growth and high rural-urban migration poses many environmental challenges for the urban areas of Ethiopia. Key problems in relation to the (solid waste management) SWM issues system in Ethiopia are Summarized below.

- Collection services are often inefficient and do not cover all areas. The number of collection vehicles in operations insufficient and municipal waste storage skips are often full and overflowing for several days before being emptied.
- Most official dump sites are poorly managed and cause significant environmental and health impact.
- Illegal dumping practice are widespread.

- In rural areas and some regional cities, solid waste management services are particularly weak, and burning of waste is commonly practiced.
- There is low level of education and public awareness on the impact of poor waste management.
- There is a lack of data in waste generation and waste flows, and there is no overall national waste management strategy for Ethiopia.
- Legislation on SWM in Ethiopia is basic and there is a lack of guidance documents and operational procedures.
- The institutional capacity is generally weak, particularly in monitoring and enforcement of SWM service performance.
- There are some overlapping and unclear institutional roles and responsibilities related to SWM. (World Bank, 2004)

Referring the solid waste management of the area is considered in parcel level. The location of waste transfer sites of the area is located at the parking exit. This will give better opportunity for managing the solid waste management mechanism by creating concerned dwellers.

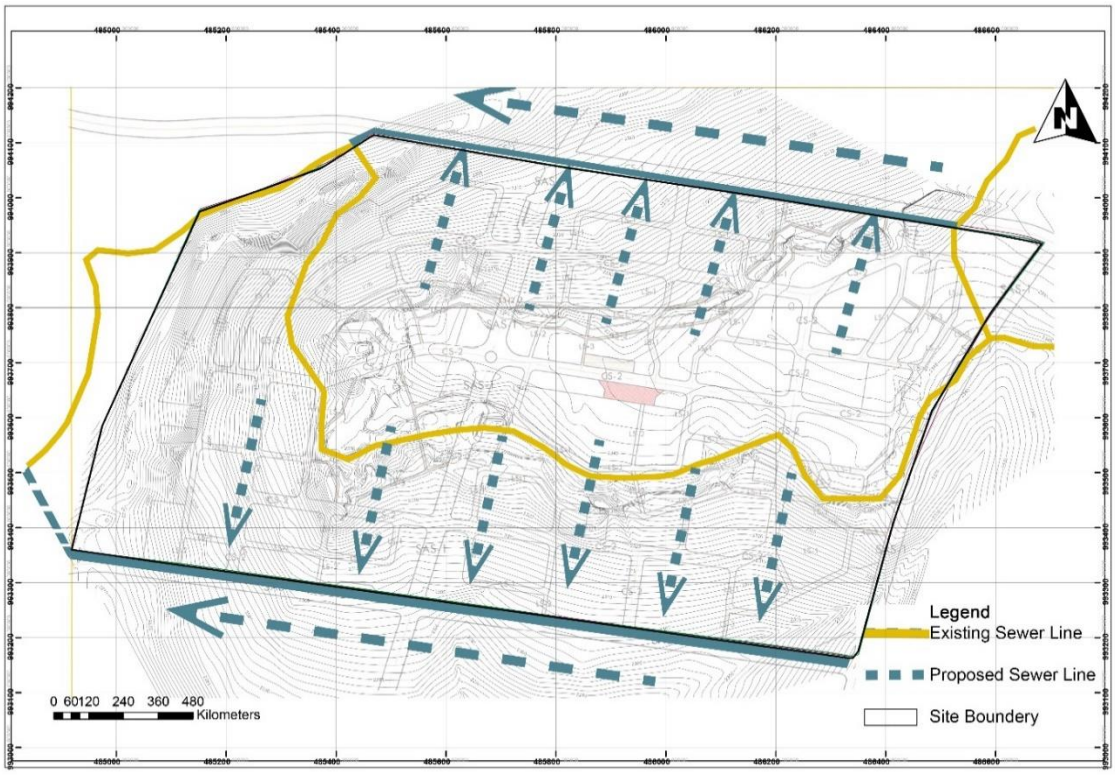

Plate 45Sewer line flow direction and linkage

Source: Bole Qatla Local Development Plan and Neighborhood Design, April 2015.

Considering million liters of liquid waste produced daily from the settlement, construction of septic tank may seem a difficult suggestion. Seas pull is also a problematic alternative considering high water table of the area. Due to the above reasons the liquid waste secreted from the site should be disposed by connecting with the sewer collection line that crosses the site (plate 45). The main sewer line run to Kotebe treatment plant. Accordingly improving the capacity of the treatment plant will be necessary. Due to that by considering dipping terrain of the area caused by the mining process new sewer lines are proposed along with the existing/ constructed sewer collection lines.

4.3.2 Progression of the Quarry Through the Prepared Local Development Plans

Since the quarry has started in the area two local development plans are prepared for the mid-density housing development. The 2011 local development plan did neither consider nor integrate the quarry practice and the terrain of the area and failed to incorporate it in the plan. Nevertheless the 2013 local development and neighborhood design of the area realize the mining practice and tried to incorporate it in the design proposal. Essentially, it dictates the design proposal. plate 46 shows the gradual increment of the mining area through the ages of the two local plans preparation period 2011 and 2013 respectively with the time this study under taken 2017.

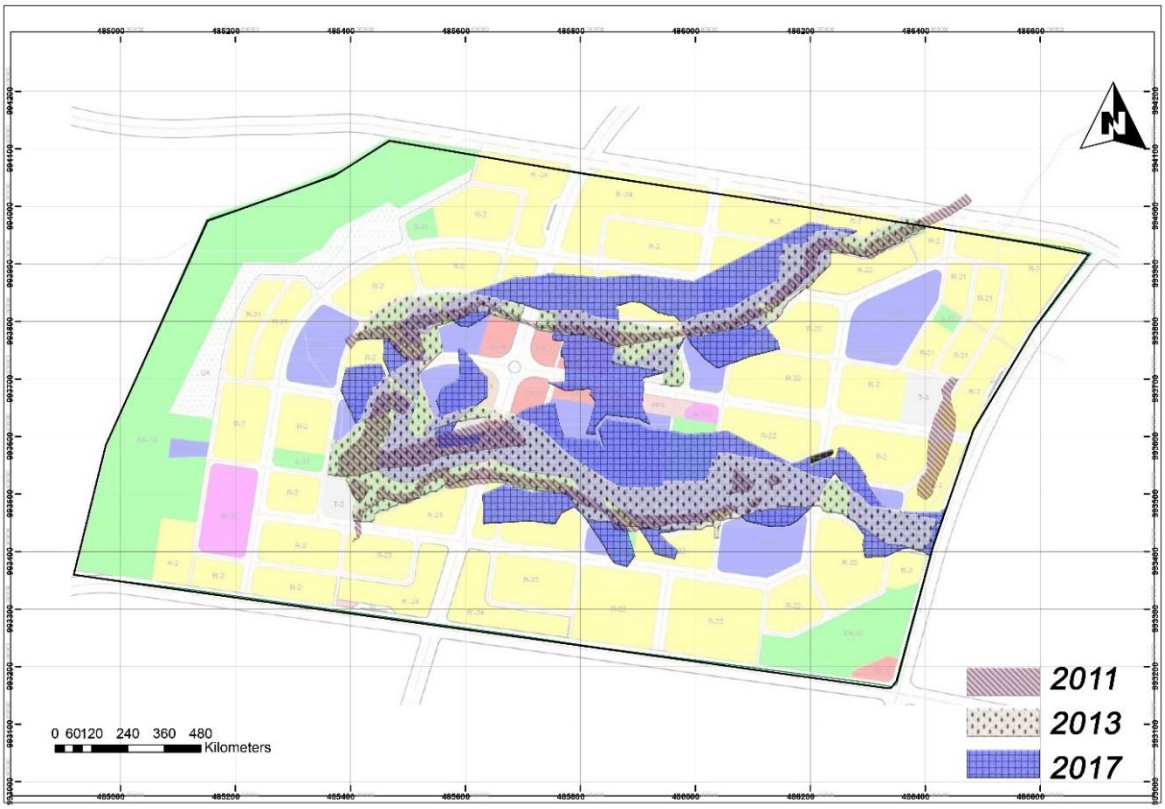

Plate 46 Evolution of Bole Qatla quarry

The quarry continues the extraction of the minerals up to the time of this research under taken. Following that the mining area continue to consume wider area while the overburden materials pilled carelessly on the area. Lack of proper mining management or reclamation plan aggravated the situation.

4.3.3 'Bole Qatla' Local Development Plan and Neighborhood Design

The Bole – Qatla local development plan of 2013 aim to create environmentally, socially and economically sustainable neighborhood. This project tried to create a suitable working and living area. As a strategy it is tried to facilitate for pedestrian friendly, comfortable and safe neighborhood. it's also planned to create integration among different income groups. The plan contains road, land use, neighborhood design, stated rules and regulations and waste management plans. The road network considered topography of the site, standard (regarding width, and hierarchy,) and the character of the abandoned mining area. The land use plan considers the road networks, river buffer areas, land use and housing mix considerations. Also, strategies developed from SMART neighborhood and New Urbanism principles. It contains a mix of uses as commercial, mixed uses and housing programs also different services. The different housing mix in the area (20/80, 40/60, private houses and those developed by investors) will help to encourage social integration and promote diversified city.

Even though it was initiated on the stated ground and has the above advantages it has also some gaps. The design is expected to incorporate a minimum of 9,720 households but the design attains only 2,310 households. It only meets 23.8 % of it. Also, the concept of the environmental sustainability is not gaining enough attention. The site need an environmental and social impact assessment, ESIA study, detailed quarry reclamation plan, also need a revision following the mining area increment. The plan also intends to focus the linkage or networks only within the site. The loop network around the neighborhood and services located at the center of the site can be proofs. The site link with the neighboring blocks and uses is not considered more than arterial road provision. Also, the proposal lacks to consider the quarry workers future direction.

4.4. Summary of Major Research Findings

Table 11Summary of major research findings.

No	Description	The major findings
1	Socioeconomic status of respondents.	• The household size of the study area is 7.59 which is higher than the city, the Bole sub-city and even the woreda which is 4.1, 3.85 and 3.87 respectively. • The marital status of respondents indicates 61% are married and 10% are widowed. There are neither single nor divorced household heads. • More than 73% of the residents are born and raised on the site. Following that 26.4% of the respondents stayed 10- 20 years, with no new comers within less than 30 years of residence time. • The family size of respondents, is big. Households with a family size 6 - 8 are 40.3% and households with more than 8 members are 59.7%. • The site is characterized by larger family size, that build strong social attachment within the years. • Housing ownership within the area 82% of the households are privately owned and administered, the remaining 18% are rented from private owners for residential use. • Most of the residents on the area are illiterate and only small youngster and youths are in elementary and KG.
	Occupation and Income	• Productive family member per household is 1.86. with high dependency level. The occupation of residents is mostly dependent on the skill and assets they have mostly agriculture and labor work. Quarter of the community still engage in agriculture directly or indirectly. The quarry also opens a business opportunity to do either pity trad or rent house.

	Social safety and security	• Land/ house tenure, fear of eviction, joblessness, sound pollution, safety, security and finally violence, crime and theft are the highest regarding social safety and security problems in the area. • Pollutions of sound from the quarry operation and activities that come along with it, bad odder from the broken sewer line and dust particles from the quarry production is affecting the neighborhood.
	Place of origin of quarry workers	• The existence of the quarry close to the neighborhood created market opportunity for renting house for different shops, liquor stores and small hotels.
	source of employment, income and livelihood strategies	• All of the quarry workers considered the sector as a primary livelihood strategy and take the job as a full-time job. • Daily income of quarry workers is directly related with the number of cobblestones produced. Correspondingly male and female workers get a daily average income of 510 birr and 330 birrs respectively. • The cobblestone project has also make changes on quarry workers life regarding income increment, and better quality of life.
	Contribution to local economy.	• The Bole Qatla Quarry site workers in collaboration with three quarry sites bought a 1.4-million-birr bond for the Grand Ethiopian Renaissance Dam (GRED). • High level of labor intensive projects like the cobblestone production project can make a positive transformation that extend from individual to nationwide GDP. This role can develop individual saving habit and improve living condition of workers.
	Social impacts of quarrying	• Derelict lands impose problems for those living and working around it. The workers face different none transmitted and pollution related diseases. The residential areas around the quarry also face the consequences according to their proximity and there way of living.

	Quarrying and physical environment	• The pile of soil and stones, overburden material is dumped within the site carelessly without proper management. The overburden material is accumulated on the site without proper management or an intention of reclaiming the quarry. • The site has been quarried for the past five to six years, following that it has created withdrawal as a waste or by product estimated, 1,233,000m^3 of overburden material is left unmanaged and carelessly deposited within the site. This impose difficulties on the reclamation processes.
	Quarrying process and pollution on air and surface water.	• Intensive mining related excavations on the area alters the natural surface water flow and due to heavy vehicles movement, air and water erosion of surface soil is aggravated. Abandoned and active quarry pits create stagnant water bodies in the area. It is being a mosquito raring location for malaria spreading. This creates a difficult situation for the dwellers around the area. • Over burden materials and topsoil erosion during rainy season causes pollution of neighboring rivers and the increased turbidity. • There were three water pounds in the area that are used for supplying potable water and other uses. These ponds were used to satisfy the community water demand that are living around the area. Through time due to the mining processes the sewer line found within the site is cracked and a sewer spills this pollute the ponds. Considering, the site lack potable water lines, the community is facing problems to access clean water. • Air pollution is observed on the study area mainly in shallow quarries. The pollution is causing respiratory organs related diseases on the dwellers.
	Quarry products and tools of production	• From Bole Qatla Quarry materials like ignimbrite. natural aggregates and others are extracted; from these cobblestone, big stone and curve stone are chiseled, and by products also used as construction aggregate

2	LULC land use/ land cover change	• The LULC of the site shows 79.8% is covered with working landscapes, 11.7% is covered with built environment and the remaining 9.2% is covered with natural areas. • The working landscapes includes abandoned and active mining pits, patches of eucalyptus, cobblestone production/ chiseling areas, grazing and agricultural land. Consequently, the built environment incorporates road network, quarry products storage, and buildings. Thus, natural areas of the site are Beshale river and open spaces. • The mining pits proximity to the residential houses shows the land use incompatibility and the mining process poor waste management scheme is causing pollutions and health risks.
	Trend and rate of land use and land cover change	• In 2007 agricultural land with 85%, grass land with 8.7%, built up areas, forest cover and river with 5.5% were the land cover of the study area with no quarry strips and mines. The green and blue infrastructures were dominant with minimum built up areas and bare land. • In 2017 some LULCs' show dramatic increment such as quarry 27.3% and grass land 12.9% even though agricultural land still takes dominant land cover with 53.2% area coverage.
3	LDP and neighborhood design of 'Bole Qatla' area. Design strategies and concept	• The 2013 LDP aim is to create environmentally, socially and economically sustainable neighborhood. • The Strategies are used to facilitate for pedestrian friendly, comfortable and safe neighborhood. This will be achieved by integrating services located at the center of the site and surrounding the open space around it.
	Bole Qatla road network	• The road network considered regarding topography, standards and the abandoned mining area, designed in a way of minimizing the steepness of the road.

		• By considering the high cost of vehicular road construction on the abandoned quarry, pedestrian road is proposed to enhance and strength the social and spatial linkage.
	Bole Qatla land use plan	• The land use plan was prepared by considering standards of road network, river buffer areas, land use and housing mix. • strategies developed from smart neighborhood and new urbanism principles. • Different land uses such as commercial, mixed uses and housing programs are included to create adverse and active neighborhood. • The variety of different housing is mixed in the area. Such as 20/80, 40/60, private houses and those developed by investors. This will help to encourage social integration and promote diversified city. • The mining area which covered around 3.1% of the total area, is covered with green frame work regarding the intention of environmental reclamation and also considering its use regarding combating flood in the future. From this green area 25 percent can be used for any needed service. • These, a complete government-built condominium houses within the project is: 2,310. For mixed use and commercial uses a FAR ratio of 1:7 unit and an area of 100m^2/HH is considered.

Source: Produced by the author, 2017

4.5 SWOT Analysis

SWOT analysis is the in-depth analysis of the strength and weakness of a particular site by focusing on the internal issues of the site though the opportunities and threats are issues which have positive or negative effects respectively on the site imposed by external issues.

Table 12 SWOT analysis of the study area

Strength	Weaknesses	Opportunities	Threats
• Availability of active working force • The community strong social interaction demonstrated by social organizations • Presence of constructed sewer line where the development is constructed • Different bureaus of the city administration motive to work on the area • Presence of wide working landscape like agricultural field and Beshale river • Need Low compensation cost due to few number of buildings with poor condition. • Presence of high stone deposit for construction. • High job opportunity due to cobblestone production.	• Lack of basic social and physical infrastructures like road, electricity, potable water, school and recreation services. • Absence of local safety and security • Lack of proper mining strategies with reclamation plan. • Lack of accountability and management on the mining processes. • Lack of proper overburden materials management approach. • Pollution of air, water (ground and surface) and sound due to the mining processes. • Poor integration of different government bureaus. • High construction cost for the future development due to unmanaged mining and topography. • Death and injury of humans and animals due to abounded quarries. • Lack of initiation and construction time frame. • The presence of degraded landscape. • Poor rehabilitation practice and vegetation cover. • High surface soil erosion by water and wind.	• Government policies encourage construction of mid-density condominium housing. • Proximity to the neighboring mid-density development. • Good governmental structure.	• Financial Problem • Pollutants released from the spilling sewer line cause of potable ponds pollution and air born disease.

Source: produced by the author, 2017

Chapter V: RECOMMENDATIONS, DESIGN PROPOSALS AND IMPLIMENTATION STRATEGIES

5.1 Conclusions

In assessing the general status of the government-owned derelict land and its overall approach to reclaim and develop medium density housing by reviewing the Bole-Qatla development plan can be conclude as follows.

- The residents living within the quarry characterized by privately owned households with large family size, long residence period and strong social attachment.
- Educational attainment of the residents, almost all of the productive age group is illiterate, generating day living from labor intensive careers like agriculture. The minimum productive family member also indicates high dependency ratio on the area. The quarry activity on the area contribute as an income means, either by petty trade or renting houses. On the other hand, quarry workers are immigrated from rural areas. It created better income and livelihood. Further from that they are contributing for the local economy and GRD.
- The mining activity cause different problems on the physical environment. Considering the site being quarried for the past five to six years, following that 1,233,000m³ of overburden material is dumped carelessly without proper management intention to reclaim the quarry. This will impose difficulties on the reclamation processes.
- The mining practice on the area cause water, air and sound pollution. The water pollution is witnessed on surface and ground water resources. The mining alters the natural surface water flow. Topsoil erosion by wind and water during rainy season specially causes pollution of neighboring rivers and increased turbidity, lories movement, too aggravate the pollution. Consequently, in rainy seasons stagnant water bodies from abandoned and active quarry pits are being a mosquito raring location for malaria. This create a health problem for the dwellers around the study area. The underground water sources pollution put the community in a difficult situation considering, absence of potable water lines in the area. The pollution is causing respiratory organs related diseases on the dwellers.
- The government-owned quarry as of ‘Bole-Qatla’ is neither managed and administered by mining plan nor have reclamation plan. This expose for environmental degradation as well as social problems on the neighboring areas.
- Since the beginning of the mining activity the LULC has been changing through the times. The working and built environment is using wider area were as the natural area is

shrinking. The working landscape covers active and abandoned quarries, coble stone production area, agricultural land, and grazing land. From these even though the agricultural land covers dominantly the quarry related uses are increasing drastically, on the expense of the agricultural land.

- The working landscape on the area includes abandoned and active mining pits, patches of eucalyptus, cobblestone production/ chiseling areas, grazing and agricultural land. Consequently, the built environment incorporates road network, quarry products storage, and buildings. Thus, natural areas of the site are Beshale River and stiped slop open spaces.
- The mining pits proximity to the residential houses shows the land use incompatibility. consequently, causing animals death and humans disabilities. the mining process poor waste management scheme is causing pollutions and health risks subsequently.
- As the rate of LULC change during 2007 and 2017 demonstrate, in 2007 the area dominated by agriculture (85%) with no quarry activity were as on 2017 quarry related uses take 27.3% and 53.2% of agricultural land. From the above data agricultural land decrease by 32.6% and mining has increased to 27.3%. following this drastic increase and absence of mining management plan it can lead to over exploitation of the area.
- Quarrying has led to a significant change in landscape and land cover. Negative landscape changes due to presence of abandoned quarry pits and pour overburden material management along with lack of quarry restoration and management plan, degraded the land.
- The proposed mead density residential settlement is intended to create sustainable neighborhood. It recognizes the abandoned and active quarry pits then integrated it to the design. The proposal mainly consists of proposed land use, road network plans and neighborhood design.
- Since 2013 (the preparation of the Bole-Qatla LDP) the mining area consumes wider area. This will create difficulties to implement the LDP. Following that, a new LDP that recognize the expanded quarry area, needs to be designed.

5.2 Recommendations

The recommendation of this paper focus on two main emphasis. These are techniques or approaches towards urban derelict land reclamation and development of mead density housing development such that the development will proceed accordingly. Therefore, in light of these justifications the following research recommendations are forwarded to realize the actual implementation of the proposals of this paper and techniques of quarry reclamation.

- The poor coordination and communication among AACRDA, MoUDH, Sub-city and Woreda level AAEPA and MSE's lead for extensive environmental, social and economic deficit. Therefore, its recommended those bureaus should work in cooperation for common goals to ensure environmentally friendly and livable mid-density neighborhood.
- Lack of awareness among different government bureaus and the community at large is a barrier that hamper the development and implementation of the proposal. Therefore, meaningful awareness creation program should be made to speed up the process and to create sense of belongingness.
- The river and quarry buffer areas of the neighborhood should be green and vegetated open space. The effectiveness is not only for the sustained functioning of the local environment sensitivity but also for their aesthetic qualities and means of control varies with topography.
- Beshale River, located within the site is being used as storm water discharge from the quarry. Following that water quality of the river is not within the recommended standard. Subsequently the rehabilitation process should consider treatment mechanism.
- Like most government-owned quarry's, the study area lacks a proper Environmental and Social Impact Assessment/ ESIA document (Annex 6 & 7). So, its recommended for the immediate preparation and implementation of the document. The ESIA implementation starts before, during and after the construction of medium density housing on the area. Also, developer should be adapting the progressive, side by side rehabilitation strategy.
- Through the rehabilitation of the quarry and subsequent establishment phases should be amended for the betterment of the environment and the neighborhood. Afterward during implementation its recommended to update the rehabilitation plan considering what went wrong.
- The government/ city administration is recommended to review quarries under its legal boundaries to prepare supervision and reclamation plan for those that lack management plan, and review it for those that have one, to succeed accordingly.

- The current vegetation has low diversity of species, and mostly covered by Eucalyptus globulus. Due to that its recommended to use indigenous plants to rapidly improve the rehabilitation process and increase the water table.
- It is recommended to stop the mining activity on the area and prepare a strategy of mining and land /slope stabilization. Also, by fixing the broken /liking sewer line on the site.

5.2.1 Recommendations for Further Research

Following ideas can be highlighted for further study by considering this research.

1. Apply the proposed design framework and recommendations for wider cases to evaluate the validity and functionality of the framework.
2. Extend the study to identify lean strategies to minimize quarry wastes and environmental impact of quarries in all 3 stages, initiation, exploitation, and finally reclaiming quarries for different purpose in Addis Ababa mining industry.
3. Extend the study to create a win -win situation for the surrounding community, and the owner of the quarry as well as the quarry workers.

5.3. Proposals Plan

The proposals of this study are based on the Bole Qatla Local development plan and Neighborhood design, Addis Ababa structure plan of 2017, and the literatures reviewed. Thus, the entire proposal considers the quarry reclamation approaches by updating or redesigning the quarry buffer area on the Bole- Qatla LDP & NHD and protecting/enhancing fragile environments. Therefore, the process depended heavily on adaptive strategies where the faith on the existing conditions and neighborhood functions takes due attention and the development will proceed accordingly.

5.3.1. Land Use, Road Accessibility and Green Framework Proposal

Land Use Proposal

The proposed land use focus on reclaiming the derelict land of Bole–Qatla without adversely affecting the overall settlement pattern of the local development plan and neighborhood plan. Basic concept for land use proposal has been developed from the existing quarry mining practice and its incremental land consumption trained. Hence the mixed use, commercial, social infrastructures, manufacturing, transport and administration uses driven from the previous plan their respective location and area coverage is strongly considered. The intervention focuses on the abounded and active mining areas during the study. The land use proposal has also considered the road network that interconnect inter and intra site linkage.

Hence the land use proposal consists of commercial uses, mixed development, services, transportation, manufacturing, administration and green areas. The commercial uses incorporate local market, shopping malls, hotel, public plazas with hard landscape and compatible commercial developments. The mixed development consists different housings such as; 20/80, 40/60, lease, single family and mixed residence. The social services consist of kindergarten, primary & secondary school, health center. Youth center, communal center and Orthodox church. Manufacturing use with its display and administration unit is incorporated.

Table 13Proposed Land use of Bole-Qatla Area

No	Land Use Category	Code	Proposed Plan		LDP/ NHD	
			Area(he)	Percentage %	Area(he)	Percentage %
1	Mixed Development	R	36.7736	34.4	54.4	50.9
2	Administration	AD-13	0.3207	0.3	0.3	0.3
3	Manufacturing	M-S2	1.3897	1.3	1.4	1.3
4	Commerce	CB, Sp, PPA	2.2449	2.1	2.2	2.1
5	Green Area	EA	30.4665	28.5	13.9	13
6	Services	S	9.7279	9.1	8.6	8
7	Transportation	T	23.4111	21.9	21.9	20.5
8	Urban Agriculture	UA	2.5656	2.4	4.2	3.9
	Total		106.9	100.0	106.9	100.0

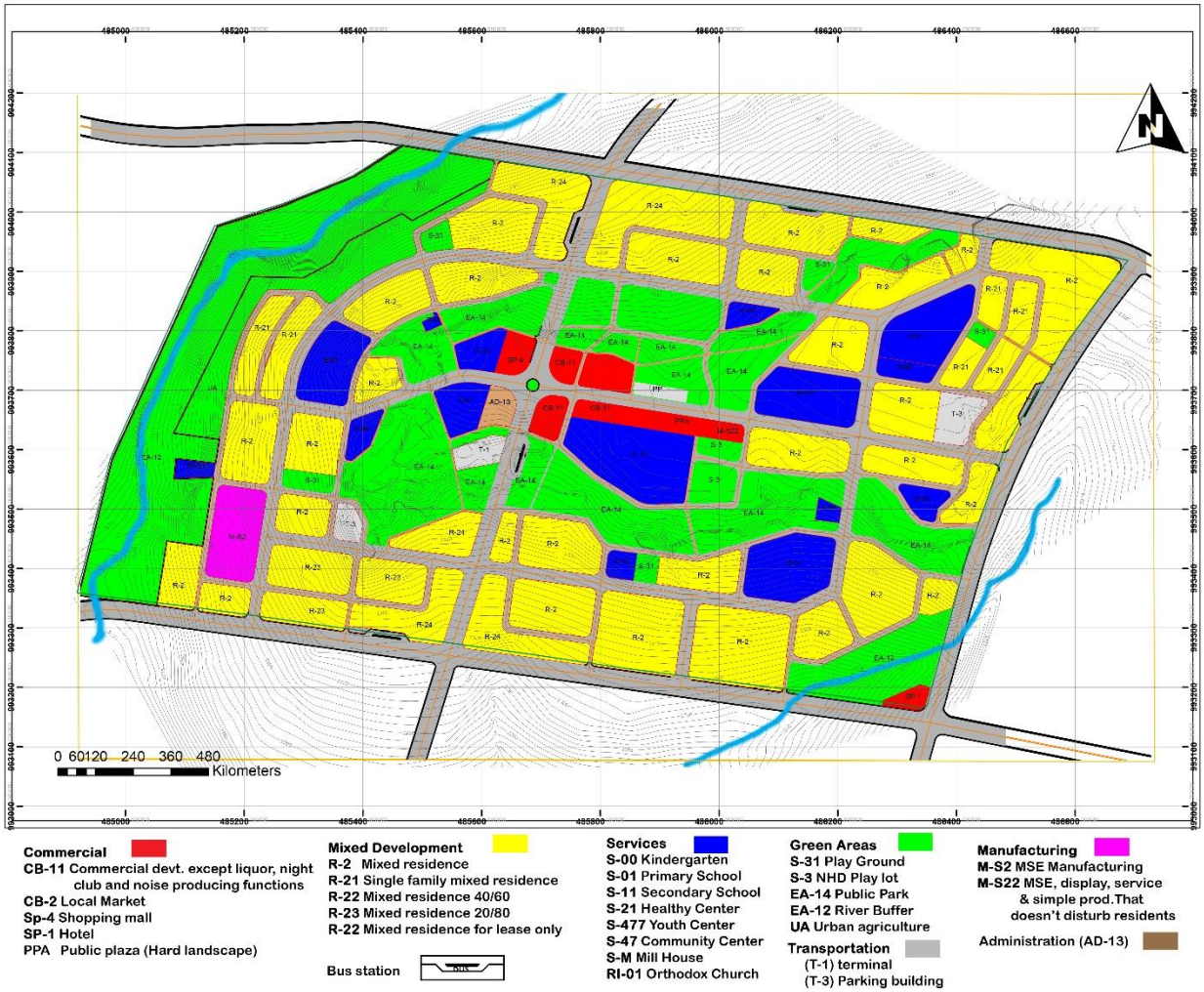

Plate 47Proposed land use plan of Bole-Qatla

Road and Accessibility Proposal

The road proposal of the study appreciates the local development plan of the area. The road coverage become 21.9%. Hence the study makes some changes mainly on the areas surrounding the extended quarry area. It is composed of different size, pavement and character of roads. A 30m PAS road, 21m and 10m SAS road, 11m collector road and 6,4-meter pedestrian walk ways within green areas is proposed. The detail walk ways within the green frame will be designed according to the landscape design and reclamation plan.

The stepped access is provided for areas situated on steep slopes and deprived of easy accessibility. The sustainability of this site is enhanced by the dry coursed road pavements that promote water infiltration and plantations on the green steps which are designed to abstract potential flood that come from the upper catchments.

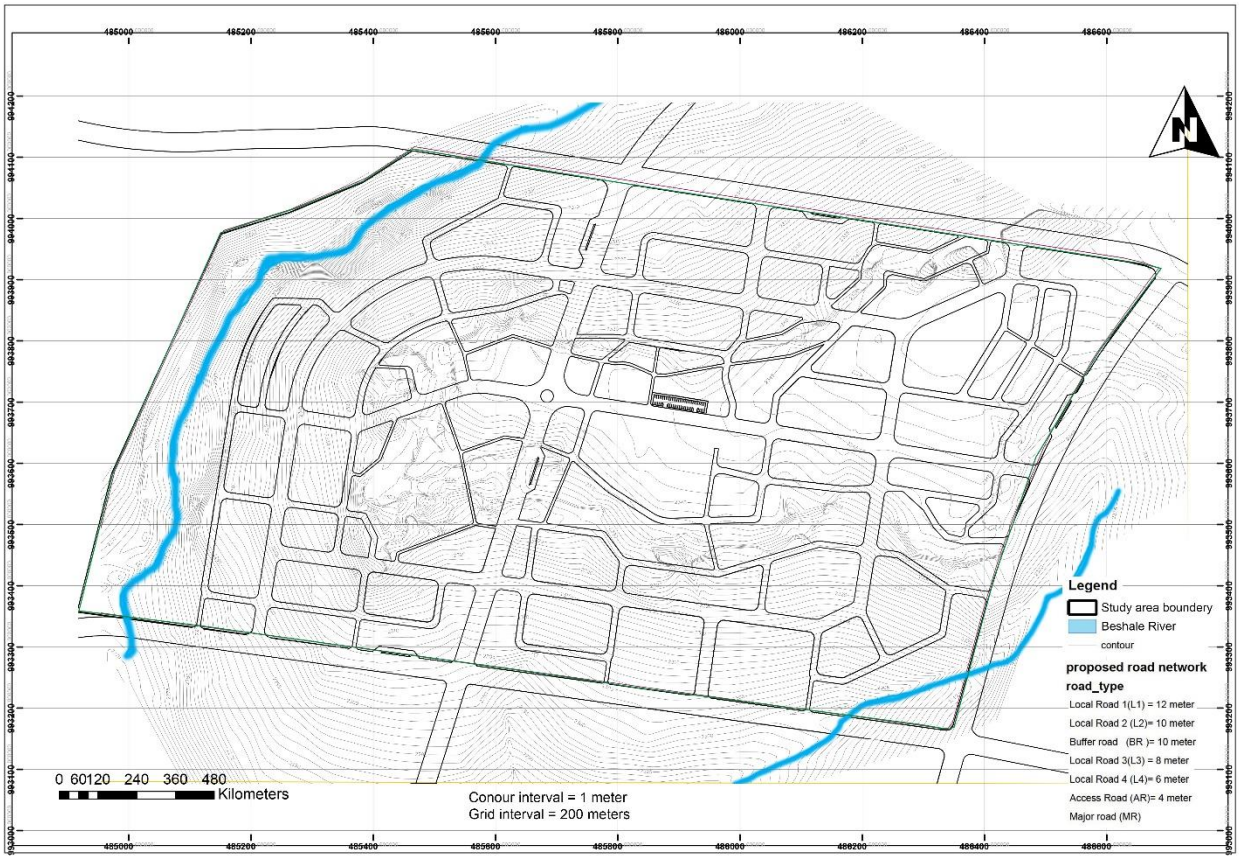

Plate 48Proposed Road Accessibility Map

Plate 49Proposed Motor ways and proposed Motor ways

Proposed Green Infrastructure

The proposed green infrastructure of the study appreciates and considered the significant roles that the local development plan suggested. Hence following special increment of the active quarry on the study area the green coverage of the site could increase subsequently. The active and abounded quarry pits should be properly reclaimed and used for the intended use. Following that the reclaimed quarry area increased by 15.5%. Green area of Bole Qatla area cover 32.8 hectare of land which takes more than 28%. Green area of the site is composed of the two river buffers, neighborhood open space and the reclaimed quarry area green coverage. Each of them has 12.9 hectare of river buffer and 19.9 hectare of communal spaces and reclaimed quarry green areas. The river buffers are defined by the 2017 city wide structural plan is implemented on the local development plan. Small open spaces are proposed in clustered residential blocks. These open spaces are used as playing ground on neighborhood design. Also, an urban agriculture of 26.1 hectare of land is proposed. It can be used as an income sours for the local residents.

Plate 50Proposed Green Map of Bole Qatla area

Plate 51Proposed Green Areas and Reclaimed Quarry Areas

5.4 Reclamation Approach of Bole -Qatla Quarry

The reclamation approach of quarries applied to reduce the visual impact of quarries and provide potential for the creation of biodiversity. The techniques can be using natural recovery, other specific technique schemes, or an integration of them. These techniques are highly dependent on number of factors such as the intended after use, availability of top soil and fill material ((Land Use Consultants, 1992a) (Walton, 2004)).

The character of Bole Qatla topography and intention to develop medium density housing development. Subsequently the study area reclamation shall use selective backfilling, bench planting, and natural recovery. The reclamation techniques shall be applied in this order.

- **Selective Back Filling**: this technique can be applied to fill shallow pits by using the housing project excavated top soil.
- **Bench Planting Technique:** this technique should be applied on back filled and modified landscape. It can stabilize the filled pits and improve the environment quality of the area.
- **Natural Recovery:** this technique can strengthen the above two reclamation techniques integration and establishing highly diverse sustainable ecosystem.

Due to longer time demand of the reclamation proses it is recommended to start early on the project and provide required of technical expertise.

On the reclamation proses the vegetations is recommended to use plants with batter soil conservation and improvement tendency with wider canopies that provide shade on the area.

5.5 Implementation Strategies

The Bole-Qatla area, medium-density housing development project consists of different tasks that are driven by implementation strategy accordingly. The implementation strategy dwells on specific tasks to do, the responsible body to implement them, and the time/ sequence of implementation. If the responsible body lacks the required budget to implement a specific task accordingly the financial issue can be a main focus. Table 14 summarize each of the tasks of the project, scale of the project at neighborhood and parcel level and responsible body to implement tasks, with implementation time frame. The timeline summaries the major deliverables of a project in a chronological sequence.

Table 14Implementation strategy of Bole Qatla medium density housing development

No	Task to implement	Scale of implementation	Responsible body to implement tasks	Implementation time frame		
				Pre-construction	During construction	Post-construction
1	To analyze the site significant change in landscape and update the local development plan and reclamation plan	Neighborhood level	• Addis Ababa Plan Institute • Addis Ababa Housing Development Project Office, AAHDPO • Saving House Development Program, SHDE			
2	. Finalize the design and mobilize	Neighborhood level	• Addis Ababa Plan Institute			
32	Solving issues related to land tenure and ownership • Quarry area • Residential and agricultural areas	Neighborhood level	• Land management bureau • Bole sub city administration • AAHDPO & SHDE			
4	Launching the reclamation process on the active and abandoned quarries of Bole-Qatla.	Parcel level				
53	Construction of Infrastructures, • Arterial, local and collector roads • potable water provision • drainage lines • electric lines • telecom lines	Neighborhood level	Addis Ababa city Road Authority (AACRDA), Addis Ababa Water and Sewerage Authority (AAWSA), EELPA, Ethio Telecom.			
64	Green areas development • neighborhood and local playing fields • river buffer areas • quarry buffer areas.	Neighborhood level	Addis green initiative with local residents			
75	Construction of different service centers • education • administration • social center • youth center	Neighborhood level	• Respective bureaus under Bole sub city administration			
8	Constructing Retaining walls and buildings	Parcel level	AAHDPO and SHDE			
9	Landscape work at the central part of the neighborhood	Neighborhood level	AAHDPO and SHDE			

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ANNEXES

Annex 1 - Household Questionnaire.

Dear respondents,

I request your cooperation in providing information requested in this questionnaire. It is provided to collect primary data needed for the preparation of a thesis research paper for the partial fulfilment of the degree of Masters of Sciences in Environmental planning and Landscape Design. All respondent's identity and responses will remain anonymous and the information will be used strictly for research purpose only.

A. **REASERCH INFORMATION: -**

Research Title:	**Reclamation of Derelict Land to Enhance Green Infrastructure Coverage of Addis Ababa**: The Case of 'Bole-Qatla'.
University	*Ethiopian institute of Architecture Building Construction and City Development /EiABC/, Addis Ababa University south campus*
Prepared By;	Amanuel Atlabachew
Supervised by:	Mulugeta Maru /MSc/.

B. **PURPOSE: -** The purpose of this questionnaire is to collect primary data on the physical, socio-economic and environmental issues in '*Bole Qatla*' which are an important issue for studying how the quarry operate and its economic, social and environmental impact on the site dwellers.

I, Household data

1. Questioner identification number _____ Date _____
2. Marital status of the household head:

   A. Single B. Married C. Divorced D. Widowed
3. Number of years in the house/ neighborhood?

   A. >10 years B. 10-20 years C. 20-30 years D. >30 years
4. Size of household:

   A. 1 B. 2-3 C. 4-5 D. 6-8 E. 8+
5. Housing ownership:

A. Private B. Kebele C. Rented from private if other _____

6. Purpose of the housing unit.

A. Pure residence B. Commercial D. Agriculture + Residence E. Commercial+ Residence

7. Education level of household members

Academic background	**(No) number of families**
Illiterate	
Kg	
1-8	
9-10	
TVET, Preparatory, Special training	
University, colleges.	

II, Socio-economic conditions.

11. The number of productive family member _____

12. Current occupation of household members.

Kind of employment	**Number**	**Kind of employment**	**Number**
agriculture		Quarry labor	
Government employees		Mixed labor in agriculture and quarry	
Private/ NGO companies		Mixed labor in agriculture and small business	
Self-employed (formal/ informal)		none	

13. If theirare unemployed family members;

In what kind of work do they, want to participate? _____

What skill/entrepreneurship/ they have? _____

14. What are the social, safety and security problems in the neighborhood?

	Description of the problems	**Yes**	**No**	**Remark**
A	Land/house tenure.			
B	Fear of eviction.			
C	Violence, Crime, Theft.			
D	Joblessness			
E	Sound pollution, safety and security.			

15. What are the major economic activities/ income generating meanness in the district in order of importance?

A. Cultivation of food crops B. livestock production

C. petty trading D. stone quarrying E. other specify

16. Average Household monthly income (In Eth. birr)

A. <1000 B. 1000-2000 C. 2001-3500 D. 3501-5000 E. >5000

17. Are there any member of your family engaged in stone quarrying?

A. Yes B. No

18. If you say Yes for the above question, specify how many and their family relation? _____

A**.** Child B. Spouse C. Relative

19. Do you agree methods of stone quarrying are responsible to habitat and land degradation in the area?

A. Strongly agree B. Agree C. Strongly disagree D. Disagree

20. Do you have information or observation of any disease due to the effect of dust?

A. Yes B. No

21. Do you remember any death or injury accident on local residents' due to quarry activities?

A. Yes B. No

22. If your answer for question number above is yes, how many

A, Death ---------- B, Injuries ---------- C, I do not remember the exact number

23. Can you list other social and environmental impacts of the quarry?

24. Due to pits of quarrying what occupational health and safety risks observed in the area?

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

25. How can you describe the methods used in the quarrying activity in terms of impacts on the physical environment?

A. doesn't have any impact B. little impact C. distractive
D. very destructive E. no certainly

26. Have there been any conflict between quarry workers and local community members in the past?

A. Yes B. No

27. If yes, what was the cause of the conflict?

III, Renewal and Relocation Related Questions

17. Do you have proper awareness related to the construction of high density residential buildings on your location? A. Yes B. No

18. What was your contribution related to the planning of high density residential buildings on your location?

19. What do you expect from the new development on your location?

20. What do you suggest for the development process?

Annex 2- Questionnaire for Quarry Workers

Dear respondents,

I request your cooperation in providing information requested in this questionnaire. It is provided to collect primary data needed for the preparation of a thesis research paper for the partial fulfilment of the degree of Masters of Sciences in Environmental planning and Landscape Design. All respondent's identity and responses will remain anonymous and the information will be used strictly for research purpose only.

A. **REASERCH INFORMATION: -**

Research Title:	**Reclamation of Derelict Land to Enhance Green Infrastructure Coverage of Addis Ababa:** The Case of 'Bole-Qatla'.
University	*Ethiopian institute of Architecture Building Construction and City Development /EiABC/, Addis Ababa University south campus*
Prepared By;	Amanuel Atlabachew
Supervised by:	Mulugeta Maru /MSc/.

1. Questioner identification number _____ Date _____
2. Migration Status: A) Indigenous B) Migrant
3. Why are you engaged in stone quarrying?
   A) Job opportunity B) additional income generation
4. For how long you have been engaged in stone quarrying?
   A) Less than 6 months B) Less than a year
   C) 1-2 yrs. D) 2- 3years E) Greater than 3 Years
5. Are there any members of your family engaged in stone quarrying?
   A) Yes B) No
6. If yes how many? Specify: _____
   A) Child B) Spouse C) Relative
7. How much do you earn per day or week or month? Specify it. _____
8. How much money do you save monthly?

A, <1000 B. 1000-2000 C. 2001-3500 D. 3501-5000 E. >5000

9. How has stone quarrying changed your status?
   A) Income B) Marital C) Children's education D) Quality of life
10. Do you consider stone quarrying a widespread economic activity in the locality/district?
    A) Yes B) No
11. Do you agree methods of stone quarrying are responsible to habitat and land degradation in the area?
    A) Strongly agree B) Agree C) Strongly disagree D) Disagree
12. What is the relationship between quarry workers and local residents in the area?
    A) Very good B) good C) bad D) Very bad E) No certain
13. Give reason to support your answer in (12) above?

_____

_____

14. Have there been any conflicts between quarry workers and local community members in the past?
    A) Yes B) No
15. If Yes, what was the cause of the conflict?

_____

_____

16. Due to pits of quarrying what occupational health and safety risks observed in the area?

A) Dust fall out B) Noise C) Psychological problem

D) Security problem E) Water pollution F) Land stability problem G) Visual impact H) Vibration I) Destruction of household material

17. Had you take any measure to minimize the problem you mentioned above?↑
    A) Yes B) No
18. If you say yes for the above question, what type of measure you take?

_____

_____

Annex 3 - Observation Checklist.

Observation checklist using Base Map of the area, Google Earth image of the study area and photographs

1. Identification of land use for the study area.
2. Identification of the housing condition of the area.
3. Topography adaptation of the settlement.
4. Identification of the housing typologies
5. Identification of the major problems on the site
6. Identification of environmental elements
7. What are the existing potential of the site?
8. What are the major constraints of the current development?
9. Identification of movement patterns within the area.
10. Observation for identifying types of agricultural activity.
11. Identification of crops that are developed within the area.
12. Identifying plant and trees species within the area.
13. Identification of waste disposal mechanism of the community.
14. Asses the pollution Level within the area.
15. Identification of Green blue infrastructure.

Annex 4 - A Checklist of Mineral and Aggregate Resource Issues

1. What are the location, size and proposed land uses of the mineral or aggregate project?
2. Is the proposed mineral or aggregate development allowed in the particular zone? Are setbacks and buffers from property lines met?
3. What are the land uses on the adjacent properties?
4. Has the developer conducted an environmental impact assessment as required in state, federal, or local regulations?
5. What will be the impacts on air and water quality, water supplies, earth subsidence, slope stability and wildlife habitat? Is the proposed development designed to minimize these impacts?
6. How will toxic substances and tailings will be handled and disposed of?
7. How much truck traffic will be involved and what routes will be used?
8. What will be the impacts of noise and vibration on nearby residential and commercial properties? Is the proposed development designed to minimize noise and vibration?
9. Has the developer obtained any necessary state or federal permits? Has the developer provided a reclamation plan?

Annex 5 - Potential Impact and Mitigation Measures for Negative Impacts

Positive impacts	Management plan
• The housing project will have a paramount significance for the housing backlog of Addis Ababa city and alleviating the housing problem of urban dwellers.	• Should incorporate all stakeholders and professionals at both construction and operation phase.
• The development will result in job creation and provision of employment during construction phase.	• All labor (skilled and unskilled) and contractors should be sourced locally where possible. • A labor and recruitment policy should be developed, displayed and implemented by the contractor, to insure the benefit of local residents and the previous quarry workers. • Where possible, labor intensive practices (as opposed to mechanized) should be practiced. • The principles of gender equality and non-discrimination shall be implemented. • Jobs for the maintenance of infrastructure and services should be created following the completion of the development. These jobs might be made available to existing labors for creating long term employment. • Service contractors could have access to other developments or projects in the area there by creating long term employment.

Annex 6 - Potential Social and Cultural Negative Impacts and their Respective Measures

Negative Issues	Potential Impacts	Mitigation Measures
Socio- economic and cultural issues	▪ Absence of enough playgrounds for children and youth; as a result, limited creativity, poor communication skill with peer groups and week health condition.	▪ Enough playground station should be included in the design and have to be implemented as per the design.
	▪ Psychological impacts such as fear associated with living in several storied buildings and depressions of settlers associated with discontinuity of already established social life ▪ Lack of awareness about communal way of life	▪ Facilitate continuous awareness creation program on communal way of life ▪ Awareness and psychotherapy by concerned bodies.
	▪ Absence of rules and regulation about communal way of life	▪ Legally supported sanctioning mechanisms have to be designed and implemented accordingly
	▪ Dislocation of people from their neighborhood, and their livelihood	▪ Ensure that any involuntary resettlement is done in accordance with proper compensation or considers alternative. ▪ Proper relocation on appropriate land
	▪ Loss of community-based organization (Edir, Eqube, Mahber…) considered as one of adverse social and cultural impact.	▪ Reorganize community-based organizations (Edir, Eqube …) during reallocation
	▪ The livelihood of the community, who might depend on making the economic benefits through trade (pity trade) may be affected	▪ Create alternative job opportunity ▪ Create permanent job opportunity

Negative Issues	Potential Impacts	Mitigation Measures
Socio- economic and cultural issues	▪ The major economic means of low income residents and labor employees will be adversely affected.	▪ Training on Entrepreneurship should be given on a regular basis.
	▪ Complex buildings and condominium houses are inaccessible for the disabled persons	▪ Complex buildings and condominium houses should be designed to incorporate facilities that can maintain the comfort of the disabled persons and constructed accordingly ▪ Apply Ethiopian building proclamation, No.624/2009
	▪ Danger for children living in storied buildings	▪ Education children on how to behave ▪ Having well fitted structures to prevent children from falling into the ground
	▪ Change in the cultural lifestyle (eating, drinking and other cultures like wedding, burial ceremonies…) ▪ Visual impact due to a change in the visual character from open space to residential area. ▪ Compromising the rural sense of place	▪ Design ways of adaptation to the new style of living ▪ Planting aesthetically appealing trees and provision of adequate open space