UNIVERSITY OF NAIROBI

SCHOOL OF THE ARTS AND DESIGN

University of Nairobi, in partial fulfilment of the Requirement for the Degree of:

M.A DESIGN

BDS603: MASTERS RESEARCH PROJECT

REDESIGNING THE RECLAIMED LANDSCAPE FOR SUSTAINABLE RECREATION IN KAYOLE

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PRESENTED TO:

SUPERVISOR

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DECLARATION

I acknowledge this project as my original work and has not been presented either in whole or part for a degree in any other university or any other award.

…… …….

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The project has been submitted for examination with the approval of the following university supervisors:

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DEDICATION

This project is dedicated to my family members who have seen me through this years.

My father, mother and sister you are a blessing and am grateful.

My husband for being loving and thoughtful and standing with me through this vigorous study.

My daughter Adia for being patient and a darling to have and to hold.

ACKNOWLEDGEMENTS

I would like to appreciate the following individuals and institutions for assistance and contribution they have accorded me towards my research and project finalization.

My supervisor Mrs. Francisca Odundo for the immense support she has accorded from the first day to the final presentation of my project. The journey has been long and weary and thank you for the push and the extra hours you gave me.

I wish to thank Mrs. Petronilla Njeri of Mihango quarry who allowed me to do field study and use Mihango quarry as my case study. Ms. Susan and other staff at City hall for giving me relevant information on my area of study.

Mr. Patrick Technical University of Kenya, Dr. Abednego Gwaya and Fredrick Ochieng Design Department, UON. Thank you all immensely for supporting with the technical bit of my study area.

I had supportive classmates who walked with me through the Journey and assigned me the lead driver to completion of our master's degree.

My parents you have pushed me to finish my studies and not to give up. Your prayers have given me strength in tough times. My sister am grateful for your time when I had pin up presentations. My husband and daughter you have been loving and supportive for you know how far we have come. I am humbled and appreciate all of you. Thank you God for providence and the strong support group that surrounded me.

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Acronyms

AMD	Acid Mine Drainage
ARD	Acid Rock Drainage
CCD	Convention to Combat Desertification
ILA	Israel Land Authority
IUCN	International Union for the Conservation of Nature and Natural Resources
QRF	Quarry Rehabilitation Fund
RPM	Respirable Particulate Matter
SCWM	Soil Conservation and Watershed management
SPM	Suspended Particulate Matter
ULP	Urban Leisure Policy
UNEP	World Commission on Environment and Development

Glossary of Terms

Commodification	Is a variety of recreation facilities.
Design guidelines	Are strategies for creating a better landscape based on research and evaluation of ecosystems.
Land degradation	Is the decline in land quality in its potential productivity.
Mining	Process by which we extract resources from the earth's surface.
Populace	Refers to people or population.
Reclamation	Is the process of improving land to support specified end use.
Recreation	Is pursuit during free time for personal relaxation.
Sustainable development	Components of mine development that influence the sustainability of social and economic benefit, post mining, should be maintained and transferred to future generations.

ABSTRACT

In the past mines were abandoned after mining activities leaving undesired effects on the landscape and water sources. Numerous accidents occur in quarries across Kenya leading to deaths of 30 people annually. Mining is an activity presenting a plethora of environmental, social and economic problems thus using abandoned quarries as sites for new construction is a useful form of reclamation, one that has occurred throughout history.

Reclamation of degraded landscapes in developing countries is an environmental issue that is under consideration. Human activities have intensified thus disturbing the ecological balance and decreasing the availability of viable land. Environmentalists have come up with policies to tackle degradation and its effects globally. This drive was mainly inspired by the conservation strategies developed and promoted by the *International Union for the Conservation of Nature and Natural Resources* (IUCN).

The proposed research is intended to provide planning approaches and design guidelines for integrated and sustainable development that would be more responsive, repurposing former quarry sites for community recreation needs and aspirations.

A case study approach is used, to give sustainable measures that most countries have adopted for projects of this nature. Different methods of degraded land rehabilitation activities will be discussed through a critical interrogation of existing literature and field experiences. The resulting study is expected to proffer solutions that ameliorate challenges facing today's landscape designer. Additionally, the study should result in a robust and context-responsive model that can be used for rebuilding quarries that have been degraded by human activity and restore it for future generations.

Key words: Land degradation, Landscape design, reclamation, recreation and sustainable development

CHAPTER ONE

1.1 INTRODUCTION

Over the past two hundred years, human activities associated with industrialization have brought about changes in the global environment that are unprecedented in both scale and magnitude. Constructions worldwide require tonnes of stone and concrete to erect structures for commercial and residential use. These stones are mined through blasting or stone cutting stripping off earth of minerals and top soil thus creating massive abandoned quarries (Chaoji, 2009)". Degraded landscapes have destroyed ecosystems that hinder the survival of plants and organisms which cannot survive unaided. . Degradation is described as "the long-term loss of ecosystem function and productivity caused by disturbances from which the land cannot recover unaided" (Bai *et al*., 2008). Land degradation takes many years to occur causing lasting impacts on people who thrive on land which is no longer productive. The UN *Convention to Combat Desertification* (CCD), of which Kenya is a signatory, recognizes land degradation as a global development and environment issue. "It is estimated that 30 per cent of Kenya was affected by very severe land degradation. Additionally, an estimated 12 million people, or a third of the Kenya's population, depended directly on land that is being degraded. The droughts of 1970-2000 accelerated soil degradation and reduced per-capita food production (GOK, 2013)".

The *World Commission on Environment and Development* (WCED) was established in 1983 by the *United Nations Environmental Program* (UNEP). It aimed to respond to the ever increasing concern about the problematic impacts of human activity on the natural resources of the earth. The scope of the commission's analysis of the global situation is comprehensive and outstanding for its major focus on the concept of sustainable development. This concept is now an accepted vital element of

the world dialogue and debate on environmental issues. Sustainable development has become an excellent solution for these abandoned, resource-depleted quarries. Dozens of cities in America and abroad have undertaken adaptive re-use projects to transform quarries into a variety of public and private spaces. The potential new uses for these vast parcels of land include sites for research and education, aquaculture, recreational activities, storage, industry and housing. From an analysis of such a report and supporting data, it is possible to identify key conclusions concerning relationships that exist among important causes of environmental degradation, the impacts of these causes and possible solutions. The slowing of human population growth is arguably the most important single factor in any sustainable development agenda as they generate a great demand for land which is scarce. Construction of recreational facilities requires parcels of land which is not enough for agriculture and human settlement that increases annually.

Recreation is thought out as any pursuit an individual partakes in during time off work for leisure and satisfaction. Recreation could also be defined as a specific activity undertaken in leisure time. (Cordell, 2002) Describes recreation as any type of conscious enjoyment. As our society becomes increasingly leisure oriented there is a growing need for more basic information about the factors governing recreation activities. The demand for facilities is increasing at an accelerating rate as proportions of available time and disposable income become larger. Recreation activities create a demand for land and specialized facilities.

In Kenya, non-traditional use of land is beginning to occur. In Kisumu town some cemeteries are being reclaimed from being eerie sites to modern recreation facilities that will attract tourists into the county. This concept of turning cemeteries into “parks for the living’ according to an article titled “Turning cemeteries for the dead into Parks for the Living” is a new conventional method that is emerging. Posted on December 1, 2010

by Peter Harnik, a number of cemeteries have been transformed into tourist attraction sites, while also benefiting local residents. “Examples of these include the famous cemetery of Cedar Hill in Hartford, Connecticut. It not only allows residents to walk dogs and ride bicycles, but also provides a platform for jazz concerts and other events and even allows residents to bring food and wine,” says Harnik.

“In Fort Collins, Colorado, Grand View Cemetery has the city’s finest remaining collection of elm trees and thus garners a steady stream of bird watchers. Its dirt road system not only attracts fat-tyre cyclists, but is also used as a training site by Colorado State University’s cross-country team, it added.”

Against this backdrop, this study will be conducted to explore the impacts of mining and land degradation on both the natural resources and man’s livelihood in Kenya. For this study will be derived from both primary data (observation) and secondary data or a review of relevant literature, and a compilation of other available information on parklands.

1.2 Background to the study

Human activities associated with industrialization have brought about changes in the global environment that are unmatched in both scale and magnitude. Constructions worldwide require tonnes of stone and concrete to erect structures for commercial and residential use. Materials for construction are obtained from the quarries through quarrying as the main extraction process. From its very nature, mining of whatever form has a devastating impacts on the environment and is an impediment to Kenya’s vision 2030 social pillar that tackles environment, water and sanitation. The environmental impacts and their intensities are different in their scale depending on nature and stage of the resource development activities.

In Juja opposite Ndarugo mines lay four quarries that are still active and stone is excavated through cutting. Suba construction owns two quarries, diamond one quarry and silver one quarry all of various sizes. Along Ngong' River stretching from Njiru to Utawala lays ten quarries on its banks. These quarries cover an area as large as 50 hectares and as deep as 200 feet per quarry which lays waste after mining is over and cause pollution to air and water streams. Here stones are dug for the purpose of being used in building, making roads through blasting. The issue remains as to what happens to these degraded lands in the long run and who wants to take charge of reclaiming this derelict landscape.

Figure 1 Quarries along Ngong' River (Source Google Earth)

According to (Kuter N. , 2013) "Reclamation of post mining landscapes is a very challenging task since there is no unique reclamation planning scheme for such landscapes, and it highly depends on the site-specific characteristics". Most of these quarries are backfilled by dumping soil and waste which takes many years to refill. Natural approaches to reclamation may not apply for the long periods it takes and human intervention is

necessary to speed up restoration. Mihango quarry is a 4 hectares piece of land where they have been dumping for the past seven year and still the portion left is quite large. Human intervention takes many years to refill a quarry depending on size and depth; this is even harder when we let nature to reclaim a site. Looking at the number of quarries it is even a greater issue to reclaim all the open pits.

The Local Government has to enforce laws with the mining companies to refill as soon excavation is over and revoke licenses if need be . The present study therefore attempts to find alternative ways of reclaiming quarries, design guidelines and their effect on increased park use in urban centres.

Urbanization and post-industrialization age has led to demand in land which in the past was useful for agriculture and recreation (Arbogast, 2000). In Kenya our economy and job creation has been advanced by recreation through amenities that contribute to tourism in the country. These facilities include parks, museums, stadiums and theatres which provide physical and social benefits to the community and individuals at large.

Our society is sensitized on the need for exercise and physical fitness due to the rise of lifestyle related illnesses. Today people are inactive, due to unhealthy habits of smoking, drinking and overeating. This can be controlled by Park visits which provide an excellent opportunity for individuals to improve personal fitness through walking, swimming, aerobics and running.

For the majority of the youth, recreation and leisure have taken on a new turn. Recreation provides personal satisfaction that boosts their energy through vigorous activities. Technology has been integrated to provide a commodification of facilities such as indoors ice skies, video games and

mobile applications for a variety of audience. Such pursuits involve participation in outdoor and in-door activities.

As our society becomes increasingly leisure oriented there is a growing need for more basic information about the factors governing recreation activities. The demand for facilities is increasing at an accelerating rate as proportions of available time and disposable income become larger. Recreation activities create a demand for land and specialized facilities .Today for the first time, there is a universal acceptance of the value of recreation and leisure. Rehabilitating degraded resources as quarries for new projects is a useful form of recycling that has occurred throughout history.

Our census indicates growth in population in every count yet our parks are not increasing at the same rate. Nairobi and its environs only have four parks Uhuru Park, Central Park, Jeevanjee Garden and City Park which was designed as early as 1932. Which all have the same characteristics of landscaping majorly trees, grass and sculptures. From observation people who frequent these grounds are those who prefer to sleep in the shades and enjoy a quiet time. Over the weekends you will find these parks filled with families and couples and youth groups who enjoy the boat rides at Uhuru Park and picnics and games at City Park and Central Park. Jeevanjee gardens is a favourite for those who are waiting upon someone who is running late as you get to sit in the benches and pass time for free as opposed to waiting in a restaurant or cyber where you will incur unnecessary charges. Many are the times Uhuru Park is used for political rallies and church functions.

Other small parks have been developed to cater for the needs of the populaces through a commodification of attractions. We have seen Haller Park which is a reclaimed land having many visitors who frequent the site even at a service charge upon entry, Nairobi National Park, Snake Park, Safari Walk, Mamba village which hosts an attraction of crocodiles,

Giraffe Centre, Paradise Lost and Blixen Gardens which rate as the most popular places visited in Nairobi (Hastings, 2015).

A commodification of leisure and recreation facilities is necessary in these modern times with increase of leisure time and disposable income. A variety of recreational pursuits are made available by various centres today. Private cooperation's such as Time Warner, Disney and Viacom have devolved the leisure industry by providing varied forms of contemporary recreation centres such as theatres, stadiums, studios and beach fronts.

There is a need of themed parks here in Kenya to cater for the various age groups and their interests for recreation. Especially with the devolved counties, each county needs to have its own park and we commend Alfred Mutua who has this vision and has seen the rise of Peoples Park in Machakos County. Kisumu is also turning cemeteries into parks for the living.

1.3 Problem Statement

Quarrying strips off minerals in the top soil 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 and insects to find a habitat. Other negative influences on mining are air pollution, stagnant waters and pollution of water tables and streams killing all aquatic organisms.

According to (Mummey, 2001)), "disturbance of soil ecosystems that disrupts normal functioning or alters the composition of soil microbial communities is potentially destructive for both short and long term ecological stability. When mining is going and has gone on, particularly top soil must be conserved because it is an essential source of seed and nutrients, and should be preserved for use in reclamation."

1.4 Objectives

Main:

- Investigate the best methods to reclaim a given site

Specific:

- Establish design guidelines for degraded quarries
- Determine leisure facilities that are more conducive to the community
- Create leisure facilities for the community

1.5 Research questions

The study sought to answer the following research questions.

Main:

1. What are the methods used to reclaim the quarry at Mihango?

Specific:

2. What is the comparative performance of reclaimed quarries like Haller Park over City Park?

3. Which are the most suitable design guidelines that can be used to rehabilitate Limestone quarries at Mihango, in Kayole and other similar areas?

4. What are the populaces' leisure requirements?

5. How can the populaces' leisure requirements be catered for?

1.6 Significance of the Study

This study makes an important contribution for developing countries to recycle abandoned quarries for projects geared towards creating sustainable recreational amenities. The study through literature review and case studies will provide plans geared towards reclaiming mine sites and restoring landscape to its potential use. This study gives a foundation for developing guidelines for recreation providers to use alternative land forms for a commodification of leisure facilities.

1.7 Scope and Delimitations

This study encompassed literature available on the topic of quarry rehabilitation, focusing primarily on Mihango quarry in Kayole. The discussion is centred on design guidelines that will aid with a commodification of recreation facilities in a park centred for its users and was informed by case studies that have reclaimed abandoned quarries.

The research was limited by lack of adequate policies on quarry rehabilitation and what methods have been used in the past to present times. Many are the companies that rehabilitate this waste lands in the country but do not have models and literature showing the steps undertaken.

Many of the degraded lands were reclaimed by backfilling as seen in my case studies with the examples of Haller Park and Ngomongo villages. A new development in China is reclaiming an abandoned quarry by building on it without refilling, but there is no documentation to show how sustainable the structure is as it is still in its developmental stages.

There is no statistical data base at the Nairobi's City Hall department of Open spaces as to how many quarries exist in the country as most of the land is privately owned and leased to the mining companies. The researcher had to physically visit Juja and Kayole and do a physical count on the existing quarries in the region.

CHAPTER TWO

2.1 LITERATURE REVIEW

New technologies have advanced into the mining industry therefore increasing negative environmental impacts to the landscape. Industrialisation and urbanisation have devastating effects on our major natural resource land which spills over to creating a global concern on

issues that mitigate fast interventions so as to benefit future generations and rehabilitate our earth to its original state (GOK, 2013).

Using abandoned quarries sites for new construction is a useful form of reclamation that is now gaining ground. For reclamation projects to be successful more than one approach should be employed for restoration concepts.

The composition of a traditional building scape combined with contemporary buildings creates a collage which forms the urban scape as we know it today. Cities today reflect societies' growth, both planned and unplanned. What we currently have is an urban scape that is devoid of sufficient recreation space and facilities. It is necessary that these qualities, services, facilities such as parks, museums, hospitals and art galleries are introduced to the city. Parks are an important part of any urban environment and provide significant services. It benefits the community environmentally, aesthetically, recreationally and economically (N.A & Brown, 2003).

In this study, the introduction of parks and open recreation areas into cities is taken as a priority in planning, in order to create living spaces that support healthy human habitation. The introduction of recreation spaces will ensure that cities form an environment that is healthy and exciting to live, work and play in. It is necessary to find a way to create an ideal living environment that is sustainable and does not negatively affect current human economic and environmental resources, particularly land resources. Reclaiming derelict landscapes is an ideal way to develop recreational spaces without disrupting human settlement and land use.

2.2 Mining

Mining, in its broadest sense refers to the process by which we extract resources such as minerals and rocks near the earth's surface. Mining generally refers to extraction of mineral resources from land, water and

sediments of rivers, lakes, seas, and oceans. Surface mining refers to extraction from the earth that involves removing the required resources without first stripping out a top layer from the earth's surface, or simply stripping out a minimal layer of top soils. With regard to the type of resource to be exploited, the types of surface mining method include; open-pit (open-cast or quarrying), strip mining, solution method and dredging (Chaoji, 2009). Similar to all developing countries, Kenya still owes much of its mineral deposits production and processing to open pit limestone quarrying.

The most widely used materials for construction are obtained from the quarries through quarrying as the main extraction process. A quarry therefore is a type of open-pit from which rocks or minerals are extracted. The types of construction materials include dimension stone, ornamental stones, road building and industrial raw materials. The demand of these quarry material is increasing in alarming rate with increasing industrialisation and construction in the country (A.E., November 2010).

Quarry operations are frequently located near human settlement in Kenya. In some cases they are as near as ten meters from the residents for example Mihango quarry in Kayole. This is mainly due to the expense of transporting raw materials into the city for industrial use in buildings and roads. As a result, residents of Kayole 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. Quarries negatively influence the environment by which man relies on for his day to day use.

Quarries are characterized by safety benches with vertical faces ranging from a few feet or meters to 200 feet (60 meters) in height while the overall depth and lateral extent of a quarry may vary from a few meters to as much as 1000 feet (300 meters) (Bugosh, 2007). From its very nature,

mining of whatever form has devastating impacts on the environment. The environmental impacts and their intensities are different in their scale depending on nature and stage of the resource development activities (Neri, Sanchez, & Hester, 2010: Nicolau J.M., 2000). Mining inflicts severe soil erosion on the ground making it infertile for any life to thrive in. Surface hydrology and groundwater levels and flow paths are also altered.

The study of Erongo region in Namibia by (Nyambe, 2009: Pegg, 2006) "found that small-scale mining contributes to poverty alleviation through employment creation, and income earning opportunities. These mines assist in the sustenance of local businesses by means of purchases done at local and nearby towns by the stakeholders in the mining business (7)". Nyambe *et al.* (2009) "noted that local small scale miners faced difficulties such as lack of appropriate tools and well-structured markets. The economic contribution of these miners and their trading activities cannot be estimated with certainty due to the informality of the sector, the lack of official statistics, and the number of seasonal and occasional workers(7)".

"Surface mining impacts negatively on both surface and underground water resources. Locally established quarries, whether operating or abandoned are run without natural or manmade water inlets and outlets which have a self-purification capability. Any water accumulated within this quarries is therefore easily contaminated. This water when it flows over long distances without access and purification, will contaminate the nearby sources, be it a river, a dam, wetlands and other riparian areas. Mining-related sediment is released into the water in streams and ponds, poisoning the fish and other aquatic creatures. The mill tailings particles can destroy aquatic habitats by covering the stream bottom and suffocating the fish eggs, by filling in pools which serve as fish habitat. Sediment can

also affect suitability of the water for human uses such as agriculture and drinking water (Shomaker, 2005(3): Governor , 2002)".

Open cast mining as a method of extraction leads to a large open pit which acts as a compost pit for most towns. Mining policies should monitor the landscape so as to minimize the negative impacts felt by the neighbouring community. The dust caused by disintegrated stones causes air pollution which causes respiratory diseases as well as killing plant life as it covers the surface and hinders photosynthesis. Top soil that is excavated during mining should be stored for future use after rehabilitation and restoration approaches have been introduced to the area. This will greatly improve the nutrients for organisms to thrive in turn flourishing the growth of flora and fauna.

2.3 The effects of opencast mining activities

Visual impacts of mining

The most obvious impact of mining is its visual or aesthetic impact. (Francavaliga, 2004) Wrote, "Mining landscapes seem a nightmarish expression of technology run amok. Visually, mining produces some of the most dramatic landscapes on earth." Open pit mines are turned to unsightly irregular steep sloped landfills.

Mining impacts on biodiversity

Mining contributes immensely to the economy of any country as its raw materials are a necessity to any construction project. Stripping of this natural resources depletes the land of its treasure therefore causing negative impacts that are felt into many generations.

According to (Mining Minerals Sustainable Development Report, 2002) "mining leads to reduction in the number of species present in a given location of a project. Even if the habitations are not openly removed by excavation, they can be affected and damaged by changes to ground water or surface water that causes some habitats to dry out or others to become flooded. Noise pollution can have a significant impact on some species and deter their successful reproduction". Water tables are polluted and spill into adjacent water bodies thus affecting the survival of aquatic species and plants. The landscape is therefore altered and made bare for any ecosystem to thrive (Whitemore, 2006).

Soil erosion occurs during mining as various methods are used to excavate minerals from the earth's surface. This top soil is important for the short and long term ecological stability of any landscape. If we contaminate this resource then rehabilitation is hindered to a great degree if we are to restore land to its original state. For restoration to impact positively miners are required to store this top soil in another location for as long as mining activities are undergoing and once a mine is closed the soil could be recycled for a healthier landscape (Berger, 2008.

According to (Kleeberg, 2008); "soil erosion is frequently related to high rates of particulate phosphorus transfer from land to water bodies. Providing a long term source of phosphorus for aquatic species, and accelerating freshwater eutrophication. In their study, a year-long monitoring, and ten short rainfall simulations on plot scale, at ridges and rills and a combination of them, revealed high erosion from bare lignite mining dumps at Schlabendorf-North, Lusatia, Germany".

"The major environmental hazard from the quarry is the effect of dust and this will be dependent on: the concentration of the dust particles in the ambient air and its rate of deposition, the type of vegetation, degree of penetration of the dust particles into the vegetation, the size distribution of

dust particles and the chemistry of the dust such as the active dusts from laterite" (Lameed & Ayodele, 2010). Plant life is affected by dust that is blown up during mining for it blocks stomata which is necessary for growth and development. Dust particles in turn reduce the number of species of plant life available in the surrounding area and worse kill vegetation cover leaving the soil prone to erosion.

Mining impacts on Health

Long term inhalation of dust may cause lung disease, skin, and eye and throat irritation. It also affects the digestive, blood and nervous system and hyperactivity. Excessive amounts of selenium can cause tooth decay. (Kuter N. , 2013) "Some Irritating symptoms have been found in the eye mucous and respiratory system of people living near abandoned mine pits." Soil samples taken at mine sites have discovered traces of lead metal which causes illnesses for the affected community. (Kibble and Saunders 2001). UN and IUCN have adopted measures to curb degradation and implement reclamation for biodiversity to thrive and multiply.

Abandoned quarries have become death traps for most people. Sarah Musyimi 31, a resident of Mihango lost her teenage son Collins Musyimi 13, who drowned while swimming in the waters in December 2013. Teenage mothers also dump foetuses and their infants due to the rising increase in poverty. At the Mihango site cases of accidental deaths have also been reported with an average of ten bodies in a span of four months in 2014 (Mabel, 2014).

Impact on water resources

Mining affects water bodies and kills aquatic life. Mines are heavy water users, as (Shomaker, 2005) (Smith, 2005) wrote: "Mining enterprises

always require water. The uses vary widely: dust suppression, milling and processing, conveyance of tailings from mills and reclamation of mined lands. In the case of open pit mines, a lake will form within the pit where the ground water re-establishes itself to form pit lakes. When rain washes the loosened top soil into streams, sediments pollute waterways. This will harm aquatic life and stifle plant life downstream, and cause disfiguration of river channels and streams, which leads to flooding." Water tables are polluted with chemicals during excavation of minerals making it lethal for use by man and wildlife.

"Acid Mine Drainage Acid Rock Drainage (ARD) is a natural process whereby sulphuric acid is produced when sulphides in rocks are exposed to air and water. Acid Mine Drainage (AMD) is essentially the same process, greatly magnified. When large quantities of rock containing sulphide minerals are excavated from an open pit or opened up in an underground mine, it reacts with water and oxygen to create sulphuric acid. When the water reaches a certain level of acidity, a naturally occurring type of bacteria called Thiobacillus ferroxidans may kick in, accelerating the oxidation and acidification processes, leaching even more trace metals from the wastes. The acid will leach from the rock as long as its source rock is exposed to air and water and until the sulphides are leached out – a process that can last hundreds, even thousands of years. Acid is carried off the mine site by rainwater or surface drainage and deposited into nearby streams, rivers, lakes and groundwater. AMD severely degrades water quality, and can kill aquatic life and make water virtually unusable (Smith, 2005)."

Mining impacts upon social environment

Mining requires access to land and natural resources which is in great demand, thus reducing land viable for agriculture and other uses. Many

people depend on mining for their daily bread and these are miners, ladies who sell tea and food to miners and security officers. Once a mine is ready for closure this people are rendered jobless. As wages of the workers increases due to availability of active quarries so does the moral decay of the members of the society as alcoholism and prostitution thrives. Sexually transmitted diseases are spread and most children are born out of wedlock (Coumans, January 2012).

"In a worst-case scenario, mines have even fueled conflict in some developing countries by providing revenue for warring factions to purchase weapons. The best-known and publicized of these cases have been in Africa, where control over diamond mines has become an objective for rebels seeking income to finance civil wars (Sherman, 2000)."

Mining Impacts on Air

According to (Ghose, 2002) "Mining causes much more environmental pollution especially air quality deterioration in respect of dust during blasting, drilling, hauling, collection, and transportation and after mining is over are the major sources of emissions and air pollution. The use of explosives, such as in mountaintop removal, releases carbon monoxide (CO) and dust particles released contributes to emissions and respiratory problems air pollution problem in the mining premises and the surrounding locations."

Dust from quarry sites causes respiratory diseases and eye infection to the local communities. Plant life is also affected as this particles block the stomata and have chemicals that hinder certain species from thriving in such an environment (Gauch, 2001).

2.4 Land degradation

Land degradation is the degeneration in productivity of land. Human activities like industrialisation and mining cause land degradation at various levels. Some levels of degradation are short term and can easily be rehabilitated while other effects are long term and cannot recover unaided therefore human intervention is necessary for reclamation to take place (MoEST, 2008).

Bai (2008) defines degradation as "the long-term loss of ecosystem function and yield caused by disturbances from which the land cannot recover unaided." The UN Convention to Combat Desertification (CCD), discusses globally environmental issues of which degradation is a major factor of which Kenya is affected for 30 percent of our lands lay waste. Climatic factors such as desertification contribute to degradation ,human activities such as poor farming methods, mining and industrialization are the greatest contributors to poor land use.

Land degradation is related to poor land use practices as well as the relationship between our intricate biodiversity. The plants rely on the soil for its nutrients. During mining activities the land is stripped off its top soil leaving behind dust which does not support sustenance of any vegetation cover. Micro-organisms that thrive in soil have no habitat in these dust that is infused with metal contaminants which in turn does not support plant health. In such areas very few plants exist and the surrounding environment resembles a dessert.

(Kuter N. , 2013) Discusses human activities as a contributing factor to land degradation which alters the natural landscape and in its place leaving an eerie sight. Kuter goes on to name but a few practices that contribute to degradation majorly relying on poor farming methods that cause soil erosion as well as pollution from our industries that are encroaching our

land. This can be reduced by executing policies on soil conservation ad watershed management (SCWM) programs.

Land degradation deters economic development of a nation as presently land use practices are changing for land is divided for agriculture, wild life conservation and recreation. United Nations Convention to Combat Desertification, the convention on biodiversity, the Kyoto Protocol on Global Climatic Change and the Millennium goals are some of the various bodies that are coming together to combat this issue (UNEP, 2007). Reclamation of these degraded landscapes needs to conserve water sources and soil compositions in order to restore our land to its former glory.

2.5 Land reclamation

Section 3.4.2.4 of the National Land Policy defines land reclamation as the process of restoring land that has been destroyed by mining for it to fulfil its specified end use.

Land reclamation of deserted landscapes was a rare practice in developing countries. Kenya has become a signatory to some of the world's environmental bodies such as International Union for the Conservation of Nature and Natural Resources (IUCN) which have implemented environmental policies and legislative frameworks that seek to reverse the adverse effects of land degradation (Siachoono, 2010).

Future generations need to have the landscape that is disturbed by mining practices restored to its original use so that they have a healthier environment to live in. Post mining policies require mine owners to restore the landscape to its ecological former state which cannot occur unaided for natural succession requires many years for reclamation to occur. Human interventions are a necessity to restore any degraded land to make it

aesthetically and environmentally compatible with surrounding areas (Markéta, 2008).

The major objective of reclamation is to reduce pollution, shape the land using a multi-disciplinary approach to restore depleted land and water sources it for the intended use for future generations. to ensure that post-mining land has a feasible self-sustaining future with respect to both environmental and socio-economic benefits (i.e., developing publicly owned land for recreation, historic purposes, conservation purposes, or open space benefits, or for constructing public facilities in communities),

On the other hand, reclaimed landscapes can be utilised for environmental benefits such as wildlife conservancies and nature walks. Economic benefits of a nation can be improved by constructing social halls, museums and recreational facilities on abandoned quarries. Various methods of reclamation can be used to support the end use of derelict lands.

2.6 Methods and techniques for reclamation

In reclamation of mining sites, two approaches can be analysed: *determinism* and *contingency*. Reclamation plan depends on many factors which are grouped in four categories: i) Initial conditions of the landscape; ii) Climatic conditions like rain and drought; iii) Surrounding ecosystems and human activities; and iv) Mining policies and legal frameworks (Kuter N.). The reclaimed areas are woven into surrounding landscapes which must be incorporated in any post-mining proposal for the development of the landscape and the environment.

Deterministic processes involved in mining reclamation have been well studied and a wide set of reclamation techniques and tools have been developed. Most typical of them in mining reclamation are abiotic limiting

factors and nutrient cycling. (Bradshaw, 1980) identified the main physical and chemical problems that can be found in mine soils and their short and long term treatments, which are shown in the table1 below. The Specific problems encountered in mine soils and their treatment.

Category		**Problems**	**Immediate treatment**	**Long-Term treatment**
Physical	Structure	Too compact	Rip or scarify	Vegetation
		Too open	Compact or recover with fine material	Vegetation
	Stability	Unstable	Stabiliser or mulch	Vegetation
	Moisture	Too wet Too dry	Drain Organic mulch	Drain Vegetation
Nutrition	Macronutrients	Nitrogen others	Fertiliser Fertiliser and lime	Legume Fertiliser and lime
	Micronutrients	-----	Fertiliser	----
Toxicity	PH	Too high	Organic matter or pyritic waste	Weathering
		Too low	Lime	Lime
	Heavy metal	Too high	Organic mulch or tolerant cultivar	Invert covering or tolerant cultivar
	Salinity	Too high	Weathering or irrigate	Tolerant species or cultivar

Table 1. Specific Problems of mine soils and their treatment (Source **(Bradshaw, 1980)**

Open cast mines need to be restored though not all sites can be recovered depending on the extent of degradation. The ecosystem of the site needs to be evaluated prior to mining and after post-mining in order to implement plans and policies that are favourable to the local climate and conditions. These reclamation policies should be implemented together with all project stakeholders and neighbouring community so as to share a common goal of the intended use of the land. The landscape will go through various levels of reclamation to create a viable and economic project that will be aesthetically appealing and resourceful to the society. Sustainable development of such mine sites will require monitoring and evaluation from time to time to realise its goals of reclamation and restoration and to minimize the negative environmental impacts on landscapes.

2.7 Recreation

Recreation is defined as participation in any pursuit during free time so as to relax from the daily routine of work. It can also be defined as intended participation in leisure activities that are involving and satisfactory to all individuals who participate (Hall & Page, 2006).

Recreation is part and parcel of our daily life and can be attributed by factors such as environment and culture, personal interests which influence the type of leisure pursuits one indulges in. Recreation is grouped into two categories majorly outdoor and indoor pursuits which can be participated by an individual solely or as group activities and team building. Leisure and recreation play a vital role of creating health and fitness which improves the social aspects of a society.

Three main positive functions which recreation performs are:

Relaxation: people indulge in leisure during their free time and weekends which provides mental and physical break from the daily routines of work.

Entertainment: recreation provides a variety of activities that are interesting and fun for all groups of the society to participate in.

Personal and social development: recreation provides an individual with satisfactory and interesting activities that break the monotony of work reviving the social and physical aspects of a person. Outdoor activities that require group participation enhances social interaction which is basic to any society

Natural settings and outdoor recreation tend to attract more visitors and tourists who enjoy nature at its fullest. Parks and beaches are a major tourist attraction in our country that contributes greatly to our economy. Our society today has higher expectations for healthier lifestyles, quality services, commodification of recreational facilities and better customer service. Budgetary allocation shows that people are allotting adequate money for recreation and entertainment.

2.8 Diversity in Participation

People have a tendency to relate recreation with sports and games and other forms of play. Studies have shown that recreation is not limited to sports but encompasses other leisure pursuits such as travelling, gardening, cooking, visiting museums and camping (Torkildsen, 2005).

There is a wide range in the types and numbers of pursuits that fall under recreation and are classified into groups of various kinds. The cluster analysis of recreation according to (Burton, 1971) is based upon 71 activities produced in 14 groups. There were some unexpected relationships which emerged from this grouping process: but in general, the activities within each group appear to be homogeneous.

Group 1	*Group 2*
Rugby	Archery
Athletics	Go-kart racing
Basketball	Fencing
Keep fit	Surfing
Cycling	Canoeing
Music	Diving
	Hunting

Group 3	*Group 4*
Hill walking	Soccer
Rambling	Cricket
Camping/caravanning	Tennis
Walking	Golf
Visit to museum/art gallery	Table tennis
	Fishing

Group 5	*Group 6*
Hobbies	Picnics
Outdoor bowling	Driving to country side
Motor racing	Gardening
Scramble	Dining out
Sky diving	Visit to a pub/club
Squash	Dancing
Boxing, wrestling/ karate	Bingo

Group 7	*Group 8*
Visit to community centre	Ice/ roller skating
Dancing old time	Bird watching
Photography	Horse riding
Church	Youth club

Group 9	*Group 10*
Sailing	Cinema
Rowing	Theatre/concert
Motor boar cruising	Library
Evening classes	

Group 11	*Group 12*
Hockey	Mountaineering
Netball	Pot-holing
Gymnastics	

Group 13	*Group 14*
Painting/drawing	Bowling
Going to a party	Swimming

Figure 2 Cluster analysis on recreational activities (Source (**Burton, 1971)**

Group 1 consists of seven activities which are physical pursuits. These are group activities except for cycling and are undertaken in a man-made, urban setting.

Group 2 consists of nine activities, which are physically active sports. They are individual activities rather than team pursuits with the exception of archery. All require considerable skill and are expensive in terms of cost of the equipment that the individual needs for participation.

Group 3 consists of five activities which take place in the countryside except for museum visit. All of them can be individual or group.

Group 4 is made up of six activities which require a group of two.

Group 5 is the largest of all groups with physically active pursuits, which involves some personal risk and danger.

Group 6 consists of seven activities which with the exception of gardening are social activities with little or no skill required for any of them.

Group 7 is made of three activities with the exception of photography and membership of a group is important.

Group 8 consists of five activities for young people. All except youth club require some degree of skill to enhance enjoyment.

Group 9 consists of five activities which are water based except for evening classes. All are group activities and require some skill and are likely to be physically demanding.

Group 10 consists of three activities which are cultural pursuits and are usually indoor, urban activities.

Group 11 consists of three physically active team sports which do not require specialized skill for enjoyment.

Group 12 consists of two activities which are physically demanding usually undertaken in groups. Both involve personal risk and danger and specialized equipment making them expensive for participants.

Group 13 has no common bond between activities.

Group 14 consists of two physically demanding activities and is undertaken in small groups.
In a sense people who tend to participate in one activity within a group are likely to participate in another activity within that group than in another group.

2.9 Recreation expenditures

Recreation boosts our economy largely as it increases the gross national product (GNP) and is accountable for millions of jobs created in the tourism, health and fitness industry as well as government sectors. Recreation pursuits improve the welfare of individuals and the society emotionally, physically and socially.

Recreation represents the largest expenditure of an individual's disposable income. Expenditures have shown growth since 1985 to 2003 with a rise from 6.6 percent to 8.5 percent (Kenya National Bureau of Statistics 2014). Recreational activities related to technology and music have increased commercial participation and experiences.

Division	2010	2011	2012	2013
Food & Non-Alcoholic Beverages	5.9	20.5	10.0	7.3
Alcoholic Beverages, Tobacco & Narcotics	7.5	9.4	9.0	6.0
Clothing & Footwear	3.4	7.1	9.6	5.2
Housing, Water, Electricity, Gas and other Fuels	3.2	11.4	9.3	4.6
Household Maintenance	3.2	8.6	10.0	4.3
Health	4.4	7.2	5.9	4.3
Transport	5.3	21.4	7.4	4.8
Communications	-10.3	-15.7	5.7	(1.5)
Recreation & Culture	1.2	7.9	9.6	6.1
Education	1.4	4.4	6.7	5.2
Restaurant & Hotels	4.0	14.6	14.4	7.1
Miscellaneous Goods & Services	2.2	7.2	9.6	4.6
Overall Kenya	**4.1**	**14.0**	**9.4**	**5.7**

Table 2. Rates of change in consumer price indices 2010-2013 (Source Kenya National Bureau of Statistics 2014)

Survey has indicated that people are spending billions of dollars on wining and dining, lottery and travel and tourism.

The table 2 above shows the distribution of expenditures for personal consumption in 2003.

The argument for the use of common revenues as the principal means of supporting recreation has long been accepted. Traditionally, outdoor recreation that was provided at low or no cost was considered a public right and much of the cost was collected through taxation. With growing demand for high quality services, more facilities and better customer service the arguments supporting pricing policies are becoming more acceptable to recreation facility providers who desire to maintain current service levels for visitors. These include services such as variety in facilities offered, and adequate facility maintenance. Positive benefits arising from increases in the output of recreation are appropriately measured by the willingness of users to pay for each unit of output provided. Willingness to pay is manifested in actions such as entry fees and other user fees.

2.10 Recreation and the Kenyan Youth

The population age bracket of 30 years and below constitutes about 75% of the Kenyan population. The government should allocate programs to cater for leisure and recreation for the youth who form the working force of this nation. Recreational activities build personal, social and physical aspects of any individual which promotes fitness and health as well as builds communication and leadership skills while indulging in this activities. (Kenya, 2007).

Sports and recreation facilities provide the youth with an array of activities to participate in and reduce boredom and negative influences such as

crime and alcoholism among the young generation. Stadiums and local cultures should be preserved passed on to this budding generation who form tomorrow's leadership (Rop, 2013).

The government under the Education Act 1944 has a duty to provide recreational facilities that are current and provide a variety of activities to target specific needs of the society. Recreation providers have shown laxity in their provision of community centres which are scarce, lack ablution blocks and little maintenance is provided making it cumbersome for the youth to exploit.

Several researchers have investigated associations between recreational facility availability and youth physical activity levels with some finding positive associations and others finding no associations. There is a dependent relationship between availability of recreational facilities and physical activity. Various case studies have proven that Strong evidence indicates that greater availability of recreational facilities is positively associated with youth's physical activity. The youth relate to facilities that have good services, maintenance, safety and youth oriented activities (Ries, 200909).

Studies have shown that youth in urban centers use parks less for the facilities offered need little physically activity for participation. The males may use parks for the purpose of sports as compared to their female counterparts who prefer passive activities. The study continues on to suggest for greater park use the activities should be centered on specific age groups. The facility should have activities targeting the children, adolescents and parents so that the whole community finds satisfaction in parks (Ries, 200909).

The Kenyan youth form the majority of the population and they have a lot of energy that they need to channel positively. Lack of employment

opportunities and free time has led some to participate in acts of crime and violence which in Maslow's hierarchy is the lowest form of leisure. The government needs to provide opportunities for the youth to channel out their energy in activities that are fun and satisfactory. There is a growing demand for more recreational facilities in most urban centres as well as rural towns. The young generation have identified their needs and would wish if they were met. We meet the youth skating besides the roads for there are no skating brinks available. The recreation management of the country needs to revise their programs to cater for the various groups in the society and provide specific activities targeted to provide entertainment and provide an escape from monotony. The toddlers, adolescents, youth, singles, parents and the aged would be considered during planning of these recreational amenities as there is need of a theme park as opposed to the public parks we currently use. Disney world has proven that this man-made parks attract people who enjoy the activities provided.

This table represents a list of publicly provided facilities in Kenya.

Category	Facility
Outdoor sport and recreation	Playing fields Golf courses Bowling rinks Stadium
Indoor sport and recreation	Swimming pools Gymnasia Sport halls Leisure centres
Outdoor informal recreation	Play spaces Open spaces Urban parks

	Beaches, lakes, rivers
Countryside recreation	Country parks National parks Camping sites Picnic sites
Cultural recreation	Concert halls Theatres Art centres Art galleries and museums
Education related	Education canters Youth clubs Community centres
Library services	District libraries Mobile libraries
Tourism, conservation and heritage	Historic sites Nature reserves Conservation areas
Entertaining, catering and conferences	Public halls Pavilions Conference centres
Housing, community and Social services	Play centres Day centres Community halls Holiday camps

Table 3. Publicly provided facilities (source **(Kenya, 2007)**)

2.11 Overview of Theoretical Concepts on Leisure

Leisure is an activity taken for relaxation and enjoyment during time off work. Various philosophers have alluded to this fact and have sought to figure ought factors that influence the choice of activities undertaken.
Aristotle proposed that leisure occurs at three levels: amusement, recreation, and contemplation.

Contemplation is when an individual purposes to involve in activities that require skill in order to participate. Recreation is activities that require physical energy during involvement. Amusement is entertainment that the audience gets while watching others. Aristotle writes: "Leisure does not connote idleness, lack of purpose, or waste of time. It is ranked above toil and struggle, as much as it is ranked above entertainment and pastime. Both the necessitated work and the relaxing entertainment, in a word, are but preparations for the ultimate function of leisure". Against this literature Aristotle's general idea of leisure may be looked into depth and profitably compared with other renowned views on the topic.

2.11.1 Self-Actualization and Flow Theory

Several contributors to this volume refer to intrinsic motivation and, in particular, the use or application of Csikszentmihalyi's "flow" or "optimal arousal" concept to apprehend the driving force of most participants (Jennings, 2007). Many discuss the flow of experiences that one gets to achieve fulfillment of activities. A participant chooses an activity that will bring adventure and entertainment then tests their strength at it and pushes oneself to do it to their level best. Flow theory draws relationship between challenge and adventure (Synder & Lopez, 2009).

Flow theory is developed from the work of Maslow with the concept of "process and product" outcomes of behavior (Synder & Lopez, 2009).

This study analyses the nature of "intrinsic motivation," with the need for activities that bring satisfaction.

Flow experience is defined as to the drive that gets one involved with a given pursuit. An activity of choice brings relaxation and amusement to the participant in a way that there is repeated action of the same activity. A person in flow enjoys the activity undertaken.

2.11.2 Serious Leisure Theory

Work and leisure are dependent on each other for a thriving society. Leisure is a compulsory component to people now than ever before with health and fitness being a key motivator (Stebbins, 2007).

Robert Stebbins, identifies "three types of serious leisure—amateurism, hobbyist pursuits, and volunteering". Serious leisure is a systematic pursuit of activities that is significant and interesting for participants. For leisure to be meaningful to a participant serious leisure theory indicates that the activities should be involving ones skills and knowledge so that the goals are attained and rewarded at the end of the pursuit. An individual needs to find the activity fulfilling enough to take it seriously as a career and only then does one realize self-actualization (Stebbins, 2007).

2.11.3 Nash's philosophy

According to Nash's philosophy of recreation and leisure as seen in figure 3, leisure activities are ranked according to their value to society. At the upper end of the scale he suggests that individuals use their leisure time for creative participation, composing music, and invention among others. At the lower end of the scale people use their leisure time for delinquent acts and crime. This theory is based on the assumption that the more enjoyable and useful activities are culturally based which is not necessarily the case in leisure pursuits. This is in converse to other

theories of recreation mentioned which are Self-Actualization and Flow Theory and Serious Leisure Theory.

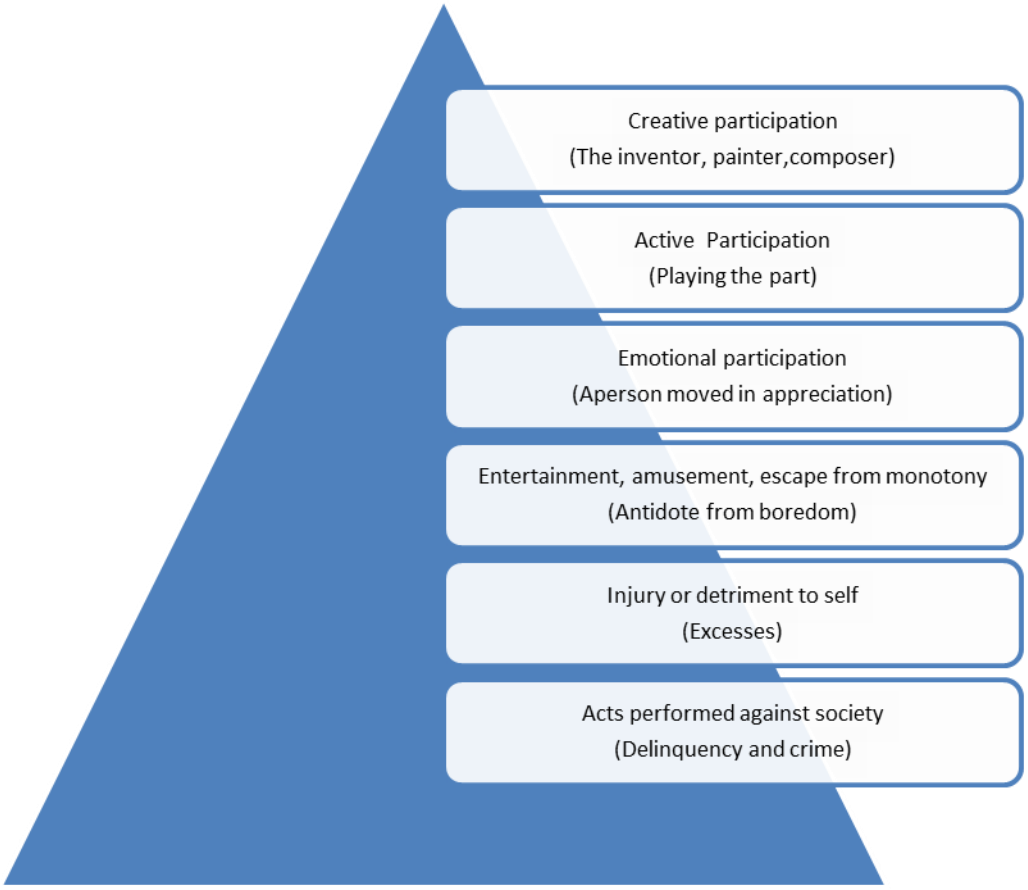


Figure 3 Nash's theory of leisure time **(source (Kuter N. , 2013)**

Conclusion

These theories on leisure have put the individual at the centre of every choice of pursuit. The motivations given in any given pursuit vary from person to person, value to society and the skills and challenges that are derived from leisure. At the end of the activity the participant gains a sense of accomplishment of a job well done.

Various theories agree that elements of leisure are play, freedom, goal setting, knowledge and skills and personal expression. This builds the individual personally and the society as a whole.

2.12 The current influences on recreation

We have inherited traditions, attitudes and knowledge from other periods in time and have a wider choice of leisure pursuits than ever before. Five major areas that influence the way people perform and enjoy recreation activities are explained below:

Society you live in: this includes the social and economic environment in which we live. It can include the standards of living in material terms, the political party that governs the country, religion, laws of the country, history of the society, technology available and international influences.

Environmental factors include the physical surroundings, either natural or manmade features and amenities that an area offers. These have an influence on recreation which can include soil type, climate, landscape and animals.

Professional and commercial life: the amount of commercial activity and income generated in a country influences the amount and type of recreation activities that take place. The more income there is to spare in a society the more the incentive there is for businesses to provide commercial facilities and generate profit.

Home, personal life and character: this relates to what influences you as an individual. Various people are influenced to undertake specific activities based on their culture and environment.

Recreational amenities: the wider the range of facilities available the richer the society will be in term of leisure provision and the greater the choice. One should consider availability of organized amenities, price,

availability of special clothing and equipment and time necessary to learn activities.

2.13 Parks

Rapidly increasing demand for recreation, springing from such factors as increase in social values, leisure time, disposable incomes, mobility, and urbanization make for continuing adjustments in resource allocations. Conservation management is open to the creation of open spaces only if it does not affect land and water resources.

A park is a natural scenery that provides relief from the polluted overcrowded towns we live in. The word park means an extensive public open space of unified character with provision for walking, sitting and playing games, sports facilities all linked by an extensive path network. The landscape of such open spaces is created by the use of vegetation, landform and architectural elements.

Tourists today are attracted to nature based recreation which is evident by the number of people currently visiting parks. This provides economic benefit to the nation as it brings revenues from the charges collected from the tourist. Parks and forest have maintained their natural and historical heritage which makes it a favorite for most visitors (Wood, 2002) (Wunder, 2000). Participants enjoy nature walk, picnics, cycling and bird watching which bring an experience that is unique from any other recreational facility.

The background to park reconstruction, expansion and the development of new parks started in the late 19th century when the first national and urban parks were opened in an effort to preserve unique and special areas and develop them for recreational use. Thus the recreational value of numerous parks with few facilities has significantly increased by the provision within them for more facilities.

2.14 Social factors promoting recreation and Parks

Since the post-industrial period reforms on recreation activities have progressed due to social factors such as"

Increase in discretionary time: Time off, holidays, annual leave and weekends have increased participation in leisure and recreation.

National affluence: Gross National Product (GNP) and disposable income has increased expenditure on recreation with a record of having a 3.9% of a person's budget.

Commodification of leisure: A variety of activities are introduced in recreation centres which enhances commodification. Companies such as Time Warner, Disney and Viacom have privatised recreation to create a variety of activities that are technologically adapted for the end user.

Population trends: An influence on leisure program has been diversified into racial, ethnic and age (children, youth, and aged) which has a significant implication on recreation participation and delivery.

Where people live: Parks make cities more liveable and attractive for tourists who seek for nature based recreation.

Influence of technology: Technology has advanced outdoor recreation by innovating trendy activities such as ice skating and scuba diving.

Health and fitness: Our society has been sensitised on the need for exercise and physical fitness. Modern lifestyle is passive and does not require physically challenging activities thus leading to poor lifestyle choices of entertainment and overweight citizens. Recreation will engage individuals more so as to curb this negative choices.

Environmental concern: Environmentalists are concerned with the provision of recreational facilities such as parks that nurture our heritage and natural resources without depleting our treasures.

Changing families: More women are engaging in sports for there is freedom created from having small families, better wages and advanced technology that helps reduce on chores. Every member of the family has free time to their disposal.

Maturation of organizations: The recreation providers have diversified from Central Government to include Local Government and private providers as well. This increase in the diversity of service providers has meant that more private institutions have gone into the business of recreation.

2.15 Conceptual framework to reclamation of mines

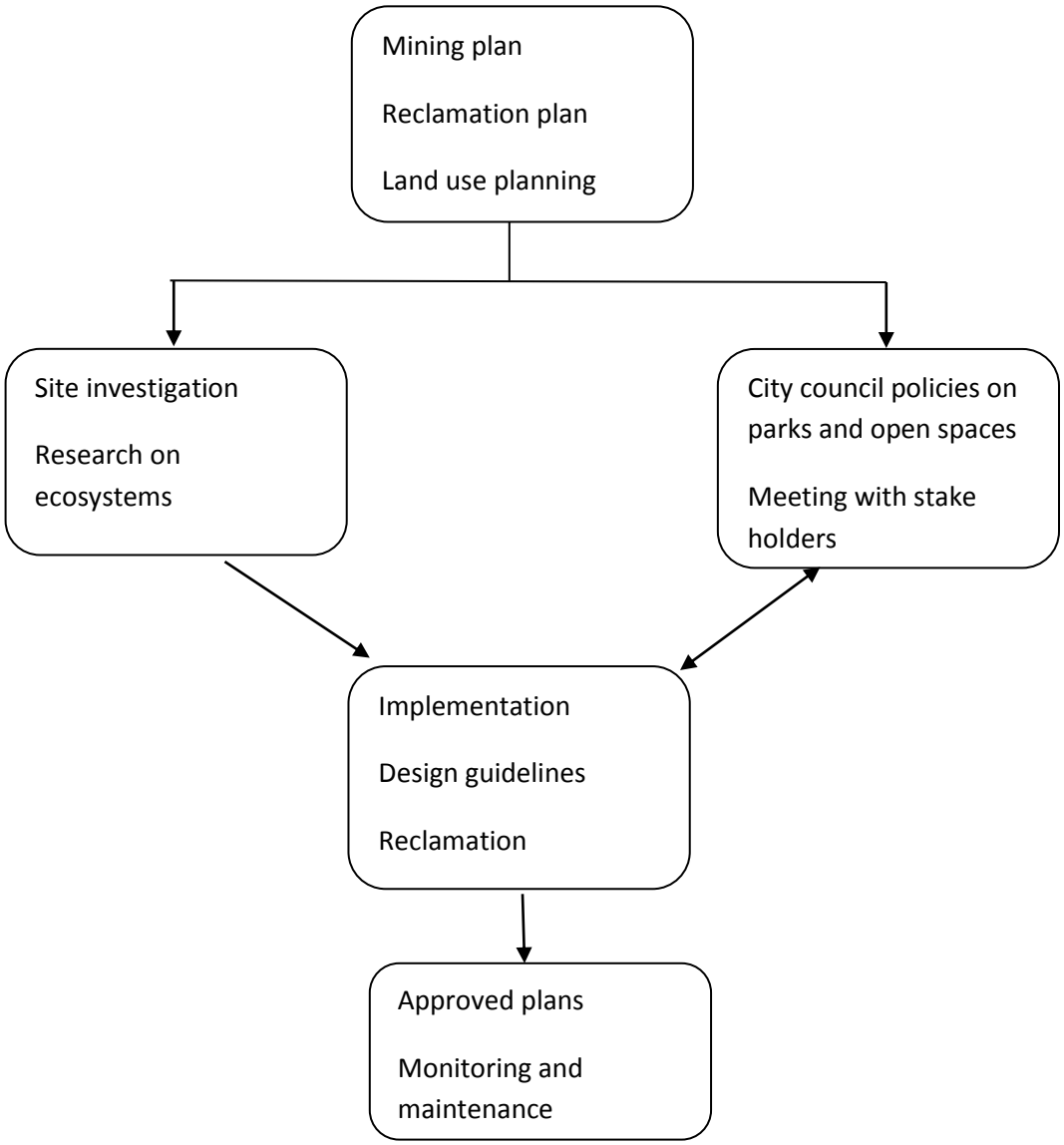
In reviewing literature a number of factors evolved in determining the reclamation techniques of degraded lands. This study applied a conceptual model figure 4 which summarizes the relationship between various factors that affect reclamation of quarries in Kenya. The model adopted explains the interaction of factors which influence land use, the intervening factors and how they lead to effective restoration of degraded landscapes like quarries.

Reclamation and rehabilitation should be planned parallel with mining activities. The main objective of reclamation is to minimise the effects of degradation and restore the landscape to its original state or reduce the effects of contamination to soil and water streams. Prior planning helps with monitoring mining activities that destroy ecosystems and post mining plans are implemented soon after excavation to reduce on the number of years the land would take to reconcile itself. (Knotts, November 4, 200).

Projects of rehabilitation vary depending on various factors of the open cast mines. Budget allocation and community needs are factors to consider for a successful land reclamation. Traditionally recycling of mine sites

was majorly for agriculture but a new trend has seen projects like recreation and wild life conservancies being projects undertaken in this type of reclamation proposals.

Haller Park in Kenya is one such wildlife park that is founded on a former quarry site. Case studies from other countries have given a wealth of examples of how degraded landscapes have been shaped aesthetically to offer recreation facilities that boost the national economy of a nation through levies charged for their services.



Engler's list	Description

Figure 4. Process

Natural	Allow nature to reclaim site with no or minimal human influence
Camouflage	Conceal mining facility using screen and buffets
Restoration	Return the land to its applicable original contour
Recycling	Use site for public amenities
Mitigation	Repair a mined out site from extensive human and natural damage
Sustainable	Recycle manmade or natural resources on site
Educative	Common mining or other resource information through outreach
Celebrative	Treat a site as a work of beauty and unique experience
Integrative	Combination of approaches integrating art and science

of the integration of surface mining and reclamation (source Ruth Mwangi 2015)

2.16 Design approaches to reclaiming mine sites

A study of landfill and sewage treatment by (Arbogast, 2000,Kuter N. , 2013) have analysed suitable methods to rehabilitate mining sites using natural and human intervention technique to restore landscapes to its functional and aesthetic façade. Reclamation is seeking to minimise the negative impact of open cast mines which are a necessity to any growing economy as this quarries provide construction materials and job opportunities for many. Nine approaches for mining reclamation are discussed below:

Table 4. Engler's design approach **(**source (Kuter N. , 2013)

The above approaches have their advantages in regards to reclamation. The most common approach is camouflage fencing using barbed wire and vegetation which may not restore the site but be a barrier to keep off people. For smaller quarries nature over a short while will fill up the quarry and vegetation cover will manifest itself. Quarries of larger areas will require human interventions to speed up reclamation. My research has revealed that Kenya has many massive abandoned quarries that back filling will not be an option. Restoration, mitigation, recycle and sustainable approaches to reclamation will be required for the majority of quarries around the country disguise the mining facility. An educative design approach works best for it creates awareness to all stakeholders on the negative effects if restoration plans are not implemented.

The researcher plans to use the recycling approach to create a recreation park for the Kayole community. The recreation amenities in Kayole is limited to small pubs in the estate with Nyama villa being the only best recreational grounds serving the thousands of people.

Integrative approach using design guidelines will be implemented to revive the grounds to a recreational facility with a manmade lake, modern restaurant and various species of trees and grass appropriate to the soils for landscaping.

Geomorphic model of reclamation

Reclamation of quarries using geomorphic principles has been practiced in Central Spain and many studies concur that it is a suitable method for rehabilitation. "Nature can provide analogues for post-mining landscapes in terms of landscape stability and also in terms of the rehabilitated structure blending in with the surrounding undisturbed landscape (Hancock, 2003)". Geomorphic principles involve topographic reconstruction, replacement of top soil and management of the long-term soil composition (Robinson, 2009).

Quarries are characterised by slopes with steep terraced benches, layers of rock and dust particles and stagnated water. For geomorphic approaches to manifest in surface mining reclamation the following should be considered: (i) the extracted mineral; (ii) extraction methods (iii) quarry form and shape; and (iv)rock formation. Karmiel quarry in Israel has adopted the landform design in reclamation. Post mining rock formation has been reused to develop a park using the existing stones to create a functional and aesthetic landscape. Reclamation is site specific which depends on the land use after successful rehabilitation. The table below analyses some approaches applicable:

Mining Method	**Most common mineral resource and topography**	**Most common result in landform with no reclamation**	**Traditional and landform with reclamation**	**Main geomorphic reclamation constraint**	**Geomorphic approach to reclamation theoretical or actual**
Open pit	Low grade high volume mainly metals	Benched circular pit, with outside waste dumps	Terraced waste dump on valley	Large pits, visual impact; run off and erosion of dumps	Dumps designed to replicate local landforms
Strip area	Strata bound, mainly coals in flat to moderately rolling terrain, with thin surficial mineral	Benched rectangular, shallow large pit with outside waste dump	Transfer mining-backfilling in terraced platform or smooth for farming or forest use	Large scale erosion movement	Hydrological basin in final pit. The fluvial geomorphic approach
Terracing	Mainly coals in flat terrain, with deep or thick deposits	Benched rectangular, deep large pit with outside waste dump	Transfer mining-backfilling in terraced platform or smooth for farming or forest use	Large scale erosion movement	Hydrological basin in final pit. The fluvial geomorphic approach
Mountain top removal	Coals that underlie the top of	Benched pit with outside waste	Terraced waste dumps on slopes	Off side effects of run off and erosion	Replication of the application original

	mountain ridges	dumps	valleys and lead of hollow fill	from waste dump	contour. Backfilling of original site
Contour	Mainly coals mined in hillside and steep terrain	High wall bench out slope topography from blasted or dug and overburden chaotically left on the bench	High wall benching and terraced waste dumps on slopes, valleys and lead of hollow fills: visual screens	On site and off site effects of run off erosion: visual impact: high wall instability spoils often scarce	High wall trench, concave slope
Slope quarry	Mainly industrial cut construction rocks and minerals				
Pit quarry	Mainly ornamental rocks e.g. graphite	Benched rectangular pit and chaotically arranged rock blocks and spoils	Rehabilitation of terraced topography on bedrock for vegetation establishment	Scarcity of waste dump to restore soils and vegetation cover	Reshaping of terraced topography following geomorphic principles, hydrologic basin
Gravel pit	Aggregate gravel and sand in floodplain and terraces	Rectangular single benched pit. Often intersects groundwater table	Filling of hollows and top-soiling for farming. Artificial lakes for natural use	Scarcity of waste dumps for landform design. Pit often below water table	Design of ecologically functional wetlands following principles of fluvial processes
Source: SMCRA United States Surface Mining Control and Reclamation Act					

Table 5 . Common surface mining methods and possible geomorphic approaches to their reclamation (source: SMCRA United States Surface Mining Control and Reclamation Act)

2.17 Vegetation approach to reclaim a mine site

Re-vegetation is a cost effective, long term method of rehabilitation. This approach is effective in that it is not only aesthetically appealing but also functional in that it minimizes water and air pollution as it provides a ground cover. Re-vegetation also prevents soil erosion and would be the best option to reclamation after back filling is employed.

(A.J., 2000) "Explains that, metalliferous wastes are very unfavourable environments for plants because the presence of many growth-limiting factors particularly residual high levels of heavy metals, macronutrient deficiencies and poor substrate structure. Such features result in most metal wastes being largely devoid of any natural vegetation, even many years after abandonment. Consequently, experimentation has been undertaken at mine sites to attempt to elucidate and overcome limitations to vegetation establishment, allowing large-scale re-vegetation schemes to be formulated. Although such schemes have often been successful at specific sites, their widespread application is limited owing to the great variation in physical, chemical and biological factors which exist between mine wastes".

Current approaches to re-vegetation and reclamation involve both ameliorative and adaptive strategies to allow plant growth.

Philosophies of re-vegetation

1. Ameliorative approach relies on using organic waste and fertiliser to boost the growth of plants.

2. Adaptive approach relies on planting a nursery on soil compositions that have controlled PH to reduce toxicity.

3. Agricultural focuses on the use of sluggish waste materials to boost plant fertility.

Advantages of vegetation in mine waste stabilisation

Vegetation is a long term approach to restoration for it is cheap to implement and can cover larger grounds compared to other methods. As discussed earlier the advantages of using plants is a more desirable eco-friendly method that cannot be outweighed. (A.J., 2000)"Vegetation can return a large proportion of percolating water to the atmosphere through transpiration, thus reducing the concentrations of soluble heavy metals entering watercourses, reduce surface erosion because the roots bind the substrate.".

Site investigation will guide towards selection of plant species that can thrive in a given area. Plants come in a variety of color and textures which weaves together the beauty of the surrounding buildings as well as creating land for agriculture and recreation purposes. Proper irrigation and maintenance will support vegetation as a long term solution to degradation.

The nature of waste materials and problems of vegetation establishment

Metalliferous mining produces waste of two distinct types, very coarse waste rock and fine grained dust. Soil structures at quarries are polluted with metal concentration which does not support plant growth. This soil also loses the capacity to retain water needed for growth and germination of plants. This makes direct vegetation impossible unless fertilizer and lime are used to improve the soil composition to support growth.

2.17CASE STUDIES

2.17.1 Case studies of reclamation in China

The Shimao Wonderland Intercontinental hotel is a unique construction in Songjiang, China, located at the base of Tianmenshan Mountain. The hotel is founded on an abandoned quarry that was characterised with stagnant water. In 2012 reclamation plans started by clearing the contaminated water to allow fresh water to stream in the quarry which would be later used as a lake. Soon after construction commenced by UK Company Atkins to provide a contemporary hotel for tourists.

Atkins Company is using sustainable energy sources from the water collected in the quarry for thermal and electrical use. The hotel has 19 storeys', 17 of which are below the ground level; two of the floors are above the 90-100 meters deep quarry. The hotel is designed in an "S" shape utilizing a convex to concave form. It also has a separate structure for the lobby that is made to replicate a flying saucer as it would descend into the quarry. Re-vegetation approach will be implemented to create a visually appealing scenery. Geomorphic approach will be used as the rock surface after mining will be used as the foundation of the building which effectively reduce the cost of construction.

The hotel will have a combination of indoor and outdoor recreation amenities. Recreation facilities include a restaurant, swimming pool, aquarium and rock climbing. (Songjiang Shimao Hotel – Atkins". Atkinsglobal.com. Retrieved 2012-06-12

Figure 5 The Shimao Wonderland Intercontinental before reclamation

(sourcewww.masterplanningthefuture.org)

Figure 6 The Shimao Wonderland Intercontinental after reclamation

(Sourcewww.masterplanningthefuture.org)

2.17.2 Case study in Israel

Quarry Rehabilitation Fund (QRF) is a foundation started in 1973 to oversee rehabilitation of quarries in Israel. It functions in cooperation with the Israel Lands Authority (ILA) and the Energy and Water Ministry, with additional representation from the Interior Ministry, the Finance Ministry, the Israel Nature and Parks Authority and the Environmental Protection Ministry.

"Once the QRF reckons a site abandoned and ready for rehabilitation, the fund and ILA representatives together would propose a predetermined land use. Next, the fund must get both the district committee for planning and building, and the relevant local authority that will be managing the site after its rehabilitation, on board. The Karmiel quarries rehabilitation evolved as a need to establish recreational centres for its growing population. QRF collects royalties from developers while the quarrying is being carried out, the percentage of which depends on the value of the minerals being harvested. With royalties collected from the various developers, the fund administrators are then able to prioritize rehabilitation as they see fit, including that of abandoned Golan Heights quarries whose former miners are not accountable to the State of Israel because they are Syrian (sourcehttp://www.jpost.com/Enviro-Tech)".

Tsurnamal Turner Landscape Architecture, has used the recycle and education approach to reclamation. The architects have used the existing rocks to create terraces and sculptures, water streams are used to irrigate the gardens within. An open air amphitheatre provides a platform for events. This case study is a good reference for future studies as it has governing bodies and clear hierarchy of planning for rehabilitation works

Figure 7. Karmiel Park before reclamation

(sourcehttp://www.jpost.com/Enviro-Tech/Abandoned-quarries-being-transformed-into-parks)

Figure 8 Karmiel Park after reclamation

(sourcehttp://www.jpost.com/Enviro-Tech/Abandoned-quarries-being-transformed-into-parks)

2.17.3 Case study in Kenya

Haller Park is located in Mombasa on the Kenyan coast. It is named after founder Dr. René Haller and was developed in 1971 as an initiative to clean up pollution. Dr. Rene was driven by the need to create a healthier environment and once restoration commenced he discovered that animals found a habitat there and a recreational park was developed. The former Bamburi Portland Cement quarry designed by Lafarge Ecosystems Company is now a tourist attraction for the local people and tourists in Mombasa.

The quarry did not have steep slopes as is characterised by others therefore re-vegetation approach was viable. The stagnant water that fills the quarry was used as a lake for the hippos that live within the sanctuary. Soil composition was improved by adding fertilisers and compost. (Gathuru, 2013)"Explains that as a result of the re-vegetation, millipedes and other life forms colonized the area which was under rehabilitation. The most important fauna were fruit bats and monkeys which acted as seed dispersers for plants and trees not initially planted. Three species of plants were found to survive in these saline conditions and they are: Whistling pine, Coconut palm and *Conocarpus lancifolius".*

Conservation management is open to the creation of parks like these that preserve land and water resources .Tourists today are attracted to nature based recreation which is evident by the 90,000 visitors who visit per year. This provides economic benefit to the nation as it brings revenues from the revenue collected at the entrance as well as from the sales of meat and plants sold from the park's nursery.

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Figure 9. Haller Park during mining (source http://www.cosy.sbg.ac.at)

Figure10.Haller Park after reclamation **(source http://www.cosy.sbg.ac.at)**

Conclusion

These case studies serve as successful adaptations of resource depleted quarries into sites that promote community engagement, housing, practical use of land. Karmiel Park and the Haller Park flawlessly utilize the empty quarry sites into parks that have become beloved by locals and tourists. Shimao Wonderland Hotel once completed is projected to provide permanent and temporary housing that yields sustainable practices.

These cases are examples of how sustainable development is a solution for abandoned, resource depleted quarries that benefits everyone. By encouraging the rehabilitation of land disturbed by quarrying, the environment can be rid of the negative effects of industrial activity like mining. The redevelopment of quarries can both benefit humans and lessen the environmental impact of quarrying without removing quarrying as a global and regional industry.

Adaptive re-use projects can transform quarries into a variety of public and private spaces other than these uses. Such options include geological sites for research and education, nature preservation areas, training courses for rescue dogs, personnel, and the military, open-air theatres, museums on quarrying heritage, film sets, rock climbing, storage and warehouses, landfills, harbours and industrial plants (McCandless, 2013).

The after-use of quarries is important because it increases public acceptance of quarrying and shows that former quarry sites are not merely degraded areas, but can give value added to the land. Land rehabilitation should be considered during mining plan for it restores land to its full potential and ready for re use for sustainable projects.

Rehabilitation of quarries can yield so many positive social, economic, and environmental that it should be reintroduced into society after their resources are depleted. Although remediation is a costly feat for most

quarry sites, the benefits seen in the cases I have presented show how the costs will be outweighed by benefits, and adaptive re-use should be undertaken as measures to make our cities more environmentally friendly healthy and visually attractive to all.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

To meet the objectives of the research, one of which was to identify design guidelines used for quarry reclamation, it was necessary to analyse observation, interview and surveys. From design research the use of digital equipment among other data collection tools was used. The data was mainly qualitative although quantitative data has been used where necessary. The methodology included collection of primary Mihango quarry and secondary data, analysis of data and presentation. The process of collecting data was mainly from City Council representative, quarry representative and park users and inductive logic was used for data analysis.

(Creswell, 2007) Data was collected and sorted by organizing it into abstract units, inductive and deductive reasoning was used to create patterns and themes while focusing on research objectives. Data was interpreted after field study using tables and related literature review.

Research Design

A research design is a plan that the researcher uses to collect answers to research questions. This research is both descriptive and casual-comparative using the case study approach.

A casual-comparative design was employed for this study as it was expected that the reclamation of quarries to parks will increase users in parks. According to (Yin, 2010) “a case study involves an observation of a single group in time that allegedly produced change. This procedure becomes more relevant in a study where there is lack of understanding of the nature, process of reclamation undertaken in the various restored mine projects internationally”.

The research problem and objectives of this study indicated that the best approach in carrying out this study was descriptive and casual-comparative. Given, (2008) “Descriptive research is defined as attempts to explore and explain while providing additional information about a topic. This is where research is trying to describe what is happening in more detail, filling in the missing gaps in knowledge and expanding our understanding”. This is also where data is collected to draw deductions as to - the 'what attracts users to parks' and 'how are reclaimed parks like Haller Park and other private parks performing better than public parks.'

Brewer, (2010) “defines causal-comparative design as a research design that seeks to find relationships between independent and dependent variables after an action or event has already occurred”. The researcher's goal is to determine whether the reclaimed landscape affected the performance of sustainable recreation. The study compares the number of visits in Haller Park over Uhuru Park. Most of the respondents showed interest in private parks over public parks as seen there were a commodification of facilities offered even though at a cost.

The outcome from the study is expected to be descriptive. Qualitative methods will be used for data analysis.

3.2 Sampling procedure

The researcher used natural sampling units of ten individuals in their daily schedules. Stratifies cluster sampling was used to select interviewees in an attempt to forecast use of thematic parks based on research. A group of ten representatives at five sampling points was determined to be a valid representation of the park users who were interviewed at different days and in different venues.

(Mugenda, 2003) “Describes population as the entire group of individuals or items under consideration in any field of inquiry and have a common

attribute". The target population of this study consisted of various focus groups living near the quarry and users of parks. The study sought stakeholders such as the City Council of Nairobi Parks and Open Spaces department and representatives of quarries.

The population of fifty interviewees made it possible to determine various recreation facilities that focuses interacted with, type of recreational pursuit restricted to specific groups in the population. Many of the young persons aged between 15and 25 years engaged in pursuits of entertainment and social activities. These persons also visited more parks outside Nairobi that incurred a higher entry fee and had more pursuits for interaction.

	Facility	**Population**
	Mihango quarry	10
	City Council	1
	Mihango representative	1
	Mihango community	10
	Jeevanjee gardens	11
	Uhuru park	10
	General public	18

Table 6. Distribution of respondents interviewed

3.3 Variables and their Conceptualization

Variable 1: Reclaimed landscape

Land reclamation of deserted landscapes was a rare practice in developing countries. Kenya has become a signatory to some of the world's environmental bodies such as International Union for the Conservation of Nature and Natural Resources (IUCN) which have implemented environmental policies and legislative frameworks that seek to reverse the adverse effects of land degradation (Siachoono, 2010).

The boundaries of Kayole have gradually expanded due to high population and eventually the quarries which used to be in the rural area have become unnecessarily involved within the Nairobi capital. This study identified ten quarries on Ngong' River stretching from Njiru to Utawala. These quarries cover an area as large as 50 hectares and as deep as 100 feet per quarry which lays waste after mining is over and becomes a hazard to the environment. Reviewed literature shows projects that have successfully converted quarries in China to build Shimao Wonderland hotel as seen in figure 5.

Mihango quarry in Kayole has been selected as a sample unit because one lady Petronila Njeri has taken upon herself to see the refill of this waste land. The responses cited having this space open poses more harm than good to the society and the sooner it is refilled the better. The interviewees were asked to give suggestions of what would be the probable use of the space after reclamation and 30 percent cited recreation.

Variable 2: Sustainable recreation

Awareness on the need for recreation is a growing trend in our society as people are seeking to keep fit and healthy lifestyles to keep lifestyle diseases at bay. It contributes to the economy by bringing in revenue and creating job opportunities for the society.

Recreation activities create a demand for land and facilities. Using existing resources as quarries for new construction is a useful form of recycling that has occurred throughout history and utilises land that was once abandoned.

Our census indicates growth in population in every count yet our parks are not increasing at the same pace. Nairobi and its environs only have four parks Uhuru Park, Central park, Jeevanje garden and City Park. These parks need to alter their facilities to match up to the growing need of the society. They all have the same characteristics of landscaping, providing a good picnic site.

Recreation is a necessity to today's individual and requires facilities to cater for this need. An individual is influenced by culture, society and international interest as to what facilities to interact with. Many factors have led to an individual's preference of one pursuit over the other as indicated in the literature review. A commodification of facilities by recreation providers will capture the needs of the society and in turn meet the demand in recreation pursuits.

3.4 Data collection

The researcher will discuss the forms of data collection tools used and exemplify the idea of triangulation.

Six methods of collecting data about reclamation and recreation will be considered in this chapter.

Interview survey has a major advantage over other research techniques for its flexibility, in that the researcher was able to interpret the information for some of the interviewees. The researcher used structured questions as a guide to collect information from the various focus groups. Site survey was also incorporated with individuals in parks, households and Mihango area in Kayole. The major difficulty with this method of data collection is analysis of data as I had four focus groups.

The object of the study is to secure answers to questions on recreation: influences, budget, use of parks, which are the popular destination sites and what does one think is missing to make our parks attractive to various user groups. Emphasis was directed to parks owned by the government and those privately owned with emphasis on their performance. The concern of the researcher is if the available interaction of existing parks and if there were an established theme park would it has more users over the public parks.

At each sampling point there was gender equality in selection of interviewees as male and female preferred certain pursuits of recreation of which the majority of men preferred going out for a drink during their leisure time. The male population preferred the introduction of clubs in parks as they did not find much social pursuits in the public parks. However the attempt to avoid bias with the interviewees was moderately successful as most men hardly visited parks and most of the questions about parks were unanswered. This insufficient data collection occurred in interviews conducted in schools and offices.

The researcher visited Uhuru Park, Jeevanjee gardens and selected interviewees who were not in pairs to avoid group work and collect true data. Interviews at Kayole were limited to the people around the quarry and quarry representatives who had experienced working with or in a mine site. Their responses were biased as most of them earned a living from this waste lands.

Observation can be defined as physical presence and reflection analysis of a given occurrence in its natural setting. The purposeful and selective watching and counting phenomena as they take place. As a systematic method of research it should satisfy three main conditions: it should be suitable for investigating why populaces like visiting parks, it should be appropriate to the population and samples that are to be studied, and it should be reliable and objective. Observation can be particularly useful as a complimentary technique to interview surveys. It can be applied to indicate the respondent's style of life, non-verbal responses and to check actual behaviour against the respondent's report of his behaviour. This method is valuable for studying small communities in action and in given situations and demands less active involvement on the part of community being studied.

A major consideration in observational study concerns timing and recording of observations. This technique ensured the representativeness of the chosen ongoing activity. The researcher selected the units in systematic ways in order to ensure representation of a defined population of behaviour. The researcher visited Uhuru Park over the weekend as this is when most populaces have free time and the ones who provide mobile recreational facilities like electronic train, water raft bubble games are available.

Jeevanjee gardens were observed on weekdays during lunch hour and in the evening as not many pursuits change thus easy to conduct observation on a weekday.

The researcher visited Uhuru Park and Jeevanjee Gardens and was able to conduct a walk-round routine and conducted systematic observations. The observations were conducted against a predetermined checklist of:

1. Age group that visited parks .i.e. family, couples, youth groups or single individuals.
2. Facilities that they interacted with while in the park
3. Number of pursuits offered
4. Charges against which certain pursuits offered
5. Hours spent in the park

Publications were relatively cheap to obtain and easy to sample. The major advantage is that they created opportunities for study over time, although the time scales are dictated by the availability of records rather than by the choice of the researcher as in my case. Another advantage is that documents provide data that is true and can be copied for further reference. A research finding gains more credibility if it appears in a number of studies. The researcher found some mass media record on quarry reclamation in Kilifi which gave some insight onto the project but was not adequate enough to give an in depth study into the reclamation process. Two project studies from the University of Nairobi and Kenyatta University came in handy as a foundation to the study (Githiomi, 2012).

A major disadvantage with this method of data collection is that thousands of studies are available in data archives, but the researcher found it difficult to find one with the variables of interest in reclamation and recreation.

Case study (Yin, 2010) "a case study involves an observation of a single group in time that allegedly produced change". The researcher used multiple case studies from China, Israel and Kenya. This provided a large platform of information on reclamation through an insight analysis of before and after reclamation. The studies were based upon degraded lands that were reclaimed using human efforts to come up with a recreation facility either a park or a hotel.

3.5 Data analysis and presentation

The data is mainly descriptive in analysis. Quantitative data has been analysed using simple statistical methods of numbers and averages. The field of statistics involves methods for describing and analysing data and for making decisions about phenomena represented by the data. Descriptive statistics according to Nachmias (2000) "enables researcher to summarize and organize data in an effective and meaningful way. They provide tools for describing collections of statistical observations and reducing information to an understandable form". This study utilized tables for data analysis on the number of parks and its users.

Inferential statistics allows the researcher to draw pattern from the statistics analysed. Whether there exists an expected pattern of recreation pursuits as designated by Maslow's theory. Statistics shall provide the tools to analyse represent and interpret relationships between patterns.

The study relied on qualitative methods of analysis. The parameter of the study was to identify the key users of parks, which parks, what influences choice of parks and identify the recreational facilities being offered. These factors are responsible for the growth of recreation and leisure in the country.

The study further measures the visits of private parks over public parks. The respondents preferred private parks for the following reasons:

- Less crowded
- Well maintained facilities
- Wildlife
- Commodification of facilities

The comparison is deemed necessary in order to establish whether the current urban population is satisfied with the facilities offered by public parks. Mugenda et al., (2003) proposes that data of this kind to be analysed in three stages. The first is to compute descriptive statistics for each sub group. The second stage is to explore differences between the parks. The final stage is to establish the relationship between the variables of study.

Data representation was analysed using tables which represented information in figures. This were the number of visitors in a given park and the number of times populaces visited parks.

Photographs have been presented to explain the population in Kayole, the number of quarries in Kayole and the reclamation projects both locally and internationally. Goggle earth was used to capture the quarries from an aerial view which provides the real picture on the ground.

CHAPTER FOUR: DATA ANALYSIS

4.0 BACKGROUND TO THE STUDY AREA

Quarrying activities around Embakasi area in Nairobi have been going on since the1950s when the place was sparsely inhabited. Today, the population of Embakasi area has grown tremendously and there is stiff competition between various land use practices in the area. Moreover, new residential areas as viewed in (figure 11) have sprouted throughout the area further instilling pressure onto what used to be open space.

According to the National Census Kayole North, South and Central constitutes 112, 740 people. Kayole is a populated region with 1,000 people per sq. ft. The population consists of middle and lower class income earners in the country. With this congestion and only one recreation centre Nyama villa most people prefer stealing and drinking as a pastime as there are many bars situated along all the streets in the estate.

Figure 11 Kayole locations (source Google Map)

Figure 12 Kayole (source https://www.google.com/)

Kayole has a big percentage of degraded land that is left bare after mining is over. The researcher studied this area to find the best way to reclaim the abandoned quarries that were many in number and big in size for example Corner quarry covers 50 acres.

The researcher sought to establish design guidelines that could be used to reclaim degraded lands other than dumping that is commonly used which takes a longer period of time as a method of reclamation.

Kayole as stated earlier is full of pubs in every corner and the only open recreation centre for all age groups is one '*Nyama Villa*' which has a restaurant, club and a playing ground with swings and bouncing castle for kids. With this in mind the researcher aimed to bring more variety of recreational facilities to the residents, bring entertainment closer home and using design guidelines to create a more user friendly, contemporary theme park.

4.2 Size and location of quarries

Along Ngong' River stretching from Njiru to Utawala lays ten quarries on its banks. These quarries cover an area as large as 50ha and as deep as 100ft per quarry which lays waste after mining is over with negative effects to land and water bodies. Here stones are dug through blasting for the purpose of being used in building, and making roads.

Figure 13 Quarries along Ngong' River (Google Earth)

Kayole has three quarry wasteland sites that have not been restored for years. These three quarries are located on land that belongs to the Kenya Army Barracks in Embakasi which has hires out part of it to mining companies at a fee. These companies include K Constructions and National Concretes who have since abandoned mining activities in them, and Kenya Builders which is still in operation meters away from the Corner quarry.

The quarries are characterized by stagnant water and human waste, both biological and paper. Despite the hazardous effects of this waste on human life, individuals use the water for their daily house chores, farming purposes, to water their animals and some swim and bathe in these water.

Residents at these three sites live not far than ten meters from the quarry wasteland with some practicing agriculture around them.

Figure 14 Corner quarry characterized by rings and Mihango Quarry **(**Source Google earth)

Figure 15 Mihango quarry and Kenya builders quarry (Source Google Earth)

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The Corner wasteland quarry site covers an area of 50 acres and is about 150 feet deep while the Mihango site covers an area of about 8 acres and is 23 feet deep with 10 feet deep waters. As the years passed and the quarries remained unfilled despite efforts of concerned local individuals to fill up the wasteland, these quarries have marked the lives of those living near them with life threatening injuries and death incidents (Mabel).

Individuals eking out a living at the quarry sites say that everybody-construction companies and private individuals in the know, knows to dump dug-up soil at the quarry in Corner which is closest to the army barracks establishments. This has offered opportunities to individuals who earn a few coins by pushing the soil outwards into the quarry. The casual labourer is paid between KSh. 50 and 150 for these services a day. Stephen Mwai, the Corner quarry Manager oversees the activities of trucks dumping soil for which one truck is charged KSh. 200 for every dump. Despite these activities that have span five years, the Mihango quarry is nowhere near filled quarter way on only one side.

Figure 16 Mihango quarry (source Mwangi, R 2015)

Figure 17 Mihango quarry (source Mwangi, R 2015)

This soil has however also offered farming activities to individuals who grow maize in it. There is a large scale maize farming activity located on the east side of the Corner quarry. The waters in the quarry provide means to irrigate their crops therefore making the practice a much easier source of income.

Following the completion of commercial mining in these quarries, locals are now breaking stones in them to make a living as small scale miners. These miners include able bodied men and women. It is in their interest that back filling should occur at a lesser pace so as to give them room to earn their living. Miners appreciate the effort underway to back fill this open pit as it is a hazard to the surrounding environment. They request as this is taking place some part of it is left for them to continue carving stone particles for sale as this is their source of income.

(Mabel, 2014)"The stones mined include dust which sells for KSh. 6-8 per bucket, *'mchele'* which is small grainy particles that sells for KSh. 10 per bucket, half inch stones used for exterior homes decoration sells for KSh. 20 per bucket and the one inch stone used in construction sells for KSh. 15per bucket. Ballast and sand soil is also a lucrative commodity in these quarries".

(Mabel, 2014) "A seven tone lorry is filled with 200 buckets of stones mined for two weeks and the buyer has to part with KSh. 15 000 at the Mihango quarry. A small pick- up would be filled for KSh. 1 500 at the Corner quarry".

According to the National Environmental Management Authority's website, before any project begins and will most definitely have an effect on the surrounding environment, it has to undergo an environmental impact assessment. This is basically an examination that would identify both the positive and negative impacts of projects such as stone quarrying would have on people, their property and the environment. NEMA is

expected to examine and give a comprehensive site report on among many other things the location of the site and reason for selecting that site, drainage and materials used for quarrying purposes.

Using the quarrying activities in Kayole, Eastlands in Nairobi as a case study, it is clear that NEMA rehabilitation and restoration orders have not been adhered to a decade after mining activities ended. According to the NEMA Environmental Restoration orders, the mining companies should have a restoration plan which should be implemented after a mine closure if not the law will subject licence holders to imprisonment of not less than 24 months, a fine of not more than Sh500 000, or both. NEMA does not categorically have plans or projects in place to fill abandoned quarry wasteland sites as this is the responsibility of the miners. The miners are required to fill out a decommission plan with NEMA three months in advance to notify the Authorities that they have completed their mining activities. They are then issued with a restoration and rehabilitation plan which they are expected to comply. In dire cases where they cannot comply, NEMA steps in and does the rehabilitation and restoration and later charges the miners. These charges are aside from fines imposed on them (Mabel, 2014)

The site of the quarries is on undeveloped Kenya Army Barracks land who is the landlord on the Kayole/ Utawala border therefore providing opportunities for large scale mining activities.

DATA PRESENTATION AND ANALYSIS

Introduction

This chapter reviews the main outcomes from the primary data collection and relates such to literature review. The study pursued the following objectives:

- Investigate the use of various parks
- Establish current influences on leisure and recreation
- Determine leisure facilities that are more conducive to the community

Data was collected using Field visit, interviews and observation were used as tools to collect data. A stratified cluster sample of fifty respondents was selected from various sub-groups. The outcomes of the analysis is presented in form of descriptive statistics such as tables and graphs.

Findings

A total of 50 interviews were conducted. The information was collected from all age groups at their respective homes, schools, park and offices.

Interview to the Quarry representative

Quarry backfilling

Petronilla Njeri is a lady who has taken upon herself the duty to refill Mihango quarry which is 8 acres in size and has done so for the last six years. She wants to help the community to have a healthy environment free from stagnant water and not a dump site for waste.

Challenges of having the quarry

She states that the quarry poses as a threat due to its stagnant water therefore people are suffering from Malaria. Other issues are drowning and people committing suicide in this abandoned land.

Petronilla is facing a challenge with hiring a bulldozer to pull in the soil once the lorries have dumped and hiring labourers to pull in the soil and watch over the quarry in the night. Security is needed in the night to stop lorries from dumping sewage and polythene waste on the land.

She tries to encounter the above issues by charging every lorry that dumps a fee of Ksh. 200 to cater for the expenses of machinery and workers.

Vision for the quarry if reclaimed

She wishes to put up a recreation centre for the community for they are congested in their homes and there are limited spaces open to the public without charging a fee. She hopes that once refilling is over the county government will chip into this community project. She is refilling out of passion for the residents and is not referring to any document or policy on reclamation.

She belongs to the senior citizen category and is a business lady in the same area.

For her leisure she prefers to travel to the countryside and unwind and her choice is influenced by her home and personal life.

A weekend out would see her spending 5,000 Ksh.

Parks visited in Nairobi and outside Nairobi

Uhuru garden, City Park, Nairobi National Park and Bomas of Kenya.

Kioto Park in Japan and Mt. Kenya Safari Club.

She visits this park thrice a year and likes the natural scenery of parks both flora and fauna.

Jeevanjee Gardens

A sample of eleven respondents were selected, the highest proportion registered was between ages 30-45 years and preferred to spend their time at home. Majority of the men preferred entertainment to bars and restaurant for leisure. The society we live in and the environment are a major influence of how they spend their leisure time.

Four of the respondents are youth between 15-25yrs and visited the park for the first time as they were awaiting a friend. Two of them were students who meet there thrice a year over the holidays for revision.

Budgetary allocation of entertainment varied between 500-3000 Ksh.

Park	Total No. of Visits
Uhuru park	8
Jeevanjee Gardens	11
City park	3
Bomblast park	1
Central	3
Christina Wangari	2
Buffalo park	1
Shedin park	1
None outside Nairobi	9

Table 7 Parks in and around Nairobi visited by users of Jeevanjee

Frequency per year

Four of the respondents visit Jeevanjee park weekly because of its location in town either to relax, enroot to another location in town or as they await

a friend. Four other respondents visit parks once a year while three had just been there for their first time.

Features that attract visit to park

- Nature
- Peace
- No charges

Proposed new facilities in parks

- Bar and restaurant
- Chess
- Swings
- Quiet space

Uhuru Park

Ten respondents were selected for interview with the highest proportion registered was between ages 20 - 35 years and preferred to spend their time at parks or restaurants. The society we live in and the environment are a major influence of how they spend their leisure time as most of the visitors to the park were families or couples.

Budgetary allocation of entertainment varied between 500-2000 Ksh.

Park	Total No. of Visits
Uhuru park	10
Jeevanjee Gardens	2
City park	2
Central	7
Nairobi National park	2
None outside Nairobi	8

Table 8 Parks in and around Nairobi visited by Uhuru Park users

Frequency per year

Six of the respondents visit Uhuru Park monthly. Four other respondents visit parks twice a month.

Features that attract visit to park

- Nature
- Peace
- Children play
- No charges

Proposed new facilities in parks

- Bar and restaurant
- Roller skating area

Mihango community

The highest proportion registered was between ages 30-40 years and preferred to spend their time in the bars. Kayole has a high density population with only one recreation facility for all ages 'Nyama villa'. Most of the respondents are employed with only 30% being self-employed. The society we live in is the major influence of how they spend their leisure time. All of the respondents spend their time in entertainment preferably going out to eat or for a drink.

Mihango Quarry

A sample of ten was selected for data collection. Most of the respondents earn a living from the quarry either as rock diggers or quarry security who oversee trucks dumping soil.

Once the quarry is refilled 70% of the respondents prefer a playing field, while 30% prefer more houses to be erected on the piece of land.

Budgetary allocation of entertainment varied between 500-3000 Ksh.

Park	Total No. of Visits
Uhuru park	3
Nairobi National park	2
City park	2
None	5

Table 9 Parks in and around Nairobi visited by Mihango Community

Frequency per year

Three of the respondents visit parks once in three months and seven of the respondents have never visited parks.

Features that attract visit to park

- Nature
- Flamingos
- No charges

Proposed new facilities in parks

- Bar and restaurant

Youth

A sample of eighteen respondents was selected for data collection. The highest proportion registered was between ages 15-30 years who are students and preferred to spend their time at home. Eight of the respondents spend their leisure time in entertainment. Personal life and society are a major influence of how they spend their leisure time.

Seven of the respondents spend their time in shopping malls; five of them spend time at home, three at the gym. Other recreation facilities that were mentioned include hiking, shooting range and sports club.

Budgetary allocation of entertainment varied between 500-10,000 Ksh.

Park	Total No. of Visits
Uhuru Park	8
Jeevanjee Gardens	2
City Park	5
Bomblast Park	1
Central	3
Nairobi National Park	12
Mamba Village	3
David Sheldrick	1
Giraffe Centre	3
Aboretum	3
Lunar Park	2

Table 10 Parks in and around Nairobi visited by Youth

Park	Total No. of Visits
Amboseli	4
Maasai Mara	5
Serengeti	1
Nakuru National	6
Tsavo	1
Haller Park	2
Lewa	1
Impala	1
Mt.Longonot	1
None	6

Table 11 Parks outside Nairobi by Youth

The youth obviously have visited a variety of parks that charge more and offer more facilities than picnic grounds.

Frequency	No. of visits
Once a year	5
Twice a year	1
Once in three months	3
Once	9

Table 12 Frequency per year by the youth

Features that attract visit to park

- Nature
- Wildlife
- Picnic
- Games
- No charges

Proposed new facilities in parks

- Concert hall
- Animals
- Pool
- Kiosks
- Paintballing

There are a number of things that make the youth not visit the public park and this includes:

- Poor toilet facilities
- Insecurity
- Crowds

Analysis

Most of the populace that visit parks are aged 20-45 years. They prefer spending their time outdoors where they interact with various facilities. 25% are those that prefer home based leisure activities.

The most attractive feature of parks is the nature reserve of plants that creates a peaceful ambience and gives a fresh air that you cannot access in our neighbourhoods. This was a sentiment echoed by several of the interviewees. One of the interviewees said "I prefer parks for the air is fresh and it is peaceful". Other features that attract visitors are animals, water facilities, sports areas, play areas and picnic areas. The following figure analyses out of the fifty interviewees how many have visited the major parks in Nairobi. It is evident that Uhuru Park is the most popular followed by Nairobi National Park and Jeevanjee gardens. With Aboretum having 0.06% of users.

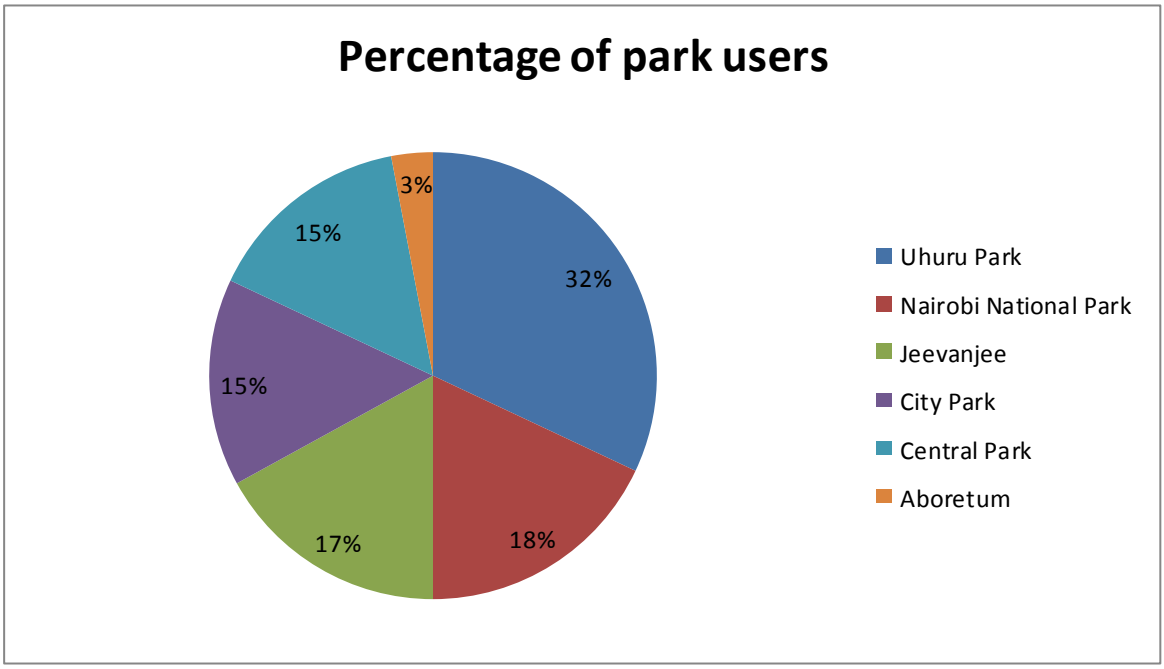

Figure 18 Number of users in Parks within Nairobi (source: Ruth Mwangi)

Things that hinder a few from visiting parks include overcrowding, poor ablution blocks and insecurity.

The youth aged 15-25 have most exposure to the varieties of parks visited within and outside Nairobi. The Park types can be divided into parks with static entertainment and parks with active entertainment. The parks with static entertainment include but are not limited to the traditional public parks such as Uhuru Park, and City Park. They carry features that do not require skill, knowledge or active participation to interact with. These are features such as lawns, greenery, ponds and sculptures. The Parks with active entertainment include the Maasai Mara, and Mamba village. The features found here require greater degree of interaction with the surrounding environment. The activities include dining, game drives, shopping, and mechanical rides. Youth are more widely exposed to these parks because they have disposable time on their hands. Youth are also

financially empowered by their parents and guardians. Youth seek adventure and are more focused in achieving their leisure goals. The youth have access to transport to reach the venues they desire to visit. One member of this cohort said that "only geeks would go to such boring parks .We go to the malls such as the Junction and Diamond Plaza instead".

Youth are mostly students but have the highest spending on entertainment in their budgetary allocation. They know what they require to be added as park facilities as opposed to the older age group of 35-45 who like the parks as they are. Their proposals include paintballing, concert halls and skating arenas. A teenager said "I visit the gym over the weekends. If only our parks would have skating alleys it would be fun for most of us. A concert hall for performances from artist would be better". According to the literature review, the population age bracket of 30 years and below constitutes about 75% of the Kenyan population. 80% of their time is free and if positively managed will keep the young professional away from delinquent acts against the society. The government should allocate programs to cater for leisure and recreation for the youth who form the working force of this nation. Recreational activities build personal, social and physical aspects of any individual which promotes fitness and health as well as builds communication and leadership skills while indulging in this activities. (Kenya, 2007).

Sports and recreation facilities provide the youth with an array of activities to participate in and reduce boredom and negative influences such as crime and alcoholism among the young generation. Stadiums, local cultures should be preserved and passed on to this budding generation who form tomorrow's leadership (Rop, 2013).

The populace aged 35-40 prefers more grass and trees as well as introduction of wildlife. The new mums opt for more facilities for children

for their sole purpose of visiting parks is to entertain their children. Most of the respondents in this age bracket concurred. One of them said "*ushawahi ona wanaume kwa parks, ni ya wamama na watoto.mkiweka club labda tutakuja*". According to figure two in literature review this age cohort mostly indulges in group 6 activities with the exception of gardening which are social activities with little or no skill required for any of them. Group 6 in recreation pursuits includes:

- Picnics
- Driving to country side
- Gardening
- Dining out
- Visit to a pub/club
- Dancing
- Bingo

Recreation represents the largest expenditure of an individual's disposable income. Expenditures have shown growth since 1985 to 2003 with a rise from 6.6 percent to 8.5 percent (Kenya National Bureau of Statistics 2014). Recreational activities related to technology and music have increased commercial participation and experiences. Survey has indicated that people are spending billions of dollars on wining and dining, lottery and travel and tourism.

The table below shows the distribution of expenditures for personal consumption in recreation and entertainment. The Y axis represents the

amount in Kshs. While the X axis represents the number of people within that range according to the findings in data collection.

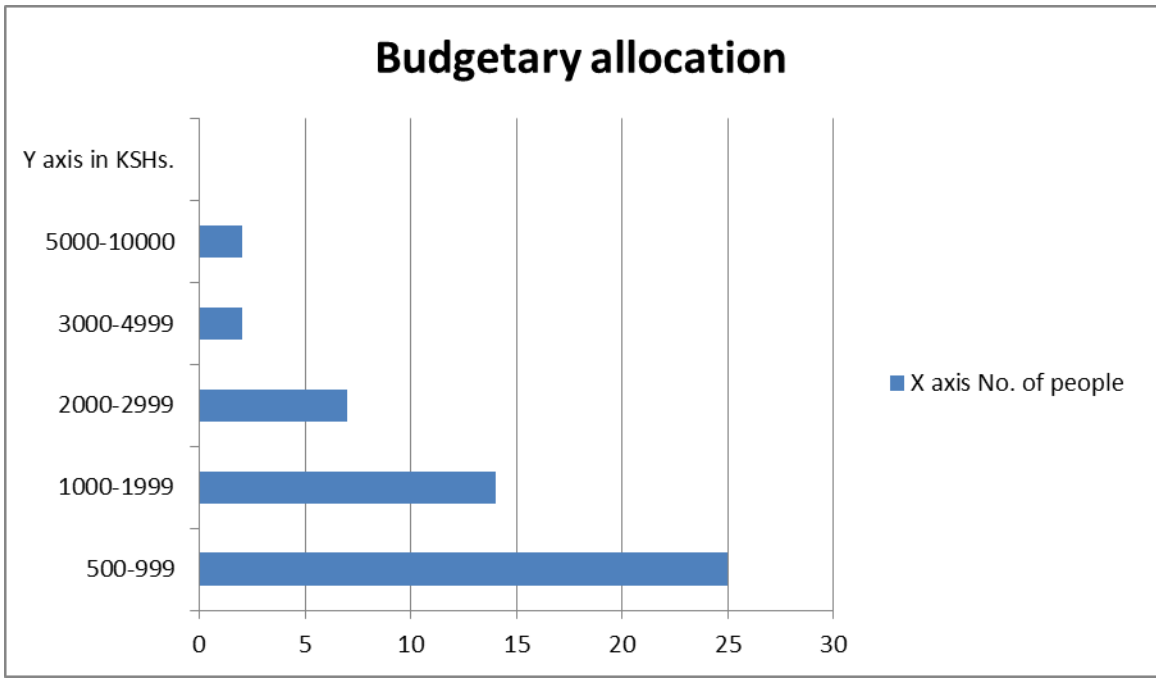

Figure 19 Budgetary allocation from respondents interviewed

With growing demand for high quality services, more facilities and better customer service the arguments supporting pricing policies are becoming more acceptable to recreation facility providers who desire to maintain current service levels for visitors. These include services such as variety in facilities offered, and adequate facility maintenance. Positive benefits arising from increases in the output of recreation are appropriately measured by the willingness of users to pay for each unit of output provided. Willingness to pay is manifested in actions such as entry fees and other user fees. One respondent said "I do not mind paying Lunar park, Sharks place *bora watoto wapate vitu ya kuchezea*"

According to Nash's philosophy of recreation and leisure, leisure activities are ranked according to their value to society. This is the activities that most of the respondents undertake on a weekly basis for leisure and require little or no skill to participate in. This study has seen majority of the populace interviewed preferring public parks for this reason. The youth however prefer indulging in activities that need more physical input and skills in order to find fulfilment otherwise they easily get bored. A youthful member of society said "we prefer malls because we can eat out, shop and even enjoy a movie all under one roof."

The range and diversity of recreation interests are very wide and most respondents conformed to factors such as:

Environmental factors include the physical surrounding either natural or manmade features and amenities that the area offers have an influence on recreation. Most of the populace prefer visiting parks for it provides a natural setting that is not found in our estates that are mainly congested and polluted. Uhuru Park is a must visit for most people for its location, scenery and landscaping that provides relief from our busy day to day schedules. "After church I bring my family here and after a few hours we go home."

Recreational amenities: the greater the facilities the richer the society will be in term of leisure provision and the greater the choice. Most of the respondents mostly men did not prefer to use parks for they felt that the facilities offered captivated women and children. The youth on the other hand preferred to visit private parks in and out of the city that provided more than landscaping and had a variety of facilities to offer. Most of their leisure time is spent in shopping centres that had a commodification of recreation amenities. "I prefer Maasai Mara cos we enjoy travelling, music, and the wildlife and food is more than we could wish for."

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

Introduction

It is evident from preceding discussions that park use is challenged by the number of facilities that it offers and private parks are doing much better with local tourism. Overcrowding, lack of clean ablution blocks, insecurity and lack of commodification of recreation pursuits are the key factors that hinder growth in our public parks.

Private parks like Nairobi National Park, Giraffe Centre, Amboseli National Park just to mention a few attract more visitors for they provide wildlife conservation, a variety of facilities, location and hygiene are some of the factors that make them popular to the masses.

The recommendations and discussions are made according to the research questions which included:

1. What are the methods used to reclaim the quarry?
2. What is the comparative performance of reclaimed quarries like Haller Park over City Park?
3. Which are the most suitable design guidelines that can be used to rehabilitate Limestone quarries at Mihango, in Kayole and other similar areas?
4. What are the populaces' leisure requirements?
5. How can the populaces' leisure requirements be catered for?

Reclamation of a quarry

Quarry reclamation occurs in two ways the traditional approach or the geomorphic approach.

Traditionally quarries would restore themselves through nature. Climatic conditions such as rainfall and mud slides would fill up a quarry over a period of time and vegetation cover would occur as a succession to this conditions. Currently human interventions is required to fill up mine spoils for their size covers up to 50 ha. Which if left to nature it would take a lifetime for restoration to occur. As discussed earlier Kuter gives approaches that can be effectively utilised to restore quarries both short term such as camouflage and long term approaches such as recycling for a sustainable landscape.

Reclamation of quarries using geomorphic principles has been practiced in Central Spain and many studies concur that it is a suitable method for rehabilitation. "Nature can provide analogues for post-mining landscapes in terms of landscape stability and also in terms of the rehabilitated structure blending in with the surrounding undisturbed landscape (Hancock, 2003)". Geomorphic principles involve topographic reconstruction, replacement of top soil and management of the long-term soil composition.

The researcher plans to use the recycling approach to create a recreation park for the Kayole community. Integrative approach using design guidelines according to Engler will be implemented to revive the grounds to a recreational facility with a manmade lake, modern restaurant and various species of trees and grass appropriate to the soils for landscaping.

Performance of recreational facilities like Haller Park over City Park

The City of Hagen, West of Germany located its City Hall on the site of an inactive quarry. Many of the natural rock outcroppings were left and the interior/exterior surface of the buildings made use of the surrounding rock.

The same is also replicated in Kikambala, Kilifi County in Kenya by Sultan Palace Development Limited. They are transforming three abandoned quarry sites within a 43 acre parcel of beach front into one of East Africa's largest water park. The quarries can hold a capacity of more than 4,200 cubic meters of water. The deepest of the quarries is seven meters, with the other two approximately 4.5 meters deep. The company has opted to develop and convert these quarries into centre pieces while at the same time cutting costs of putting up similar features on other usable parts of the park. It will cost them Ksh.50 million, which could have risen significantly if it were to be excavated from a new site (Wairimu, July 30, 2015)

Haller Park is located in Mombasa on the Kenyan coast. It is named after founder Dr. René Haller and was developed in 1971 as an initiative to clean up pollution. Dr. Rene was driven by the need to create a healthier environment and once restoration commenced he discovered that animals found a habitat there and a recreational park was developed. The former Bamburi Portland Cement quarry designed by Lafarge Ecosystems Company is now a tourist attraction for the local people and tourists in Mombasa.

The quarry did not have steep slopes as is characterised by others therefore re-vegetation approach was viable. The stagnant water that fills the quarry was used as a lake for the hippos that live within the sanctuary. Soil composition was improved by adding fertilisers and compost. (Gathuru)"Explains that as a result of the re-vegetation, millipedes and other life forms colonized the area which was under rehabilitation. The most important fauna were fruit bats and monkeys which acted as seed dispersers for plants and trees not initially planted. Three species of plants were found to survive in these saline conditions and they are: Whistling pine, Coconut palm and *Conocarpus lancifolius" (47).*

Figure 19. Pioneer Casurina seedling (source Biodiversity case study)

Figure 20. Red legged millipedes mating (source Biodiversity case study)

Figure 21. Elands in the quarry(source Biodiversity case study)

Design guidelines for quarry reclamation

Mining, in its broadest sense refers to the process by which we extract resources such as minerals and rocks near the earth's surface. Mining generally refers to extraction of mineral resources from land, water and sediments of rivers, lakes, seas, and oceans. Mining contributes immensely to the economy of any country as its raw materials are a necessity to any construction project. Stripping of this natural resources depletes the land of its treasure therefore causing negative impacts that are felt into many generations.

Globally UN and the government seek to restore the quarried landscape using various reclamation techniques. Reclamation's main objective is to minimise contamination and negative impacts on the natural resources giving the land better use and practices that will support life for future generations.

A study of landfill and sewage treatment by (Arbogast, 2000,Kuter N. , 2013) have analysed suitable methods to rehabilitate mining sites using natural and human intervention technique to restore landscapes to its functional and aesthetic façade. Reclamation is seeking to minimise the negative impact of open cast mines which are a necessity to any growing economy as this quarries provide construction materials and job opportunities for many. Nine approaches for mining reclamation are discussed in table five below.

Engler's list	Description
Natural	Allow nature to reclaim site with no or minimal human influence
Camouflage	Conceal mining facility using screen and buffets
Restoration	Return the land to its applicable original contour
Recycling	Use site for public amenities
Mitigation	Repair a mined out site from extensive human and natural damage
Sustainable	Recycle manmade or natural resources on site
Educative	Common mining or other resource information through outreach
Celebrative	Treat a site as a work of beauty and unique experience
Integrative	Combination of approaches intergrading art and science

Table 5.Engler's design approach

We will study in depth a few guidelines according to Engler that are applicable to majority of the sites in Kenya. The two sites in Mombasa used as a case study have used various approaches to reclamation. Ngomongo village has used a combination of restoration and integrative approach to create a cultural centre that is attracting local tourism. Haller Park has used a combination of sustainable and recycling approach to create a tourist attraction site that uses the stagnant water to create a habitat for some hippos in the surrounding environment.

Other post mining landscapes that do not have a reclamation plan experience the natural approach to restoration over the years. For smaller mines this occurs over a couples of years, while backfilling using waste

materials is a preferred method to restoration in Kayole area. Mihango quarry will incorporate the design guidelines discussed in chapter two to create a functional and aesthetic landscape for sustainable recreation that preserves the community's values and culture .According to Engler's design approaches camouflage would be the first step to restoration through erection of a stone fence to keep the outside dust and minimize dumping of wastes by residents. Secondly the mitigation method will be a faster method of restoration using construction as a method to conserve the sore landscape. A modern recreation centre will use the celebrative approach as its last step to create a landscape that is appealing to its users. In the next pages the researcher has highlighted the recommended design concept that will revive this degraded landscape to a functional environment. The design process will create a sustainable development plan with monitoring and control mechanisms following the land, mining and reclamation plan that was discussed in the conceptual framework to create a design of quality. The design will combine post mining constraints and characteristics combined with sustainable methods to develop a recreational centre that will improve user experience.

Leisure requirement for the masses

The researcher used the interview guide to deduct the factors that influence leisure pursuits before planning anything. Another important factor for consideration while planning was the type of recreation the respondents interacted with regularly and the facilities they would wish included in our existing parks to make it more fun.

Because of the facilities planned the Mihango Park will come in the category of leisure and Sports Park. No charge will be made for most of the facilities. The overall concept ensures sporting activities, some taking place on grounds open to all, while others will be reserved and will cost a fair share. The following activities are planned to be free of charge: gym,

playground, skating, field sports, walking, cycling and reading. Activities for which a charge will be made include miniature golf, fishing, boat riding, bungee jumping, rock climbing and restaurant use.

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The principal attraction in this landscape is the glass façade of the restaurant. The lake around it separates the southwest part from the leisure area northern zone with rows of trees mostly pine, cedar, bamboo running in various abstract rows. The balanced relationship between active and passive areas enable the park to be used simultaneously by highly differentiated population groups, allowing the desire of specific groups of individuals to be met.(Laurie, Nature in cities, 1979)

Design conceptualization

The researcher had in mind three objectives in mind when planning for this park:

To categorize user groups based on families, gender and age.

Segment the recreation market according to the user groups. Further analysis was conducted through the question in the interview guides asking for their profession: student, employed, self-employed, business person or retired as various factors influence the choice of leisure pursuit.

Developing suitable programs to cater for the needs of the various user groups. Some activities need programs that suit team work as opposed to individual pursuits and peak hours are factors that need to be catered for which is vital to the success of the organization. One of the major challenges was coming up with a facility that would inspire these different diverse groups to interact with the park as well as bring them under one roof “my friends and I meet at the malls over the weekend for there are a lot of things to do such as shopping, dining and movies.”

The researcher came up with various ideas but settled on this one. Given the knowledge of user groups, this design concept is intended to divide the park into three main areas. The red area for activities that need more physical activity, the blue area that needs less physical activity and the purple area for people who visit for specific use e.g. the social hall for meetings only.

The researcher developed areas for child play which is all encompassing 1-15 years of age. The children can play in their play area, or engage in a match in the football pitch, they could also enjoy skating in the rinks or go swimming with their parents in the manmade lake. This commodification of facilities caters for the introverts and extroverts who have a variety of outdoor pursuits to engage in.

The researcher in the design conceptualization catered for the youth by providing the football pitch, skating rink, bungee jumping and quiet areas for the female youth who would like to engage in conversation in the quiet zone. Fishing and golf is also available to the youth who prefer pursuits that require less energy.

The adults group includes family people, working class and the retired who can also find pursuits that motivates them to visit parks. The researcher thought of including the football pitch, miniature golf, quiet area with gym and tables with counters that offer a game of chess which was an inspiration from the outdoor tables at Aga Khan Hospital. These facilities were targeted to attract more males to visit parks as they rarely do according to the research. The ladies would also find motivation in pursuing various activities other than watching over their young ones. As this was seen in the literature review where the family unit is devolving to accommodate few children and working mothers providing leisure time which socially strengthens families.

Analo (2011) “States that design can have major impact on the success or failure of recreational open spaces”. Design features within recreational open spaces do need much attention and his study proved that recreational open spaces lacked detailed design input as they simply comprise of simple fenced open spaces.

Because of the facilities planned the Mihango Park will come in the category of leisure and Sports Park. No charge will be made for most of the facilities. The overall concept ensures sporting activities, some taking place on grounds open to all, while others will be reserved and will cost a fair share. The following activities are planned to be free of charge: gym, playground, skating, field sports, walking, cycling and reading. Activities for which a charge will be made include miniature golf, fishing, boat riding, bungee jumping, rock climbing and restaurant use.

The park is designed to host a capacity of two thousand people when full. The car park will accommodate a hundred cars while the ablution block will have 20 WC for the ladies and ten WC for the gents each with one toilet for people with special needs. The social hall should accommodate 500pax. The restaurant will cater for 100 persons in round tables. The drawings include site analysis, concept drawings and preliminary drawings of proposed project.

Design recommendations to cater for leisure requirements

Producing a design

The use of survey-analysis-design (SAD) method previously discussed will be appropriate, and the starting point. A study of the natural and human patterns that exist on the site will be discussed in:

Survey:

1. Access is from the North East

2. The site is dominated by an abandoned mine hole
3. Water has settled in the west of the quarry

Analysis:

1. Recreation use is compatible to the site
2. A fence is required next to the road

Design:

1. The park should be on the northeast side of the site to evade pollution from the neighbouring active mine
2. There should be re-vegetation after site investigation to identify plant species that can thrive in an area.
3. The water used for fishing and swimming will be turned into a manmade lake
4. Use excavated rocks to create mosaic on the pavements and sculptures in the garden
5. Create a restaurant with a glass front for a scenic view of the environment

Site Analysis

According to NEMA there were twenty eight quarries located in Nairobi County. Out of this nineteen quarries are located in Embakasi area alone. Eight quarries are still in operation while the rest have closed and relocated to other areas, some of the closed quarries have started rehabilitation but some have not.

Location

The area under study is Kayole and Mihango area, which is located in the Eastern part of Nairobi in Embakasi district.

Relief and Drainage

Nairobi is at 1,795 meters above sea level. The study area which is Embakasi is relatively flat in some area while in some areas it is sloppy. The study area has several streams and rivers for example Ngong' River. Most of the quarries are located along the rivers that flow through the area.

Geology

The exposed rock formation of the study area can be divided into three major geological formations: the Precambrian basement rocks: mostly metamorphic, Quaternary Volcanic and, to a small extent, Quaternary Sedimentary deposits. The rock being quarried at Embakasi quarries is phonolite which is tough dark grey lava commonly referred to as 'block trap' and is vesicular with a fissile and platy flow texture. Black clay soil covers the area.

Climate

Kayole enjoys a moderate climate. In the June and July the temperature can drop to10 °C, this are the coldest months in the year. Summer time is in December to March, when temperatures are 22°C on average during the day. There are two rainy seasons; the first rainy season is between the months of March and May which is referred to as the long rains, while the second season is short rains between October and December. The average annual rainfall in Nairobi is about 900m, but the actual amount in any one year may vary from less than 500 mm to more than 1500 mm.

Vegetation

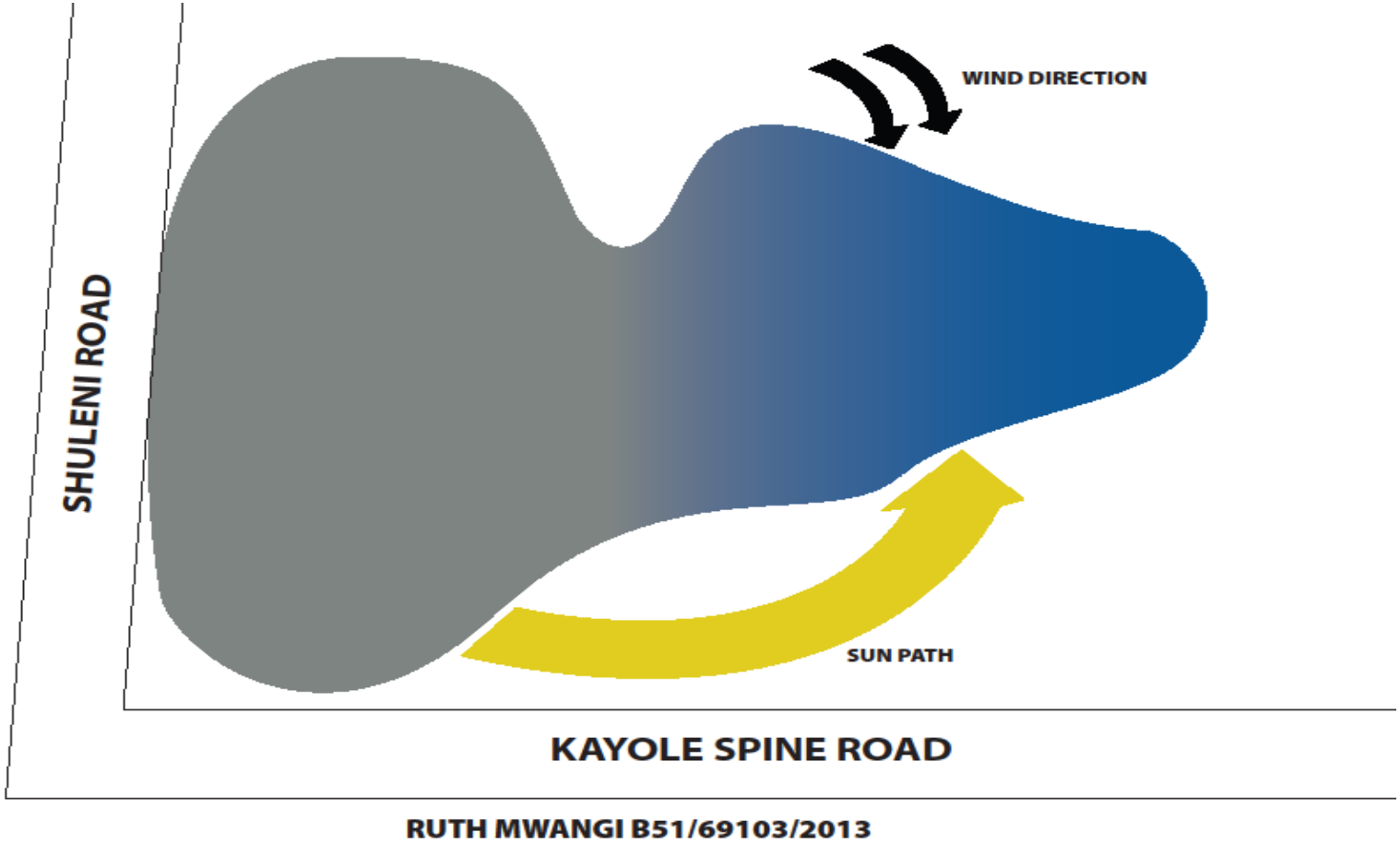
The area of study does not have gazetted forests; there is also no notable agro-forestry practiced in the area. Due to the quarrying activity, the area has lost most of its vegetative cover. However, there exist isolated eucalyptus trees and short grass within the quarry site.

Population

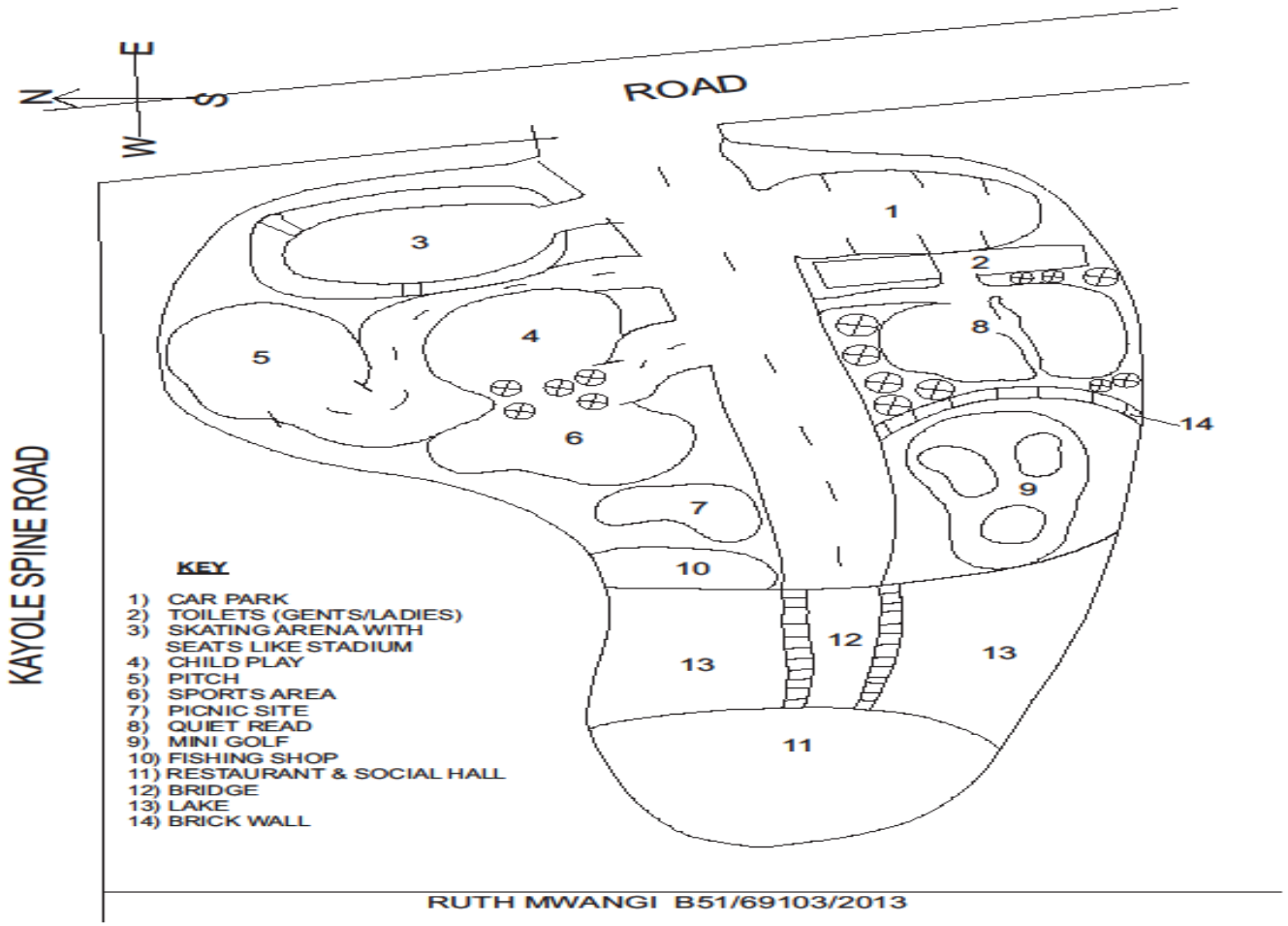
The population of Nairobi and specifically the Embakasi area has increased tremendously over the years. When the quarries were being established the population was very low with the total population of 7,749 people and that allowed the location at that particular time. Currently Kayole area has more people living in a small area that is overcrowded which is a danger to their combated by poor housing with poor drainage system.

Other human activities

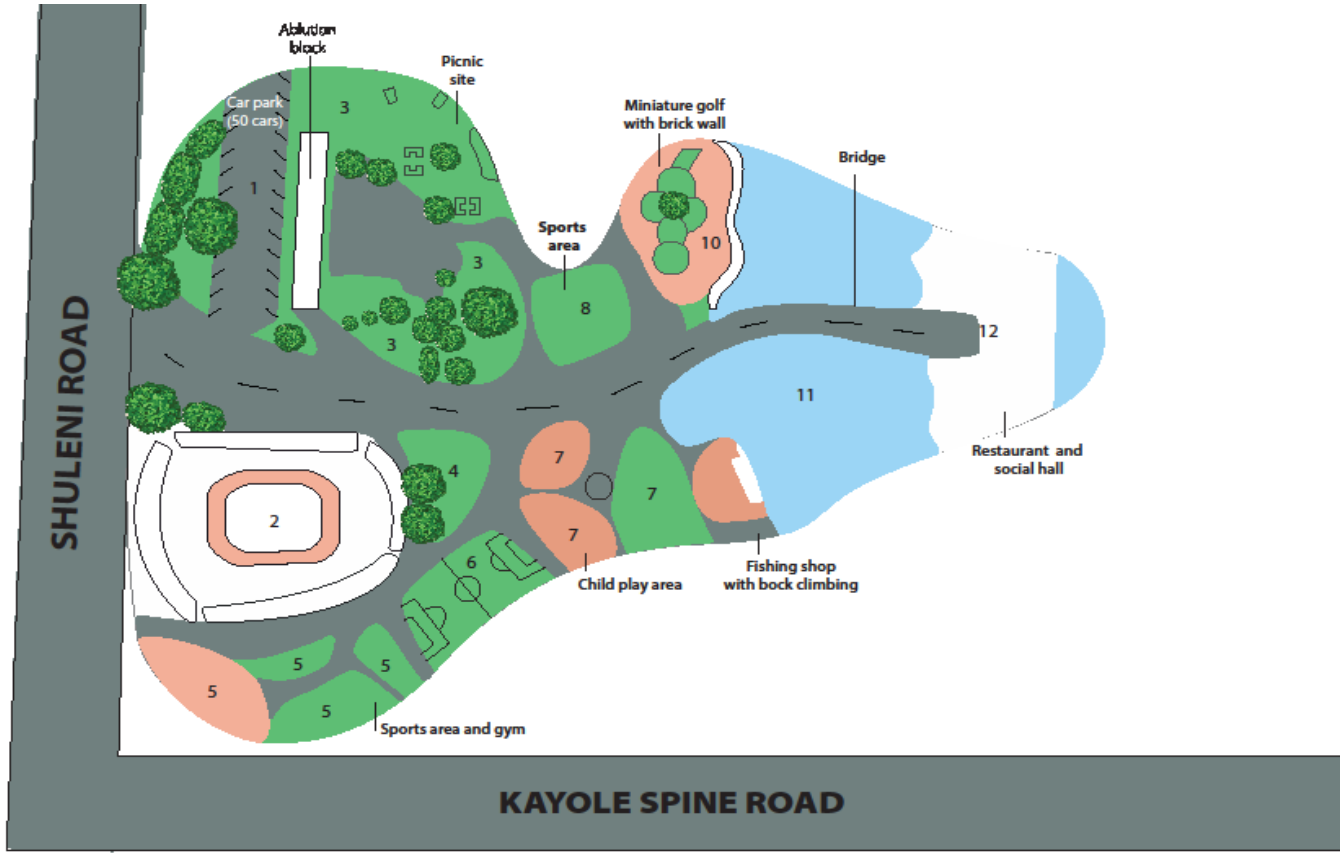
The area consists of individuals who are engaged in small and medium businesses. Other are engaged in income generating activities within the area and derive their livelihood from various activities such as offloading solid waste, gathering sand and small scale quarrying activities at the abandoned quarries. Several pastoralists can be found in this area especially during the dry season due to the presence of grass in the area. There are several schools that are located in the given area with some of them being very close to these quarries. Several industries are located in this are for example the processing industries near the industrial area.



Drawing	Site analysis
Site	Mihango quarry
Scale	To sketch
Registration	B51/69103/2013



Drawing	Design concept 1
Site	Mihango quarry
Scale	To sketch
Registration	B51/69103/2013



Drawing	Design concept 2
Site	Mihango quarry
Scale	To sketch
Registration	B51/69103/2013

RUTH MWANGI B51/69103/2013

Drawing	Design concept 3
Site	Mihango quarry
Scale	To sketch
Registration	B51/69103/2013

5.2 Conclusion

Arising from the findings several conclusions have been developed in regard to quarry reclamation, design guidelines to reclamation and park use in the country. More acute measures need to be put in place as more and more mines lay waste and pose as a threat to health and the environment at large. These measures need to be instigated by the relevant authorities who need to take responsibility for the duties assigned them. Though individuals have taken responsibility in some cases, the work of reclamation cannot be left to them alone.

Although quarrying plays a major role in boosting the economy through the construction industry. Environmental impacts have been felt after mine closures for this abandoned sites are a breeding ground for pollutants that deprive water and land resources through contamination. The City Council does not have statistics on the number of quarries in the country as most of this are on private land. Kenya's vision 2030 Social pillar necessitates a healthy environment free from pollution.

The design guidelines to quarry reclamation according to Engler constitute bringing back the degraded land through human factors to an aesthetically functional space for the community. For Mihango quarry human intervention has taken place as Petronila Njeri has taken upon herself to refill this waste land with soil from construction sites. Landscapers have the mandate to advice stakeholders on sustainable approaches to reclamation that are long term and cost effective.

Our case studies have shown attempts by the East African Portland Cement Company to rehabilitate the quarries through refilling the site with waste and by re-vegetation. This has been adopted by Ngomongo village which is a cultural centre built on an abandoned quarry in Mombasa. Another project is coming up in Kilifi to rehabilitate two quarries to a

hotel with large swimming pools. The researcher recommends that the design guidelines discussed above could be replicated to all counties to reclaim quarries to useful recreational facilities. A major hindrance with these projects is that they cost millions of shillings to build a structure such as the Hotel constructed in Kilifi. Alternative measures may be used to develop basic parks like the Karmiel Park in Israel where natural resources are utilized from the existing quarry in creating a park.

Literature review has indicated that reclamation plan should be implemented alongside mining plan for effective restoration after mining operation ceases. There is need for participation by the local private sector in the mining sector to build a whole eco-system that will boost capacity and improve productivity in the extractive industry.

Recommendations

The conclusions above create a basis for the improvement of our environment to make it more sustainable in line with the Vision 2030. The *World Commission on Environment and Development* (WCED) was established in 1983 by the *United Nations Environmental Program* (UNEP). It aimed to respond to the emergent concern about the negative impacts of human activity on the natural resources of the earth. In Israel the QRF collects revenues from the mining companies which is used to develop the closed mine by bodies in charge of reclamation. Our Local Government should divulge information on the funds they collect from transporters that collect minerals and from the mine operators for reclamation.

There are reclamation approaches by Engler that require little financial cost for implementation. Stake holders, mine owners and the community should have a proposed plan of the land use projects after mine closure. Israel provides a good bench mark for reclamation process to take place whereby they have instituted bodies that oversee reclamation programs to the end. There is need for participation by the local private sector in the

mining space to build a whole eco-system that will boost capacity and improve productivity in the extractive industry.

Physical planning Act (CAP 286) policy implements power on land use planning to local authorities like City Council of Nairobi for planning of various land use activities including provision of recreational open spaces. The Act under section (IV) subsection (B) details the procedures on preparation of a Local Physical Development plan and approval development applications which should entail stakeholder participation. This includes a proposal by the City Council to convert land set aside for recreation to other land uses and has to be agreed upon by the local residents. This has not been the case in Kayole. The same Act gives powers for development control to local authorities such as the City Council to ensure adequate land is provided for recreation and enjoyment by urban residents (Analo, 2011).

Kenya Army Barracks at Kayole should reclaim this quarry to a recreation facility for their staff which will in turn be open to the general public and will generate income for their day to day expenses. They stand at an advantage by reclamation for they have many families who live in the Barracks most of their lives without much recreational facilities for use. Recreational facilities such as a shooting range can be opened to licensed users who are then charged a user fee.

NEMA can license this degraded lands to the private sector with the financial capability of investing in major infrastructure projects that will increase revenue for the country and provide a variety of recreation outlets for its communities and to enhance tourist activity base.

Finally the reclamation steps that are used by various countries in their restoration projects should be documented in detail to aid any further research in this field. There is a knowledge gap that needs to be filled from

the early authors like Bradshaw and Burton of 1970's who gave an in depth contribution to reclamation and restoration for recreation purposes. Today we have few scholars exploring this field of post mining landscapes and their environmental impacts both positively and negatively. Haller Park in Kenya is one such publication that has detailed the geomorphological and re-vegetation steps that were integrated to create the landscape to the tourist attraction it is today.

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Appendices

Appendix 1: Interview schedule for the Quarry Representative

This interview will investigate the use of degraded land to create a recreational park. A report of this research will be strictly for academic purpose only

Section A

Name _____

Location _____

Date of Interview _____

Section B

1. What is the name of this quarry?
2. Who owns it?
3. What challenges do you encounter for having this abandoned land over the years?
4. What was your drive in filling this quarry?
5. What are the challenges you are facing if any?
6. How can you overcome?
7. What is your vision for this land in the end?
8. Who will gain from this facility?
9. Why would the Government or any NGO fund this project in the future?
10. What other private or voluntary bodies providing recreational facilities are you using as a study?
11. Is there a document or policy you are using as a guide?

Section C

12. Which category do you fit in?

Age

20-25 ☐ 25-30 ☐ 30-35 ☐

35-40 ☐ 40-50 ☐ 60 and over ☐

Profession

Student ☐ employed ☐ self employed ☐

Business ☐ retired ☐

13. What do you do with your leisure time?

Open air outings: parks, sea beaches, countryside, camping

Entertainment, social, cultural activities: going out for a drink, meal, dance, cinema, museums, art galleries, sports centres, church

Home based: listening to music or watching t.v., reading books, gardening and playing with children

Any other

14. What influences your leisure?

Society ☐

Environment ☐

Professional life ☐

Home and personal life ☐

Recreational amenities ☐

15. How much do you spend on a weekend out?
16. Which parks in Nairobi have you visited?
17. Which parks outside Nairobi or outside the country have you visited?
18. How often do you visit parks?
19. What features of the park do you like/dislike?
20. What features or facilities would you like to be introduced in parks?

Appendix 2: Interview schedule for the City Council Department of Parks and Open Spaces

This interview will investigate the use of degraded land to create a recreational park. A report of this research will be strictly for academic purpose only

Section A

Name _____

Location _____

Date of Interview _____

Section B

1. How many parks do we have in Nairobi?
2. Why is it adequate for our large population?
3. What age group of our community do parks target?
4. Do you have a strategic policy or document on parks and what does it contain?
5. Is there a budget allocation for recreational parks. What is the figure?
6. Who is in charge of maintaining this Parks?
7. What are your impediments to creating parks if any?

Section C

8. Which category do you fit in?

Age

20-25 ☐ 25-30 ☐ 30-35 ☐

35-40 ☐ 40-50 ☐ 60 and over ☐

Profession

Student ☐ ☐ employed self employed ☐

Business ▭ retired ▭

9. What do you do with your leisure time?

   Open air outings: parks, sea beaches, countryside, camping

   Entertainment, social, cultural activities: going out for a drink, meal, dance, cinema, museums, art galleries, sports centres, church

   Home based: listening to music or watching tv, reading books, gardening and playing with children

   Any other

10. What influences your leisure?
    Society ▭
    Environment ▭
    Professional life ▭
    Home and personal life ▭
    Recreational amenities ▭
11. How much do you spend on a weekend out?
12. Which parks in Nairobi have you visited?
13. Which parks outside Nairobi or outside the country have you visited?
14. How often do you visit parks?
15. What features of the park do you like/dislike?

Appendix 3: Interview schedule for the community near Mihango Quarry

This interview will investigate the use of degraded land to create a recreational park. A report of this research will be strictly for academic purpose only

Section A

Name _____

Location _____

Date of Interview_____

Section B

1. Which category do you fit in?

   Age

   20-25 ☐ 25-30 ☐ 30-35 ☐

   35-40 ☐ 40-50 ☐ 60 and over ☐

   Profession

   Student ☐ employed ☐ self employed ☐

   Business ☐ retired ☐

2. What are your encounters with this quarry either positive or negative?
3. What are the recreational facilities available in Kayole?
4. What would be your vision for this space once backfilling is over?
5. What do you do with your leisure time?

   Open air outings: parks, sea beaches, countryside, camping

Entertainment, social, cultural activities: going out for a drink, meal, dance, cinema, museums, art galleries, sports centres, church

Home based: listening to music or watching tv, reading books, gardening and playing with children

Any other

6. What influences your leisure?
   Society ☐
   Environment ☐
   Professional life ☐
   Home and personal life ☐
   Recreational amenities ☐
7. How much do you spend on a weekend out?
8. Which parks in Nairobi have you visited?
9. Which parks outside Nairobi or outside the country have you visited?
10. How often do you visit parks?
11. What features of the park do you like/dislike?
12. What features or facilities would you like to be introduced in parks?

Appendix 4: Interview schedule for the Youth and General Public

This interview will investigate the use of degraded land to create a recreational park. A report of this research will be strictly for academic purpose only

Section A

Name _____

Location _____

Date of Interview _____

Section B

1. Which category do you fit in?

   Age

   20-25☐ 25-30 ☐ 30-35☐

   35-40 ☐ 40-50 ☐ 60 and over☐

   Profession

   Student ☐ employed☐ self employed☐

   Business☐ retired ☐

2. What do you do with your leisure time?

   Open air outings: parks, sea beaches, countryside, camping

   Entertainment, social, cultural activities: going out for a drink, meal, dance, cinema, museums, art galleries, sports centres, church

Home based: listening to music or watching t.v., reading books, gardening and playing with children

Any other

3. What influences your leisure?
   Society ☐
   Environment ☐
   Professional life ☐
   Home and personal life ☐
   Recreational amenities ☐
4. How much do you spend on a weekend out?
5. Which parks in Nairobi have you visited?
6. Which parks outside Nairobi or outside the country have you visited?
7. How often do you visit parks?
8. What features of the park do you like/dislike?
9. What features or facilities would you like to be introduced in parks?