

**RECLAMATION OF DERELICT PONDS OF BIRNIN KEBBI  
URBAN ENVIRONMENT**

*By*

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M.TECH/SSSE/990/2003/2004**

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**MINNA**

**MAY, 2006**

## DEDICATION

To my children: Emmanuel (Asantu), Hauwa (Miracle), and Maryam my beloved wife.

Mallam Abubakar A Umar, Alh Rilwanu Danmaigona, Andy Emmanuel Yakubu JP and a host of others. May God richly reward your concern for me Amen.



**Approval page**

This thesis has satisfied the requirement of the Post Graduate School and the Department of Geography of the Federal University of Technology Minna, for the award of Master of Technology (M.Tech) Degree in Remote Sensing Application, and it is hereby approved accordingly.

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## **Abstract**

People settle in danger zones before they understood the risks, and many of them are too poor to move from those areas. Even after disaster has occurred in such areas, some prefer to return to the life they know best. The research therefore, aims at identifying areas that are liable to future floods and their associated health hazards in the Birnin Kebbi urban area. The Master Plan of Birnin Kebbi 1980-2000 is regarded here as a potential contributory data source for evaluating health hazards, reflecting that over the years, incidences of disease from monthly returns of the hospitals illustrate high gastro intestinal complaints among children treated. Also treated were respiratory infections, malaria, typhoid, skin and eye infections in high proportions. All these are frequently associated with impure drinking water, and inadequate washing facilities and sanitation.

The Nigeria Sat 1 Image of 2003 of the Birnin Kebbi area has been used for land use/land cover mapping of the area as well as identifies the derelict pond sin the imageries. This is made possible through the use of the intelligence of Arc View GIS software. The result obtained shows that satellite data are acceptable for quick assessment of environmental issues.

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## GLOSSARY OF TERMS

1. **Borrow pit:** The term is applied to a temporary mineral supplying Reserve used solely in a specific construction project, particularly roads.
2. **Dam:** A wall built across a river to control the flow of water, a reservoir forms behind the dam.
3. **Derelict:** Run down and abandoned. In law, goods Intentionally abandoned by the owner. Both the intention and the external act of abandonment are necessary to render the property derelict.
4. **Dwelling:** A building to live in (Like a house or flat)
5. **Erosion:** The wearing away of rock, stones and soil by rivers, the wind or glaciers.
6. **Exploit:** Make us of someone or something for profit.
7. **External Dereliction:** This refers to land now derelict but including sites caused by planning conditions and permissions.
8. **Flash Flood:** A sudden flood usually caused by a very heavy burst of rain.
9. **Flood:** An overflow of water from the river or pond.
10. **Flood Plain:** Flat land around a river that gets flooded when the river overflows.
11. **Ground Water:** Rain water that has soaked down through the ground and filled up the cracks in the rock below.
12. **Impermeable:** Does not let water pass through.
13. **Infiltration:** The soaking of rain water into the ground
14. **Infrastructure:** The basic services in a country, such as roads, railways, water supply, telephone system etc.
15. **Latitude:** How far a place is north or south of the equator, in degrees
16. **Longitude:** How far a place is east or west of the prime meridian. It is measured in degrees

17. **Partial Dereliction:** This is sub-division into regressive, that is land which has been derelict and although not reclaimed has been put to other us.
18. **Reclamation:** A term applied to the utilization and improvement of land and water resources for agriculture and other purposes, through irrigation, drainage of tidal marshland, restoration of mine workings and other construction activities.
19. **Residential Area:** An area which is mainly homes (Rather than shops or offices)
20. **Urban Area:** A built up area, such as a town or city.



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## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.0 Study Background**

The urban environment, the physical aspect of the urban area is consisting of complex mix of built and natural elements. These elements are increasingly studied to recognize their importance and influence on the quality of life that is found in the urban areas, to be accountable in the pursuit of management or safeguarding of the urban environment. It might be considered the opposite of the natural environment, since it concentrates so many people, buildings and economic activities that also supports infrastructure such as roads, water pipes, drains, electricity and telephone systems. However, human interventions have so radically shaped the environment to taste and these have far removed it from natural processes and resources.

#### **1.1 The Diversity of Urban Environment**

It is difficult to protect the environmental advantages of city sites, when there is growth in population. This is because several cities have outgrown the natural advantage of their site where the expansion has made the inhabitants to build homes on hill sides that are often steep or unsuitable for safe residential development, for instance, in Rio de Janeiro and Caracas where expanding population have had to build houses on dangerous sites.



The very large increases in the generation of air pollution have revealed the limitations of certain city sites for the dispersion of pollution. For instance, the site of Mexico City is of considerable natural beauty, well suited to a major city; it had been chosen by the Aztecs as the location of their great city Technochtitan, before the arrival of Europeans. And until relatively recently, it was regarded as a pleasant city site. Now it has serious problems of air pollution because the high altitude, lack of winds, and shape of the valley in which it is situated make the site ill-suited to a very large city with high concentration of industries and motor traffic, unless emissions from these sources are strictly controlled.

Cities have always been much influenced by the knowledge and culture of their inhabitants. This can be seen both in the form of buildings and in the design of neighbourhoods and public spaces. These characteristics are shaped by climate and geographical condition such as building design, the material used, and the organization of public and private spaces that helps to moderate extreme temperature and provide protection from rain, wind and where needed, limit rises from natural hazards. All urban environments represent a combination of individual and collective human efforts to make the natural environment more convenient for human activities for instance, allowing the clustering of economic activities and the homes of the needed workforce. In virtually all urban centres, there are legal and institutional measures to reduce both natural and human created environmental hazards within the urban boundaries.

In many urban centres however, lower income groups live on land sites subject to flooding or landslides because it is too expensive for them to rent, buy or build housing on safer sites (David, 2004).

## **1.2 Environmental Problems within Urban Areas**

There are several urban centres around the world that include among the healthiest and the most dangerous human environments. At their best, they provide healthy homes and workplaces combined with centres of culture, entertainment and leisure. At their worst, urban environments with high infant mortality rates such that one third of children dies before their fifth birthday and with much of urban population suffering unnecessarily from ill-health or injury from environmental hazards. From a health perspective, environmental problems are best identified if considered in terms of the nature of the hazard and the physical context in which they occur. Physical hazards are a major source of injury and premature death in most urban areas.

## **1.3 Why Do People Live in Danger Zones?**

Millions of people live near plate edges, where earthquakes and volcanoes do take place for the following reasons:-

- a) People settle in danger zones before they understood the risks.
- b) Many people are too poor to move. And even after a disaster, some prefer to return to the life they know best.

- c) Some of the settlements have grown into enormous cities – like Mexico and Tokyo, where could all these people go now?
- d) A good job and a good way of life may keep you in a danger zone, even if you feel a little nervous.
- e) We often think disasters happened only to other people. We ignore the dangers and get on with life.
- f) We rely on the technology like in places like California and Japan; they are well prepared for earth quakes. This makes people feel safe. But as the population of the earth grows, more people will live in danger zones. We need to get better at predicting earth quakes and eruptions, and protecting people from hazard. (Rosemarie, et-al 2001).

#### **1.4 Preparation for flood eventualities**

Some countries of the world are better equipped than others when it comes to the matter of flood control measures. In England, the neighbourhood of the Wales an environmental agency secures the banks of the rivers, through the use of the following: Using ordinance survey maps as source of help. They in some other times build flood defences which involve raising the banks in form of embankments. And from time to time the water dept is frequently measured to monitor flood eventualities.

All these are accurately carried out in collaboration with the metrological agency and the police to warn people using Radio, TV, telephone or knocking on doors should there be certainties that flood is likely to take place.

### 1.5 **Statement of Problem**

The impact of material quarrying in Birnin Kebbi urban area has caused reduction in the availability of land for development, while causing devastation through the clearing and digging process of the soil in these areas.

After the digging, the areas are left exposed and highly degraded. Now, every year around the same time July through September, the residents around the ponds experience flash floods. The floods come when rain falls, and the ponds overflow.

The left out dugged areas retain water after the floods recedes but the level begins to rise at the down of every rainy season, deepening and widening as well as the material extraction continuing at the sides, and water lilies accompanying them becoming conducive grounds for the breeding of mosquitoes creating health hazardous condition for people in the neighbourhood.

The 2004 flooding was particularly worst from these ponds that it invaded many homes and the Sir Yahaya Memorial Specialist Hospital where floors, furniture, and electric wiring got damaged. Ground based electric transformers were submerged, lights were out then, else there would have been electric shocks. Shops around the area were flooded, businesses came to a halt, the roads covered and no freeway, car engines were ruined.

The perennial flooding as experience in most parts of the town has therefore, a source of anxiety to most resident close to the ponds. Consequently, successive administration in the State has attempted to tame this menace without much success. The

first meaningful attempt however was in 2003, when the contract for the construction of Rafin Atiku was awarded to CGC; a Chinese firm. The project which is now completed, involved the construction of 4 Kilometres Drainage System to the out-fall at the total cost of N460, 000,000.00. This is in addition to the construction of link drainages with a total length of 1.35 kilometres with a combined cost of N180, 000,000.00. Other feeder drainage systems have also been constructed mostly by the present administration in order to reduce the menace of flood.

Despite the amount expended by the State Government, a lot more needs to be done to tackle the problems created yearly by the flood especially along the roads of the town and the numerous abandoned borrow pits located in the densely populated residential areas. There are also waste dumps at the banks of these ponds and have contributed in polluting the environment with material waste, and the spread of diseases e.g. typhoid since drinking water got contaminated by sewage.

There are seven major areas in the Birnin Kebbi township where these materials' mining has turned them into ponds such as:-

- Rafin Atiku pond
- GRA pond
- Tudun Wada pond
- Yanyara Market pond
- Illela Yari pond (behind old prisons)
- New Cemetery road pond (Dukku River Road)
- Atiku Villa pond (Behind UBN Plc)

All these regions were once mud hills which some inhabitants of Birnin Kebbi made use of as suitable materials for the construction of local mud bricks for the building of their residences, as well as road construction projects.

These areas have been greatly exploited leaving behind large ponds that are yearly filled up with water during the rainy seasons. But owing to the lack of adequate drain, have created several problems of flood. Two of these derelict ponds (Rafin Atiku and Atiku Villa ponds) are located at the central district, and the overflow from them over the years have been a great concern to the government and people of the township because of the cardinal slopes that feed them with surface run-off.

## **1.5 Aim and Objectives of Study**

### **1.6.1 Aim:**

The major aim of the study is to assess the effects of derelict ponds in the Birnin Kebbi Urban area, in order of provide a mitigative measure towards effective reclamation of the ponds for social and economic uses.

### **1.6.2 Objectives**

The aim of the study is to be achieved through the following objectives:-

- 1) To produce the urban spatial map of the Birnin Kebbi Urban area through the use of remotely sensed data.
- 2) To identify locations and sizes of the various derelict ponds within the township and then possible effects.
- 3) To identify the action of government on the ponds.
- 4) Provide recommendation for the reclamation of all derelict ponds in the study area.

### 1.7 **Justification of Study**

The research made on these ponds is necessary to help combat the menace of flood that keep repeating itself at the down of every rainy season from these derelict ponds. The flood comes when people are not prepared for it and if allowed would jeopardize every effort people are making to live.

The quarrying of construction materials is severe in these pond areas and has devastated the land greatly, some have been completely abandoned and their existence does not have any economic benefit.

After the area is mined as it is characteristic with mining sites, the pits are left exposed and degraded, unsuitable for any use, the hilly areas and slopes are affected by severe erosion as well as the floods that follow. The continual existence of these derelict ponds also jeopardizes the aesthetics of the township.

Water collects and stagnates in them where mosquitoes continue to breed contributing to health hazards, potentially increasing the incidences of malaria and other



water borne diseases. The study intends to provide a better understanding of the impact of the derelict ponds and material mining. It enables adequate monitoring and prevention technique for appropriate environmental management practice, useful in assisting decision makers and planners in finding possible ways to ameliorate the adverse effects their existence might pose to the people.

## **1.8 Scope of the Study**

The project intends to cover the existing seven (7) derelict ponds in Birnin Kebbi Township. It focuses on the negative effects of the existing ponds and the action of government on the menace of flood. The study does not cover the analysis of reclamation of Rafin Atiku Pond, it only endeavours to mention the estimates of how much it caused government to reclaim the pond, as well as highlights the need to reclaim others remaining.

## **1.9 The Study Area**

### **1.9.1 Location of the Study Area**

Birnin Kebbi (Fig 1.1) is situated in the north-western part of Nigeria, at a strategic position midway down the Sokoto-Rima Valley but is negated by the lack of an established river crossing point. The town is an old traditional trade route (primarily cattle) to the South. The town is situated between latitude  $12^{\circ} 28^1$  and longitude  $4^{\circ} 15^1$ , and it is approximately 150 kilometres South-West of Sokoto and 500 kilometres North-West of Abuja. Birnin Kebbi is the capital city of Kebbi State with lowland, relief characteristics, broken up in many places by the River Sokoto, and its tributaries. These rivers have flat-



floored valleys, which are normally flooded during the rainy seasons. The flood plains called fadamas. The land mass situated within the northern guinea savannah, and experiences tropical climate with long dry season and short wet seasons.

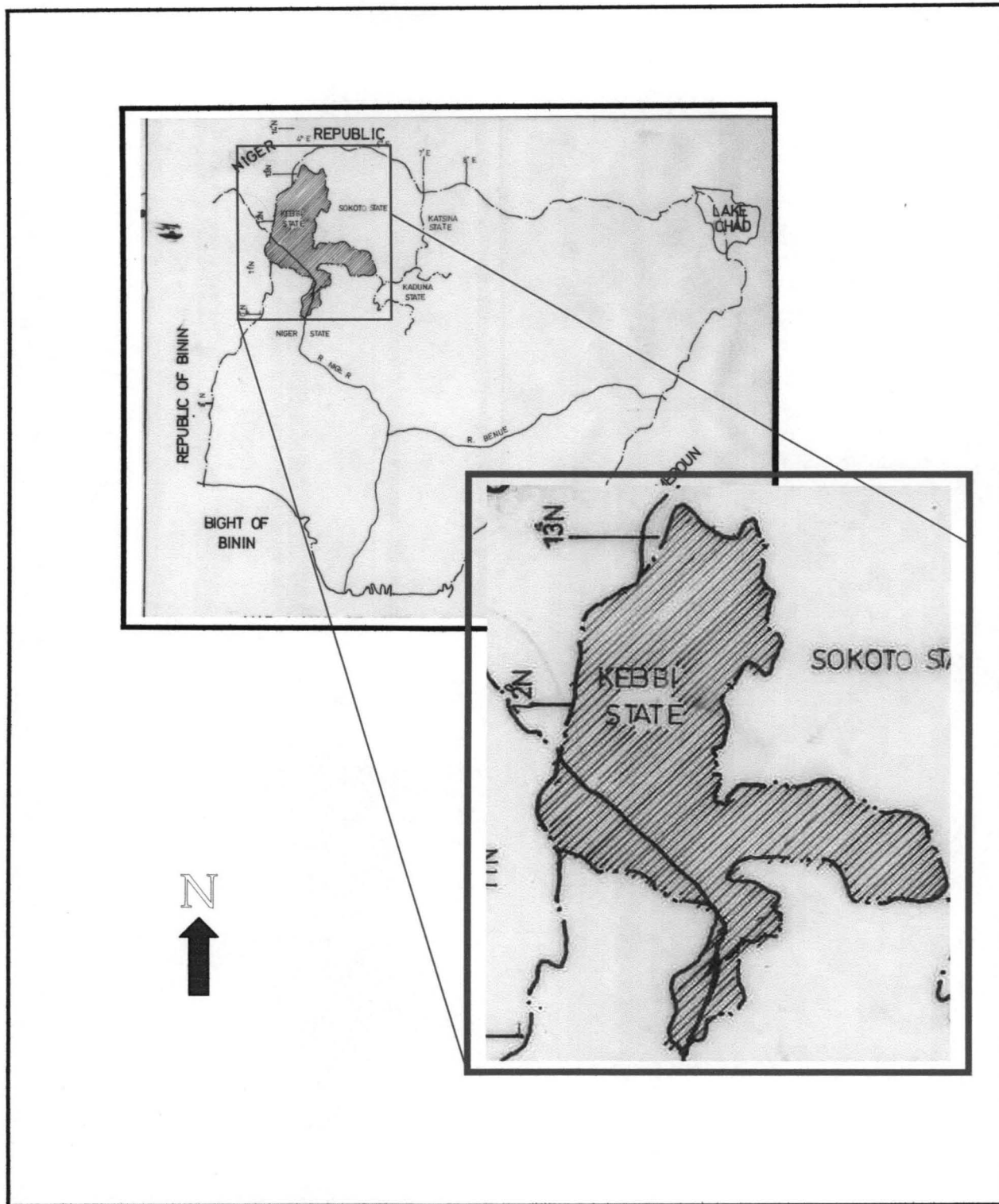


Fig.1.1: Map of Kebbi State the Study Area

### 1.10 **Brief History of Birnin Kebbi**

The master plan of Birnin Kebbi (1980-2000) describes Birnin Kebbi as a very old established town dating back over 500 years, and it became an important town when it was made an emirate (Gwandu Emirate Council), the oldest part of the town is the north, on the scarp which has eventually merged with the rest of the township.

Development in 1940's and 1950's led to Nasarawa residential quarters, a little over a kilometre to the south of the old town. A general infill of the town proceeded with government and residential development.

From the mid-1960's, the town started its next major expansion phase, going west to Dan Galadima and Makera Gwandu, and east from the centre of the old town. By 1974, Dan Galadima and Makera Gwandu were almost completed, along with the area to the east of the old town. Further westward, expansion started in what is now Rafin Atiku. The major civic expansion has been in the north with a large area of land allocated for government developments, and with the massive polytechnic site, which is under development. In the south, there are other developments, both educational and civil in nature.

The development of the polytechnic over the years has provided rapid growth to the township.

### **1.11 Human Habitation in Birnin Kebbi**

The Birnin Kebbi Inhabitants ingeniously adapt their dwellings to fit the environment; they make use of suitable material that protects them from the people manage to construct comfortable dwellings as shelter varying from one location to another, ranging from mud, stone and modern synthetic materials such as concrete(Birnin Kebbi Master Plan, 1980-2000).

The physical characteristics of the houses built in the township depend on the aerial climate, technological know-how, Land tenure and ownership, personal taste and financial resources of the owners. Some of the Birnin Kebbi people develop their own houses out of the material in the immediate area, while others with greater capacity and wealth are not limited to materials found nearby (Birnin Kebbi Master Plan, 1980-2000).

### **1.12 Soils and Physiography**

Birnin Kebbi as the Master Plan (1980-2000) states middle Eocene period in the tertiary age. The rock type is sedimentary, consisting of sandstone, shale and limestones; there are outcroppings and steel cliffs of limestone. The soil, which has developed over the geology, is of a sandy, coarse texture, freely drained with discontinuous iron pan. However, though freely drained, if surface run-off does not occur, the soil exhibits a high erosive potential, which will be increased if development occurs.

The fadama lies to the north, an extension from the Sokoto Rima River. Here the annual flooding of the valley floor has provided fadama soils of high clay content producing an alluvial soil of high agricultural value.

### 1.13 **Climate**

Although, there are no climatic recording stations that exist in Birnin Kebbi, the town falls within the Theison polygon whose recording stations is situated at Sokoto. The average maximum temperature ranges between 30<sup>0</sup>c and 41<sup>0</sup>c while the average minimum ranges between 15<sup>0</sup>c and 26<sup>0</sup>c.

Average rainfall is 740mm annually, and spreads over a rainy season of about 120 days. A larger water deficit occurs due to a high potential of evaporation level during the hot season. This is of great importance to agriculture, especially in relation to dry season farming (Birnin Kebbi Master Plan 1980-2000).

### 1.13 **Vegetation**

The secondary climax vegetation of the upland area is Sudan Savannah consisting of a scrub savannah of low Acacia trees and shrubs grasses. Mainly pyrophytic in nature, which rapidly returns where previously cultivated and much more when the land is left under fallow. However, it has in the fadama area, tittles natural vegetation due to continuous farming practices. That which does exist is mainly grasses. A few palm trees

producing coconuts and activated in occasional rows in the fadama. Irrigation practices are done with shallow wells and boreholes (Birnin Kebbi Master Plan, 1980-2000).

#### **1.14 Housing and Social Structure**

In the Birnin Kebbi Urban Centre, housing takes the largest use of land. The knowledge and understanding of the existing housing condition and past trends will be a necessary aid to planning for the future development of the township.

The residential areas of the township are splinted into sub-areas (Shiyas) as follows: The Old Town, Takalafia, Tudunwada, Makera Gandu, Nassarawa, Rafin Atiku, Badariya, G.R.A., Gesse Phase I and II, Shiyar Fada and Polytechnic Permanent Site respectively. The land use in Birnin Kebbi is categorized into Urban, Semi Urban and Agriculture.

The mainly urban area consist of organic and continuous development comprises of paved roads with heavy vehicular traffic and a lot of commercial and other activities. The building and pavement of this zone contributes to the heavy run-off because of the hard surfaces that emerge.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.0 Ponds**

The ponds conservation trust, 2004 of the United states defines ponds as man-made or natural water bodies between one meter and two hectares square in area, which hold water for four months of the year or more. Some of them are semi-seasoned and temporary ponds because they dry up in the dry seasons but can support both specialised and valuable pond communities. Ponds are usually small, quiet and shallow body of water that sunlight penetrates to reach the bottom. The sun light enables rooted plants to grow across the bottom making a great variety of animals and plant life. Many other ponds have rooted plants that extends above the surface inform of leafy plants and float on the surface of the water.

Ponds may be formed by natural condition or by human activities such as being established at construction sites where the earth is taken from place to place as a source of fill dirt, and once removed, the dirt is gone forever used for perhaps road construction or as a source material for building of residential or commercial projects. Ponds that were excavated and are associated with building are typically shallow or moderately deep holes in the ground that turns out sometimes to be sites for severe erosion and sediment run-off to adjacent streams and wetlands. However, they also can become breeding grounds for mosquitoes. This is to say that borrow pits can be an un-attractive nuisance and an overall eyesore, for this reason the United States environmental and natural resources division

embarked on research that came out with a suggestion that it is best to make use of this kind of places as fish ponds and not to allow them to be derelict then properly manage them so that they can be turned into valuable sites.

The ponds conservation trust, environmental agency and English nature jointly sponsored and produced a report that reveals that Britains ponds have been lost over the last hundred years. Between 1984-1990, 2% of them were lost in the country side. The 2000 survey now shows that losses are slowing down because awareness have been created on the importance these ponds produce to the environment such as bringing a unique biodiversity resource, rich in species of plants, invertebrates and amphibians an important part of history, culture and past agricultural practices that reveals a visual focus in many landscapes and an amenity for many communities as a source of recreation and education. Despite their importance to wildlife, archaeology, culture and leisure, ponds are consistently undervalued probably because of their small size, familiarity and perceived abundance. The recommendations made by the research says that further loss and damage to ponds should be avoided except in exceptional circumstances. And relevant statutory regulations were enacted as follows:

- (a) National parks and access to the countryside act 1949 that your pond may be designated as/or be part of a local nature reserve. If so the pond will be protected by planning policy.
- (b) Wildlife and countryside act 1981 (as amended) that the pond be part of a site of special scientific interest which is a legal mechanism to protect



flora, fauna or geological or physiographical features. Under this act, protection is given to wild animals also.

- (c) Town and country planning act 1990- planning permission may be required to create, drain or infill a pond. The planning authority will consult their development plans to ensure local policy on ponds and associated features are adhered to
- (d) Salmon freshwater fisheries act 1975- you will require section 30 consent to remove or stock fish in your pond. Other than children, need a rod licence to fish. Removing fish using nets or traps also requires a licence.
- (e) Land drainage act 1991 stipulates that you may require a land drainage consent if you are altering any water course or affecting the flow of water down stream or significantly affecting drainage within a catchment.
- (f) Water resources act 1991-consent will be required via an abstraction licence to take water from a pond or fill a new pond with water other than from mains supply. Where a pond is created on-line along a water course an impoundment licence will be necessary.
- (g) Ancient monuments and archaeological area act 1979- your pond may be part of a scheduled monument designated by the department of culture, media and sport. It is a criminal offence to damage a scheduled monument and a consent is required from DCMS for any works that affect the monument.

- (h) Countryside and rights of way act 2000- this is a protection act to allow increased powers of entry by conservation agencies, penalties for damage, compulsory purchase and site specific byelaws. The law gives right to wild life and natural features by making provisions for their conservation and biodiversity.

The research concludes that destruction of ponds is unsustainable development therefore; working together will create a future for ponds. Ponds must be protected as wildlife havens and as an important part of our natural heritage for future generations to study, appreciate and enjoy.(Environmental agency, 2001)

### **2.0.1 Building with Earth (Earth Mining)**

The department of natural resources according Microsoft Encarta premium, 2004 explains about homes that results from material mining are affordable, comfortable, sustainable and enduring. Earthen homes are appropriate for a variety of climates and are ideally suited for passive solar heating and cooling. If designed well, they stay warm in the winter and cool in the summer with little, if any need for auxiliary energy. Built largely from soil excavated on site, earthen homes require substantially less fossil fuel derived energy to build than the conventional wood frame homes. The materials are collected locally and the blemish produced when extracting earth can generally be repaired quickly and easily with little environmental impact.

A dunged hole to extract day-rich dirt for an adobe home, for instance, can be filled in, regarded and replanted, or it can be left to fill with water, creating a pond for wildlife to drink from on hot summer days.

The earth homes can be quit economically, further adding to their appeal.

Courtesy of Santa Fe Habitat for Humanity, Adobe brick-home building is an ancient technique that originated in the Middle East and later spread to Europe. As the Spanish sought riches in the new world, they brought this method with them. Today it is still practiced in Mexico and to a lesser degree in other parts of North America (Dan, 2002).

Traditional builders use adobe blocks made from a mix of clay-rich soil, sand, straw and water. The mixture is paused into block forms and baked in the sun. A couple of weeks later, the bricks are ready for use. Although traditional adobe block-making still reigns in poorer countries, many contemporary adobe builders in North America are substituting machine - made blocks called pressed earth blocks – for sun – dried adobes.

Pressed earth blocks are stabilized with a little cement and cranked out in a fraction of the time of a traditional adobe brick. This process generates more uniform blocks and makes adobe have construction feasible in weather climates, despite these advantages, pressed earth blocks represent industrial production shunned by some in the natural building movement.

## **2.0.2 Building with Rammed Earth**

Rammed earth is one of the oldest of all natural building methods. Rooted in North Africa and the Middle East, it dates back to the time of the pharaohs. Today, commercial builders still use them in California, New Mexico, Arizona and Colorado to construct modern homes.

To build a rammed – earths home, wooden or steel are moisture with dirt and tamped with a device. The moisture soil dries, creating thick, strong sandstone – like wall. Traditional rammed – earth construction relies on a mix of 70 percent aggregate (small stone) and 30 percent clay. The clay acts as a binding agent. But in areas where moisture and earthquakes are a problem, rammed-earth builders often use a mix of sand and cement, although the result lack the visual appeal of raw earth walls. And posses the advantages of being extremely attractive and enduring structure, suitable for many different architectural styles, often cheaper to build than brick, stone and adobe structures.

This forms the basis for the early inhabitants of Birnin Kebbi to extract parts of the earth that resulted into the present derelict ponds all over the township, the result of which have had a negative impact on the building structures environment and the people.(David, 2005)

## 2.1 Problems Associated With Derelict Ponds

**Land Insufficient:** Since we live, work and play on land, the uninhabitable derelict ponds further reduces the availability of land on which human can live considering the growing population, land for development become limited. (Payne and Hahn, 1995)

**Malaria:** The introduction of favourable malariogenic factors by man in the form of extensive breeding places for the vectors is a problem to man. The scope by the malaria hazards depends largely on other epidemiological factors connected with climatic condition, feeding habits of the vector and its potency, the housing condition; socio economic station of the people, storage of water behind human residences becomes serious risks of malaria infection.

**Solid Waste:** The trash that is collected from our homes are composed of a wide variety of familiar materials which may include paper, cardboard, clothing, yard waste, wood pallets, food waste, cafeteria waste, glass, metal, plastics etc open dumping of these waste around a pond would be compacted and each day, a layer of soil pushed over the most recently dumped and decomposition produces unpleasant odours to the environment. (Payne and Hahn, 1995). This is characteristic of the Birnin Kebbi inhabitants and especially around the pond areas.

**Flood:** According to Adeniran, 2001 there is no universally accepted definition of floods because different people view it differently. It has been generally described as a situation when a place is filled up or covered by water, an overflow of or place that is usually dry. All these positions reveal the inadequacy in the accommodation of excess discharge.

The major areas of Nigeria that suffer flood hazards still by Adeniran are:-

1. Low-lying coastal areas in southern parts of the country where annual rainfall is very high.
2. The higher Delta areas
3. The flood plains of larger rivers namely, Niger, Benue, Gongola, Sokoto, Kaduna, Katsina – Ala, Osun etc.
4. Flat low-lying areas around and to the south of lake Chad.
5. Flood hazards are also common in flood plain of urban rivers where human activities have great impact on the environment.

### 2.1.1 Flood Types

A better understanding of flood is perhaps through the types Oriola (2000) has described six different types:-

- i). **Flash floods:** these are results of high intensity rain associated with conventional rainfall. They have short duration, lasting for some minutes and covering small areas. Thus, the appearance and disappearance are sudden e.g. most streets in Nigeria cities are flooded after the intensive rain.
- ii). **A single event flood:** these are floods with a single high flow unlike flash floods, they have longer duration. The Ibadan flood of 1980 was a result of more than ten hours down pour, and in some cases, the rain may be for days.

- iii). **multiple event floods:** they are associated with cyclonic rainfall, they cover a large geographical area, produce a large volume of stream flow and extends over a period of several weeks or months.
- iv. Seasonal flood: these are re-occurrence of multiple even flooding. The periods of high water after extend over several months. The flooding areas always extend more than thousands of kilometre. Several floods are often a combined effort of inflow of water from many tributaries.
- v). **Coastal flood:** coastal floods are associated with meteorological condition which produce abnormal high sea level. They are known as storm surged, which occur at spring tides. When the win speed is high, the tea pile up against the coastline and large scale turbulence are generated, moving the wave up the shore above the height of the embankment wall. This type of flood has been reported at the Lagos bar beach.
- vi). **Estuarine Flood:-** This type occurs at the mouth of a river, it is a situation when the high spring tides impede the sea ward and fresh water flows, which consequently exceeds the channel storage capability of the river. Similarly, there is conflict between river and sea water in Delta areas, which equally results in flooding.

### **Causes of Floods**

Microsoft Premium Encarta (2004) explains the causes of floods as when it rains, or snow falls some of the water is retained by the soil some are absorbed by vegetation, while others evaporate, and the remainder which reaches river channels called run-off. Floods occur when the soil and vegetation cannot absorb all the water; and water then runs

off the land in quantities that cannot be carried in river channels or retained in natural or artificial pond as constructed to serve as reservoirs.

Floods damage property and endanger the lives of human and animals, but have other effects as well. Rapid run-off causes soil erosion as well as sediment deposition problems down stream. When this happens fish and wildlife habitats are often destroyed (Encarta, 2004). In urban centres prolonged high floods delay traffic and interfere with drainage and economic use of lands, making financial losses amounting to million of naira each year. A North Carolina website (2005) highlights the effects of flood as described above and suggest that open space in urban environment can help to prevent and/or reduce the severity of floods. How does it do that, well, a flood according to the website is simply a natural event where the amount of water flowing into a stream or pond exceeds the ability of it containing to excess. The bank overflow and spills out onto lands surrounding called flood plains.

Floods have occurred throughout history and will continue to do so forever, to the advantage and disadvantage of others. Humans do not create floods, but they are quite often made worse by our activities.

To predict run-off problems is to compare the total amount of impervious surface to the amount of land left undisturbed. The comparison yields a number called the impervious surface ratio. For example, a certain area may have an impervious surface ratio of 18, which means that 18 percent of the surface of the earth within the area is covered by materials that cannot absorb water. This also means that 18 percent more storm water will

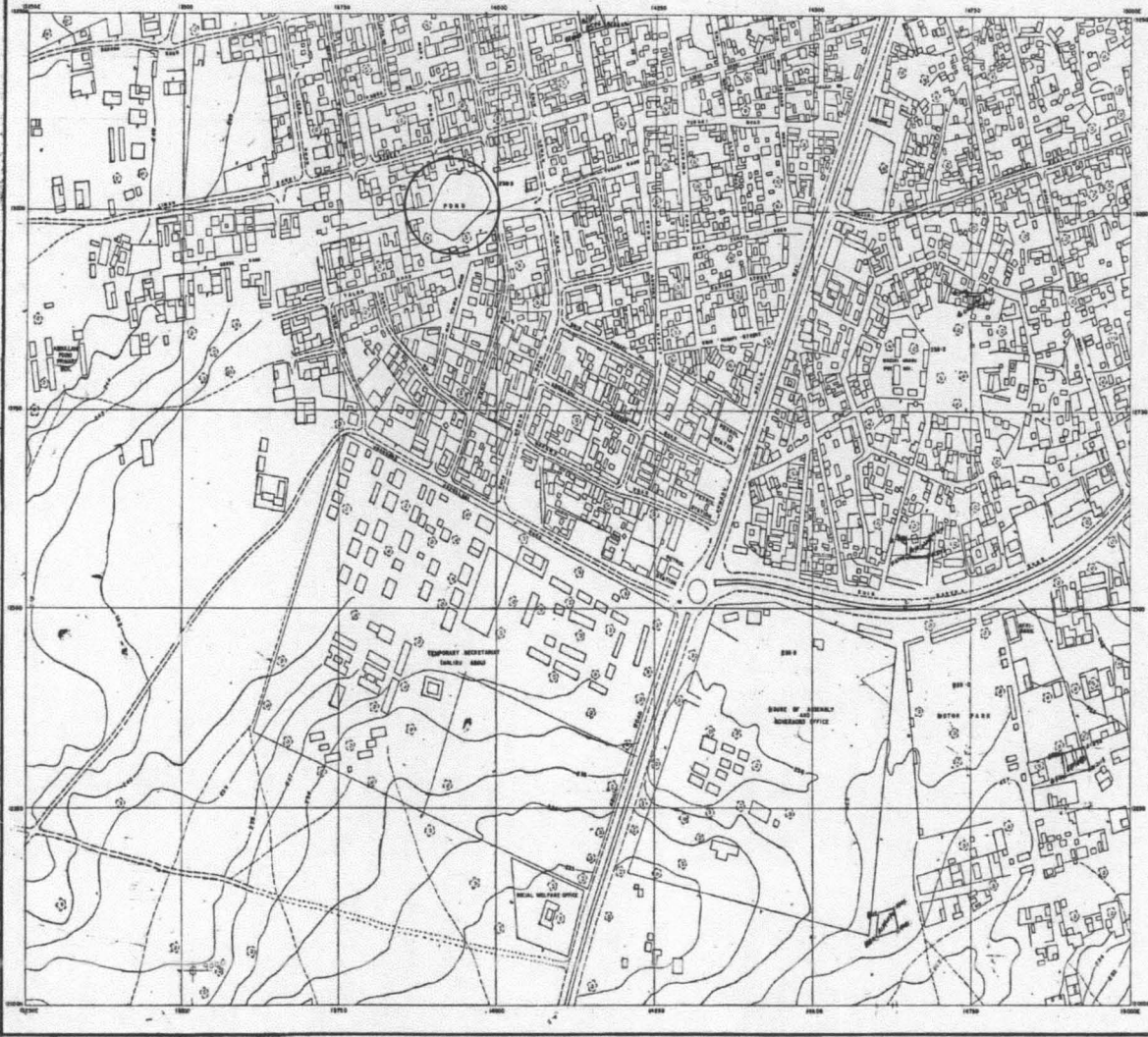


run off into our streams and rivers, upsetting the annual balance that took thousands of years to establish. There are a variety of solutions to floods ranging from easy to expensive and difficult but one way is to preserve open space. Every open space preserved lessens, the impervious surface ratio.

Another way is to explore technique for reducing the amount of impervious surfaces by using relatively new materials technique called porous asphalt when building parking lots. This materials looks and acts just like the regular asphalt, but it allows water to soak through the soil underneath.

## **2.2 The Birnin Kebbi Flooding**

The master plan of Birnin Kebbi, 1980-2000 reveals that the soil condition in the Birnin Kebbi urban area would normally allow rain fall to percolate into the ground without causing flooding. However, as the town continue to expand and develop, the original area becomes covered with impermeable materials such as zinc, roofing concrete and tarred roads. The capacity for the remaining area to absorb the rainfall is greatly reduced; consequently, flooding is unavoidable year in year out around tpond areas making homes to be flooded floors and furniture are ruined and the roads underwater while some are washed down causing erosion at the banks. The concerned present administration had to embark on reclamation exercise which consequently, had brought a lot of positive physical development in the state capital. Although , a lot more needs to be done because many more still exist in other areas of the town that requires urgent attention.



LEGEND

- Contour
- Built up Areas

- Road networks
- Derelict pond (Rafin Atiku)



Fig.2.1: The Topographic Map of Kebbi Township showing Rafin Atiku

### **2.3 Reclamations**

Reclamation is a term applied to the utilization and improvement of water and land resources for agriculture and other purposes, through irrigation, drainage of tidal marshland, restoration of mine workings, and other construction activities. In the coastal areas it is possible to reclaim land only when the offshore of tidal marshland are covered by shallow water.

This is made possible through construction of ditches and followed by artificial drainage. In Britain, land has been reclaimed on the coast of East Anglia (particularly around the wash). The most successful reclamation efforts of this kind were undertaken along the Zuiderzee area of the Netherlands only that problems associated with reclamation from the sea are that there is always a considerable amount of salt in the land reclaimed; therefore fresh water has to be applied to the surface to wash out the excess salt and carry it away by drainage water (Encarta, 2005).

According to a proposal made by East Lincolnshire council on reclamation of derelict land, the land was to be returned to beneficial use so that regard will be given to the present existing flora, fauna and archaeological remains on the site. The project was undertaken within the Borough, approximately 60 hectares of land that were incapable of beneficial use without treatment. Much of this is either dockland, railway land or land which has been tipped, with considerable proportions being in the ownership of the council and associated British ports. In the present form, this land was clearly a waste of scarce resources and a source of visual pollution which needed to be addressed. Therefore, consideration was given to extent of existing flora and fauna in the reclamation scheme. This was done

through treatment and monitoring after performing laboratory and field tests of soils and habitat then, integrating the result into a GIS system. The system was new on an international level from both conceptual and technological points of view.

### **2.3.1 Reclamation in Ohio**

Reclamation of the land beings almost immediately once mining is completed. Surface mining and reclamation laws were enacted during the 1940 through 1972 and it required that trees be planted as the final vegetative cover of our area mined. That type of reclamation exercise according to the environmental /stewardship website produces lovely forested hills and valleys that make up the heart of recreation of land.

The American Electric Power Authority showed a commitment in this regard, through reducing the effects of mining of coal in Ohio. The company adopted a corporate wide environmental leadership by seeking the most effective way to protect and enhance the environment which providing reliable electricity at a competitive cost. After the project, a variety of conservation organizations did commended the effort of the Authority. This is because the exercise was a voluntary project laws at that time mandated. The land not only was reclaimed, but it was recreated into recreational distinction for people to enjoy (Environmental/Stewardship, 2005).

In Ohio, Agriculture dominated the economy until 1940s when the harvest dwindled, the population declined and land values dropped. The lands completely were full of coal. The Electric Power Authority had to take over the mining of the coal because it was important for the production of electricity. It mined more than 2 billion cubic yards

of earth, eight times more than the panama canal-yielding 110 million tons of coal. The mining involved the removal of trees, vegetation, and topsoil carefully and taken to storage areas, where it remains. Until mining was completed after which the reclamation of the land began. (Environmental/Stewardship, 20005)

The earth that was removed from over the coal seam was put back in place. The land backfilled and graded to create the contours designated in the reclamation plans. Water run-offs were created to protect the land against soil erosion, they were fed into the ponds and lakes built into the reclaimed land as reservoirs.

Fertilizers were then applied to the land to improve the quality of the soil. Finally, the area has revived with a variety of grasses, which protects the soil from erosion and help restore the land for useful purposes.

From 1981, the American Electric Power Authority have received over forty five land management and habitat awards for its land stewardship activities, various organizations including the United States Department of Interior, the US department of Energy, Edison Electric Institutes, American Forest Council, National Wild Turkey Federation, the Ohio Department of National Resources, etc have all commended their effort. Today, that great reclaimed area is now called the rolling hills consisting forest and grass that now provides shelter and habitat for wildlife and variety of recreation at an estimation of 160,000 people visiting this area for recreation each year, providing an estimate social and economic benefit in excess of \$5 million annually. (Environmental/stewardship, 2005)

### **2.3.2 Salford City Reclamation**

(Perry, 2004) writes of the experience of Salford city council that has also embarked on projects that regards land reclamation. Many valuable open spaces and developmental sites have been created from discussed and contaminated sites such as:-

- a) Creation of leisure from a cycle of footpaths network of former mineral working where railway lines were provided at the end as linkages throughout Salford city.
- b) A project that caused the transformation of a chemical working site and reservoir to a country park and wildlife reserve.
- c) Development of angling facilities as ponds at derelict landfith sites.
- d) Reclamation of former household waste sites to create public open spaces.
- e) The former dock at Salford quays has been transformed by the initial provision of infrastructure, roads, and walk-ways to generate developments of the area.

### **2.3.3 Land Reclamation in the Nether Lands**

Microsoft Encarta, (2005) reveals that at one time, much of the land of the Netherlands lay underwater. But through the centuries, the Dutch government endeavoured to reclaim the land from the sea by building surrounding dykes and removing the water with pumps powered by windmills. Also electric pumps were and are now still in use to drain water.



An area of the reclaimed land is known as a polder. At Amsterdam and Brussels, about 1600 – 1900 kilometres of land have been reclaimed while at Rhine, Schelde and Lek, 1900 kilometres of land has been reclaimed.

#### **2.3.4 Land Enclosure and Agricultural labour Britain**

The parliamentary enclosure of land in Britain was fundamental to Agricultural Revolution; however, enclosure had been in operation since medieval period. Indeed, by the mid 18<sup>th</sup> century a substantial part of the country was already enclosed. The two main surges in reclaiming new land for cultivation and the enclosure of communal land holdings during the 18<sup>th</sup> century came first in the 1770's, and during the Napoleonic Wars. The primary reason for enclosure was simply land reclamation, rather than the re-organization of arable land for increased efficiency.

Reclamation of waste and common land enabled a shift to larger farms, in which it was often pointless to enclose small farms. Consequently, numerous small farm owners could not manage to feed their families because their subsistence had relied on customary rights of grazing, hunting and other activities embedded within the ancient usage of the common lands. As a result, these small land owners were forced to sell up to large landowners. Enclosure also represented away for land lords to raise the rent by the necessary regeneration of lease arrangements (Encarta, 2005).

### **2.3.5 Land Reclamation in Campagna Di Roma Italy**

Campagna Di Roma is a plain in central Italy, an undulating area surrounding Rome, in Latin region. The district, with an area of about 2100 square kilometres, extends along the coast of the Tyorheman Sea from the city of civilarecchia to the city of terracing. From the coast the district extends in land to the Alban and the Sabine hills. The ground which never rises higher than 61 metres above sea level is almost entirely volcanic.

The many lakes were formed in the crates of extinct volcanoes until the 5<sup>th</sup> and 6<sup>th</sup> centuries AD. The Campagna Di Roma was well populated and was filled with luxurious villas, ruins of which have been found. During the middle ages, the political insecurity of the region following the fall of Rome as well as the poor soil resulting from misuse of the land and the failure of the water supply, led to a gradual depopulation and to an increase of unhealthy condition including Malaria. Reclamation of the district begun in the 19<sup>th</sup> century and largely completed in the 1930's.

Today, the district has grazing lands for sheep and cattle and land suitable for growing cereals, vegetables and fruit (Encarta, 2005).

### **2.3.6 Land Reclaimed at Croatia**

The Microsoft Encarta 2005 also describes the environmental concerns of Croatia as having industrial pollution. Air pollution was severe and water pollution in the rivers too. The water had to be treated even for industrial use. Part of Croatians Sara valley is protected in a biosphere reserve, which in turn contains three bird sanctuaries. The flood plain of the Sara is extensive resulting in wetlands that provide a habitat for numerous



plant and animal species. Despite the presence of the reserve, these wetlands are at risk as a result of encroaching agriculture, drainage and land reclamation and water pollution. Today, Croatia protects 6.7 percent in 1999 of its total land area in parks and other reserves.

### **2.3.7 Reclamation in Israel**

Cooperative farming establishments called Kibbutzin and moshavina provide much of Israel's agricultural output. Agriculture, forestry and fishing employed just 2.7 percent of the labour force and contributed only 2.6 percent of GDP in 1995, yet its structure and successes are an important aspect of national identity and pride. This success has been made possible by reliance on scientific research and advanced technology, particularly the implementation of land reclamation and irrigation programmes. Israeli farming settlements are organised into three principal types. In the collective settlement (Kibbutzi), people share equally in the work and its profits. The cooperative settlement (Moshav) individual farms are worked separately but the produce is pooled and marketed by the settlement. In the small holders settlement (Moshava) individual farms are worked as private enterprises.

A major portion of the land reclamation and conservation programme in Israel is afforestation, or the establishment of forest cover, mainly in the hilly areas. About six percent of Israel is forested. In 1999 the fish catch was about 24, 661 tonnes, more than half of this quantity consisted of fresh water fish raised mainly in artificial fish ponds (Corbas, 2005).

### **2.3.8 Reclamation in United Arab Emirates**

Although the United Arab Emirates has a tradition of subsistence agriculture and fishing, which contributes, 2.5 percent of GDP, farming is handicapped by water shortages, and less than 0.5 percent of United Arab Emirates Territory is cultivated. Land reclamation and desalination programmes have made the United Arab Emirates self sufficient for most of its fruit and vegetative needs, but other types of food still need to be imported. Fishing is significantly resourced, with a total fish catch of 117, 607 tonnes in 1999 (Encarta, 2005).

### **2.3.9 Land Reclamation in Egypt Africa**

The Egyptian agriculture is characterized by intense cultivation, irrigation, and the use of fertilizers. The farmland yields rank among the highest in the world. But most of the countries arable land lies along the banks of the Nile and in the delta region. Government programmes have expanded arable areas through reclamation, irrigation (notable since the completion of the Aswan High Dam in 1990) and the use of advanced technology (fertilizer mechanized equipment. (The Hutchison Library of Holland, 2004)

### **2.3.10 Reclamations in Nigeria**

Reclamation of derelict lands can be done in two ways:

- a) By embarking on a well planned drainage system or

b) By cultivating water plants to remove excess water in water logged areas, for example, in Lagos region, at Awumo-Odofin area where FESTAC buildings were erected, the land has been reclaimed through the use of well planned drainage system. (Aguda et al, 1999)

Accordingly, Africa has received attention in the parts of Anambra and Imo States of Nigeria especially, the Nanka, Agulu, Oyo and Enugu Nsuka areas. Zaria, and the Jos Plateau area one of the oldest and most thoroughly documented. The documentations were necessary because they had bearing with agriculture and population density. (Olurami, 1988)

#### **2.3.11 Soil Conservation Projects in Nigeria**

The history of soil conservation or reclamation of gullies dates back to 1911 at the Udi Plateau. The region offered one of the finest examples of hill erosion areas in the tropics that have destroyed forest vegetation. Between 1918 and 1923 a team of foreigners visited the area and introduced control measures, they introduced drains and the reconstruction of property stepped drains and the prohibition of grazing on the hill slopes. Ditches and ridges were constructed along contour lines in the land between the review and trees also introduced were seeds and transplant along the ridges. At the sides of the project area, Bachama grasses were transplanted to stop erosion and check raindrop in part while increasing soil stability, but the project did not last for long The government of Easter Nigeria at some time announced that it was gong to sole the soil erosion problems but polities, money and particularly the Civil War between 1965 – 70 prevented any such

action, to day, the gullies in these regions have worsen in many areas and they remain unreclaimed even with the introduction of stabilizers. The reasons are as follows:-

- (a) The local people have not got themselves sufficiently involved in solving the problems. They see themselves being helpless, even when politicians reassure them that there can be collaboration with government to combat the menace
- (b) The past and present government too do not seem to have any conservation in the country. Projects under taken in the past have always been ad-hoc in design to check particular damaged areas of interest
- (c) There is also several Ignorance on the part of the people through exertion of excessive pressure on the land, especially now with population growth.(Oluranmi. 1988)

An African front website (2005) also mentions the case of for plateau as being pathetic, the land in devastated by mining after May yeas, and the magnitude of it is attracting public attention. Consequently, a special allocation for land reclamation is being sort fort and it is likely to be granted to the State by the Federal Government. This was stated at an inspection tour of mining ponds and erosion areas. The Permanent Secretary in charge of Ecological fund office in the presidency (Nigeria), Dr Kingsley Nkumah, described that the scene was Unbelievable to him. Accompanied by the Governor of the State Chief Joshua Dariye, promised to forward the result of what he saw to the minister, for special duties so that the State can be considered by the Federal Government. While expressing shock at the sight of heaps of sand dug out during the

years of tin mining. Nkumeh maintained that apart from the 50.5% share of the N1.8 Billion Naira Ecological Fund normally shared among 36 States of the Nigerian Federation and Abuja. The State should be considered for special allocation. Nkumah's visit to the State was prompted by previous visits of Governor Dariye to Abuja to attract the attention of the Federal Government to the pathetic state of land devastated by mining activities in the State.

Abiodun, (1999) also discuss how Nigerians most beautiful city is being disfigured by polluted water supplies, impoverished land and radioactive waste left behind by unregulated tin mining activities. Jos, Abiodun declares with its cool climate and hilly backdrop will soon change if the areas unregulated tin mining activities continue for much longer. Today, many locals are complaining that the decades of tin mining have left them a legacy of polluted water and others.

The area has also been described as a lunar landscape of steep-sided mounds and multi colure ponds or lakes by non-government organization. Tor lorapuu, who belongs to one of the community based non governmental organization of forum (CBD-NGO FORUM) warns, there are underground grumblings, the people are watching, and they are watching carefully. No one took responsibility for clearing up the mess left behind. Moses Ogunleye an environmental activist based in Lagos agrees that the cost of closing all the abandoned mines and clearing up polluted streams and rivers is beyond the miners means.

With all these, it does not look like the government is ready to finance such a programme either. A senior official in the newly created Ministry of Solid Mineral

Development had this to say, we don't have plans for that now but we are aware of the magnitude of the problem.

## CHAPTER THREE

### RESEARCH METHODOLOGY

#### 3.0 Data Description

The basic materials used for this project are:-

- a) A photogrammetric compiled topographical map sheet of Birnin Kebbi (NW) sheet 30 at scale 1:2,500 published in 1996 covering part of the study area. The map was obtained from the Ministry of Lands, Housing and Urban Development Birnin Kebbi.
- b) NigeriaSat 1 data of October 2003 covering Birnin Kebbi and environs at scale 1:25,000 and ground sampling distance (GSD) 60cm or spatial resolution of 32m, obtained from Natural Centre for Remote Sensing, Jos.
- c) Administrative map of Kebbi State showing the locational position of the study area compiled by V-Mobile Communication Nigeria Ltd.
- d) Conventional photography covering various derelict ponds within the township and the reclaimed Rafin Atiku Area.
- e) Annual Rainfall data of Birnin Kebbi for 50 years obtained from Kebbi Environmental Protection Agency and Centre for Climatological Research FUT Minna.
- f) Malaria and typhoid data treated at the Sir Yahaya Memorial Specialist Hospital for ten years in Birnin Kebbi 1996 – 2004.

- g) Questionnaire survey data conducted at the neighbourhood of the ponds designed by researcher.

### 3.1 Instrumentation

- 1). Arc view GIS software package version 3.2.
- 2). Pentium IV Hardware Computer System
- 3). Handheld GPS Receiver.
- 4). Scanner

### 3.2 Study Methodology

The methodology may best be of interest if the aim of the research is once again highlighted.

The aim of the study is to assess the Impact of Derelict Ponds that is widely distributed in the Birnin Kebbi Urban Environment in order to provide a mitigating measure for economic uses. And the aim is to be achieved through the following objectives:-

- 1. To provide an urban spatial map of Birnin Kebbi through the use of remotely sensed data.
- 2. To identify locations and sizes of the various derelict ponds within the township.
- 3. Provide the negative impacts of these ponds to the environment.
- 4. Assess the action of Government on the ponds
- 5. Provide recommendation for effective reclamation.



### **3.2.1 Production of Land Use Map**

The introduction of Remote Sensing Technique and Computer based Geographic Information System (GIS) has revolutionized land used mapping and made it possible to gather large amount of information quickly and accurately. The technique relies on the data collected via satellites. But they come with the effect of geometric distortions due to sensor geometry, scanner and platform instabilities, earth rotation, earth curvature, and etc. Some of these images are corrected by the image supplier and other can be corrected through referencing the images to an existing map.

Remotely sensing data in raw format contain no reference to the location of the data. In order to integrate these data with other data in a GIS it is necessary to correct and adapt them geometrically.

### **3.2.2. Geo-Referencing**

When an image is created, it is stored in row and column geometry in raster format. There is no relationship between the rows/columns and real world coordinates (UTM, geographic coordinates, or any other reference map projection). The process called geo-referencing establishes the relation between row and column numbers and real world coordinates. You specify the coordinates of the lower left as minimum X, Y and upper right corner as maximum X, Y of the raster Image and the actual pixel size. A geo-reference corner is north oriented and should be used when rasterizing point, segment, or polygon map and also the output geo-reference when resampling.

The raw satellite image data of Birnin Kebbi acquired by the NigeriaSat1 of 20003 had to pass through the above mentioned procedure to make it fit for the production of land use/land cover map of the study area. It was possible to carry out these processes through the intelligence of Arcview GIS version 3.2 software. And through on-screen digitization, all the features that appeared on the image were mapped out in segments as follows:- Birnin Kebbi Township, Dukku Barracks, Buchasa Forestry, Polytechnic Permanent Site, Gwawangwaji, Dukku Hill, Fadama etc.

Land use and land cover are dynamic phenomena that are characterized by seasonal changes, particularly in areas that population rate are fast on increase. In order to effectively manage these phenomena, it was necessary to map the different themes from the image. This provides a good understanding of the land use/ land cover pattern. For better human visual perceptibility, the image passed through contrast stretching and enhancement after the geo-reference exercise.

### **3.2.3 Digitizing on Screen**

To on-screen digitize, the layer is first displayed in a map window, this layer may be raster or vector and will define the reference system and coordinates for the digitized features. The NigeriaSat1 data are Raster, therefore the map window on which the digitizing was done contained several layers. For instance, digitizing a flood polygon such as the Fadama areas of Birnin Kebbi, it was done on a grouped file and displayed as such.

With the appropriate layer highlighted on a composer, the digitizing icon is clicked OK. The left mouse button was used to identify points, position, course or boundary of features. The features are formed as the digitizing progress. And to finish any feature, the right mouse button is clicked. Digitizing operation may require you to create a new vector layer or add feature on an existing vector layer as the case may be through on-screen digitizing. It does not matter which layer is highlighted in composer, when you begin digitizing, and intends to append an existing vector file, however, you can simply highlight that vector layer in the composer before clicking the digitize icon.

#### **3.2.4 Scanning Operation**

Conventional photographs of some selected sites such as the ponds of Birnin Kebbi, the flood of 2004, the reclaimed Rafin Atiku and Ray field pond of Jos. The topographic map of part of Birnin Kebbi and plotted details of the derelict ponds were all together scanned into digital format for computer compatibility. These photographs and other images were utilized to justify that these excavated regions within the city exist in several areas of the town and each has its peculiar disadvantage to the surrounding.

The operation makes use of Optical Scanner that converts photographic or graphic data into computer readable format automatically, through recording of the spatial data in narrow strips across the data surface. The scanners convert the data in eight bits for each picture element. They are further made into rows and column ordered matrix of reference

values some scanners are restricted to black and white operations only, hence they are suitable for line maps. But the raster format includes grids or cells and matrices data structure, which makes them compatible with modern input/output hardware.

The researcher made use of the scanner that is of the grace scale type, an AO intelligent scanning technology scan jet, colour and capable of quite respectable resolution of 300-600 dpi, flat bed which conveniently accommodated the topographical map and other data into a CD-ROM with module tif-idrisi software, capable of reading most of this format for gray scale level. (Lo, 1986)

### 3.2.5 Sequence of Scanning Operation

- Set up the scanner and its accessories
- Paste image of map or photographs
- Open the tip scan jet scanner group window
- Double click on the scan jet Leon
- After reading choose acquire from the file menu to pen scan jet twain
- Click preview and the picture pasted on the scanner will appear on the VDU of the computer
- Select the entire window/zooming browser
- Go to the menu for brightness, contrast and sharpness
- Click OK
- Return back and click scan
- The scanning will last for about a minute from 1. % to 100% automatically.

- Slot a CD-Rom into the drive
- Select format for saving tiff file forma
- Go to export file
- Click tiff format and type file name
- Click OK.

### 3.3 Ground Surveys Using GPS

Global Position Systems (GPS) surveys use the signals transmitted by satellites having trajectories such that any point on the earth's surface can be determined around the clock and independently of weather conditions. The positional accuracies with them depend largely on the type of the tips receiver and on the observation and post processing techniques used. (Karl, 2000)

Observation were carried out at the seven locations of the ponds, using a land held GPS, Garmin 12 ex, having twelve channels, version 2.01 of 1998. Sample points were selected at strategic positions for a round coverage of each pond location.

The GPS satellites are configured, primarily to provide the user with the capability of determining his position in terms of latitude, longitude and height.

The GPS has 24 satellites arranged in six orbital planes that is four satellites per orbital plane and are spaced equally around the earth; they orbit the earth at an altitude of 20,200km with orbital inclinations of  $55^{\circ}$ , orbital radius of 25, 5670km and twice a day. This makes up the space segment (Henstride, 1991).

With the GPS, the coordinates of the calculated positions are based on the WGS 84 ellipsoid. (World Geodetic System 1984)

The coordinates obtained from the round coverage of each pond were used on the Raster Image to identify the location of the pond on the image. The exact locations were adequately digitized on-screen as point features. These pond locations are shown on the pond location map in figure 3.

### 3.3.1 Calculation of Area of Ponds

The areas of the ponds were calculated from the coordinates obtained from the GP observation. The coordinates of each point consists of latitude (E) and longitude (N). The trapezoidal rule was used in terms of easting and northing, such as

$$A = [\frac{1}{2} (E_4 + E_1) (N_4 - N_1)] - [\frac{1}{2} (E_2 + E_1) (N_2 - N_1)] - [\frac{1}{2} (E_3 + E_2) (N_3 - N_2)] - \dots - [\frac{1}{2} (E_n + E_n) (N_n - N_n)]$$

By altering the signs to suit the convention of signs in the coordinate's system e.g.

$$- [2 \times A(E_4 + E) (N_1 - N_4)] + [(E_2 + E_1)(N_2 - N_1)] + [(E_3 + E_2)(N_3 - N_2)] + [(E_4 + E_3)(N_4 + N_3)].$$

The coordinates of each point are illustrated in appendix II

### **3.4 Impacts of Derelict Pond on Environment**

#### **3.4.1 Land Degradation**

At the dawn of every year, a fraction of land around the pond areas suffers physical degradation due to the activities of material mining. The areas degraded reduce the potential capability to provide sanitary and recreational uses. This degradation is largely human-induced and this includes a strong socio-cultural component. Consequently, land conservation and rehabilitation can technically be feasible, but often at high costs. The environmental impact of the mining activity is severe in some regions of the township. For instance, the land behind Illela Yari Old Prisons has been greatly devastated through the clearing and digging. Now, this area is unsuitable for any development activity, the hilly sides even suffer severe erosion and the left out dugged areas collect stagnant water. In such regions, there are no free movement neither are they suitable for further development. This is illustrated in plate 3.

#### **3.4.2 Aesthetics**

The existence of these derelict ponds distributed about the urban environment do not provide aesthetically good quality environment. Overgrown grasses and water lilies are found in most of the abandoned ponds, thus making the site unpleasant since they are located in the midst of residential areas.

According to Shuaibu, (1999) environmental damage can undermine future productivity. Thus, soils that are degraded, aquifers that are depilated, Geosystems that



are destroyed in the name of raising incomes today can jeopardize the prospects of tomorrow.

Professional surveys report also reveals that, derelict ponds have their disadvantages in terms of pond location, positions, site designation, health and safety.

### **3.4.3 Refuse Disposal**

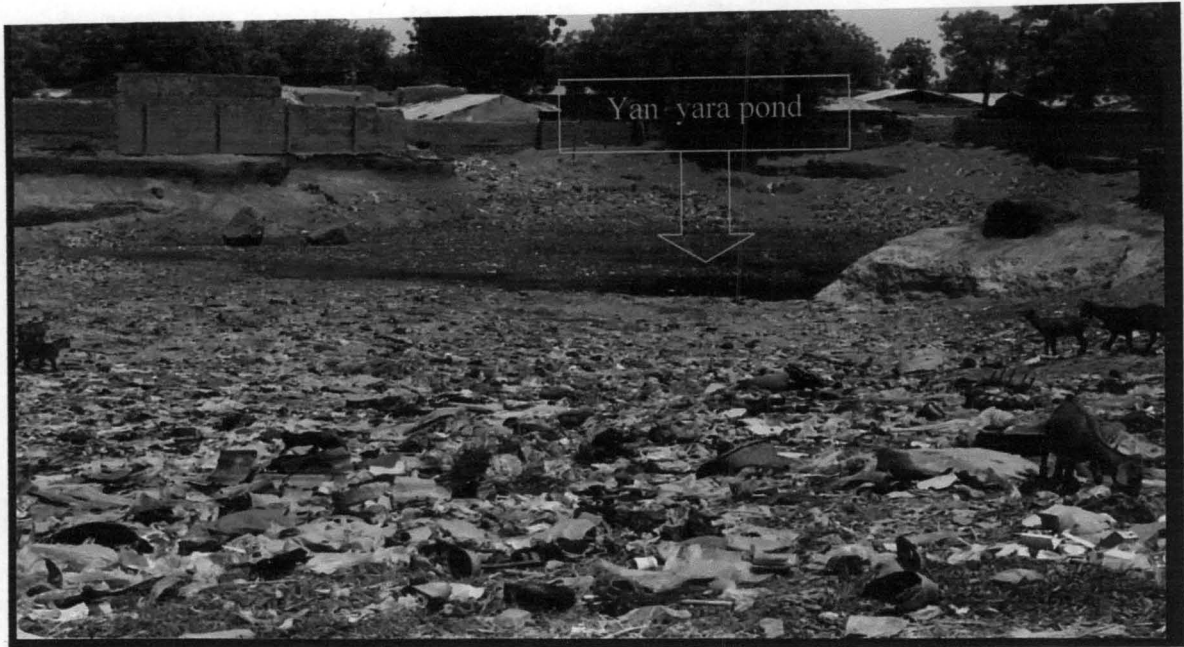
Solid wastes are those materials that are not easily carried by water or air flows. The Federal Government defines a solid waste as any descended material that is not specifically excluded. Discarded means that the material is abandoned recycled or considered inherently waste like (John, 1999).

The ponds of Birnin Kebbi Urban Environment are characterized by refuse inside and around consisting of essentially garbage, rubbish as defined above. The presences of this solid waste constitute health problems because dumps provide feeds for insects, rodents and dogs. We see refuses dumped all over the place littered or in mighty bags.

Udoh, 1988 had this to say, the dumps in the river course are not limited to the villages only, and the August 1980 Ogunpa flood disaster in Ibadan city is an excellent example. With years of dumping of refuse into the river valley along its course, the river bed was considerably raised, and with the continuous twelve hours down pour of rain, the conditions of the wide spread flood was ripe, because the river valley could not contain the



volume of water. Photographs of the refuse dumped at the pond an area is shown on plate 1.



**Plate 1:** Solid Waste dumped in one of the ponds (Yan yara pond)

#### 3.4.4. **Health Hazards**

##### 3.4.4.1 **Malaria**

The Birnin Kebbi people are exposed to a wide range of this disease because of the ponds. These ponds are exposed and abandoned, without any form of management. The ponds too contain water all year round and there are no adequate drainages to convey the stagnant water from the ponds. Therefore, a lot of mosquitoes breed in them and because they are widely distributed from each other, the spreading of the mosquitoes is wide in the township. The study of the malaria cases enabled the researcher to design a questionnaire

as well as personnel interview at the Sir Yahaya Memorial Specialist Hospital one of the oldest hospital in the township. The cases of treatment of malaria for ten years were given from 1996-2004(see appendix III). The data provided were as being treated on daily basis, the mean percentage is calculated at the dawn of each new month and consequently for the year each containing both adult and children likewise.

#### 3.4.4.3 Typhoid Fever

Typhoid Fever has to do with water and general sanitation problems especially that which has to do with dirt and infections. This disease has similar symptoms with malaria, therefore, the data collected from sir Yahaya hospital consisted of both malaria and widal test respectively. Also associated with this, is a report of IRIN news.org of 7th August 2005 that at least 20 people have died from cholera in Kebbi state, northern Nigeria, state radio said this on Tuesday. Maiahu, the then commissioner of health had taken steps to curb the spread of the disease. He said the outbreak occurred because people depend on unsafe drinking water from sources such as rivers and ponds that were often contaminated with faecal matter and Looking around in our cities, towns and villages, several conditions are seen that encourages dirt and the spread of infections. Rain is the main source of all water and given rise to surface water, when it rains water runs off the ground and empties into the streams and ponds.

Scientist say that, there is no such thing as water is chemically pure, apart from the two elements of which is composed, many other substances such as dirt, mud, germs, dissolved mineral, decayed plants and animals are all found in water.

Disease producing germs do not normally multiply in water, but they can survive in water and remain in a state that can set up an infection in a human host. Water serves as an important vehicle for the transfer of disease of the alimentary canal as well a worm, such as guinea worm or hookworm. But the four major infections which are transmitted through water, notably by drinking or eating any food washed with infected water, are typhoid fever. Paratyphoid, cholera and bacillary dysentery. Of all the above mentioned, the researcher was only able to get data on treatment of typhoid fever from the hospital for ten years 1995-2004 (See appendix IV).

### **3.5 Floods**

Rainfall and human activities brought about floods in Birnin Kebbi, the perennial flooding was a source of anxiety to a great percentage of the neighbourhoods of the ponds. Consequently, successive administrations of Kebbi State have attempted to curb the menace through the awards of contracts to construct drainages along these areas but all their effort ended up in total fiasco. The only meaningful attempt is the one done in 2003 by the present administration through adequate drainage facilities. The work has coursed the present administration millions of Naira but a lot more is still needed.

#### **3.5.1 Rainfall**

Rainfall is the most important climatic factor which affects urban drainage and causes flood menace. In order to obtain reliable forecast with a fair degree of accuracy of amount of run off expected or that resulted to flood therefore, data on rainfall

characteristics from seasons to season has to be obtained. This information should be available for periods of months and years

### 3.6 Action of Government

The Kebbi State Government in 2003 awarded the construction of a 4 Kilometre drainage system that emptied the Rafin Atiku Pond that was like a monster to the neighbourhood. The drainage system empties into the Shella Fadama east of the township.

Apart from the construction of drainage, the pond that formerly received its run-off from three cardinal slops from Dukku Hill Area, Dukku Barracks, and Haliru Abdul Secretariat, has also been reclaimed into children's park through emptying the pond of all its content and sand filling (See plate2).



**Plate 2:** At the reclaimed Rafin Atiku derelict pond by Kebbi State Government

## **3.6 Field survey and Questionnaire Administration**

### **3.6.1 Research Design**

#### **3.6.1.1 Study Population**

Population can be defined as the entire group under study as specified by the objective of the research (Pedhazur & Schmelkin, 1991). Since the objective of this study was to assess the impact of derelict ponds in township for possible reclamation. Specifically, the target population includes the residence around the locations of the derelict ponds and the ministry of environment as well as other related information centres in the state study areas.

#### **3.6.1.2 Sampling**

Sampling is a procedure that uses a small number of units of a given population as a basis for drawing conclusions about the whole population (Zikmund, 1997). Sampling is an important method for increasing the validity of the collected data and ensuring that the sample is representative of a population. The sample for this study was collected by a simple random sampling method from the identified sampling frame.

#### **3.6.1.3 Sample Size**

This study employed Simple statistical Analysis for the presentation. However, 100 sampled questionnaires were administered randomly in each of the selected areas at the sample frame. Thus, the target usable sample size for this study was at least 20. Therefore,

in order to meet the sample size for this study, a total of 100 survey questionnaires were administered to the target population, in the study area.

The sample size is calculated, adopting the following statistical formular.

$$n = pq / (SE)^2$$

Where

n = Sample size

p = proportion of population (95%)

q = 1 - p

SE = Sample Error (estimated using confidence interval of 10% divided by 1.96 of the confidence level(95%).



## CHAPTER FOUR

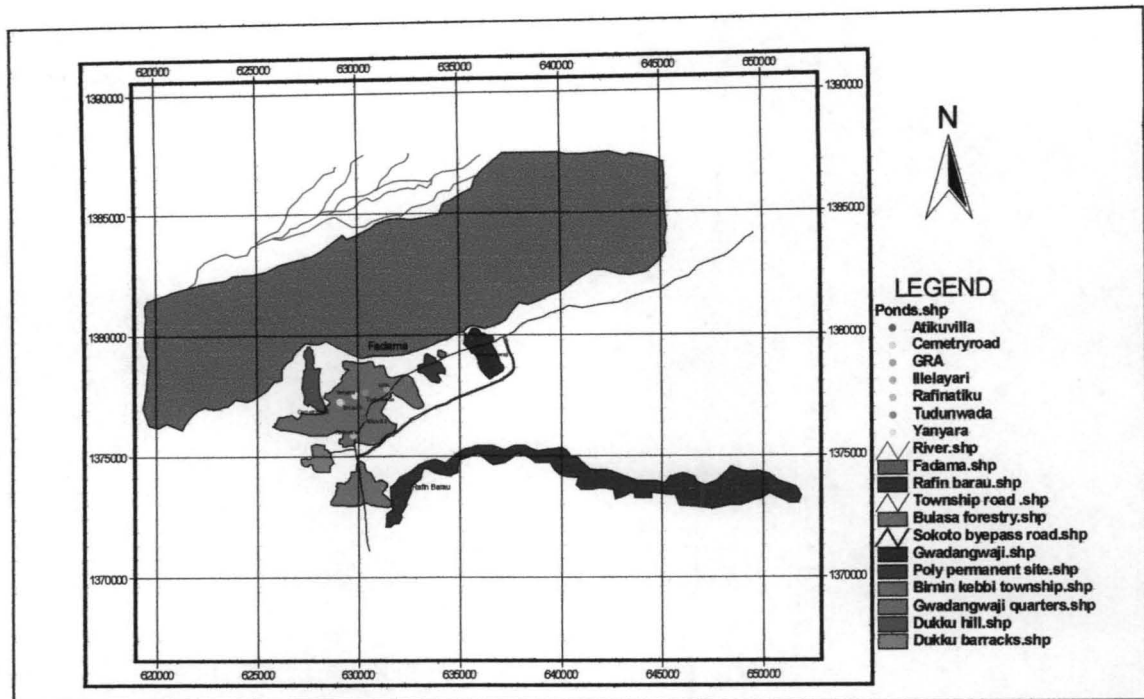
### ANALYSIS AND RESULTS OF FINDINGS

#### 4.1 Land Use Map

The satellite image covering Birnin Kebbi was used to produce a land use map and coverage of the township. The boundaries of each development was delineated using on-screen digitization. However, minor details such as roads and streets were not easily recognizable due to the low spatial resolution of the image. In addition to low radiometric quality, it can be deduced therefore, that Nigeria Sat- 1 image data is adequate for mapping but at regional level. It can produce thematic information at small scales. During the on-screen digitizations, relevant features on the imagery were classified in the following themes/segments:

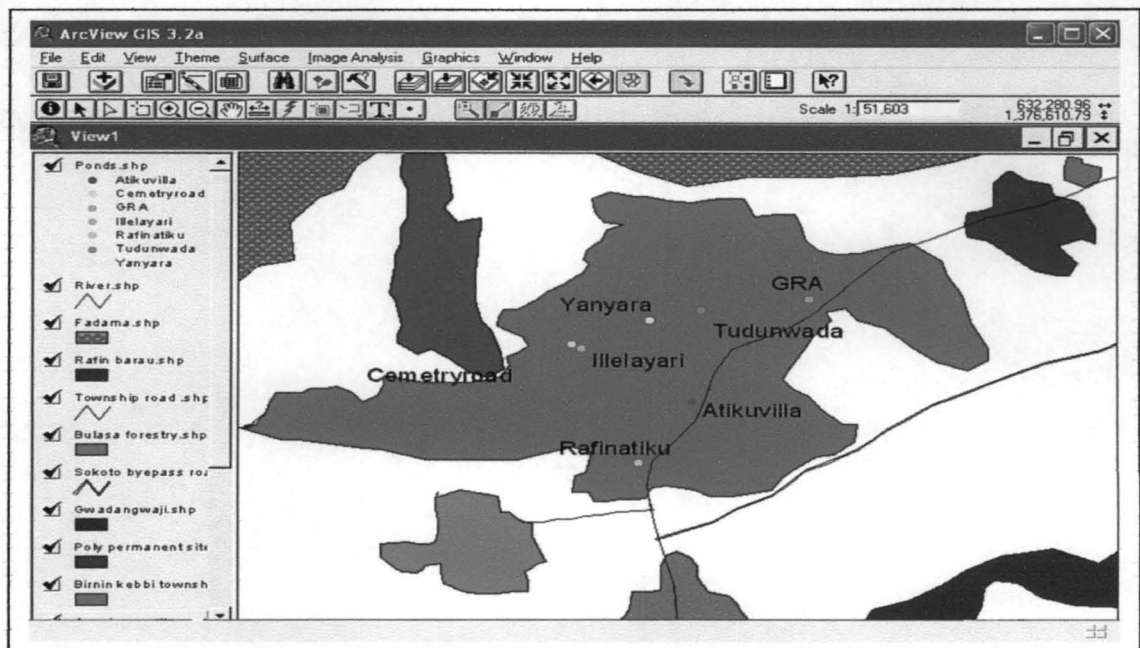
- (i) The flood plain areas as Fadamas (Sokoto-Rima Fadama, Shella)
- (ii) Major roads (Sokoto bye pass)
- (iii) Hills (Dukku)
- (iv) Township area segment
- (v) Forest
- (vi) Pond location etc.

All these details were properly edited after digitization and were subjected to quality connectively and completeness of coverage (See figure 4.1a&b).



Source: Author's work

Figure 4.1a: Kebbi Township Map showing various landuses and the location of ponds



Source: Author's work

Figure 4.1b: Land use Map of Kebbi State Township in GIS environment



#### 4.2 **The Effect of the ponds on the Physical Environment (Degradations)**

Photographs of the derelict ponds were obtained from selected suitable position such that areas where no building caused any obstruction to the oblique view of the entire pond area as well as the drainage construction were chosen.

These photographs reveal the environmental degradation resulting from the direct effect of the ponds. For example, the flood how the overflow of the pond submerged the road and houses as shown in plate 3. The overflow was all over the streets and obstructed free flow of traffic and the environment was littered with solid waste materials. Also noted from the photograph are the areas of the ponds that have turned into refuse dumps both inside and the surrounding (refer to plate 2). The photographs also reveal the abandoned borrow pits it contain water lilies growing inside since stagnate water in some of the pond remain all year round (See plate 4). The effect of erosion at the edges of the pond towards residential building is also noted on the plates as indicated in plates 5.



**Plate 3:** Flood effect resulting from overflow of Rafin Atiku pond in 2004



**Plate4:** A pond covered by water Lilly



**Plate 5:** The effect of derelict ponds on the structural development (Expansion of Ponds eroding the foundation of buildings).

### 4.3 **Health Effect of the Derelict Ponds**

#### 4.3.1 **Malaria and Typhoid Fever**

The main health facilities available in Birnin Kebbi are the Federal Medical Centre, the Sir Yahaya Memorial Specialist Hospital, Fati Lami Hospital for Women and Children, VVF Centre, Fati Eye Centre and several private clinics. There is also a Malaria Control Unit set up as part of Federal Government Schemes.

The annual returns of the Sir Yahaya Memorial Specialist Hospital of the cases of malaria and typhoid fever for a period of ten years (1995-2004) the number of patients treated or cases of malaria and typhoid reveals high cases of the diseases between July and

November of every year (see figure 4.2). This coincided with the period of High rainfall which is usually recorded between the month of July and October every year.

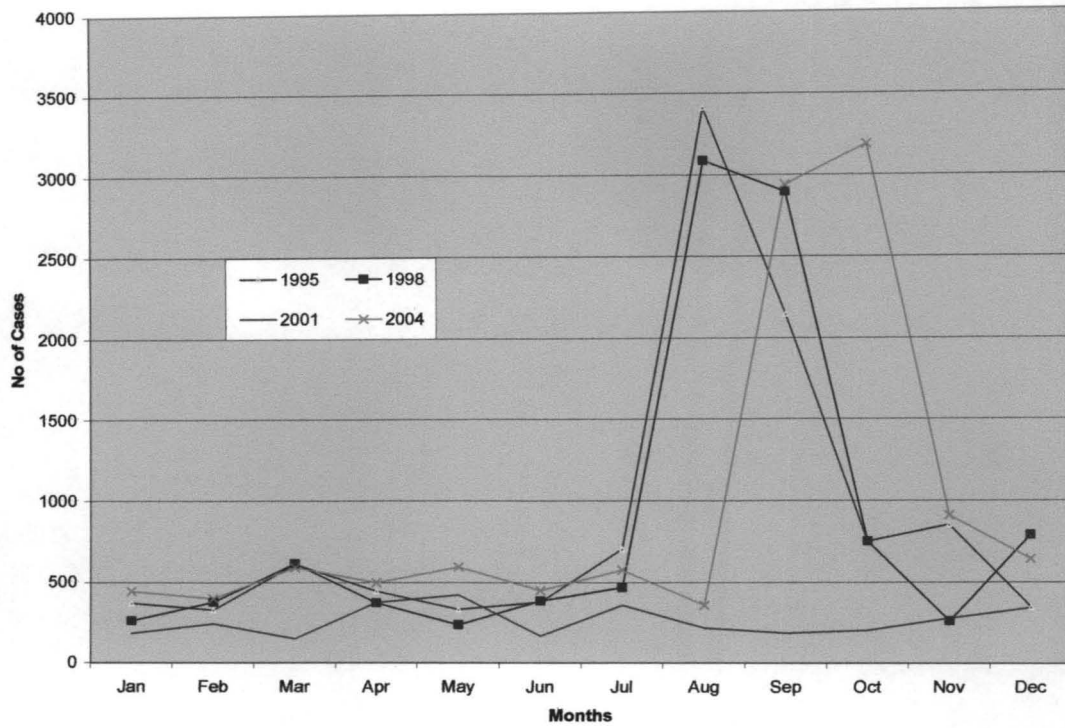


Fig.4.2: Cases of Malaria & typhoid treated (1995 – 2004)

ANNUAL RAINFALL(1970 - 1990)

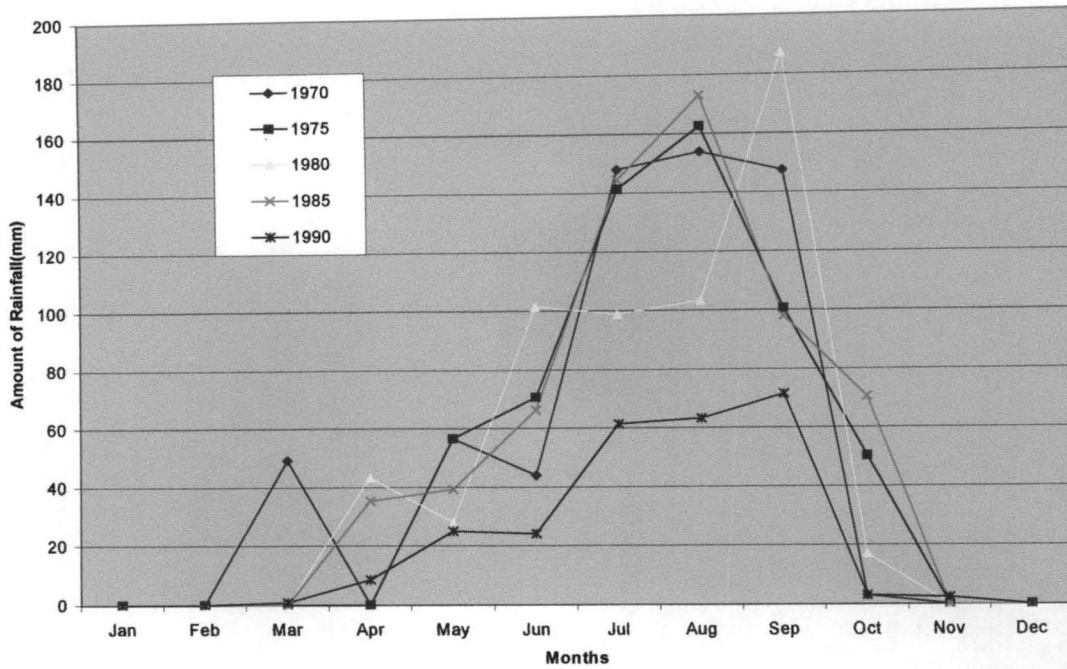


Fig.4.3: Trend of Annual Rainfall (1970– 1990)

#### 4.4 The Socioeconomic Effect of the Derelicts ponds

Floods are catastrophic events which put at risk human lives, valued property, homes and businesses. The existence of the derelict ponds(Earth mining ponds) in Birnin Kebbi township as resulted into floods over the years have occurred without warning and with effect of rainfall., Enormous property have been lost and even lives. The town's infrastructure has also been affected severely including the communication and transportation facilities. The result(Fig.4.4) of the field analysis conducted reveals that

effect of these ponds in the township has resulted into environmental degradations (34%), constitute health hazard (30%),lost of valuable properties(16%),psychological trauma(12%) and lost of lives(8%).

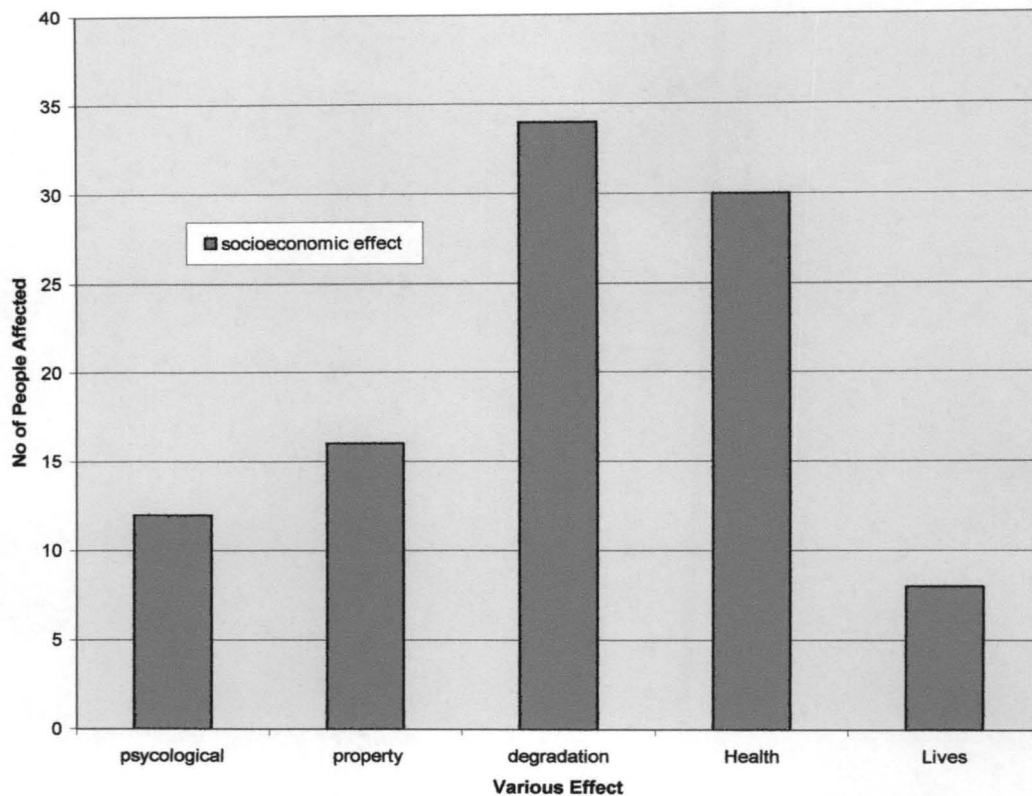


Fig.4.4: Socioeconomic Effect of the Derelicts ponds

#### 4.5 Computation of Ponds Area coverage

One of the primary objectives of land surveys is to determine the area it involves a closed traverse are made to coincide with property lines where possible. The boundaries of the ponds are irregular in shape and not quite easy to carry out derelict measurement on them. The lengths and coordinates of all boundaries points selected were digitally



obtained through the use of the GPS. The corners of the ponds are coordinated with respect to the regional system (UTM). The calculation of the areas therefore, involved finding the areas of trapezoids formed by projecting the lines upon one of the pair of coordinate areas, usually a prime meridian and a parallel at right angles thereto. The area of the pond was computed by summing algebraically the areas of the trapezoids formed by projecting the lines upon the reference meridian. The results of these areas are displaced in Table 4.1 below.

**Table 4.1:** The computed areas of the Ponds

S/N	NAME	AREA M <sup>2</sup>	RECLAIMED?	ANY DRAINAGE?
1.	Tudun Wada Pond	251.001	No	No
2.	GRA Pond	518.735	Sand filling in progress	No
3.	Rafin Atiku Pond	278.890	Yes	Yes
4.	Illela Yari Pond	348.175	No	No
5.	New Cemetery Road Pond	139.445	No	No
6.	Ya Yara Market Pond	334.668	No	No
7.	Atiku Villa Pond	139.445	No	Yes

**Source:** Field Survey 2004

#### 4.6 Reclamations

Table 4.1 above has revealed that only one out of the seven ponds distributed within the Birnin Kebbi Urban Environment have been reclaimed. This is to find tasting solution to the re-occurrence of the flooding, colossal amount of money amounting to 450,000,000, was approved for the completion of the Rafin Atiku drainage which is four

kilometres to the out let. This involved resettlement and compensation of the flood drainage victims.

The 4 kilometre drainage system has been constructed from the pond area into shella fadama, the eastern part of the township. The pond itself has been reclaimed and converted the area into children's park, whose construction work has since began see plate 6.



**Plate 6:** Construction of drainages to discharge water from Rafin Atiku pond

An assessment carried out by Hybrid Design and Associates on the reclaimed pond indicates that, minor works would still be required to properly drain both silages and storm waters emanating from the densely populated areas adjacent to the drainage system. Similarly, in order to protect the park from future destruction there is need to construct perimeter drainage to receive water from the catchments area around the former pond.



This is important because the reclaimed area is still at a low-level print in relation to its surrounding.

The GRA pond has also begun to receive attention in the process of reclamation. Sand filling work around the pond area is in progress but there are yet any forms of drainage to the area.

The analysis of field survey(Fig.4.5) has revealed that majority of the respondents(70%) are of the opinion that the derelict ponds be reclaimed for recreational purposes the remaining(30%) suggested that the ponds be reclaimed into open spaces or any useful purposes, most especially building construction i.e. mini markets.

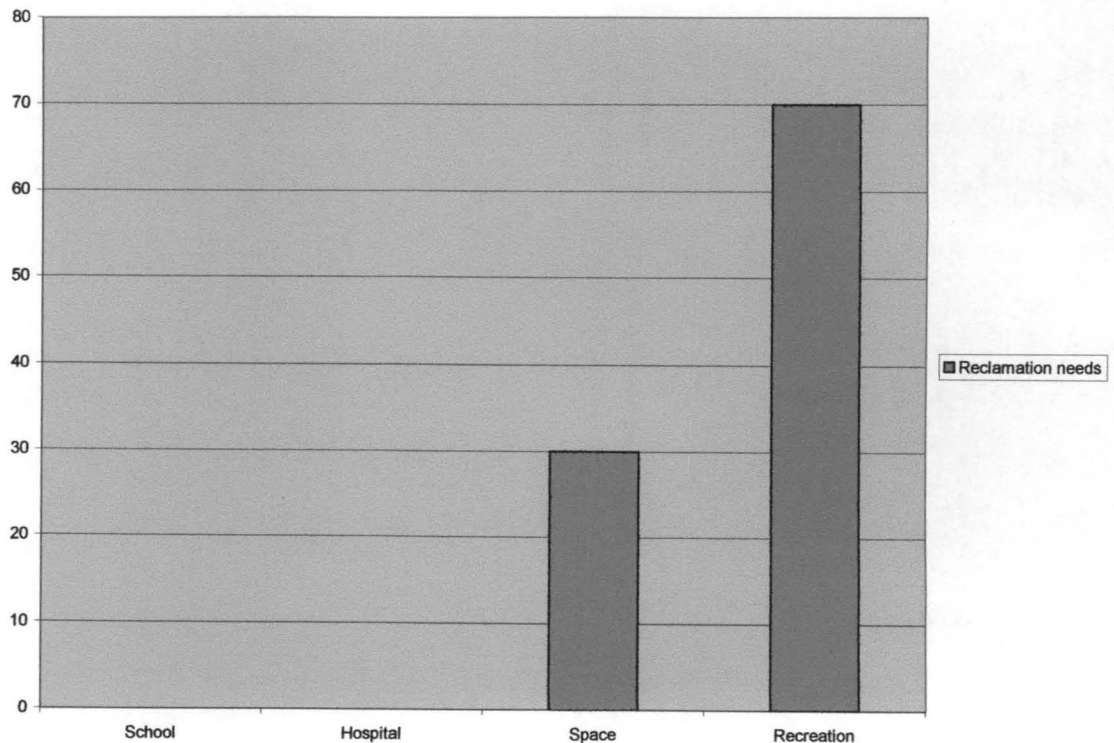


Figure: 4.5. Response to the need for Reclamation

## CHAPTER FIVE

### SUMMARY OF FINDINGS

#### 5.1 Summary

Floods are catastrophic events which jeopardize human lives, valued property, homes and businesses. People sometimes ignore the threat of floods because of the periods of time that pass by without them. The floods in Birnin Kebbi caused by the derelict ponds over the years have occurred suddenly with little warning, and residents of the neighbourhood to the ponds such as those at Rafin Atiku, Tudun Wada, Yaryara and Atiku Villa have lost valuable properties and even lives. The town's infrastructure has also been affected severing both communication and transport. The impact of these floods can thus be summarized as being Physical, Economic, Environmental, Social and Financial.

Floods are caused by many factors but for Birnin Kebbi, rainfall and human decisions about land use are the most prevalent. There are several areas of the town especially the pond areas where drainage channels are inadequate. If there were drainages, the effects of these re-occurring floods would have been reduced.

Despite the colossal amount expended by the State Government on the menace of flood consequently, reclaiming Rafin Atiku through well planned drainage system from the pond area to the outskirts of the township and construction of new roads respectively, a lot more needs to be done to tackle the problems associated with the existence of these abandoned ponds located in the densely populated residential areas of the town.

## 5.2 **Conclusion**

Reclamation exercises are aimed at improving water or land resources for agriculture and other purposes through the use of drainage or irrigations, restoration of mine workings and other construction activities. In the United States where there are laws binding mining activities, the reclamation work starts immediately the mining is completed, through planting of trees and grasses. In this type of procedures lovely forested hills, plains or valleys are the result which later becomes economical to the government since people visit such places as tourism potentials site.

The Birnin Kebbi situation is such that there is no law binding quarrying activities. The earths mined from the site are gone forever; it's irreplaceable. The reclamation of Rafin Atiku was done with earth transported from another area to sand fill the pond hence creating another potential from where this sand are mined. There reclaimed Rafin Atiku pond has been put recreation park children use.

## 5.3 **Recommendation**

- (1) Imagery of higher resolution such as IKONOS, quick bird or SPOTS -5 should be acquired by the State Government to effectively study and map this area in order to reduce the menace associated with these ponds.
- (2) Other ponds should also be reclaimed and be adequately put to uses.
- (3) The reclaimed ponds (GRA) should be adequately monitored before any construction is embarked upon it.

- (4) The drainage system embarked upon by the present administration should be extended to the existing derelict ponds to drain the water in event of rainfall so as to prevent reoccurrence of future floods.
- (5) Remote sensing and GIS technologies could be adopted in the monitoring, implementation and environmental management. The State should also embrace this use of these technologies through training and upgrading of the Department of land surveying of the Waziri Umaru Polytechnic to enhance in the challenge of geoinformatics technology for environmental research and management.

#### 5.4 **Suggestions for Future Research**

In urban regions of rapid growth and change, typical of Birnin Kebbi, urban planners need regular information on what is happening on the ground. I suggest further research on urban growth using geospatial technique and a digital terrain model of the entire township.

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## APPENDICIES

### Appendix I Field GSP Readings

#### (a)ILLELA YARI POND

S/NO	LATITUDE	LONGITUDE
1	628854	1376686
2	628859	1376672
3	628928	1376740
4	628949	1376769
5	629004	1376803
6	629033	1376819
7	629044	1376851
8	629082	1376899
9	629148	1376917
10	629175	1376879
11	629091	1376820
12	629086	1376751
13	629039	1376736
14	629009	1376724
15	628989	1376720
16	628973	1376708
17	628963	1376672
18	628933	1376677
19	628898	1376667



(b)CEMETRY ROAD POND ILLELA YARI

S/NO	LATITUDE	LONGITUDE
1	629031	1377044
2	629025	1377034
3	629023	1377024
4	629024	1377014
5	629037	1376992
6	629045	1377975
7	629080	1377018
8	629064	1377055
9	629036	1377059

(c)TUDUN WADA POND

S/NO	LATITUDE	LONGITUDE
1	630229	1377502
2	630236	1377468
3	630237	1377433
4	630247	1377422
5	630272	1377411
6	630310	1377407
7	630312	1377436
8	630315	1377457
9	630295	1377478
10	630297	1377493
11	630300	1377512
12	630282	1377524
13	630264	1377520
14	630236	1377521

(d)YANYARA MARKET POND

S/NO	LATITUDE	LONGITUDE
1	629759	1377282
2	629769	1377299
3	3629772	1377266
4	629790	1377307
5	629786	1377248
6	629803	1377241
7	629807	1377287
8	629821	1377246
9	629810	1377287
10	629846	1377255
11	629846	1377283
12	629860	1377265

(e)RAFIN ATIKU POND

S/NO	LATITUDE	LONGITUDE
1	629846	1375390
2	629674	1375324
3	629679	1375410
4	629840	1375437

(f)ATIKU VILLA POND

S/NO	LATITUDE	LONGITUDE
1	630406	1376209
2	630353	1376191
3	630330	1376191
4	630329	1376214
5	630392	1376231

(g) GRA POND

S/NO	LATITUDE	LONGITUDE
1	631340	1377568
2	631342	1377603
3	631385	1377608
4	631531	1377426
5	631580	1377440
6	631567	1377539
7	631642	1377433
8	631677	1377379
9	631708	1377475
10	631712	1377375
11	631744	1377375
12	631768	1377380
13	631782	1377402

**Appendix II**

**Malaria /Typhoid Data**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1995	370	326	609	443	333	375	702	3409	2146	751	854	346
1998	261	375	614	371	236	383	467	3085	2896	751	260	791
2001	182	242	149	374	423	166	357	214	185	202	279	343
2004	444	399	590	499	595	449	574	356	2942	3187	912	644

Source: Sir Yahaya Memorial Hospital, Birinin Kebbi, 2005

### Appendix III

#### RAINFALL DATA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970	0.0	0.0	49.3	0.0	56.6	44.0	147.8	153.9	147.5	3.0	0.0	0.0
1975	0.0	0.0	0.0	0.0	56.5	70.6	141.2	162.6	100.6	50.4	0.0	0.0
1980	0.0	0.0	0.0	43.4	28.0	101.37	98.7	103.4	187.2	17.1	0.0	0.0
1985	0.0	0.0	0.0	35.5	39.3	66.3	144.3	173.0	98.0	70.6	0.0	0.0
1990	0.0	0.0	0.8	8.6	25.1	24.1	61.4	63.3	71.6	3.0	2.3	0.0

**Appendix IV**  
**Sample Questionnaire**

**FEDERAL UNIVERSITY OF TECHNOLOGY MINNA**  
**SCHOOL OF SCIENCE AND SCIENCE EDUCATION**  
**DEPARTMENT OF GEOGRAPHY**  
**M.TECH THESIS 2003/2004**

**QUESTIONNAIRE DESIGNED FOR RESEARCH ON:**

**RECLAMATION OF DIRECT PONDS IN BIRNIN KEBBI URBAN ENVIRONMENT**

- 1, place of residence.....
- 2, Sex: (a) Male (b) Female
- 3, Age: (a) 0-10 years (b) 10-20 yrs (c) 20-30 yrs (d) 30-40 yrs (e) 40 and above
- 4, Marital status: (a) single (b) married (c) separated (d) Divorced (e) widow (f) others
- 5, Occupation: (a) civil servant (b) private worker (c) self employed (d) student (e) other

**RECLAMATION OF DERELICT PONDS**

1. Are you aware of existence of ponds within Birnin Kebbi Township? Yes [ ] No [ ]
2. What are the causes of their formation? (a) Material mining (b) natural (c) Mineral exploration (d) others.
3. How many do you know? (a) 1-2 (b) 2-4 (c) 4-6 (d) 6-8
4. Do you have knowledge that these ponds were causing flash floods? Yes [ ] No [ ]
5. How many ponds were over flowing? (a) 1-2 (b) 2-4 (c) 4-6 (d) 6-8
6. Brief histories of ponds were over flowing? (a) 1-5 yrs (b) 6-10yrs (c) 11-15yrs (d) 16 and above.
7. What is the name (s) of the pond(s) that were over flowing?.....
8. What is the case of the flood? (a) Rainfall (b) River overflow (c) Blockages from drains (d) Leakages from pipes (e) Other.
9. Effect of flash floods to people and environment. (a) No effect (b) Little (c) Great.

**BENEFITS OF PONDS**

1. Are there any benefits derived from these ponds? Yes [ ] No [ ]
2. What benefits? (a) Material mining (b) source of drinking water for man and animal (c) Fish pond (d) other.
3. Do they add any beauty to the township? Yes [ ] No [ ].
4. The ponds the source of breeding grounds to mosquitoes. Yes [ ] No [ ]
5. There is high incidence of malaria and typhoid fever in the ownership, and these are
6. Local residence around the ponds has suffered other effect?  
Specify.....
7. These ponds also degrade the land Yes [ ] No [ ]
8. Overall impact of relict ponds in Birnin Kebbi. (a) Very negative (b) Negative (c) Positive (d) very positive

**ACTION OF GOVERNMENT**

1. Rafin Atiku pond has been reclaimed. Yes [ ] No [ ]
2. The action of government on Rafin Atiku pond. (a) Excellent (b) good (c) fair (d) poor
3. Would you oppose or support there reclamation of other ponds in township?  
(A) Strongly support (b) support (c) strongly oppose (d) oppose
4. If they are to be reclaimed what do you suggest the area be turned to? (a) School (b) Hospital (c) space (d) recreational centre.
5. What other suggestion will you offer as regards the ponds?  
.....  
.....