



---

## DEVELOPMENT OF FISCAL OF CADASTRE OF BAP 7 LAYOUT AREA OF BAUCHI METROPOLIS, BAUCHI STATE, NIGERIA

<sup>1</sup>YUSUF M. INUWA.; <sup>1</sup>DR. MUSA, S. I.; <sup>1</sup>ABDULMUMIN O. ABDULSALAM; <sup>1</sup>DR. SHUAIBU, M. A.; & <sup>2</sup>ABDUL AZIZ DAUDA.

<sup>1</sup>Department of Surveying and Geo-informatics, Abubakar Tafawa Balewa University, Bauchi State, Nigeria. <sup>2</sup>Department of Surveying and Geo-informatics, Abubakar Tatari Ali State Polytechnic, Bauchi State, Nigeria

---

### Abstract

*The prospect of this project is to create comprehensive data base that will help to check, analyse, update and improve the standard of keeping records on land in Bauchi state. The basic objective of this project titled 'Development of Fiscal Cadastral System' is to provide an easy access to individual records and to safe guard information from unauthorised persons. This project also concerned with the conversion of analogue maps to digital format through coordinate geometry (COGO) using computer assisted drafting software while the attribute data will be structured using relational database management software and analysis through geographical information system software such as ArcGis10.0,*

**Keywords:** *GIS, Land Administration, Cadastral Information System, geo-spatial Database*

---

## INTRODUCTION

### Background to the Study

Therefore, the success for Development of physical Cadastre planning activities at a Micro-level depends to a large extent on the quality and amount of data that can be obtained from natural and socio-economic resources. Specially, a thorough database should serve as an efficient tool in the handling, storage, and retrieval of data that creates the possibility of analyzing different types of land tenure scenarios such as land title information, land management data, and other natural resource management information. Conflicts over land are raising the numbers fight over the same piece of land. The rising population creates a high demand for land and massive pressure

on the natural resources for food, fuel wood, clay mining for bricks and other raw materials, the Nigeria people are few has customary land owners possess an actual land title.

In the past, the recognition of customary land rights was only marginally important and also undermined by civil conflicts, demographic and socio-cultural changes, customary ownership and land governance In spite of an adapted. Land disputes remain a major hindrance to land use and tenure security in Africa (Niang & Dieng, 2004). Land registration is vital to the security of tenure and security of tenure plays an important role in enhancing investments in land. In particular, access to land with secure tenure is significant to urban housing delivery. This is important to Nigeria as it faces a severe urban housing shortage. The overall housing deficit is estimated at 17 million units as of 2014 (The Nigeria Housing Finance Programme, 2014).

Using technology to improve land administration systems, therefore, can reduce government costs and may reduce conflicts among existing landholders and between landholders and new land buyers (Enemark et al., 2014). Receiving formal legal documentation can lead to further financial opportunities such as access to credit (Rekha, 2012) and such land tenure formalization is also proposed as supporting efficient land markets (FAO, 2002). Therefore technology may make it easier for landholders in both customary and formal systems to realize more secure land tenure, as well as some of the associated benefits. In Nigeria, access to urban land is such a sensitive matter that the security of land rights can be precarious. This is reflected in the difficulty in searching for information for land transactions and the inefficient production of formal land title documents by the government (Federal Ministry of Housing and Urban Development, 2006)

Land tenure refers to a set of land rights and land governance institutions which can be informal (customary, traditional) or formal (legally recognized), that define relationships between people and land and natural resources (Lawry et al., 2017).

In other instances existing customary land tenure systems may be sufficient to ensure land tenure security (and support sustainable land management and investments in land productivity) for participants within the system (Lawry et al., 2017). However, when competition for scarce land resources increases, or when there are more people in a given locality than a customary land tenure system is able to support, conflicts may emerge or customary land tenure systems can break down, leading to land insecurity (Holden & Otsuka, 2014).

The presence of multiple different land tenure systems within a country can also pose costs and administrative burdens for central governments, or lead to uncertainty surrounding formal land rights definition and enforcement

(Hughes, 2014). Yet in spite of the widely recognized benefits of land tenure security more than 70 percent of the world's population lack access to formal systems to register their property and receive land titles (Reynolds et al., 2014).

In formal systems, information on rights is often recorded in some form of land registration system, but registration systems may be incomplete, poorly-integrated, or inaccessible to certain populations or users (Lawry et al., 2017). The use of technology can simplify data collection, property registration, and record management, and has the potential to reduce the costs and time associated with delivering land titles (Allen, 2014).

### **Statement of the Problem**

The present system of ground rent collection by the Bauchi State Ministry of Land and Housing is based on the manual method which is a general problem in Nigeria (Iyola, Effiong and Abubakar, 2013). This study intended to develop a fiscal cadastre using geographical information system (GIS) which will be a complete solution to the above mentioned problem.

### **Aim and Objectives**

The aim of this project is to develop a comprehensive information system for ground rent collection in BAP7 layout plan, Bauchi this will be achieved through the following objectives.

- i. To collect geometric data of the study area using ground survey method.
- ii. To collect attribute data of the land parcel within study area, by file inspection from the Bauchi state ministry of land and housing.
- iii. To convert the hard copy cadastre layout plan of the study area into digital forms.
- iv. To Design and create a relational database of the study area.
- v. To produce a digital composite map of the study area.

### **Scope and Limitation**

This study in detailed the development of a comprehensive information system using GIS Its requires spatial information like cadastre layout plan of the study area and the coordinate of some prominent points or features within the study area as well as attribute information like plot number, land number, survey number, land tenure, ground rent, area value of improve, land use, name of plot owner, street name, data of allocation, as well as owners address, state of origin, place of Birth, occupation, age and nationality. This study

intended to cover the whole of Bauchi metropolis. But due to time and financial constraints, it is therefore, limited to BAP7 residential layout plan in government residential area (GRA) Bauchi which consist of 284 Plot that are mostly residential.

### **Justification of Study**

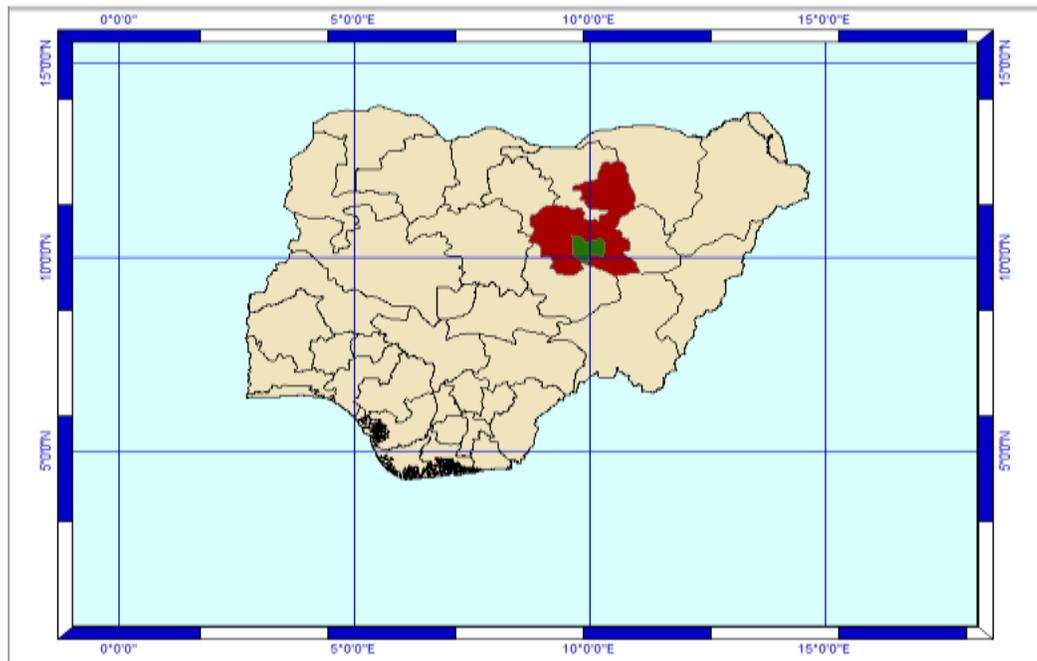
This project, whose end product is a comprehensive information system that provides information at parcel level, will support the integration of land ownership record, land use, status, transaction as well as updating, processing and retrieval of updated information of the land parcels The project will also save guard, such from unauthorized person. Finally the project, if adapted by Bauchi State Ministry of land and Housing will serve as tools that will be effective in terms of revenue collection in the study area and the State at large.

### **Significance of the Study**

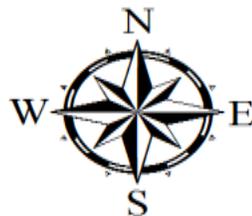
Under the present conditions of high population growth, large-scale economic globalization, climate change, natural disasters and mass migration caused by land degradation, pollution, war, mining and land encouragement. The city's rapid growth has resulted in increasing pressure to convert rural land for industrial, housing or other urban use". In particular in countries marked by fragile institutions, weak governance as well as socio-economic and gender gaps. The prevention and resolution of land conflicts, therefore, pose major challenges for a broad spectrum of actors, including governments, private sector and development Cooperation. On the one hand, land conflicts can be the result of deeper lying causes. On the other hand, land can be a source of broader conflict in and of itself, many conflicts that are perceived to be clashes between different cultures Bonn/Eschborn, (April 2017.).

### **Location and Extend**

The study area covers the whole of BAP 7 layout plan which formally referred to as new GRA Bauchi. The area is part of Bauchi metropolis, the capital of Bauchi State and of the Bauchi Local Government within the state. The area lies between latitude 56°04"45" and 11° 56"02"north of equator and longitudes 52°32"34" and 11°14"34" east of greenwitch meridian and cover a total area of 2.85 km<sup>2</sup> as show below.



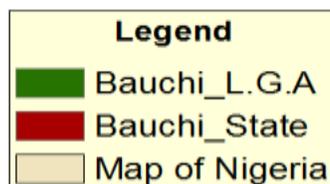
**LOCATIONAL MAP OF NIGERIA SHOWING STUDY AREA**



Coordinate System: GCS WGS 1984  
Datum: WGS 1984  
Units: Degree

0 70 140 280 420 560 Miles

1:11,880,289



Surv. Yusuf Mohammed Inuwa  
Date: 19/03/2020

### Historical development of Bauchi state

Bauchi state is one of the thirty-six state politically administrative state in Nigeria .it is one of the nineteen loosely referred to as the northern state and one of the eight often referred to as the far northern, dominantly Hausa/Fulani and Muslim state in the country, however created as a state in 1976 when the north-east state was split in to three difference state of business Bauchi, Borno and Gongola. Bauchi state remain intact in it 1976 boundaries surviving two subsequent state creation exercise of 1987 and 1991.

How, ever in October 1996, Gombe state was carved out, then Bauchi state with eight local government area forming the new Gombe state and remaining of local government are Bauchi, Alkali, Darazo, Dass, Bagor, T/Falewa, Toro, Warji, Itas/Gadau, jama'are, Gamawa, kirfi, Ganjuwa, Misau, Damabam, Giade, Zaki, Shira, Katagum, Ningi and forming a new Bauchi state (Historical development Bauchi state posted online 1/29/2003).

### **Bauchi State Administration**

There are twenty local governments 1996. When Gombe state was carved out, the present Bauchi state was left with fifteen LGA. some of them were, in October 1996, further divided to make up the present twenty local the state comprised comprise several previously independent powerful emirate, including for instance Bauchi, Ningi, Katagum, Dass Kananm and Duguri. The LGA are t Sub-divided in to District which are made up of various village area/group. (Historical development Bauchi state posted online 1/29/2003). The state now has an eight -like shape, with a blotted lower region, with about two- third of the land are being south f the latitude 11 15 N. the neighbouring state by location, clockwise, are Yobe Gombe, Taraba, Plaeau, Kaduna, Kano and Jigawa states thus Bauchi state could potentially operate in mutual development programmes and projects with up to seven others state which share border with her indeed, the state occupies a central location spatially among north-east group of state in Nigeria.

Another Location advantage which Bauchi state has is its proximity to Jos Plateau which is less than 100km south of the state by which it has access to a commercial airport and to a large market for its agriculture produce, particularly fruit and (Historical development).

### **Topography, Relief and Geology**

Bauchi state lie generally at an altitude of about 600m above the sea level, being part of the central Nigeria highland and jos plateau complex however, two broad relief zone can be identified as follow a western high land area of hill ranges, including the northern edges of the jos plateau complex.

This is part of the crystalline rock area in central northern Nigeria. The hill range is developed on basement complex rock, in an area which is also characterised by extensive plateau surface and volcanic extrusion. The base of the hill range is generally at the 600m level, while peak rise to 700.6m on the hill and 729.3m on the Bunsil hill.

A central high plain (of the Hausa Land) area belonging to the kerri-Kerri and Gombe sandstone and shale, of tertiary age, Isolated hill punctuate the high plain several place, and reach height of 798.5m on the Lamurde hill and 816.4m on the Ligri hill. Indeed, most of the isolated hill in this zone is over

760m Bauchi town lie within the undifferentiated basement complex with old granite out crops and younger granite out crops. (Historical development Bauchi state posted online 1/29/2003

### Vegetation

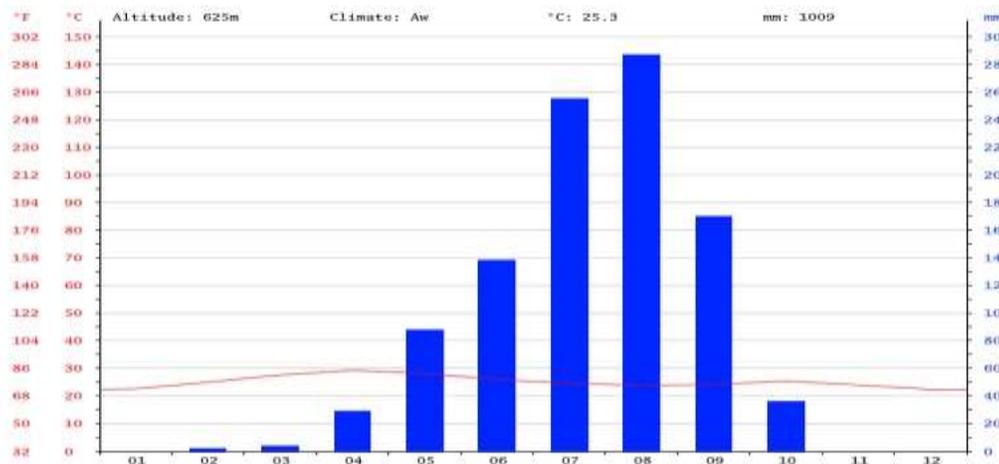
the vegetation type is savannah composed of scattered tree ,shrubs and mainly flat lying grasses .the grasses along the river band tend to be greenish all year round (according to one peter who is living there, I did not see it during dry session)

Vegetation has been reduced to acacia shrub of less than 35% vegetation cover at micro level. The vegetation is less uniform and grasses are shorter than what grows. The vegetation types as described above are conditioned by climatic factors, which in turn determine the amount of rainfall received in the area (BASG, 2012).

### Climate and Rainfall

The temperatures should be expected, generally high in the state. Mean daily maximum Temperature range from 29.2°C in July and august to 37.6° in March and April. The mean daily minimum range from about 11.7°C in December and January to about 24.7°C in April and May sunshine hour range from about 5.1 hour in July to about 8.9 hour in November. Indeed, October to February usually record the longest sunshine Hour in the state. Humidity range from about twelve per cent in February to about 68 per cent in august.

**BAUCHI CLIMATE GRAPH // WEATHER BY MONTH**



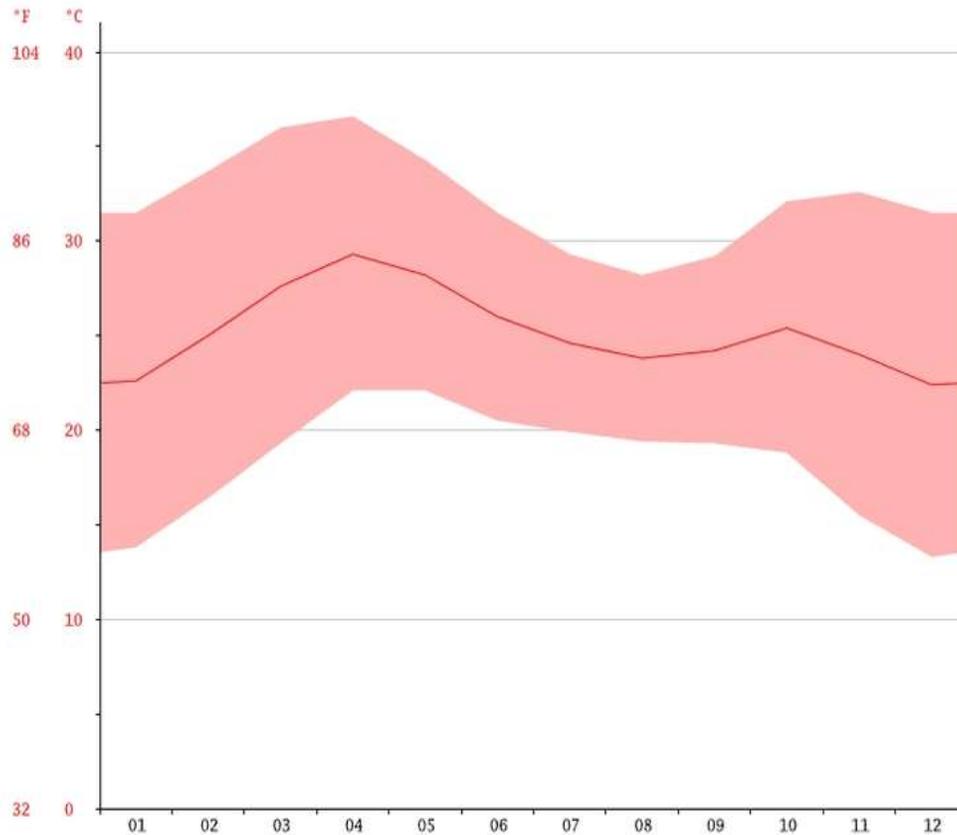
Precipitation is the lowest in January, with an average of 0 mm | 0.0 inch. Most of the precipitation here falls in August, averaging 287 mm | 11.3 inch.

### The Rainy Season

Month it's May to September, when humidity range from about 37 per cent to 68 per cent. Monthly rainfall range from 0.0mm in December and January, though only trace of less than 0.1mm in February and November, to about 343mm in July. Onset of the rain is often in March while they end virtually by October.

Precipitation is the lowest in January, with an average of 0 mm | 0.0 inch. Most of the precipitation here falls in August, averaging 287 mm | 11.3 inch.

### BAUCHI AVERAGE TEMPERATURE



At an average temperature of 29.3 °C | 84.7 °F, April is the hottest month of the year. December is the coldest month, with temperatures averaging 22.4 °C | 72.3 °F.

**BAUCHI WEATHER BY MONTH // WEATHER AVERAGES**

	Avg. Temperature (°C)	Avg. Temperature (°F)	Precipitation / Rainfall (mm)
January	22.6	72.7	0
February	25	77.0	2
March	27.6	81.7	4
April	29.3	84.7	29
May	28.2	82.8	68
June	26	78.8	136
July	24.6	76.3	269
August	23.8	74.8	287
September	24.2	75.6	170
October	25.4	77.7	36
November	24	75.2	0
December	22.4	72.3	0

	January	February	March	April	May	June	July	August	September	October
Avg. Temperature (°C)	22.6	25	27.6	29.3	28.2	26	24.6	23.8	24.2	25.4
Min. Temperature (°C)	13.8	16.4	19.3	22.1	22.1	20.5	19.0	19.4	19.3	18.8
Max. Temperature (°C)	31.8	33.7	36	38.6	34.3	31.8	29.3	28.2	29.3	32.1
Avg. Temperature (°F)	72.7	77.0	81.7	84.7	82.8	78.8	76.3	74.8	75.6	77.7
Min. Temperature	56.8	61.5	66.7	71.8	71.8	68.9	67.8	66.9	66.7	65.8

**Radiation**

is fairly even throughout the year, ranging from about 11.3mm in July to about 18.7mm in April. how, ever, it is relatively highest in March, April and may, when it is generally between 16.1 mm and 18.7mm similarly evaporation in the state range from 2.4mm in July and august to about 15.7mm in March, the month of January, April being the period of greatest evaporation. Bauchi state spans two distinct vegetation zones namely the Sudan savannah in south part and the Sahel savannah in the northern part. Its generally characterised by undifferentiated (mixed) woodland, particularly mixed acacia.

### **Surface Drainage and Ground Water Situation**

The state is drained by several river systems. The dominant one is river Gongola which originated in the Jos plateau area, south west of Bauchi state it traverses, in a southwest-north east direction through the southern L.G.A of the state including Dass, T/balewa, Bogoro, Bauchi and Kirfi thence to Gombe state it has numerous headwater and tributaries within the state. They include rivers Surr, Lere, Maijuju, farin Bagel, Gangala and Gubi Dam in the southwest part, rivers Guji, Yuli, Ruhu, Dukut and Panana in the south and south-east parts. Through these tributaries and several other smaller streams and rivulets, the Gongola system provides considerable advantage for the state. The western and northern part of the state are drained by the rivers bunga and jama"are systems.

The bunga, with its many tributaries, including river Fanro Magariya and Dan warra, flow into the jama"are system and thence constitute part of the river yobe system. Within the north-eastern part of the state is river Dingaiye system with its tributaries such as river Kasi. The latter has river farin ruwa, Jiminy and Amny others as its own tributaries also in the extreme northern part of the state is a considerable stretch of the river Katagum system (Historical development Bauchi state posted online 1/29/2003).

### **Population and Major Economic Activities**

Bauchi state has a total of 55 tribal groups in which Geraw, Sayawa, Jarawa, Kirfa, Turawa, Bolawakarekare, Kanuri, fa"awa, Butawa, Warjawa, Zulawa, Mbadau, Fulani and Hausawa are the main tribes. These mean that they have background, occupation, pattern, beliefs and many other things that form part of the existence of the people of the state. There are cultural similarities in the people's language, occupational practices, festivals, dress and there is a high degree of ethnic interaction especially in marriage and economic existence. Some of the ethnic groups have joking relationships that exist between them e.g. Fulani and Kanuri, Jarawa and Sayawa. Besides, there is also a major highway which links Bauchi, Yobe and Borno states. The area has adequate telephone services and a number of hospitals.

Bauchi Urban Area Population History

1950	24,000	1951	24,000	1952	25,000	1953	26,000	1954	27,000
1955	28,000	1956	29,000	1957	30,000	1958	31,000	1959	32,000
1960	34,000	1961	35,000	1962	36,000	1963	37,000	1964	39,000
1965	42,000	1966	44,000	1967	47,000	1968	50,000	1969	53,000
1970	57,000	1971	60,000	1972	64,000	1973	68,000	1974	72,000
1975	77,000	1976	81,000	1977	86,000	1978	92,000	1979	97,000
1980	104,000	1981	110,000	1982	117,000	1983	124,000	1984	132,000
1985	140,000	1986	149,000	1987	158,000	1988	168,000	1989	179,000
1990	190,000	1991	202,000	1992	211,000	1993	219,000	1994	227,000
1995	236,000	1996	245,000	1997	254,000	1998	264,000	1999	274,000
2000	284,000	2001	295,000	2002	306,000	2003	318,000	2004	330,000
2005	342,000	2006	355,000	2007	369,000	2008	383,000	2009	397,000
2010	412,000	2011	428,000	2012	444,000	2013	461,000	2014	478,000
2015	496,000	2016	515,000	2017	534,000	2018	555,000	2019	576,000
2020	598,000								

Bauchi Urban Area Population Projections

2021	621,000	2022	645,000	2023	670,000	2024	697,000	2025	724,000
2026	752,000	2027	781,000	2028	810,000	2029	840,000	2030	871,000
2031	903,000	2032	934,000	2033	967,000	2034	1,000,000	2035	1,033,000

### Infrastructural Facilities

The rural infrastructures, in the state include electrification, dam and agriculture facilities. Among the numerous dam in the state are Gubi dam, Kafin Madaki Adam, Tilden Fulani dam Kastinawa dam in Bauchi state . the rural electrification have been extended to several palace, while the Nepa plc national electrification a grid lines have extended to many settlement including the L.G.A and Head Quarters.

Bauchi state agriculture and rural development agency has provide several facilities including water borehole in many location in the state .the state agriculture and rural programs, organised in zone within the state has also led to the provision of various agricultural infrastructure. Numerous model farm centres have been established in various part of the state .both of the Hadeja, Jama”are river basin authority and upper Benue river authority have also provide some facilities.

### LITERATURE REVIEW

This section described in details the literature of the previous work in the aspects of development of fiscal Cadastre layout in BAP 7 Layout Area of

Bauchi State, Nigeria. In which some of the conceptual framework were reviewed that includes conceptual design, local design and physical design.

### Conceptual Frame Work

The conceptual of Development of fiscal cadastre system is build around the principle of design and creation of a relational database where different entities are integrated and linked to their attributes. This principle involves the following the stages:

- Conceptual design stage
- Logical design stage
- Physical design stage

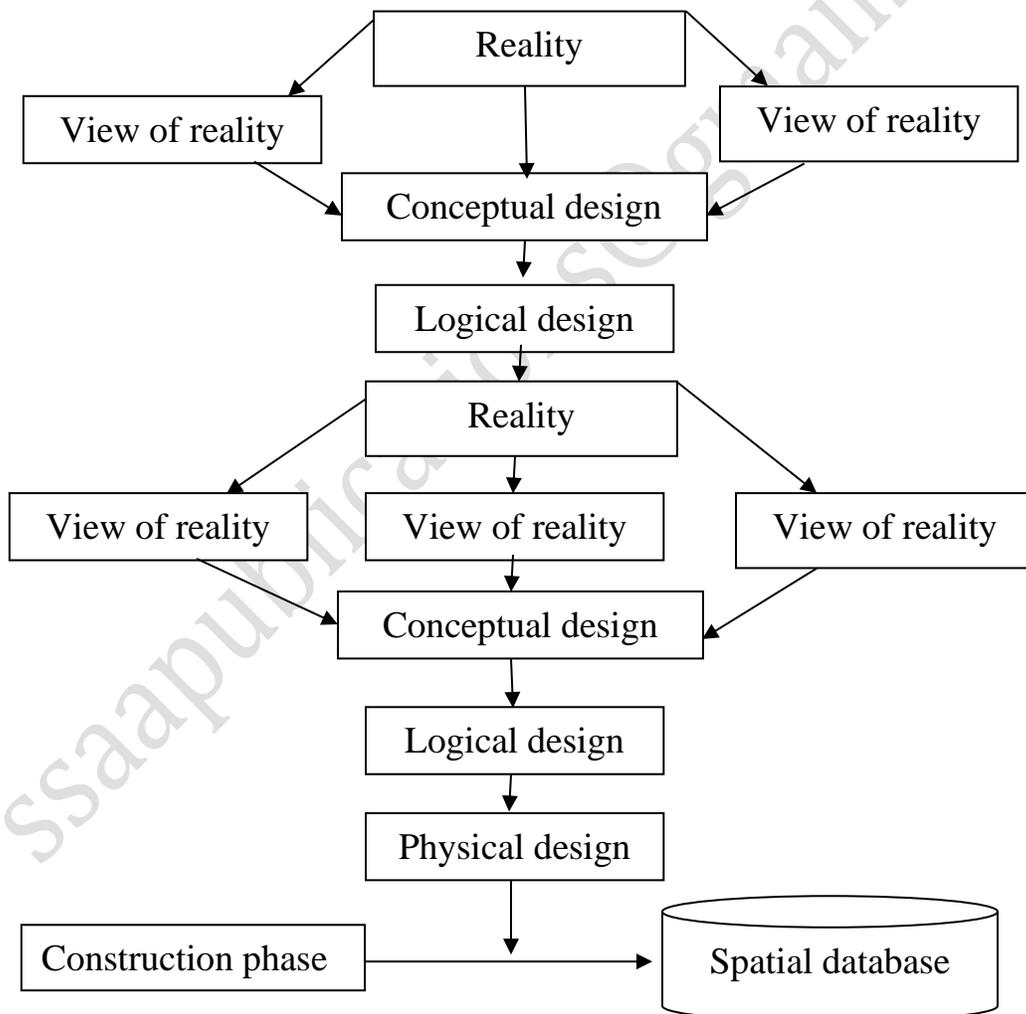


Figure 2: Design and construction phase of spatial database (Shad, Shad, Mesgari, Aghamohammadi, & Molaei, 2009)

### Reality

Reality articulation is the view of the phenomenon as it really exists, including all features that may or may not be perceived by individuals. Realities were collected based on geographic data within the project area with respect to parcel information. These include plot number, streets, area, etc.

### Conceptual Design

This is the expression of reality, which is the conceptualization of reality by individual and how each object is to be represented so as to meet the information requirement. This can be represented so as meet the information requirement. This can be represented in three ways: TESSELATION representation VECTOR representation and OBJECT ORIENTED representation. But in this case the vector base conceptual design was used due to the capturing storage XYZ coordinate. The conceptual model adopted in project is described below.

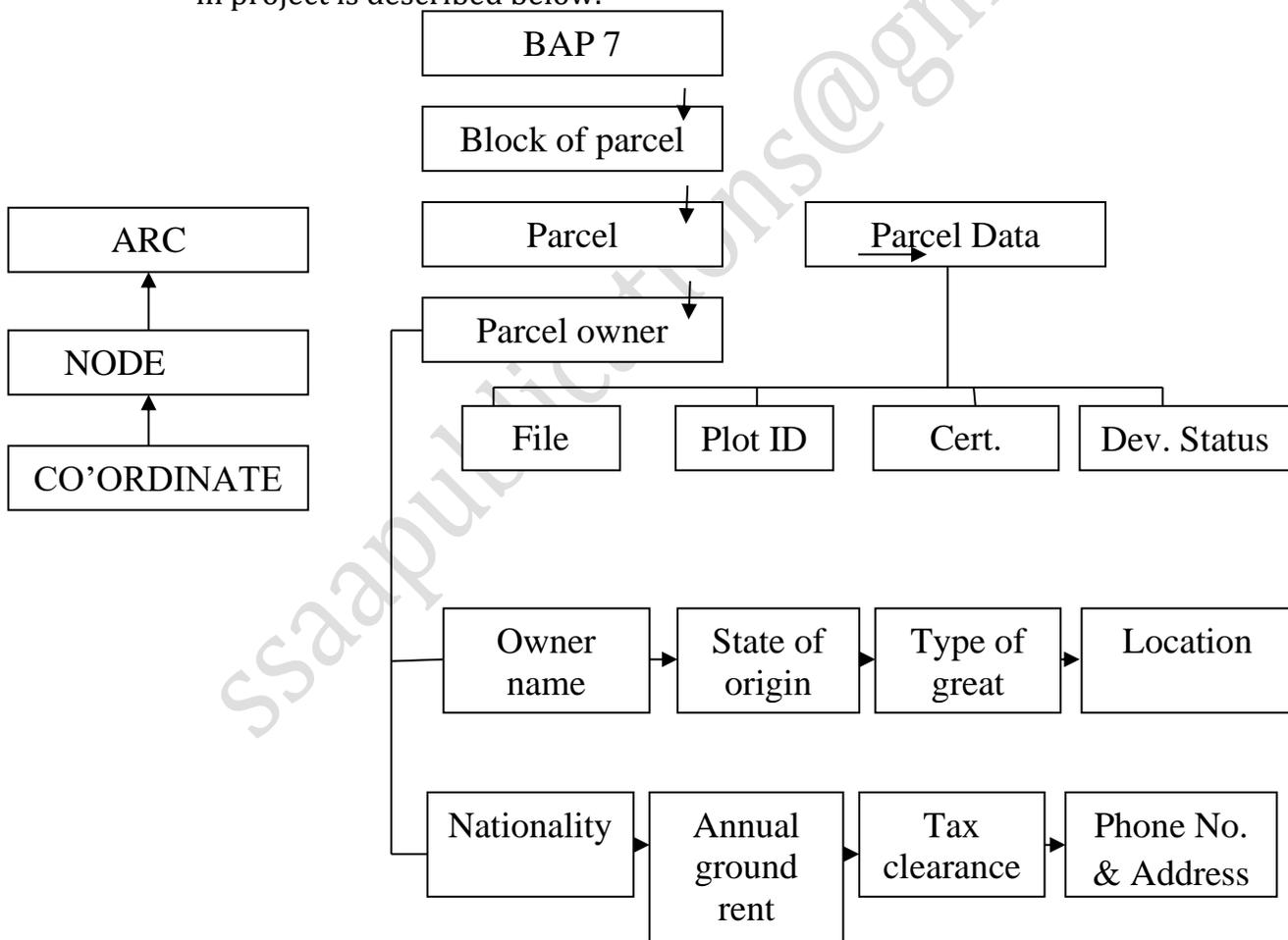


Figure 3: Entity Relationship Model

### Logical design

This is how the database management (Computer Software System) views the data and the representation of conceptual data model designed. The data was logically translated into data structures as entities with attributes in database language as can be seen in the table below.

**Table 1: Entities and attribute**

<i>Entities</i>	<i>Attributes</i>
<i>Road</i>	ID, class name
<i>Parcel</i>	ID, owners use Beacon

### Physical design

Physical design is the physical representation of data structure in the format of the implementation software. In this project the implementation software is ACRGIS10.0

### Theoretical Framework

The issue enveloped in this chapter is a review of previous related literature on the Subject matter to development fiscal cadastre system literature in any subject refers to using information in the past with the belief that the past will help in explaining the present and provide a guide of the future (Shad et al., 2009).

It details what land registration entails while relying on renowned writers' materials on the topic and brings involved the history, enhancements, classifications, and even reveals internationally accepted standards of modern and future land registration systems. This chapter also gives an overview of land registration in three countries that have aligned their systems to the recent global trends (Dobhal & Regan, 2016).

Conveyance and land registration remain a complex branch of law and it thus calls for a careful and cautious analysis. The information for fiscal cadastre reform was an official inventory of land parcel that provide necessary information to be able to determined value of property for taxation (Shad et al., 2009).

The fiscal cadastre system for the purpose of this research, comprise all element of the input process and out for property valuation and taxation. The

cadastre since inception has been a manually maintained land records system that serves a single purpose of revenue generation. A cadastre, using a cadastral survey or cadastral map, is a comprehensive register of the metes-and-bounds real property of a country. It commonly includes details of the ownership, the tenure, the precise location (some include GPS coordinates), the dimensions (and area), the cultivations if rural, and the value of individual parcels of land.

The objective of the software is to improve the completeness and quality of evidence relating to claims to rights and interests in land (Williamson, 2005).

### **Prior Works on Development of Fiscal Cadastre**

It means that there is an official record of rights on land or of deeds concerning changes in the legal situation of the defined units in land. This is the product of the process of registration and it is referred to as the land register (Lemmen, 2012).

Another product of registration is the land title, certificate of land, or the land ownership deeds. The land register is also referred to as the Grundbuch (land book) in the Middle European jurisdictions (Zevenbergen, 2002)

According to Steudler, the Theresian cadastre of Austro-Hungarian Empire was established by Empress Maria Theresia in 1748 for taxation of all the lands in the Empire. This evolved to the Grundbuch System popular in Central European States. Later on in 1804 in France under Napoleon the Code Civil was introduced and it brought with it a new cadastre which was more comprehensive than the earlier records (Li, 2016).

The components of the Napoleon Cadastre included the parcel Number, acreage, land use, land value, and owner which were all based on maps (Steudler 2004). Under this form of registration, the land registry registers the right and the rightful claimant, and thus, creating legal rights and consequence. With this registration, the title or right is created (Kolkman, et al., 2011). Under the deeds system it is the deed itself that is registered. A deed is a record of a particular transaction and serves as evidence of that specific agreement. It is not itself 26 proof of the legal right (Kolkman, et al., 2011).

In many countries around the world, the deeds registration systems are not in this category and documents are in poor physical state, difficult to retrieve,

and even more difficult to link with a chain of titles that can trace a pattern of ownership over the past years (Wayumba, 2013). Fiscal cadastre reform and the implement for geomantic practitioners have a long history of collection, modeling analysis and presentation of spatial data. This requires skill and knowledge which was a wide diversity of application one such application which is relatively unexplored by professional.

They go to the notary who prepares the notaries deed of transfer (or agreement). The deed is the act that passes and transfers the property (Kolkman, et al., 2011).

Insurance Principle Proponents of this principle and institutes where it applies assert a degree of State responsibility to compensate losses incurred due to land registry error. This is institutions where the register fails to effectively mirror the interests in land; and, an innocent third party incurred loss from relying on the registers' wrong information. This principle provides financial security and indemnity to the owners or anyone else suffers loss which is traceable to an error in the register (Bray, 2010).

Publicity principle implies that the land register is open for public inspection and that members of the public hold the published facts to be the truth about the land units referenced. According to (Nilofer,2012). Expeditious and Timeliness When there are complaints about delay in land registration the system runs into disrepute. The system should provide up-to-date information in a timely fashion. Timeliness is also recognized by the World Bank as an important criterion for successful administration of land rights (Nilofer, 2012).

Fairness Land registration should not only be fair but should be seen as being fair. It should be separated from the political processes and include attributes such as: equitable access to the system by all, decentralized offices, and simple and cost effective procedures (Dobhal & Regan 2016) Suitability to Circumstances what determines suitability is what is feasible with a particular community, availability of funds, manpower, and expertise therein (Stuedler, 2004).

Facilitates Taxation the earliest forms of land records were established to facilitate taxation (Larsson et al, 2000). Land registries thus assist governments to value, assess, and Collect taxes. Collection of taxes leads to

more revenue for the State, thereby, Enhancing local development (Larsson et al, 2000), improved standards of living, and poverty reduction (Nguyen, 2014). Land Control for Sustainable Development Land control measures are administered through bureaucratic processes which essentially enable the State to control land use, development, ownership, and transfers (Habitat, 2012).

Sometimes this will require training in agricultural best practices, sustainable use of the wetlands, and the riparian areas. Other modes of development control measures include approval of building plans as well as ways to enhance a forestation to curb desertification. However, very stringent land control rules will stifle land market and so the application of the same has to be weighed against the economic good.

Recording of deeds dealing with land as well as a cadastre for property tax were introduced in the Netherlands during the French annexation in the early 19th century. Particularly, it was in 1810 that the introduction of a fiscal cadastre came to existence after the mentioned annexation of the Kingdom of the Netherlands by France (Kolkman et al, 2011).

This required surveying all land parcels in Rwanda and providing land titles to all rightful claimants nationwide. Approximately 10 million parcels were registered through a low-cost, community based land tenure regularization (LTR) process over five years (Gillingham & Buckle, 2014).

The National Land Policy and the Law Governing Land in Rwanda (LGLR) were consequently adopted in 2004 and 2013 respectively. The LGLR outlined new procedures for land tenure, titling, registering, administering land, and land titles (Gillingham & Buckle 2014).

Traditional and contemporary methods of mass media (television, press, internet and radio), posters, flyers, and booklets were used, but in order to reach the most marginalized groups greater innovation was needed. Here the program recorded songs, performed plays, and dances to illustrate the LTR process. The program also established a 'helpline' to assist with any queries that claimants might have had. Based on this experience a poster of 'frequently asked questions' (FAQs) was produced in the Kinyarwanda language, it was to be displayed at every cell office (Gillingham & Buckle 2014).

Automation also enhances efficiency, transparency, and reduces corruption opportunities. Where the processes and procedures are digitalized and a file tracking system is developed the tracing of a registration of transaction in the registry is open to scrutiny. The administrative officers dealing with a particular case may not hold onto files. Instead, the tracking system records what cases are currently being investigated and when there is a substantial delay, warning messages are sent through the system.

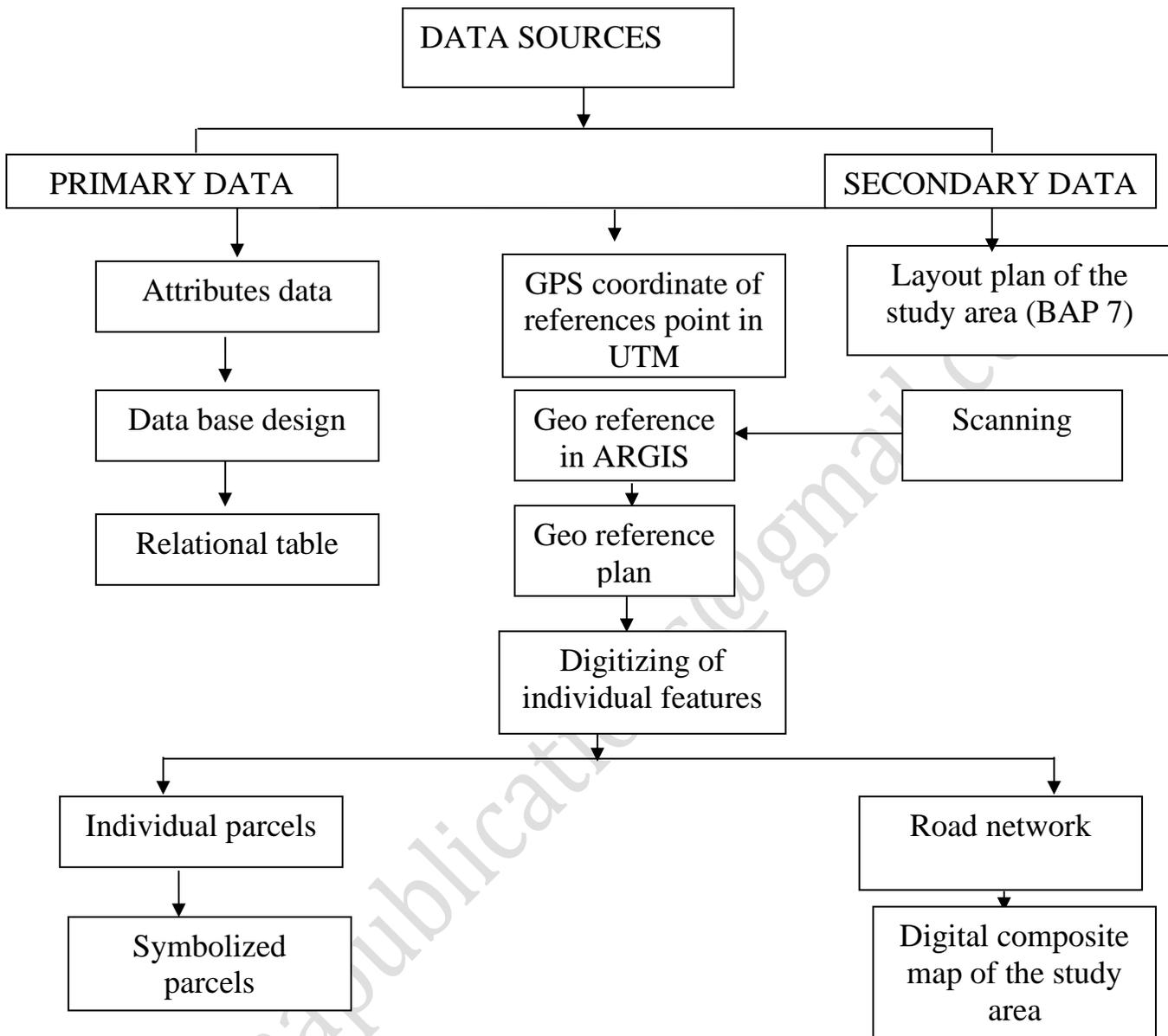
Members of staff at the registry cannot engage in corrupt behaviours, such as expecting payment from a customer in order to expedite a case, as the digital system regularizes the management process (HABITAT, 2013). Information technology also increases public engagement and public confidence in the systems. It improves engagement with clientele as people are more likely to offer information about themselves, including the documents that governments may require to improve land data bases (HABITAT, 2013).

Consequently, the Advantages development of fiscal Cadastre Information System over Classical Cadastre noted that land administration can no longer rely on manual processes. the introduction of Computer-based land administration system, include: standardization in the spread and processing of land data, decrease of the cost and space required for storing land records, prevention of unnecessary duplication of land allocation, facilitation of accessibility to land related data, time efficiency and cost involved in transferring property rights, and also would reduce the conflict between land owners

Therefore, the research at hand adopted the use of cartographic means for acquiring spatial data and physical inspection for collecting non spatial **attributes data** the combine data was processed and analyzed using ARCGIS software which will ease data entry, editing and updating. Using geo-spatial approached.

### **Methodology**

The methodology here is referring to the systematic approach taken to accomplish the stated aim and objectives of the entire research work. It involves the sequential order or procedure in executing a proto-type development of fiscal cadastre.



**Figure 3:** flow chart of methodology

#### **Data Source**

The primary and secondary data for the research were generated from various sources.

#### **Primary Sources of Data**

The attribute data such as parcel information ownership details land use and tax records were obtained from the cadastral and land sections of the Bauchi

State ministry of land and housing by extracting information from file, one by one. For the purpose of geo-referencing a hand held global positioning system (GPS) Receive, (Garmin 72) was used to obtain the universal transverse Mercator (UTM) coordinate often identified (prominent) point within the study area.

### Secondary Sources of Data

The layout plan of the study area was obtained from the Bauchi state Ministry of land and Housing Bauchi state.

### Hardware and Software.

Hardware and software for data collection and processing including the following:-

#### Hardware

- ❖ Hand held GPS
- ❖ Dell laptop (Intel Celeron) with 2.00GB Ram and 250GB hard disks
- ❖ Hp DeskJet printer, photocopier
- ❖ Hp digital scanner



#### Software Include

- ✓ ARCGIS 10.0
- ✓ Microsoft office word 2007

- ✓ Microsoft office excel 2007

### Scanning the Layout Plan:

The layout plan of the study was Scanned using Hp digital scanner and printer after which it was exported to the project folder as can be. See in the figure below.

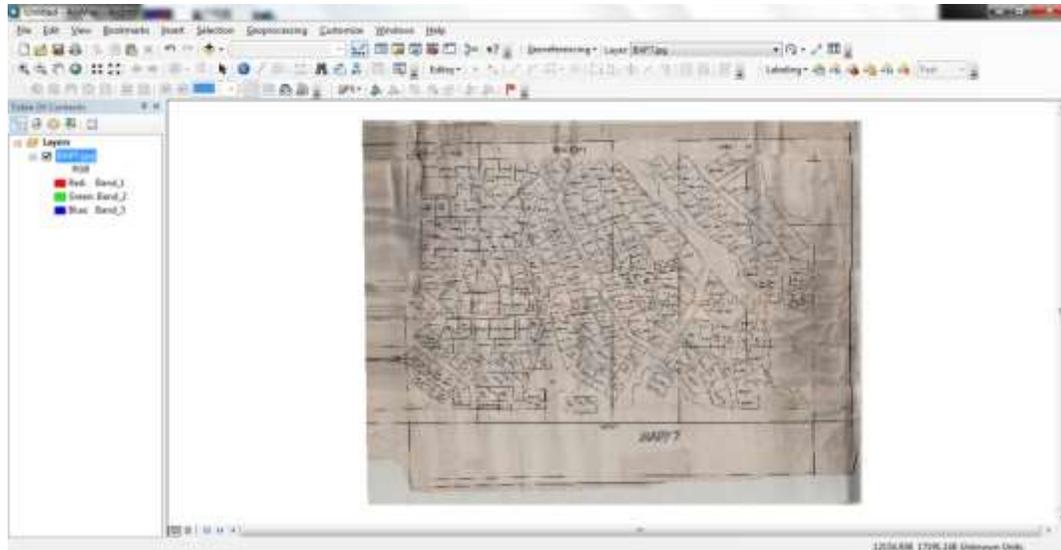


Figure 5: The exported layout on software for geo-referencing.

### Geo-referencing

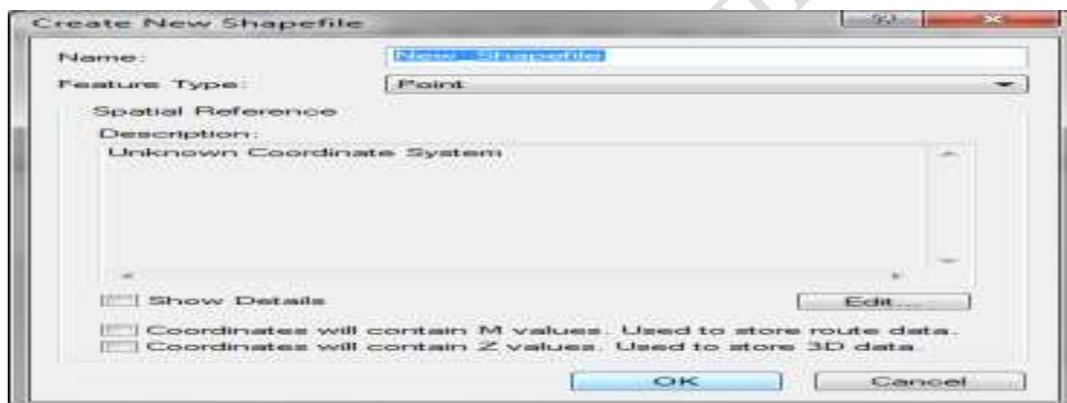
**The Layout Plan:** The scanned layout plan of the study area was imported in ARCMAP environment. after which the defined the position of four prominent point, were used to age reference the plan so that it attained geodetic references as shown in figure below.



Figure 6: procedure of geo-referencing of analogue layout of the study area

### Creation of Shape File (Themes)

For this study, the shape file or theme such as Parcel and road were created in the ARCCATALOG environment after which they were imported into ARCMAP environment for digitizing.



**Figure 7:** cataloged that shows how to created shape file (theme). By selecting point, polygon or multi point for preparation of digitizing.

### Digitizing of Features

The digitizing was achieved using on Screen Method (using computer cursor) to trace the futures from the scanned and geo-referencing plan. Two features (parcel, road, natural and artificial future of the area) within the study area were digitized (traced). Each of the groups' features was digitized, in the ARCMAP environment as independent thematic layer. After digitizing, editing of the traced features was followed immediately. The editing involved the trimming of lines; erasing the unwanted details etc. The digitized and edited features (parcels and roads) are shown in the figure below.

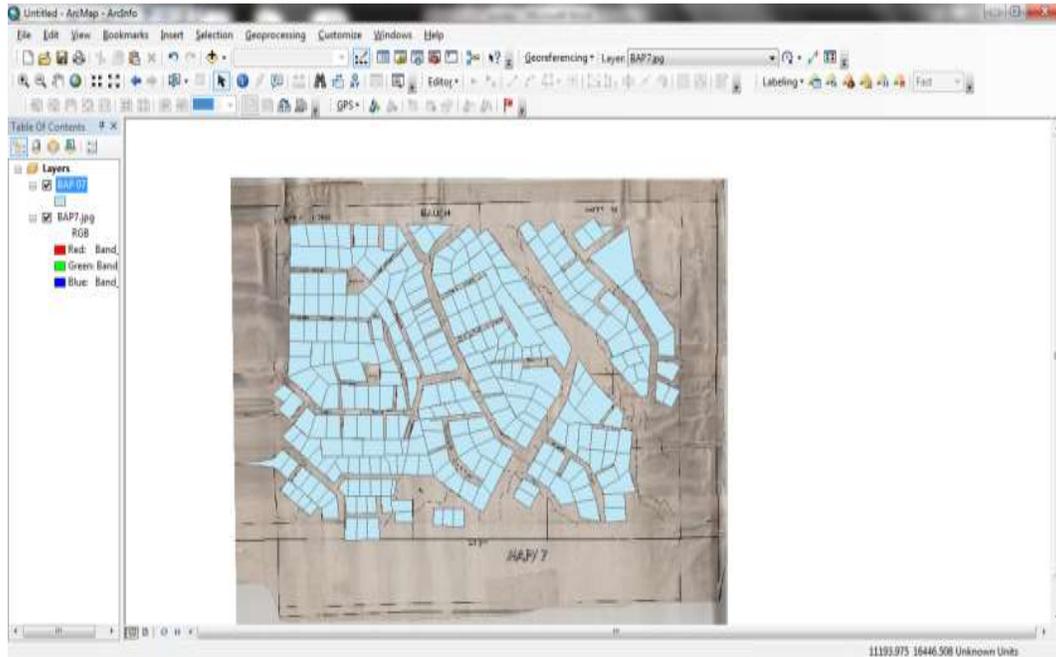


Figure 8: Digital Composite Map of study area

### Generation of digital Composite Map

The digital composite map of the study area was generated by overlaying the parcel and the road layer in the arc map environment after which grids; names of street and appropriate annotation were added to give it a cartographic outlook as Shown above.

### PRESENTATION AND ANALYSIS OF RESULT

Collection of Geometric and Attribute Data of Study Area Looking back at the objectives of the study, it will be seen that the first one is to collect geometric data of the study area using ground survey method. This objective has been achieved as can see in the table below.

Table 2: GPS Coordinates of Some Prominent Points in UTM.

S/N	Points	Easting(m)	Northing(m)	Accuracy(m)
1	ZARANDA HOTEL	630338.00	1290921.00	±3
2	DOGON YARD ROUND ABOUND	630707.00	1290938.00	±2
3	ALBARKA FM BAUCHI	630709.00	1290527	±2

4	GLOBE FM BAUCHI	630446.00	1290504.00	±4
---	-----------------	-----------	------------	----

The second objectives of the study is to collect attribute data of the land parcel within study area by file inspection form the Bauchi state ministry of land and housing. This objective has been satisfactorily fulfilled as can see in Figure below.



**Figure 10 and 11:** the attribute data of the study area, by file Inspection from Bauchi Ministry of Land Housing Bauchi sate.

### Conversion of Analogue Cadastre Layout Plan into Digital Format.

The hard copy of the analogue cadastre layout plan was converted into digital format. This objective has been satisfactory fulfilled as can be seen in figure below.

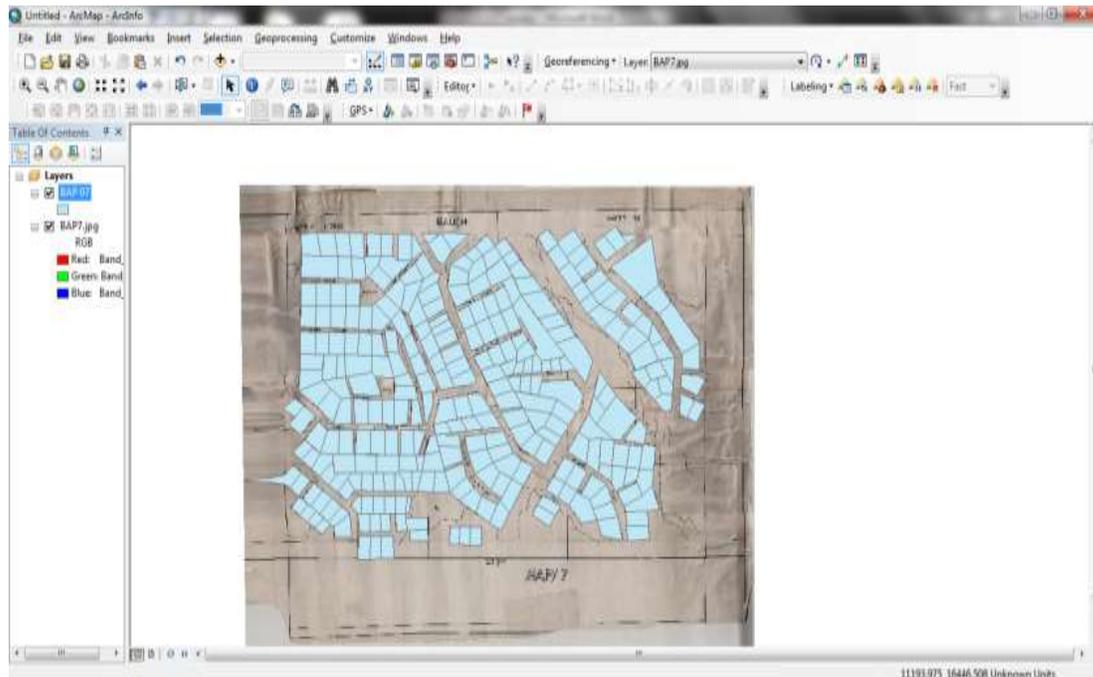


Figure12: Digital cadastre layout plan of study area.

The importance of a digital layout plan is numerous some of which are

1. It is more handy and portable
2. It occupies quite a very small space when compared with the hard copy
3. It allows for unlimited sharing of information
4. It denounced the risk of being destroyed by termites, bad handling or hiding by greedy and selfish individuals, etc.

### The Relational Database of the Study

Another objective of the study is to design and create a relational database of study area.

The database is relational because it Consist of entities and their attributes. The important factor to analyze in relational database creation is the correctness of the attributes information linked to the individual parcel. It can be seen in the figure below.

ID	SHAPE	OWN	OWN_NAME	OWN_ADDRESS	OCCUPATION	PHONE_NUMBER	DATE_BORN	DATE_ALICE	LAND_USE	STATE_ORIG	MATERIALITY	ASR_ABBREV	ATC_ABBREV	AREA	PERIMETER	COORDINATE	EASTING	LONG
1	Polygon	0	SUM MOSES	1	SWP ET	POLICE	70842793	1977	1978	RESIDENTIAL	BALUCH	WOGRA	PAID	1179	709	1978	12043	197
2	Polygon	0	ELIBERT OLU		SWP ET	POLICE	00291803	1968	1973	RESIDENTIAL	BALUCH	WOGRA	PAID	1553	119	1978	12072	197
3	Polygon	0	SEN DAUSA SAMB		SWP ET	SOLDIER	007032799	1959	1972	RESIDENTIAL	BALUCH	WOGRA	PAID	1403	154	1978	12009	197
4	Polygon	0	SAH T FALF		SWP ET	C SERVANT	009082790	1984	1985	RESIDENTIAL	BALUCH	WOGRA	NOT PAID	1437	794	1989	12079	197
5	Polygon	0	ALH O AMEED		SWP ET	C SERVANT	008754321	1980	1990	COMMERCIAL	BALUCH	WOGRA	NOT PAID	2073	219	1993	12020	197
6	Polygon	0	AMRU ALI TEE		SWP ET	C SERVANT	707713487	1987	1988	RESIDENTIAL	BALUCH	WOGRA	NOT PAID	2428	206	1988	12058	197
7	Polygon	0	ALH MAH MADARA		SWP ET	C SERVANT	009074523	1979	1989	RESIDENTIAL	BALUCH	WOGRA	PAID	2670	214	1977	12029	198
8	Polygon	0	COOR MORTALA B		SWP ET	C SERVANT	708178888	1985	1988	RESIDENTIAL	BALUCH	WOGRA	PAID	2159	218	1978	12062	197
9	Polygon	0	EDREL ENKUSA		SWP ET	C SERVANT	003487800	1981	1988	RESIDENTIAL	BALUCH	WOGRA	PAID	2184	203	1978	12063	197
10	Polygon	0	ABDULRAK M J		SWP ET	C SERVANT	708572234	1980	1990	RESIDENTIAL	BALUCH	WOGRA	PAID	2088	230	1989	12070	197
11	Polygon	0	SUM RAHILLA		SWP ET	C SERVANT	708872349	1977	1988	RESIDENTIAL	BALUCH	WOGRA	NOT PAID	2038	199	1978	12079	197
12	Polygon	0	SOOR SOOR I		SWP ET	CONTRACTOR	708071980	1970	1988	COMMERCIAL	BALUCH	WOGRA	NOT PAID	1363	194	1983	12070	197
13	Polygon	0	HAJWA ELHAB		SWP ET	BUSINESS	008074522	1987	1989	COMMERCIAL	BALUCH	WOGRA	NOT PAID	2281	192	1984	12052	197
14	Polygon	0	HALAM RUL K		SWP ET	BUSINESS	007841021	1981	1987	RESIDENTIAL	BALUCH	WOGRA	PAID	2128	188	1974	12028	197
15	Polygon	0	SULE OATYOM		SWP ET	BUSINESS	008192248	1986	1979	RESIDENTIAL	BALUCH	WOGRA	PAID	2116	189	1974	12068	197
16	Polygon	0	SOLAMON DANIEL		SWP ET	BUSINESS	007654208	1986	1979	RESIDENTIAL	BALUCH	WOGRA	PAID	2028	183	1974	12065	197
17	Polygon	0	DOGARA YAKUB		SWP ET	POLICE	008574800	1980	1990	RESIDENTIAL	BALUCH	WOGRA	PAID	2026	183	1978	12069	197
18	Polygon	0	JONATHAN MADR		SWP ET	C SERVANT	708482478	1977	1978	COMMERCIAL	BALUCH	WOGRA	PAID	2083	234	1978	12063	197
19	Polygon	0	SOOR KHANZA		SWP ET	C SERVANT	008042008	1988	1988	RESIDENTIAL	BALUCH	WOGRA	PAID	2124	196	1988	12071	197
20	Polygon	0	OHAKOLE ADZ		SWP ET	C SERVANT	008074500	1984	1799	RESIDENTIAL	BALUCH	WOGRA	PAID	1699	179	1978	12022	197
21	Polygon	0	JULIET LOHE		SWP ET	C SERVANT	008084700	1979	1989	RESIDENTIAL	BALUCH	WOGRA	PAID	2184	187	1978	12011	197
22	Polygon	0	ALH HUNA AJAK		SWP ET	C SERVANT	004873800	1983	1988	RESIDENTIAL	BALUCH	WOGRA	NOT PAID	2088	198	1974	12088	197
23	Polygon	0	IRHANABED DALUA		SWP ET	C SERVANT	708573800	1980	1988	RESIDENTIAL	BALUCH	WOGRA	NOT PAID	2173	191	1978	12084	197
24	Polygon	0	HAJWA T BELLO		SWP ET	C SERVANT	008745239	1982	1988	RESIDENTIAL	BALUCH	WOGRA	PAID	2040	229	1979	12025	197
25	Polygon	0	SOOR RAHMA		SWP ET	C SERVANT	708781974	1979	1988	RESIDENTIAL	BALUCH	WOGRA	PAID	2144	202	1978	12049	197
26	Polygon	0	SARVIMAN BR		SWP ET	LECTURER	008814521	1987	1987	RESIDENTIAL	BALUCH	WOGRA	PAID	2162	200	1978	12088	197
27	Polygon	0	SABAMA GARD		SWP ET	BUSINESS	004890000	1983	1985	RESIDENTIAL	BALUCH	WOGRA	PAID	2158	188	1978	12071	197
28	Polygon	0	BEKKE ALAYI		SWP ET	C SERVANT	707841245	1987	1989	COMMERCIAL	BALUCH	WOGRA	PAID	2182	184	1978	12045	197
29	Polygon	0	ALH AMRU YAKS		SWP ET	C SERVANT	007488012	1983	1979	RESIDENTIAL	BALUCH	WOGRA	NOT PAID	2181	198	1978	12078	197
30	Polygon	0	BAKAFAN B ALYU		SWP ET	C SERVANT	004873239	1980	1986	RESIDENTIAL	BALUCH	WOGRA	PAID	2261	199	1978	12026	197
31	Polygon	0	IFE NATHANIL		SWP ET	C SERVANT	008748819	2009	1998	RESIDENTIAL	BALUCH	WOGRA	PAID	2338	193	1974	12004	197

Figure 13: Relational Database of study Area.

### The Digital Composite Map of Study Area

Another objective of study area. This objective has been satisfactorily. From this map mono-thematic maps can be produced at any required scale very quickly and cheaply for different applications. The application includes provision of refuse collection centers, proper placement of infrastructure and utilities etc. Therefore, the map will serve as a tool for proper and effective of ground rent collection as well as infrastructural management and development within the area. The grid lines will make it possible to compute bearing and distance between any points or feature on the map and another point or features outside the map (if the UTM Coordinates of that point or feature are known the map is available in soft and hard copies for future reference and update).

### Queries by Attributes

The most basic of all tools provide in geographical information system are those related to database query. Queries are specific questions asked what is where and (what the distribution of a phenomena over time is) and answers provided through manipulation and processing of the spatial database of the link between the graphic (geometric) data and attributes information which must be acceptable to the implementing software (Arc GIS) using the query builder already predefined in the database from the arc map.

For Example.

Query to checks who are those that paid the Annual Ground Rent per Annum,

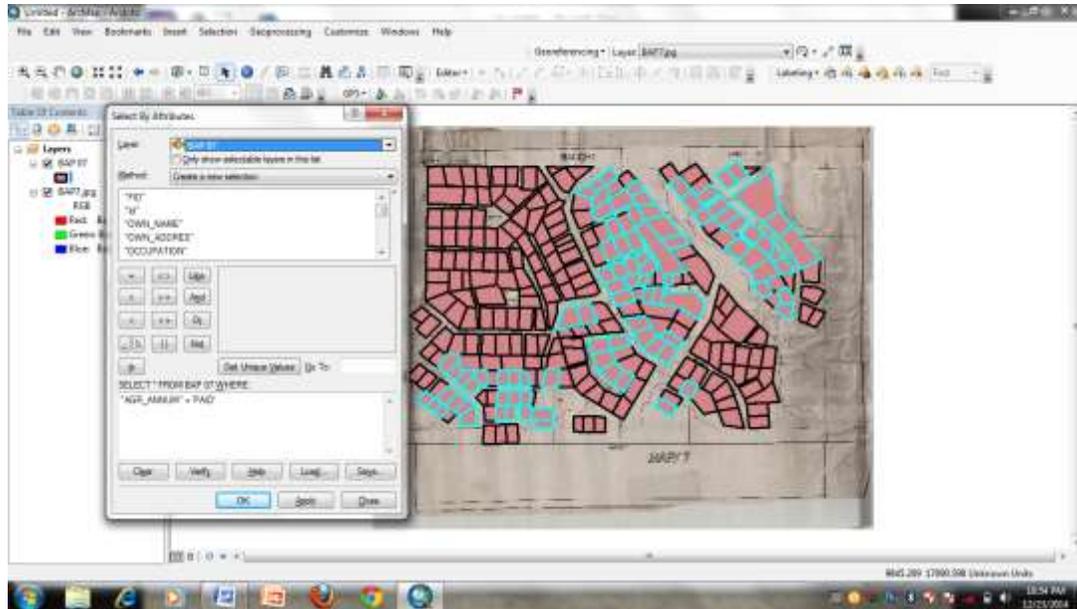
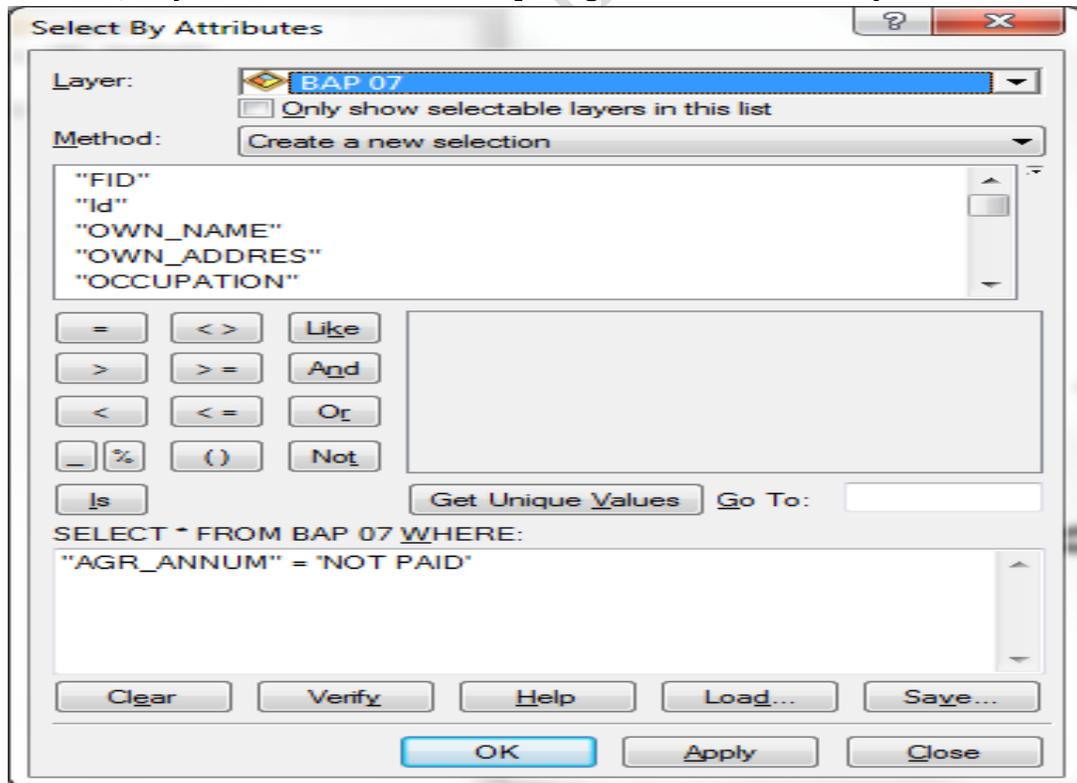


Figure 14: Query result showing those that paid ground rent annually.

❖ Query to checks who are not paid ground rent at the layout.



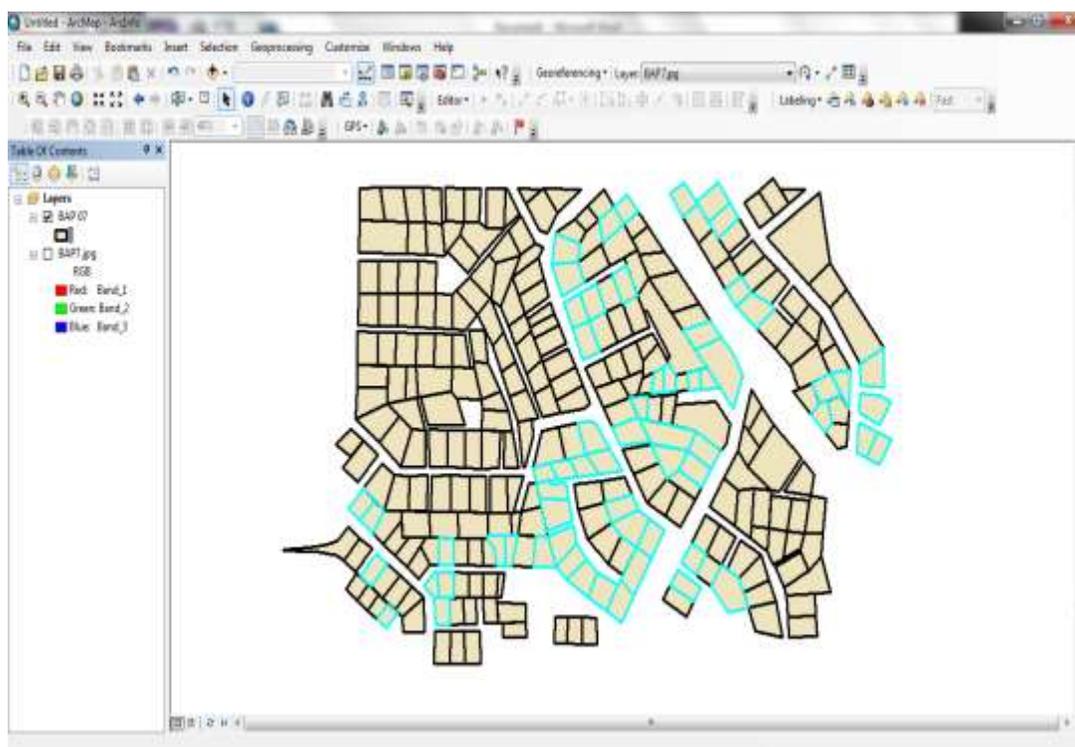


Figure 15 the Result showing those that do not paid ground rent. The database was design with Column of phone number for further information from parcel. If the rent is not paid by the end of year, the record office should inform him.

❖ Query to check who are those paid the tax clearance per annum

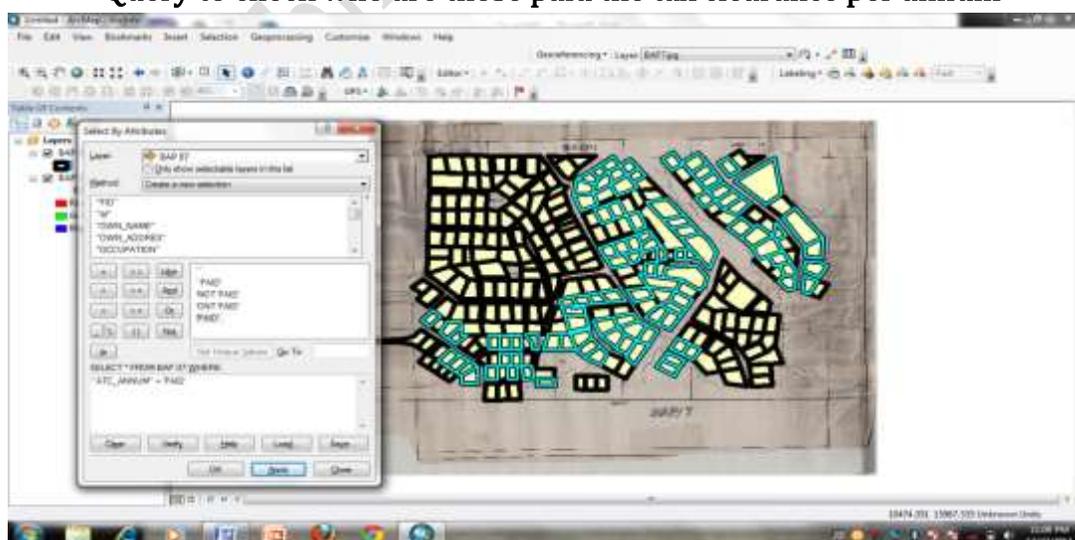


Figure 16: The result showing those that paid tax clearance per annum

❖ Query to checks who does not paid tax clearance per annum.

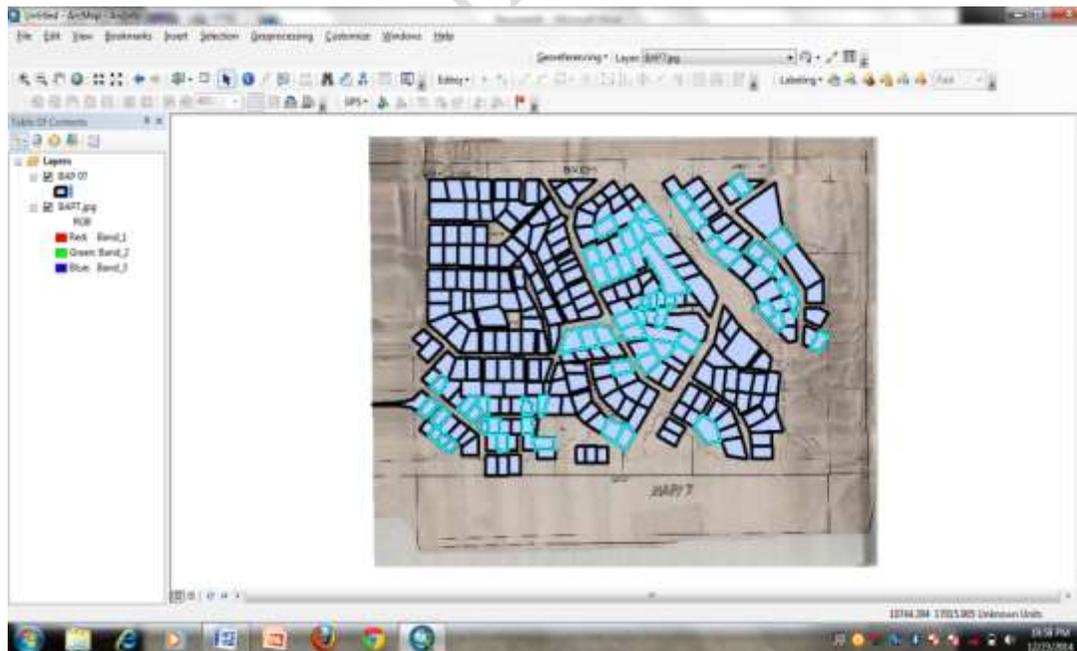
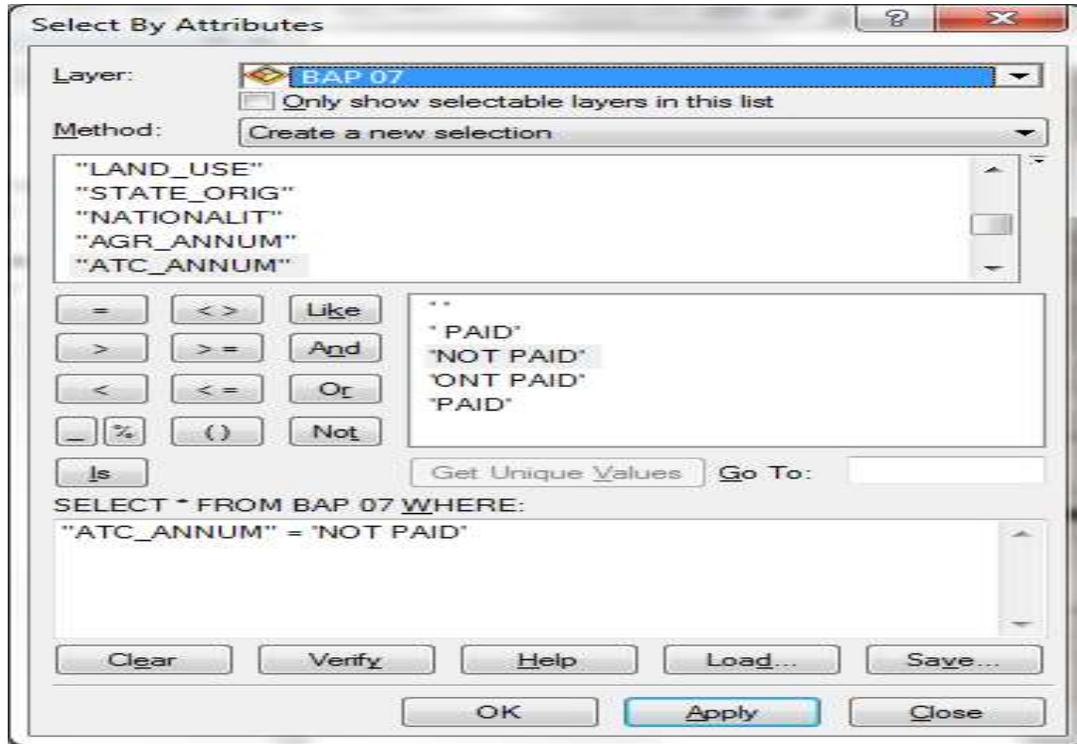


Figure 17: the result showing those that do not paid tax clearance per annum.

- ❖ **Note**, for Most of the civil Servant the Government use to deduct the Tax from their salary monthly.
- ❖ **Query** to checks who are the Citizens of Bauchi State as well as their local government of origin.

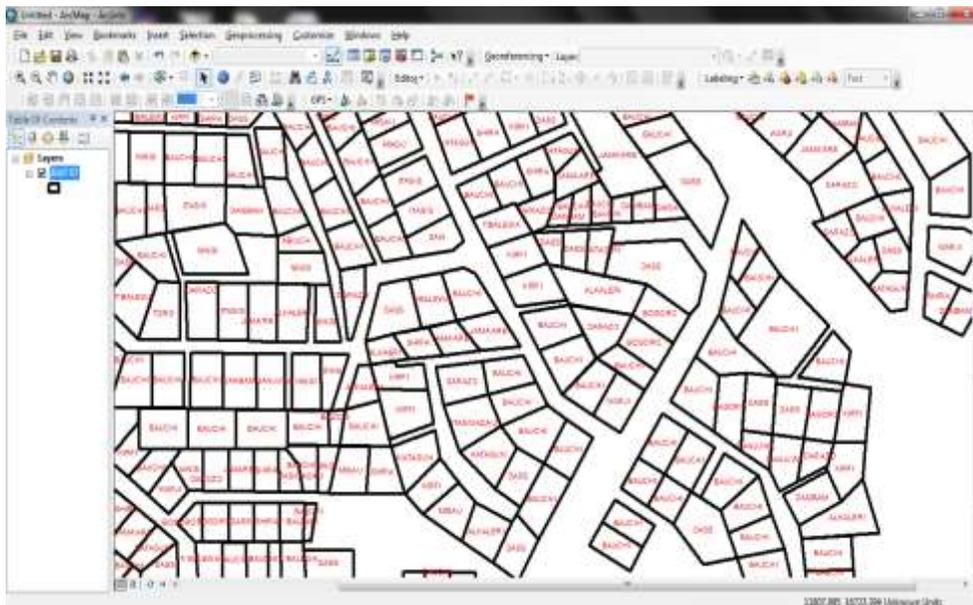


Figure 18: the result showing the citizens of Bauchi state.

- ❖ **Query** to check the parcel allocated for residential purpose.

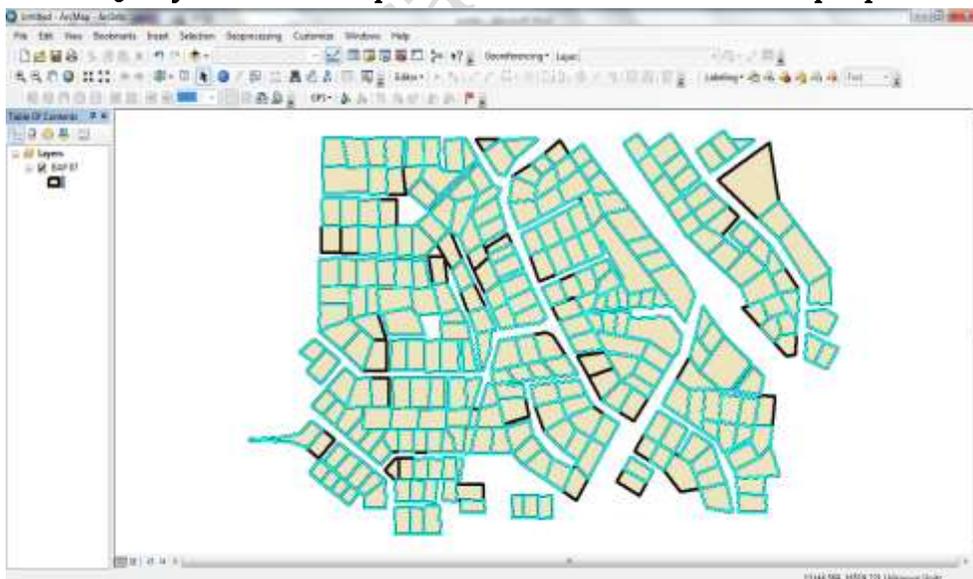


Figure 29: The parcels allocation for residential purpose, it is almost ninety percent residential.

❖ Query to check underdeveloped plots within the layout BAP 7.

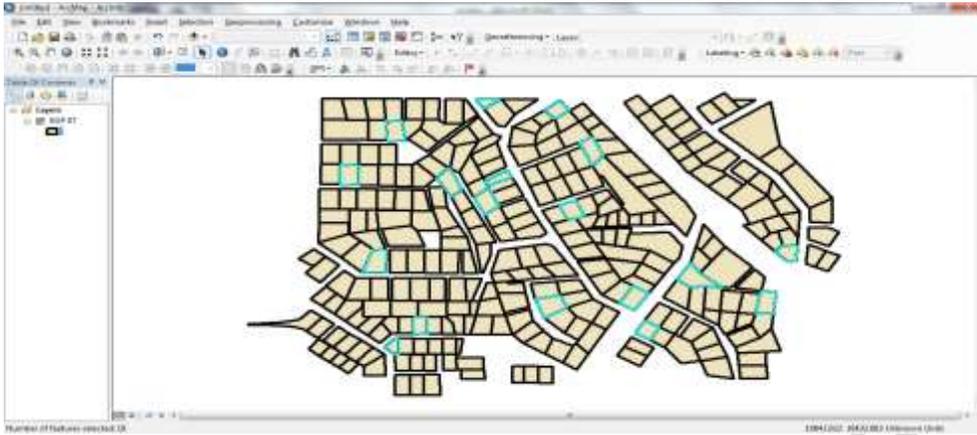


Figure 20: the result showing the under developed plots

❖ Query to check the plot that has BA/NO or Survey Number at the Layout plan.



Figure 21: Query the result showing the plot that has BA/NO or Survey Number.

❖ Use Query to level the plot by showing the name of parcel

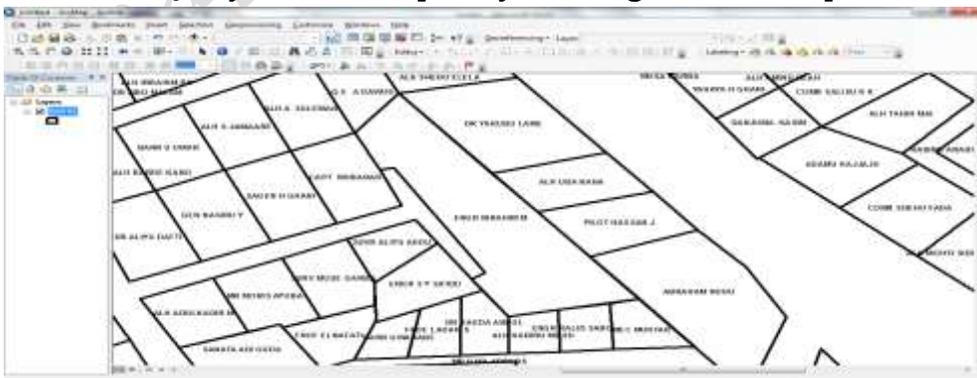


Figure 22: The result showing the Names of the Owner's plots.

- ❖ Query by using identified tool to check information of each and every individual file within the layout.

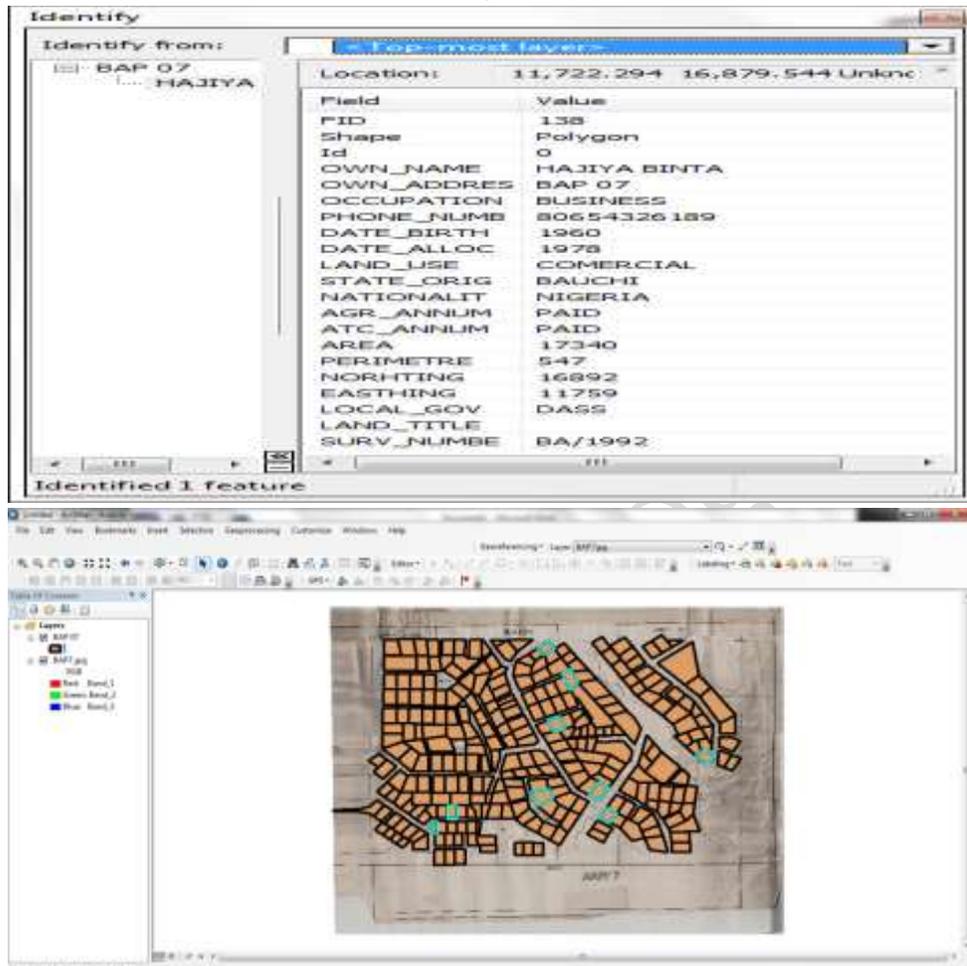


Figure 23: Query the result showing the all information of the plots by using identifier tool.

If you consider with the database design, you can see that the all information of the plot such as plot number, land number survey number, land tenure, ground rent, area, value of improve, land use, name of plot owner , street name, name of owner, date of allocation, state of origin, place of birth, occupation, nationality and local government area. It provide in digital format. It is also easy to check, analysis, integrate and update the information of the plot any time. If there is problem, the government should inform the owner parcel.

## SUMMARY, CONCLUSION AND RECOMMENDATIONS

This section discussed the

### Summary

This study is a computer based project whose end product is a comprehensive information system that provides information at parcel level. It is built around an accurate and reliable spatial framework, cadastral layout plan information generated through relevant offices and physical inspection. Hence, it supports both the legal and fiscal purposes.

The study shows how computer technology has come to play a vital role in modifying the tedious and manual method of record keeping and retrieving. The technique and the general procedures for digital cadastral mapping and spatial database design and creation have been fully demonstrated in the study.

The study proves that digital survey equipment in conjunction with geographic information system (GIS) software can be a good and sufficient tool for managing land and land resources because of their easy, simple and automatic operation as well as their ability to capture a large amount of data in a short period of time.

### Conclusions

In essence, the study has achieved its objectives in the provision of information on who owns a plot in the area, the status of the plot, the use to which the plot is put to, as well as the value of the structure reacted on etc. Then, this information is properly managed and supported with the right decision and implementation would go a long way in addressing the problem highlighted earlier in the study.

### Recommendations

This research has no doubt uncovers the current condition of most land and survey ministries, agencies, organizations, etc. in terms of their non-adoption and implementation of (GIS) techniques in collecting and managing spatial information.

Therefore, it is recommended that the bodies concerned should adopt the current trend in order to rescue the large amount of valuable hard copy maps,

plans and other related data that are slowly decaying and eating away by the insect. the study stops only at developing a relational database without providing a means of accessing it from different office Hence,

It is recommended that, another study should be undertaken to establish a local network that will link all the offices in the ministry in order to make them appreciate more the importance of development of fiscal cadastre.

Also, it is at always easier for a change to manifest if decision and directives comes from the top to the bottom rather than the other way round. Therefore, in order to have a transition from analogue to digital system in the ministries, agencies, organization e.t.c that deals with fiscal cadastre development matters the following. Recommendations are proffered.

- (i) Development of fiscal cadastre system should be embraced as it assures dimensional stability of storage medium, eliminates loss of data or detail by transfers from one medium to the other and maintains positional accuracy since the data are help in numerical form.
- (ii) (ii) GIS section should be established, so that to handle the responsibility of coordinating and managing land related information.
- (iii) Government should make it a condition or requirement for the appointment of the heads of these ministries, agencies, and organization etc. knowledge of GIS or any relevant field.

## REFERENCE

- Hughes, O. (2014). *Literature review of land tenure in Niger, Burkina Faso, and Mali. Context and Opportunities*. (August), 54.
- Lawry, S., Samii, C., Hall, R., Leopold, A., Hornby, D., & Mtero, F. (2017). The impact of land property rights interventions on investment and agricultural productivity in developing countries: a systematic review. *Journal of Development Effectiveness*, 9(1), 61-81. <https://doi.org/10.1080/19439342.2016.1160947>
- Reynolds, T., Biscaye, P., Callaway, K., Chen, K., Mcdonald, M., Morton, E., ... Anderson, C. L. (2014). *Land Tenure Technologies*. 1-50.
- Shad, R., Shad, A., Mesgari, M. S., Aghamohammadi, H., & Molaei, D. (2009). Fuzzy topological simulation for deducing in GIS. *Applied Geomatics*, 1(4), 121-129. <https://doi.org/10.1007/s12518-009-0012-2>
- Dobhal A., Regan (2016), Immutability and Auditability: The Critical Elements of Property Rights Registries. A Paper presented in Washington DC at the World Bank's 2016 Conference on Land and Poverty
- Williamson I. (2005) Thinking Outside The Triangle – Taking advantage of Modern Land Markets. The University of Melbourne, Australia.

- Lemmen C.H.J. (2012) A Domain Model For Land Administration. PhD Thesis. Delft University of Technology. The Netherlands.
- Zevenbergen J. A., (2002) Systems of Land Registration – Aspects and Effects, PhD Thesis. Delft University of Technology. Netherlands Geodetic Commission. (NCG), Netherlands.
- Li L. (2016) Transformation of Law of The Farmland Transfer in China: From a Governance Perspective. Eleven International publishing, The Hague, Netherlands.
- Stuedler D., (2004). A framework for the evaluation of land administration systems. PhD Thesis. Department of Geomatics. The University of Melbourne, Melbourne, Australia
- Kolkman W.D., Verstappen L.C.A., & Vonck F.J. (2011) Building Blocks For The Rule of Law – Land Law. BBRL, University of Groningen (Unpublished), Netherlands.
- Wayumba G.O., (2013) An Evaluation of the Cadastral System in Kenya and Development of a Modernization Strategy. PhD in Geospatial Engineering, University of Nairobi, Kenya.
- Bray J. (2010), (3rd Ed.). *Unlocking Land Law*. Hodder Education, and Hachette UK Company, London, England.
- Nilofer C. (2012) *Land Administration For Macroeconomic Management*. PhD Thesis. The University of Melbourne, Australia.
- Dobhal A., Regan (2016), Immutability and Auditability: The Critical Elements of Property Rights Registries. A Paper presented in Washington DC at the World Bank’s 2016 Conference on Land and Poverty
- Daniel Stuedler (2004), A Framework For the Evaluation of Land Administration Systems. University of Melbourne, Australia.
- Kuria D., Kasaine A., Khalif A.& Kinoti S. (2016) Developing a National Land Information Management System – The Kenya Strategy. A Paper presented at the 2016 World Bank Conference on Land & Poverty, in Washington DC March 14-18, 2016
- Larsson G. (2000) Land Registration and Cadastral Systems; Tools for Land Information and Management. KTH, Stockholm, Sweden.
- Nguyen L.H. (2014) *Farmers’ Land Tenure Security in Vietnam and China*. PhD Thesis. University of Groningen, The Netherlands.
- UN – HABITAT. (2012-B) *Handling Land; Innovative Tools For Land Governance and Secure Tenure*. UN – Habitat Nairobi, Kenya.
- Gillingham P. and Buckle F. (2014) *Rwanda Land Tenure Regularisation Case Study*. Evidence on Demand and DFID. Available on [http://dx.doi.org/10.12774/eod\\_hd.march-2014.gillingham](http://dx.doi.org/10.12774/eod_hd.march-2014.gillingham) last accessed on 18th March 2016

#### APPENDIX: 1

**Table 1: Entities and attribute**

<i>Entities</i>	<i>Attributes</i>
Road	ID, class name
Parcel	ID, owners use Beacon

#### APPENDIX: 11

**Table 2: GPS Coordinates of Some Prominent Points in UTM.**

<i>S/N</i>	<i>Points</i>	<i>Easting(m)</i>	<i>Northing(m)</i>	<i>Accuracy(m)</i>
1	A	630338.00	1290921.00	±3
2	B	630707.00	1290938.00	±2
3	C	630709.00	1290527	±2
4	D	630446.00	1290504.00	±4

**APPENDIX: 111**

The second objectives of the study is to collect attribute data of the land parcel within study area by file inspection form the Bauchi state ministry of land and housing. This objective has been satisfactorily fulfilled as can see in Figure below.

