PHYSICAL PLANNING PROPOSALS FOR EFFECTIVE PROVISION OF UTILITIES IN BAUCHI TOWN

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DECLARATION

I hereby declare that this thesis: "Physical Planning Proposals for Effective Provision of Utilities in Bauchi Town" has been composed by myself and that it is the outcome of my research work. It has not been presented before to any examiner for the award of a higher degree.

Isa, Adamu Harir July, 1992

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CERTIFICATION

This thesis titled: "Physical Planning Proposals for Effective Provision of Utilities in Bauchi Town" by Isa, Adamu Harir, meets the regulations governing the award of the degree of Master of Science, Urban and Regional Planning, Ahmadu Bello University, Zaria, Nigeria, and is approved for its contribution to knowledge and literary presentation.

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D E D I C A T I O N

This thesis is dedicated to my parents, relations, wife and children for their patience and endurance during my 30 months absence from home, for this study.

Adamu H. Isa.

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A B S T R A C T

The weakening economies of most developing countries over the years, have hampered the implementation of many urban planning programmes. This has motivated the search for alternative planning and management strategies in sectors of urban development including the provision of utilities. The study set out to examine the physical planning and management practice for the provision of utilities, using Bauchi town as a study area.

Planning the provision of utilities in towns consists of physical planning and engineering operations and application of economic rationale. They are parts of a broad spectrum of plan formulation and implementation and maintenance or management of utility projects. Co-ordination is therefore, required to control and integrate operations for the realisation of efficient utility provision and urban development. Therefore, a comprehensive planning approach in the form of agencies co-ordination, economic effectiveness and social welfare consideration were used as criteria for assessing the efficiency of utilities provision in the study area.

The analysis shows the absence of a suitable framework to co-ordinate operations between the various sectors of utility planning (especially at the policy formulation level) as one of the major factors hampering the efficient provision of utilities in Bauchi town. Associated with this are the problems of lack of adequate funding by the government to finance the provision of utilities and the required facilities for distribution due to massive subsidisation policy. Over provision of land area for housing development and growth have led to rapid expansion of land area beyond the financial limits of utiLity management agencies to provide facilities. These and the failure to stop development from encroaching on utility lines have contributed to the inefficiencies of utility systems in Bauchi town.

In view of these problems of utility provision in Bauchi town, corporate plan formulation approach through a utility planning committee and the adoption of a cost recovery approach with a clearly defined minimum subsidisation of utilities based on affordability of urban population is suggested to resolve the problems of utility planning and management in Bauchi town.

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CHAPTER - ONE

INTRODUCTION

Utilities like water, electricity and severage disposal systems are basic necessities for urban living which are provided through network systems of pipes and cables. Utility planning and management within a city or region have some physical planning, economic and engineering ramifications, each differing in scope and methodology of operations. These differences which also define the extent of involvement of each sector in the entire planning process, dictates the need for integrated utility plan formulation and strategy identification for its implementation. This integration is to ensure that projects are executed within a comprehensive urban development framework, the master plan. However, this integration has often been difficult to achieve due to ineffective management strategies. Indeed, co-ordination is one of the most difficult but essential tasks in physical development plan implementation. In Nigeria, although the need for this proper co-ordination between urban activity sectors have been recognised and advocated for, (Mabogunje, 1969; Vagale, 1976; Akinade, 1988 and Abubakar, 1990), an efficient machinery to make it effective is yet to be developed in most urban areas. In Bauchi for example, the absence of proper intersectoral co-ordination is partially accountable for the inefficiencies

in most urban activities including utilities provision (Abubakar: 1990). Therefore, there is need for more research in this area so as to evolve strategies for co-ordination.

Of these components of utility planning, physical planning is the foundation on which the economic and engineering elements are based. Although, each of these disciplines is concerned with efficient planning and management of utilities in towns, however, the physical planner should be more interested because of his concern with spatial order, aesthetics, economy, living comfort and the environmentally hazardous effects of inappropriate utility planning and management. This research is derived from this premise.

1.10 THE RESEARCH ISSUE

Over the years, utility planning has been fragmented between engineers skilled in specific fields like water, electricity, and sewerage disposal systems, (Burberry, 1970 and Fadumila, 1983). Physical planners therefore, relied on these professionals to provide design standards and criteria as planning guides for what they regarded as a purely technical affair. This approach tends to emphasise optimal engineering standards and to limit the scope of physical planning in this field to the provision of space to accommodate utility facilities. Furthermore, in this process, the socio-economic implication of utility planning

and management is often stumbled upon only at the stage of implementing the utility plan proposals, (physical development plan implementation). This is a known fact in most urban physical development plans and layout proposals in Nigeria. In Bauchi, for example, most physical development plans (for districts and neighbourhoods) are prepared without the cost analysis of the provision of utilities like water and electricity and its implication to the people, or property developers and the responsible management agencies being reflected. Consequently, proposals for residential development have achieved only about 31% level of implementation (Abubakar, 1990:P.99).

Considering the nature of activities involved in the provision of utilities, this narrow engineering approach and the misconceived scope of physical planning can hardly be effective. Therefore, this absence of a systematic and comprehensive approach to urban planning from master plan to subject plan level, partly explains the inefficiencies in urban utility planning and management.

In Nigeria, most research work in this area have mainly centred on normative judgements in plans for the development of urban utilities with little efforts on the coverage and appraisal of what had happened after a project is executed and put into operation, that is the management aspects. These include the works of Fadumila (1983) and Sani,(1990). In these studies the management implication

of the success of utility schemes and their continuous operation were not considered. This has therefore, contributed to the inability of city planners and management authorities to comprehend clearly the scope of potentials and constraints in areas of urban utility provision in Nigeria.

In Bauchi, as in many urban areas in Nigeria, utilities are not only inadequate and inefficient but also hardly accessible in some areas. The distribution networks are haphazard and insufficient in areal extent to effectively deliver utilities to all the town's population. Furthermore, there seems to exist little co-ordination between the activities of the various participants responsible for the planning and management of utilities in the town. These problems of urban utilities have persisted over the years and may even worsen unless rational innovative strategies are evolved to resolve them. This therefore, forms the focus of this study.

1.20 AIM AND OBJECTIVES OF THE STUDY

1.21 Aim

The aim of the study is to assess the planning and management of urban utilities in Bauchi town as a basis for making appropriate recommendations for effective provision of urban utilities. The study is therefore, an attempt to examine the role of physical planning and

management strategies in the process of urban utility provision using Bauchi town as a case study.

1.22 Objectives

(a) To highlight the importance of utilities in urban development.

(b) To review the physical planning and management strategies for the provision of urban utilities.

(c) To investigate the planning and management of urban utilities in Bauchi town.

(d) To recommend effective planning and management strategies for urban utilities in Bauchi town.

1.30 SCOPE AND LIMITATION

Planning and managing the provision of utilities has physical, economic and engineering ramifications. This study considers physical planning and management of water, electricity and sewerage disposal systems in Bauchi town. The study is however, limited to the following:

i. Physical Planning Techniques

Physical planning techniques as it relates to the spatial organisation of population and landuses into hierarchies of desirable densities and thresholds so as to reduce the unit cost of utility provision per capita. Also to be covered are the provision of adequate space

(easements) to accommodate utility installations and the arrangement of such easements into suitable pattern to facilitate the efficient operation of utility facilities at a minimum cost. The synthesised effects of these physical planning operations on the cost and efficiency of utility provision and its implication to the inhabitants and the management agencies will also be evaluated.

ii. Management Strategies

Management strategies as it relates to co-ordination of activities and resource mobilisation to ensure economic viability of utility agencies to maintain continuous operation to provide efficient utilities to the urban population at a reasonably affordable cost.

1.40 METHODS AND SOURCES OF DATA COLLECTION

1.41 Household Survey

Household survey will be conducted to obtain data on socio-economic characteristics of the inhabitants so as to assess their ability to pay for utilities. This will also be used to examine the availability and level of efficiency of utilities in Bauchi town.

For the purpose of this survey, Bauchi town will be divided into two, namely: the traditional (walled) area and the areas of recent developments outside the wall. This is because of the observed socio-economic and spatial dessimilarities between the two areas.

1.42 Sample Selection

Bauchi town was expected to have an estimated population of 239,352 by 1991 (Max Lock, 1976); and an average household size of 6 Persons. A total of 400 households will be surveyed, representing 1.00 Percent (400 x 6 Persons) of the estimated population of the study area.

This number will be clustered for questionnaire administration based on the area of each ward and its relative population density. This will apply both to the traditional and modern areas.

1.43 Sources of Data

i. Reconnaisance Survey

A survey was carried out to identify utility facilities and their spatial disposition. A landuse inventory was also done aimed at quick assessment of problems and prospects of utility development in the town.

ii. Documents and Literature

Available literature on the subject matter will be utilised in addition to documents from the various Government and Private Organisations in Bauchi. Among them are documents from the Bauchi State Ministries of Economic Planning; Lands and Surveys; Bauchi State Urban Planning and Development Board (BSUPDB); Bauchi State Water

Board (BSWB); Bakolori Nigeria Limited and the National Electric Power Authority (N.E.P.A).

iii. Maps and Layouts

These will be used to examine design orientation, sizes of plots and utility easements in Bauchi town.

iv. Questionnaire Administration and Interview

Questionnaires will be administered to the management of various utility agencies. The purpose will be to obtain data on the mode of operation, level of inter agency interaction and general proposals and problems encountered.

Informal interview with staff and professionals in the field of utility planning and management will be carried out continuously during the period of field work for the study.

1.50 DATA PRESENTATION

1.51 Maps, Graphs and Tables

Maps will be used to show the existing utility systems, their spatial pattern and their relationship with relief and topography.

Graphs and charts will be utilised to express the demorgraphic characteristics of the inhabitants in Bauchi town.

1.52 Photographs

Photographs will be employed as visual aids to show some of the conditions or characteristics of utility supply systems in Bauchi town.

1.60 CONCEPTS AND DEFINITIONS

1.61 The Term Utilities

Utilities, services, and facilities have diverse connotations both in literature and professional usage. However, the general concensus is that services are the intangible products utilised by people, and utilities the tangible products delivered in pipes or cables (Onokerhoraye, 1980). On the other hand facilities are the physical components or media used to deliver services or utilities. With this concept, water, electricity, etc., are utilities (Farris and Sampson, 1973); health, education, sewerage system, etc., are services, while hospitals, schools pipes and cables are facilities (Onokerhoraye: Op.cit).

In physical planning, these elements are generally classified into two; with utilities and services as interchangeable terms while infrastructure is used to describe facilities characterised by a fixed point location. These include facilities like schools, hospitals and clinics. In this thesis, the simplified perspective is used. That is to regard utilities to also mean services. Urban utilities are therefore, the basic

necessities for urban living, as required by people in all classes and for smooth operation of all urban activities. These include water, electricity and sewerage disposal systems.

1.62 Strategy

Strategy is a schematic blue print designed towards attacking a particular problem. In this study, it is conceived as the operational methodologies within the process of urban utility planning and management. They are therefore, a combination of means and approaches within the process of urban utilities provision.

1.63 Utility Management

Management is the process of resource acquisition and co-ordination to accomplish a set of planned objectives. In this study, it entails the mobilisation of resources and co-ordination of activities in the process of plan formulation and execution of utility projects and also to maintain their continuous operation efficiently. This implies the adoption of a policy (either public or private) in relation to effective co-ordination of activities and the effects of their economic policies on the accessibility of the urban population to utilities.

CHAPTER - TWO

THE IMPORTANCE OF UTILITIES IN URBAN DEVELOPMENT

Water, electricity and sewerage disposal systems, p a key role in achieving societal welfare as well as socio-economic and political growth of a city (Farris and Sampson, 1973). The provision of utilities of optimum desirable standards has profound influence in the economi efficiency and welfare of citizens in every community.

2.10 UTILITIES AND PHYSICAL DEVELOPMENT

The efficient provision of water, electricity and sewerage disposal system is complimentary to a well planned layout to attract physical development and socio-economic activities. Utilities are needed to enhan health, convenience, economy and safety of lives and property in any activity area, the absence of which scare off people, renders areas less attractive and slows the rate of development. This has been one of the factors responsible for the wide gap between the success of implementation and landuse proposals in many urban areas in Nigeria. In Bauchi, for example, many layouts experience little development over the years due to lack of water supply and electricity.

Utilities not only attract people and activities into the city but also influence their spatial location.

Its availability or otherwise decides to a large extent the pattern of landuses. Therefore, it can serve a useful purpose for planners to manipulate and effect spatial organisation of activities. This will ensure efficient physical development in all segments of the city. However, unplanned provision distorts plans and the phasing of developments within the city. For example, satellite settlements are used as strategies to control densities and decongest core areas in cities in developed countries. The strategy is less effective in developing countries largely due to lack of planned provision of utilities. In Nigeria, most of these sattelite settlements are not supplied with utilities to make them attractive for the needed investments in housing, industries and commerce and are therefore, not viable enough to sustain the level of activity needed for urban living.

The absence of or insufficient consideration for utility provision in urban planning has been costly and often inpracticable to rectify. Attempted schemes have been accompanied by high socio-economic cost in the form of social displacement and cost of urban renewal or upgrading. In Nigeria such schemes like the Bauchi urban renewal 1978 and Katsina storm water drainage 1991, are associated with high construction costs.

2.20 UTILITIES AND URBAN ECONOMY

The availability of utilities attracts people with talents and capital into a city. This facilitates growth in productivity and incomes of citizens and their nation. The availability of water and electricity promotes the growth of industries and commerce, and the multiplier effects of these are increase in employment opportunities and more income to the urban population.

"No economy can progress without good supply of utilities" Farris and Sampson (1973:P.7). Power, water supply and telecommunication are needed in the process of production and marketing. Indeed, telecommunication is the life line of modern business. Inefficiencies in utility systems retards the rate of economic growth and urban development.

A properly planned and managed sewerage disposal system is an economic resource. Human excreta is used as manure to restore soil fatility and increase crop production. In China decomposed faeces have been applied on farm-lands as manure, (Oluwande, 1978:P.1). Many biogas plants rely on faeces as one of the sources of raw materials in the Phillipines; Bangladesh; Indonesia; Sri-Lanka and China (United Nation, 1982:P.485). In China alone about 8 million biogas composing plants existed in 1979 (El-Hinnawi and El-Gohary 1981). This is a source of employment for citizens and increased income for farmers.

Treated sullage waters can be utilised for market garden irrigation near urban areas. The provision of efficient utilities raises environmental quality and land rent. This has been utilised to attract investment and redistribute income in urban areas.

2.30 UTILITIES, URBAN HEALTH AND SANITATION

The manner in which utilities are supplied, used and the resultant waste disposed is one of the most significant factors in the health of citizens in an urban area. Efficient water supply improves sanitation and raises environmental quality. As Walker (1978:P.2) noted, "these and other services increase life expectancy and reduce mortality rate". Lack of sufficient potable water, well drained and waste free living and working environment precludes the attainment of good health. Indeed, one of the greatest barriers to a healthy and productive growth of a community is the insufficient supply of basic utilities like water, electricity and sewerage disposal systems. Insufficient utilisation of potable water expose people to a number of parasitic disease organisms, for instance, in areas where safe water may not be easily accessible or its use is restricted by high charges by vendors.

Poorly disposed sewage and sullage wastes pollute water and contaminate food as well as spread viruses and

bacteria. Improperly disposed faeces increases the possibility of infection by a wide margin. This is greater in areas where untreated sewerage finds its way into water reservoirs used for domestic chores. Insanitary disposal of faeces is a major cause of infant diarrhoea, gastro intestinal diseases, cholera, and schistosomisis. A significant association has been established for mortality from diarrhoea and lack of potable water in the metropolitan areas of Southern Brazil (W.H.O., 1991:P.7).

The absence of or an insufficient drainage of surface water results in waste water accumulation. This creates water ponds and often leads to floods in cities. Water ponds are agents for vector breeding and disease infection while urban floods are associated with erosion of roads, undermining of building foundations, contamination of water reservoirs and heavy loss of lives and property. For example, the river Ogunpa flood disaster in Ibadan was accompanied by losses to lives and property worth millions of Naira. The incidence of Malaria is noted as one of the serious single killer disease in most of Africa (United Nation, 1982:P.358). It accounts for the death of about one million children per annum in this continent and about 200,000 in Nigeria alone.

The frequent disease epidemics in many developing countries of the world, have often been associated with

unplanned rapid urban growth and the deterioration of efficiency of urban utility provision. For example, cholera epidemics in 1991 has claimed the lives of many citizens in these nations. In Peru, Latin America about 1,100 died of the attack in 1991 (V.O.A., 26th April, 1991). Other countries are Zambia 5,000; Chad Republic 8,000; and Cote'de Voire 602. For African continent the total estimate was 12,000 death as at October, 1991 (B.B.C. 26th October, 1991). In Nigeria, although official figures are not available, it is known fact that many people died of cholera attack in Katsina, Kano, Bauchi, Kaduna and a host of other States, between January to October, 1991. Urban water supply and waste management is largely accountable for these incidences.

There is no doubt, the modern urban society is greatly dependent upon utilities, hence to do without it is almost impracticable. This is a known fact when utilities supply is interrupted. Therefore, the foundation of any forward looking and effective town planning is adequate provision of utilities (Fadumila, 1983). For harmony in growth and development, utilities of minimum acceptable standards must be provided in all the segments of a city at an affordable tarriff.

CHAPTER THREE

STAGES OF, AND APPROACHES TO URBAN UTILITIES PLANNING AND THE ROLE OF A PHYSICAL PLANNER

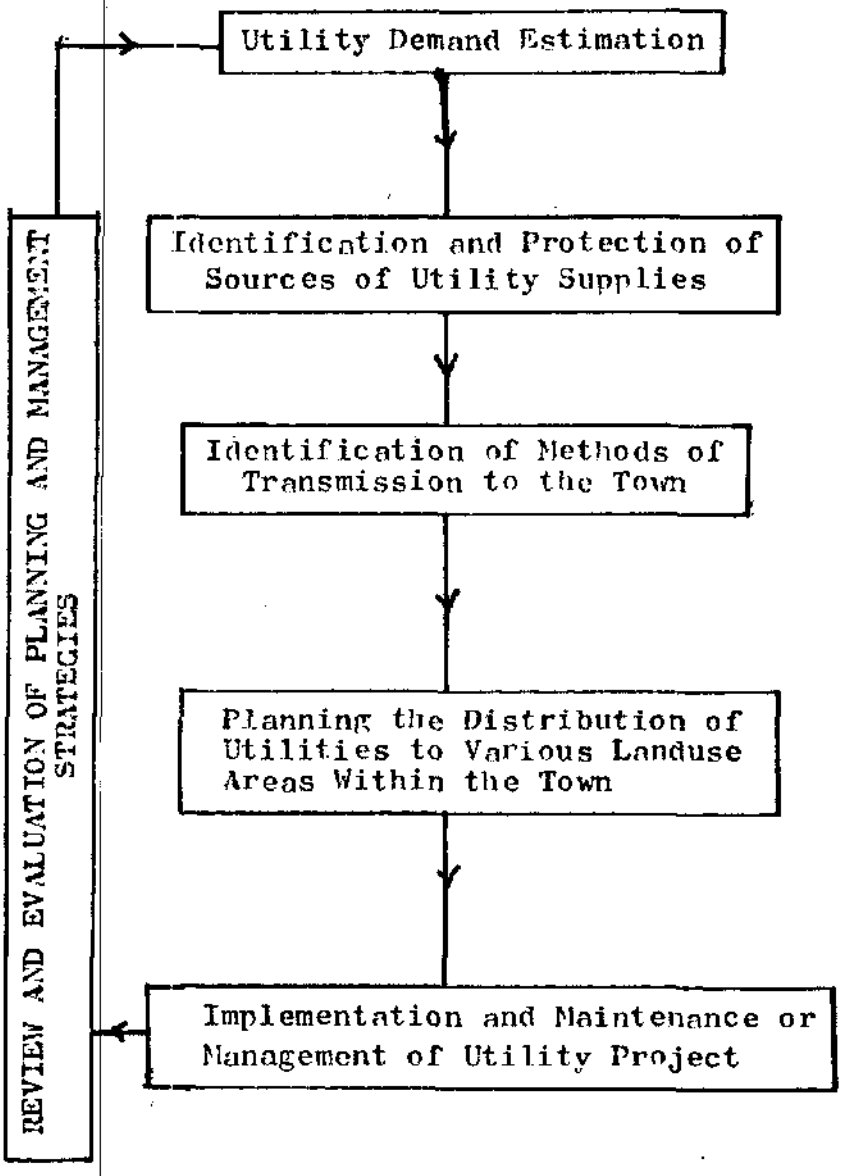
In chapter one by which this study was introduced, the utilities like water, electricity and sewage disposal system whose planning and management form the focus of the study were noted. Chapter two, discussed their role in urban development. In chapter three, the stages of utility planning will be described and, within each stage, the approach generally adopted will be examined and the role of the physical (Town) planners as it relates to landuse planning techniques and the provision of efficient utility systems will be described.

3.10 STAGES OF UTILITY PLANNING

Planning the provision of water, electricity and sewage system in urban areas normally involves the following stages (Fig. 3.1).

The stages involve the estimation of water and electricity demand and the quantities of sewage and sullage to be disposal of and, their categorisation based on landuse and population characteristics. They also include the forecast of growth trend and development in demand. This is followed by the identification of sources of water and electricity supplies and their protection and also the identification of suitable disposal sites for the sewage system.

FIGURE - 3.1: Stages of Utility Planning



The next stage is planning the extraction of utilities at the source. This is followed by the identification of methods of delivering utilities (like water and electricity) from the source to the town and its subsequent distribution to the various landuse areas within the town. While in the case of a sewage system, it involves the collection and transmission of sewage and sullage wastes from landuse areas in the town to a suitably selected disposal site. The next stage is the implementation and maintenance of utility projects and review and evaluation of strategies in these stages as may be required to accommodate changes and innovations.

3.20 APPROACHES TO URBAN UTILITIES PLANNING AND THE ROLE OF A PHYSICAL PLANNER

Within each of the stages outlined above, specific steps are taken by the various professionals concerned with utility provision in towns. These steps and the role of physical planning will be described in the following sub-sections:

3.21 Determining the Demand for Urban Utilities:

As shown in Fig. 3.1, the first stage or step towards the planning of urban urilities supply is to determine the present and future demand by the residents of the town.

1. The Case of Water Demand:

The demand for urban water is determined based on the average quantity consumed by each resident per day for domestic uses (like cooking, drinking, and washing) and non-domestic uses (like industrial, commercial and recreational purposes. Therefore, the total demand for water in each area of the town is evaluated based on the population characteristics, viz; the number and their requirements for the various landuse activities in the town. Water engineers use this information to determine the sizes (capacities) of network facilities to be installed in each area.

ii. The Case of Electricity Demand:

The demand for electric power in towns is evaluated through a similar process to that of water. First is to determine the average power consumption per person per day, including domestic and non-domestic uses. This is followed by demand categorisation into power requirement for activities in each landuse area of the town. This serves as a basis for determining the capacities of electric power distribution transformers to be installed in each area.

iii. The Case of Sewage Disposal:

In the case of sewage disposal system, the first step is to estimate the quantities of sewage and sullage waste discharged in each landuse area of the town. This is normally based on the amount of water consumed. This is estimated to be about 80% of the total water supply to an area.

In these exercises, the town planners' roles are tied up with the planning scheme for the town. For example, the pattern of growth in the demand for utilities depends to a large extent in the increase in population and landuse activities, while the cost of installing network facilities depends on the extent of landuse coverage and that of extending these facilities (to integrate new developments) is influenced by the rate of spatial expansion in towns respectively. Therefore, the physical planners as custodians of landuse information and the architects of spatial development proposals are to make these data available to the engineers to enable proper evaluation of existing and future demand for utilities and the sizes (capacities) of their required facilities, in addition to the formulation of the cost which the provision and its growth might entail. This shows the importance of physical planning as one of the data bases for evaluating the required inputs and their cost for effective

planning and management of utilities in towns.

3.22 Identification of Sources of Utilities Supply and Method of Their Protection:

When the quantity of utility to be demanded has been determined, identification of reliable sources of supply follows. These are usually those alternative sources with the potential to satisfy demand at a minimum cost.

i. The Case of Water Supply:

Surface and ground water reservoirs are the two sources of urban water supply. Through geophysical surveys of ground water acquifers and hydrographic analysis of surface water reservoirs an alternative source with a reliable quantity of water to satisfy demand is identified. After a reliable source has been established, identification of method of extraction then follows. These are aqueducts and dams for surface water; and boreholes and shallow wells for ground water reservoirs.

Ground water reservoirs are nroamlly of good quality. However, in fissued rock strata with fluctuating water table, infiltration rate is high, and pollutants (like dissolved chemicals, sewage and sullage wastes) easily flow into surrounding water

acquifers. To protect water reservoirs from pollution a set back of between 30 and 50 meter radius ring from boreholes and between 15 and 30 meters from shallow wells is maintained as a development free zone. Boreholes have limited yield, usually just enough to cover the population of a neighbourhood. Therefore, multiple number of boreholes are required for urban water supplies. This number increases as the population grows. The setback performance standard is low in many urban areas due to this large number of boreholes and the numerous competing uses for land and also the high urban land rent. Besides this, the use of boreholes require electric power to operate water pumping plants and also some operation and maintenance staff. These additional overhead cost to the system, often renders ground water sources economically unfit in urban areas.

Surface water reservoirs are also vulnerable to pollution. Storm water introduce refuse, mud and silt into water reservoirs and disolved sewage and chemicals wastes also flow into surface water reservoirs. To prevent this pollution about 1 kilometer setback (as development free zone) is maintained from surface water reservoirs. Surface water reservoirs are more reliable and one project can cover the entire population of a town or region. In the extraction of surface water the

projects are often designed to serve multiple purpose. For example, a dam constructed to supply water for a variety of use like domestic, industrial, farming and also generate electricity or control flood. This integrated utilities project for large scale supply to cover a town or region minimises duplication of projects and reduce the cost of operation and management. It also allows comprehensive development of utility resources for optimum socio-economic benefits.

ii. The Case of Electricity Supply:

The sources of electricity supply are hydro power generation, thermal and nuclear. Through drainage basin analysis potential hydro power generation locations like rapids and water falls are identified while thermal and nuclear sources depends on the availability of raw materials (like uranium) and high level technology for their development. To protect urban dwellers from the dangers of high tension electric power transmission lines and accidental explosion of electric power stations, about 100 meter setback is maintained between activity areas and power transmission lines and power stations are normally located at the urban pheriphery and away from industrial areas.

Nuclear electric power generation plants produce toxic wastes and thermal stations are associated with heat

emission. These are sources of environmental pollution. However, hydro power generation system has less negative environmental impacts. The dam project can be designed to serve multiple purpose use. For example, a hydro power dam to also supply water, control flood and use as a tourism centre. This reduces the cost of utility provision and ease management.

iii. The Case of Sewage Disposal:

The individual household or insitu disposal and infiltration method and the convential or piped network disposal system are the alternative methods of sewage disposal. Suitable sites for treatment and disposal of sewage are identified based on the analysis of soil condition and wind directions. To prevent the infiltration of sewage into water reservoirs setbacks are maintained between pit toilets and wells.

The conventional network sewage system is the most efficient in urban areas. This is because household (sullage and sewage) wastes are collected and transported to a carefully selected location for treatment before disposal. However, the conventiaonal sewage system requires an extensive network of sewer (pipes) for collection and transportation of sewage to treatment and disposal sites. The cost of sewer pipes and the treatment plant are high and requires hard currency to

import. This renders the system less feasible in many developing countries. Furthermore, the system requires uninterrupted water supply, which is "about 27 litres per person per day" Oluwande (1978, p. 44), for effective operation. In Nigeria, most urban water supplies are inadequate and intermittent. Therefore, the use of conventional sewerage system is likely to increase water shortage and also create environmental nuisance. Furthermore, economic constraint is a barrier to the system construction in most urban areas in Nigeria. However, the total construction cost is reduced by about seventy percent if domestic materials are utilised to manufacture sewer pipes locally, (Oluwande, 1978). Therefore, the conventional sewage disposal system is feasible when water supply is efficient and sewer pipes are produced locally.

The individual household or unsewered sewage disposal methods like pit latrine, and water closet are popular in most urban areas in developing countries. The method is cheap to construct, and simple to operate. It is also efficient provided construction is executed to minimum standard and sewage is disludge as required. However, the water closet also requires adequate and uninterrupted water supply and the pit latrine has no provision for sullage waste disposal. These are limitations to the use of this methods for sewage disposal

in urban areas in Nigeria. An improved non network method is "the aqua pury." It operates without piped water for flushing and requires a minimum of about four litres of water per day. The system is sanitary and efficient and twice less expensive than the water closet. It can be designed to cater for both sewage and sullage wastes. The system is worth trying in Nigeria to minimise the environmental (sanitation) problems associated with water shortages and sewage disposal practice in urban areas. The non network sewage disposal method is more feasible in Nigeria because it has low construction cost and ease of maintenance. Moreso, it requires little municipal authority involvement. It is also suitable (particularly the aqua privy) where water is used for anal cleansing as is the practice in most parts of Northern Nigeria.

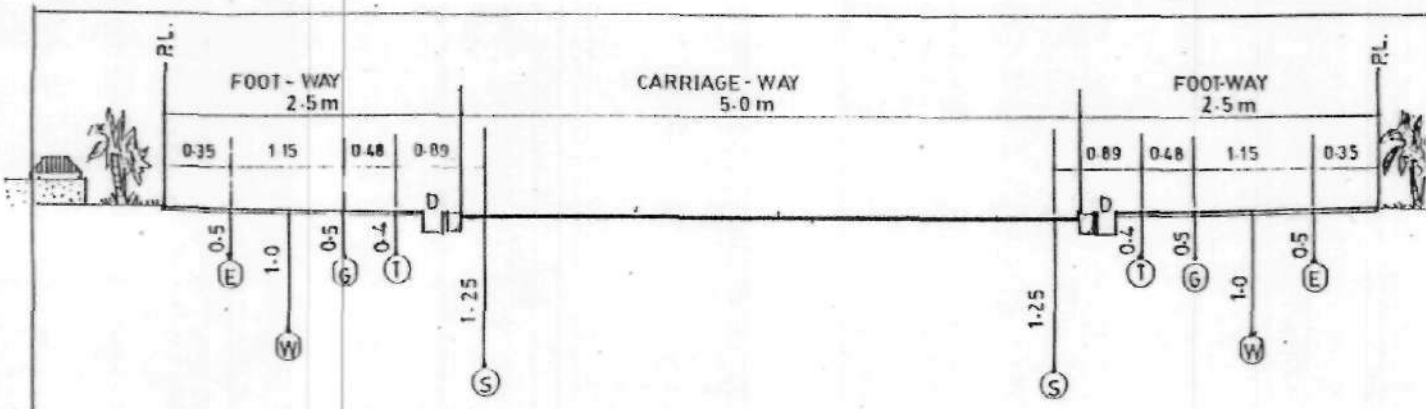
The preceeding discussion shows that in identifying sources of utility supply, most of the operations are mainly engineering. However, planning the protection of utility sources largely depends on physical planning techniques to provide and maintain standard setbacks (or development free zone) through landuse control and management policies.

3.23 THE DELIVERY AND DISTRIBUTION OF UTILITIES IN TOWNS

There are two approaches to the transmission of utilities. These are either the underground or overhead systems. In whichever form they exist, utility facilities require space of some minimum standards and orientation in relation to relief and topography in order to achieve efficient distribution and to minimise construction and operation cost of the system. In this sub-section, the role of physical planning is to be examined with regard to landuse planning and the spatial arrangement of utility corridors to satisfy these engineering requirements.

i. The Provision of Adequate Utility Corridors:

A minimum space between 2.5 meters (for underground system) and 4 meters (for overhead system) is required to accommodate utility facilities, (Fig. 3.2). The physical planner caters for these provisions in area development plans to accommodate the facilities required for immediate use and also the need for their future extension in the town. The absence of this provision or insufficient consideration of these requirements are costly to rectify and often impracticable. For example, it may entail demolition or renewal exercise in a large scale to create easements. Therefore, the provision of adequate space to accommodate utility systems is one of



LEGEND

ELECTRICITY . . E	TELEPHONE . . . T	NOTE: THE MINIMUM DESIRABLE UTILITIES RESERVATION IS 2·5 METER.
WATER . . . . W	SEWERAGE . . . S	
GAS . . . . G	DRAINAGE . . . D	ALL DIMENSIONS ARE IN METER.
PROPERTY LINE P.L.		

Fig 3·2 CROSS SECTION OF A UTILITIES DISTRIBUTION NETWORK.

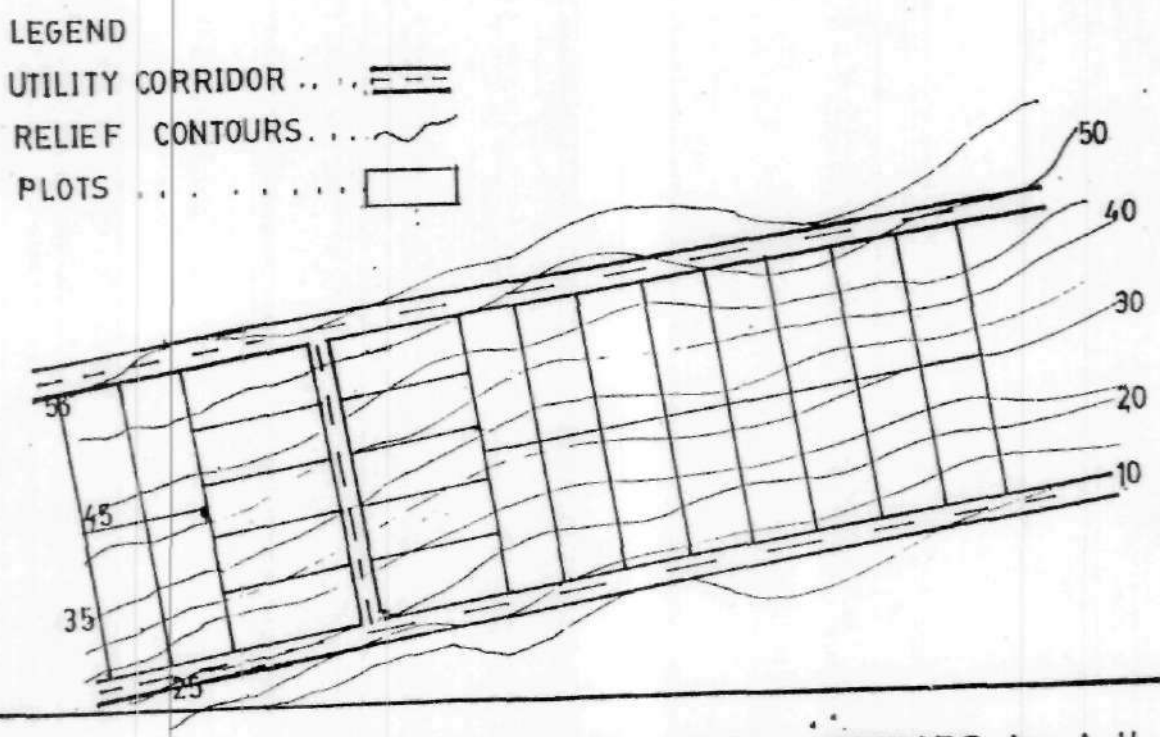


Fig. 3·3 DESIRED ALLIGNMENT OF UTILITIES CORRIDORS TO RELIEF CONTOURS AND TO PLOT ORIENTATION.

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the roles of physical planning in achieving efficient utility distribution. Furthermore, effective development control is necessary to ensure that facilities are alligned in accordance with design proposals to prevent encroachment of one use category or facility into the space reserved for another. The absence of this results to haphazard utility network and inefficiency in the distribution system.

ii. Spatial Orientation of Utility Corridors

The integration of relief and topography in planning the location of utility corridors (in layout designs) enhances the efficiency of facilities in the distribution network and also minimises both the construction and operation cost of the system. For example, in water distribution system, the use of hills and knolls as footings reduces the cost of elevating storage reservoirs to achieve natural flow by gravitation. Furthermore, when utility corridors are alligned as parallel as possible with relief contours (Fig. 3.3), the force required to maintain adequate pressure in pipes reduces. This minimises the need for mechanical pumping to aid flow in pipes for water distribution and sewerage disposal systems. The anticontour allignment of these pipe networks increase the force required to maintain efficient flow in the network system. This introduces

additional cost of operation and inefficiencies into the system in for example areas where high pumping pressure is employed to overcome frictional force in pipes as a result of steep relief. High pumping pressure results in frequent fracture and leaking in pipes. "A fractured pipe of diameter 0.33mm leaking at 50 pressure seconds per 0.33mm (pipe length) losses about 600,000 litres of water per day", Sleeman (1953, p. 20) and fractured sewers releases effluent to create environmental nuisance and pollution. Furthermore, leaking pipes create low pressures and reduce flow of utilities in the pipes. This increase with distance to create undersupply or dry pipes in advancing areas.

Utility networks are laid under the ground mainly for protection and environmental aesthetics. Pipes for the supply of water and sewerage disposal need protection against the weight of pedestrian movement and the vibration effects of road traffic in utility easements. However, where easements are arranged along steep slope (direction), soil erosion sets in to undermine this protection function through a gradual removal and unconsolidation of the soil layers. Eventually, the pipes are either exposed (plate1&11) or the ability of the soil to protect the pipes is reduced. This result to pipe fractures and inefficiencies in the systems and other associated problems as earlier noted.

The Effects of Soil Erosion on Water Supply Pipe Network



PLATE - I: Pipes Exposed through Soil'Erosion

NOTE: The Water Loss from Leaking Pipe and also Causing Obstruction to Traffic.



PLATE - II: Pipes Exposed to the Weight of Traffic and Human Temper (especially by children).

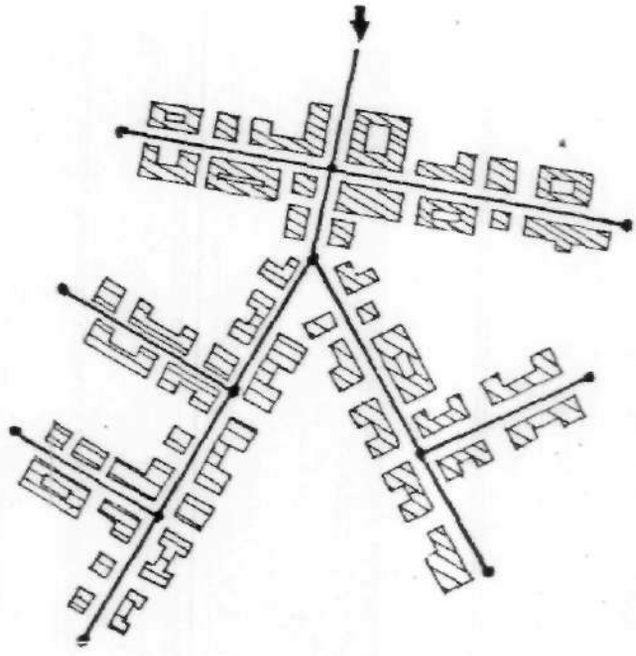
iii. Pattern of Utility Corridors:

Utility networks are either laid in a grid, looped or radial pattern, Fig. 5.4. In the loop and grid distribution system, consumers can be supplied from more than one direction. These networks are most efficient for water and electricity systems because continuous supply is ensured in an event of damage to one part (or direction) of the network. This is much needed in urban areas in Nigeria, where frequent interruption of utility supplies to effect repairs are common. For sewerage disposal system, radial network is effective in areas with gentle slopes. However, in areas with steep slopes interception method is the most effective.

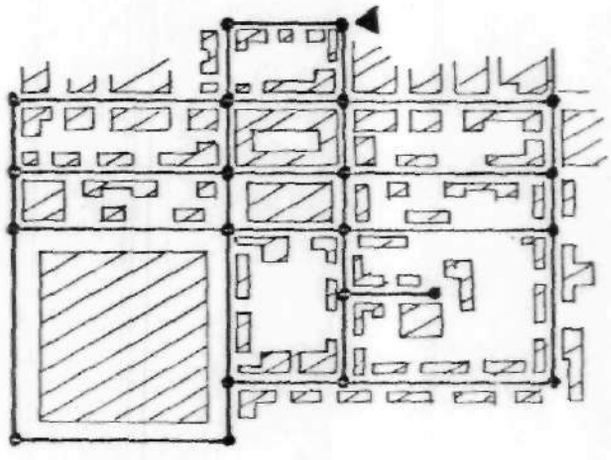
In these exercises, physical planning skill is required in layout design to arrange easements in appropriate pattern (as may be required by the engineers) to facilitate the installation of a suitable network for efficient utility systems.

iv. Landuse Density and Affordability of Utilities to the Population:

The concentration of population to form optimum desirable densities in landuse areas brings economies of scale to utility provision. As density increases, the cost of utility facilities decreases when expressed as



I. RADIAL NETWORK PATTERN.



II. LOOPED OR GRID NETWORK PATTERN.

Fig. 3.4 PATTERNS OF UTILITY NETWORK.

unit cost per person or per landuse elements. However, plot size determines to a large extent the net density in an activity area. Therefore, physical planning contribution in the design of minimum plot size for judicious use is important in reducing the cost of utility provision per capita, so as to increase affordability of utilities to the population. However, social acceptability is as important in deciding plot size as is the need to achieve economies of scale in utility provision (Dar Al-Handasah, 1978). Densities which deviate significantly from social norms are not likely to be acceptable to the society. However, the norms for a society varies with the level of urbanisation. For example, "residential densities of up to 590 persons per hectre in Alexandria in Egypt and as high as 800 persons per hectre in Hong Kong" Dal Al-Handasah (1978, p. 62) are acceptable because of the social respect for privacy within the home. Therefore, artificially created densities are difficult to enforce at the stage of physical plan implementation. There is thus a limitation in utilising densities (solely by reducing plot size) to achieve affordability.

Plot orientation as it relates to utility corridors is also important in reducing the cost of network facilities per plot. Arranging the shorter sides (widths) of plots to face utility corridors reduces the average

length of network facilities required to service a plot (Fig. 3.3). This increases the number of people to be covered per unit length of network facilities and generally bring economies of scale in utility provision. The spatial orientation of a series of plots of a given size affects the cost of utility provision. However, this is the responsibility of physical planning as is expressed in the skill and standards of layout designs.

v. Density Control and Network Efficiency:

Population number and landuse characteristics are the basis for utility demand evaluation, (refer to section 3.11). Physical planning seggregates and organises landuse activities into planning areas to form hierarchies of population densities. Based on the optimum densities expected in each heirarchy when it is fully developed, ultimate demand thresholds for utilities are analysed and facilities of required capacities are installed for efficient distribution of utilities. However, failure to control developments and densities, so as to limit demand within the installed capacities of network facilities leads to over-utilisation. This will overstretch the utility systems and render them inefficient. For example, overloading of transformers leads to low electric current and in the case of pipe mains, it creates undersupply. The physical planner, has a greater role to play in

controlling densities, by allocating plots of minimum size to avoid subdivision. Plot fragmentation is associated with overprovision. This affects demand for utilities in two perspectives. It increases the numerical densities beyond the expected population and secondly, it may create changes in landuse characteristics. These increase demand above the necessary provision. For example, a change in landuse from residential to commercial can increase water demand by about five times. Therefore, a comparative analysis between the demand characteristics of the existing and proposed landuse is necessary in a situation where change of use is desirable.

In most urban areas in developing countries, utilities are supplied with preference to those groups with political leverages. These include the rich, the power brokers, and the elites. These social groups normally reside in the low density residential areas. Therefore, utilities are often unevenly distributed between social areas in the town. This is more severe in a situation of shortages. However, the integration of social groups would ameliorate this situation. For example, by designing mixed density residential layout. Furthermore, these social groups have the economic and political control, hence influences the provision of the distribution network. Therefore, the integration of social groups in design can facilitate the extension of

utilities to the less affordable areas and people. This can be achieved, if the need to maintain minimum seggregation in the layout to reflect socio-economic status is considered.

It is important to note that the ultimate aim of utility planning is to achieve optimum provision at a minimum socio-economic cost. However, to attain this status, co-ordination of activity systems in plan formulation, implementation and in the operation of projects is obligatory. This calls for an effective management strategy or modus operandi. Therefore, the next chapter centres in review of management strategies.

CHAPTER - FOUR

URBAN UTILITIES MANAGEMENT STRATEGIES

An analysis of the nature of utility management strategies under different social institutions is essential in order to uncover the reasons why efforts in many developing countries by both Government and utility planners to eliminate inefficiency in urban utilities sector have had little success. The conception is that social and political institutions and policies affect the perception, function and operations of utility management or managers. For instance, social and political policy affects the level of co-ordination and scope of operations in utility planning process and also the management approach to resource mobilisation for implementation and maintenance of utility projects. Therefore, the review centres on the relative ability of management strategies to achieve co-ordination and ensure economic stability of agencies to deliver efficient utilities at reasonable tarriff to the urban population.

Basically, there are two types of utility management strategies, namely; private and public utility systems. However, based on economic policy approach there can be three management strategies. These are, free market profit oriented private companies, public corporations with

subsidisation approach, and public commercial corporations operating on cost recovery but without emphasis on profit making.

4.10 THE PRIVATE UTILITIES MANAGEMENT STRATEGY

These are profit oriented utility companies. They operate on free market mechanism to make optimum profit. In many parts of developed countries, private companies supply water, electricity and sewerage disposal systems on user charge basis, as is found in the capitalists economy. In the United States of America and the United Kingdom, private companies were the pioneers of large scale utilities supply. "In 1799, Mahattan Water Company was incorporated by Aoron Burr and Alexander Hamilton to supply New York city with piped water, and in 1975 Aqueduct Corporation supplied water to Boston city" Muhammad (1981 P:13). In England and the Wales there were about 130 private utility companies in 1953 (Sleeman, 1953). However, at about 1902, the importance of utilities in economic growth and national development increased, so the demand increase beyond the capabilities of private firms. Therefore, the need for public sector participation was recognised and initiated to increase supplies, regulate charges and maintain quality. Although, private utility companies continue to operate in these countries, however, a machinery to control their operations is highly developed

and firmly vested in the Government so as to safeguard public interest.

Private utility companies are noted for their effective management operations to enhance growth and efficiency. This is much needed to cater for the expanding demand for urban utilities in the developing countries. However, in Nigeria, as in many countries in Africa, the income of some urban inhabitants are low, the legal system inadequate and urban management machinery not comprehensive enough to protect the interest of the urban poor. Therefore, fears are expressed that any unqualified operation of free market mechanism may defeat the objective of equal access of basic utilities to the urban dwellers.

4.20 <u>The Public Statutory Corporation Management Strategy With Subsidisation Approach</u>

These are Government parastatals set up mainly to provide essential utilities and services. They exists in many parts of the world as social welfare institutions to provide subsidised utilities to the population.

In Britain, United States and Scotland urban utilities were largely provided by the Government. Although, in Britain and United States of America, private companies pioneered the supply of utilities, however, the Government became actively involved to increase quantities, control operations and safeguard public interest as well as ensure

equity in distribution to the population. In Britain public water supply became largely a function of the Government and her agencies as from 1902 (Sleeman, **1953).** This was in response **to increasing demand for utilities and** also to extend supplies to (less economically viable) areas that fail to attract private utility companies. Furthermore, utility undertakings are long term investment (projects) with large scale capital requirements and a slow rate of profit turnover» hence are hardly attractive to private investors. This is because of the huge capital requirement and also the numerous competing alternative uses with higher or faster rate of profit turnover, especially at the infant stage of economic development in most countries. Therefore, Government participation **is necessary** at this stage., In recognition of this, import a'nt participatory role, in United States of America, the Government financed most of the water supply projects (Farris and Sampson, 1973), a|id budgetary expenditure on utility projects was "more than 10 million Dollars between 1956 and 1965" Muhammad (1981, P:l3). In Nigeria, for example, alternative business ventures like transport and commerce have less capital requirement, and high or fast rate of profit returns than utilities. Therefore, utilities may not attract the needed investment from private sector to keep growth ip pace with the demand requirements. More so, shortages exists in the supply of utilities because of the rapid increase in demand due to urban growth and industrial

development. Therefore, Government investment is needed to increase production and expend facilities to cover more people and areas.

"In Scotland", observed Grieve (1972, P.30) "in various regions public corporations have achieved between 90 and 97% household connections in the provision of water, electricity and sewerage disposal systems. Utilities are operated with some level of monopoly to achieve efficiency and optimum resource utilisation. However, the protection of public interest from the adverse effect of monopoly is necessary. It is public corporations that makes it convenient for the Government to control and regulate the operation of urban utilities. Equity in access to utilities in urban areas is fundamental in the developing countries, because of the weak urban economic base. In Nigeria, for example, the economic base, in many urban areas is not developed to a position to guarantee all inhabitants access to basic utilities on a free market economy. Therefore, the unqualified adoption of free market strategy, may seggregate provision or even lead to cuts in the supply of basic utilities in some areas and to some people.

Public utility managements often attract sympathy and contribution from private and public organisation and philantrophic individuals. In the United States of America, for example, Benjamin Franklin, donated £100,000, in 1789

to be expended on Public works. These include water supply project for Philadelphia and Boston cities. J. B. Kirkwood, also built a water filter for Paughkeepsie, New York in 1871 (Muhammad, 1981). In Nigeria public launching and donations have been employed to generate funds for public industrial development projects, education, social welfare, and sports activities. Therefore, the extension of this to areas of utilities development is worth given a trial.

To ease co-ordination and minimise managerial overhead cost, public corporations are often arranged to plan and finance utility project on a joint venture basis. However, it is public ownership of utility systems that facilitate the adoption of the corporate management strategy, because of the shared objective of social welfare. Therefore, regional Government or neighbouring municipal authorities easily pull resources together to finance a single giant project to supply water, and electricity in bulk to their citizens. In England and the Wales, United Kingdom, the strategy has proved effective, in managing urban utility provisions. In 1953, about 90% of the total population in Britain had access to piped water (Sleeman, 1953). The strategy has encouraged the participation of local and smaller municipal councils in areas of utility supply. For example, the Derwent Valley Water Board supplies bulk water to Norttingham, Shieffield and Derby and the Metropolitan Water Board covers most part of London area, serving a

population of over six million. Joint financing and management is worth studying for possible application in Nigeria, since individual local government authorities can hardly undertake large scale utility projects.

Corporate utility planning and management approach minimises construction cost and reduce administrative overhead cost. It also ensures co-ordination of operations to make utility systems efficient. Furthermore, the strategy provides a platform to co-ordinate utility planning and management as may be required in urban areas controlled by multiple local councils in Nigeria.

Joint management strategy, encourage the formation of regional and local utility committees. This allows interaction to dessiminate knowledge, share field ideas, expose local problems and their innovative solutions. In Britain and other parts of the world, the strategy has facilitated effective planning and management of utilities provision. For example, there were nine committees in 1944 representing 354 water undertaking in Britain, (Sleeman, 1953). There is need for such strategies in Nigeria, to co-ordinate the diverse activities of urban utility agencies towards the mains objective of planned and phased urban development.

The problems of public corporations are generally traced to emphasis on social service perspective and undue interference by the parent Government, (Manasa, 1991). These create political and bureaucratic hurdles in the process of planning and implementation of utility schemes. As observed in Dallas, Texas, political diversion of water revenues to other city operations dragged the urban water management into debts and render the system inefficient (Graeser, 1978). Graeser agitated a limited liability status for the management to remedy this problem of revenue diversion. In Nigeria, a decline in the flow of funds to the management of urban utilities has been observed over the years (Abubakar, 1990) and political interference is partially accountable. For example, Government budgetary allocation are often diverted before reaching the action state. This is because the service main for delivery of resources from the sources to the management has not been properly secured from leakage. Furthermore, in Nigeria Government parastatals are amongst the obstinate debtors of utility corporations. However, this interference often prevent the use of rational measures like disconnection of supplies to recover huge debts and also ensure prompt payment in the future.

The importance of utilities in the urban support system and its huge capital requirements defines public finance and minimum control of operations as crucial and

necessary. However, lack of adequate resources to cover the need for growth and subsidisation as well as undue interference in utility management operations results to inefficiencies. In Nigeria, the decline in finance (Abubakar, 1990) and the heavy reliance in the Government unforthcoming resources to subsidise utilities has constrained growth and efficiencies in urban utility sector. For instance, only 40% of the £51.69 million, voted for water supply and sewerage disposal projects was expended during the second National Development Plan Period and the Third National Development Plan achieved about 50% execution. Therefore, the quality, quantity, reliability and regularity of utilities supply as well as the extent of spatial coverage of urban utilities provision in Nigeria is below the demand requirement. This is often attributed to the continuous conception of urban utilities as a social service by the government and her citizens. This has rendered efforts to cope with increase in demand and to achieve efficiency in utilities provision with little success.

The degree of plan execution depends to a larger extent on the amount of co-ordination and integration of ideas in both the planning and implementation stages. However, in many developing countries, bureaucratic policies make co-ordination between several (Government) agencies difficult. Government management often regard

horizontal consultation as sub-bordination. This lengthens plan formulation and implementation process, cause duplication of efforts and wastage in resources. For example, in Nigeria delays in plan implementation make the proposals obsolete and unfeasible because of the rapid change in socio-economic elements like population growth and inflation rate. Thus, the entire plan may need a review.

4.30 The Public Corporation Management Strategy: With Cost Recovery Approach

These are Government Corporations that operate mainly on cost recovery basis. They are set up by the Government to provide utilities but the management is granted more independence, in operation and use of funds, than a typical public corporation. Here, management can draw up policies and implement quick innovative decisions without going through much of the Government bureaucratic processes. However, operations must be within Government general policy guidelines. This management strategy is an intermediate (mid-way) between a public corporation with subsidisation approach and the private limited companies with profit motive. This management approach ensures more freedom of operations, some degree of Government control and does operate to make profit. Therefore, it shares the advantages of profit oriented management strategy and that

of public corporations with subsidisation policy. This is much needed in Nigeria to enhance growth and safeguard the interest of urban poor. Furthermore, the management often looks up to the parent Government for technical and financial aid to execute large scale utilities project.

The Government serves them as guarantor and facilitator to obtain loans, foreign aids and technical assistance. Furthermore, they differ from private companies, since management charge just enough tarriff to break-even and Government has greater influence and control over their operations. The strategy can be effective, in Nigeria in areas of utilities provision. For example, operations on cost recovery makes management self sustain, therefore, annual subvention can be used to extend facilities to cover more areas. Moreso, operations on cost recovery policy with minimum Government interference, gives both the economic and political independence to management. This makes management dynamic, to respond effectively to changes in economic situation to cope with increasing demand and rising cost of utility facilities. Therefore, expansion in capacity and spatial growth is enhanced to provide sufficient utilities. Furthermore, cost recovery approach in collaboration with a realistic pricing system controls utility consumption to minimise wastage. Thus, expenditure on utilities provision is reduced. The freedom of policy formulation invites

innovative and creative management decisions to provide solutions to local problems.

4.40 SUMMARY OF EVALUATION

In Nigeria, the present economic situation and managerial inefficiencies has constrained the Government ability to finance and manage the provision of urban utilities effectively. Therefore, the current move towards privatisation and commercialisation of public ventures including utilities. This is to enable the Government assume a regulatory and facilitatory function in the public sector operations in Nigeria. Indeed, a machinery is already set in motion to make this policy of "minimum Governance" effective.

Although privatisation is effective in ensuring adequate quantity, quality and regular supply of utilities to the population, however, the application of free market operations in utilities provision at the present level of economic development in Nigeria conflicts with the need to protect the welfare of urban poor. Moreso, the Government administrative and legal system has so far failed to enforce effective control over the operations of other private urban services like transport and housing in Nigeria. This in addition to the consumers ignorance of their right and lack of organised pressure groups to advocate public interests, is conducive, a

climate for private utility management to operate suppliers market. That is to hike prices and make optimum profit. This will create marginalisation and unavailability or restrictive use of basic utilities to some urban inhabitants. The consequencies of this may be greater or even more costly than subsidisation.

Generally, resource scarcity, economic cost effectiveness, consumers sovereignty are fundamental, so long as economic efficiency is a social goal in areas of urban utilities provision. Therefore, in Nigeria for a management strategy to be effective in achieving growth and equity in access to utilities, a compromise is required between the current social service subsidisation and free market provision. Thus, the adoption of a cost recovery approach, in collaboration with realistic pricing policies as well as selective subsidisation to a target group (the urban poor) is likely to resolve the complexities of urban utilities management problems in Nigeria.

CHAPTER - FIVE

UTILITY PLANNING IN BAUCHI TOWN

So far the effectiveness of various utility planning and management strategies has been evaluated with highlights on the importance of physical planning in the attempt to achieve efficiency in utility provision (Sections 3.00 and 4.00). This chapter will introduce the study area and examine the utility planning practice and its outcomes on utility operations in Bauchi town.

5.10 THE STUDY AREA CHARACTERISTIC AND UTILITY PROVISION

Bauchi town, the capital city of Bauchi State is located in the North-eastern part of Nigeria (Figure 5.1). As one of the important traditional towns in Northern Nigeria, it served as a trade centre and a provincial headquarters for colonial administration. Today, Bauchi exhibits dual socio-economic characteristics as well as a dual political status. The town is a State and Local Government headquarter and also a zonal headquarter to a host of public and private organisations in North-eastern part of Nigeria. These dynamics have stimulated population growth and physical development in Bauchi town and consequently rapid increase in the demand for utilities and cost of its provision.

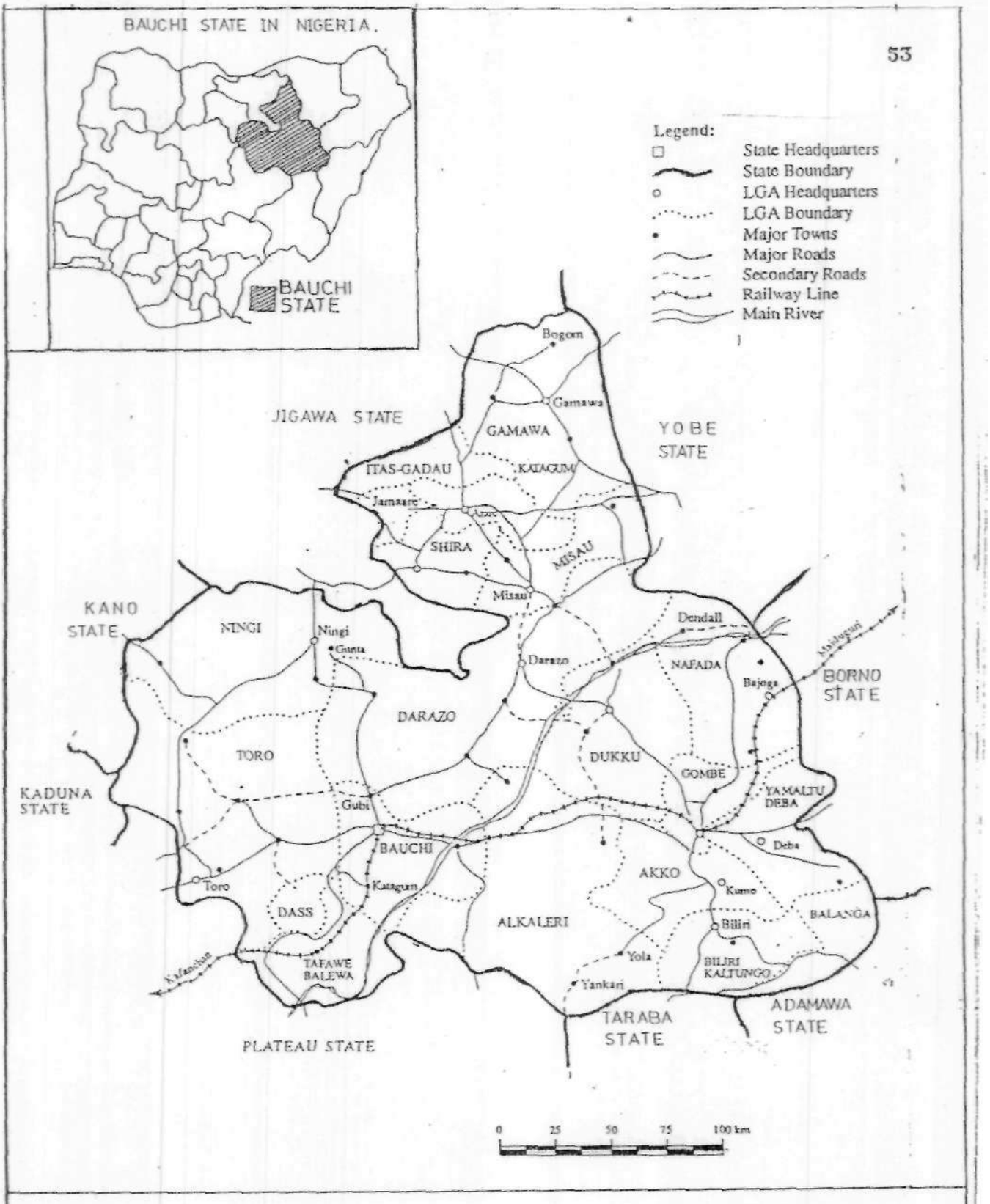
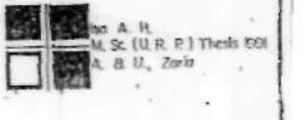


Fig. 5.1 Administrative Map of Bauchi State



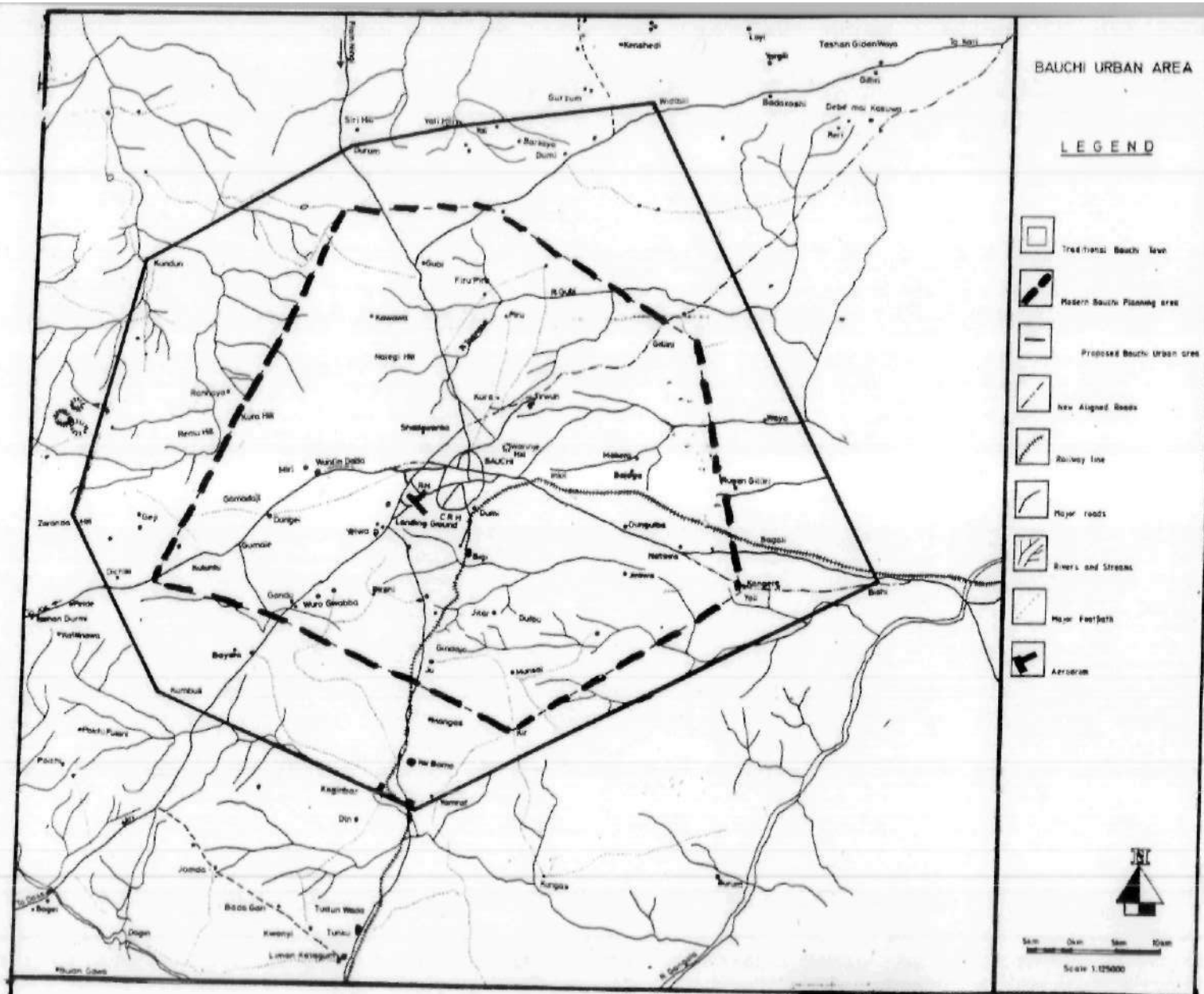


Fig. 5.2 BAUCHI URBAN SETTING.
(NOTE THE DRAINAGE REGIME)

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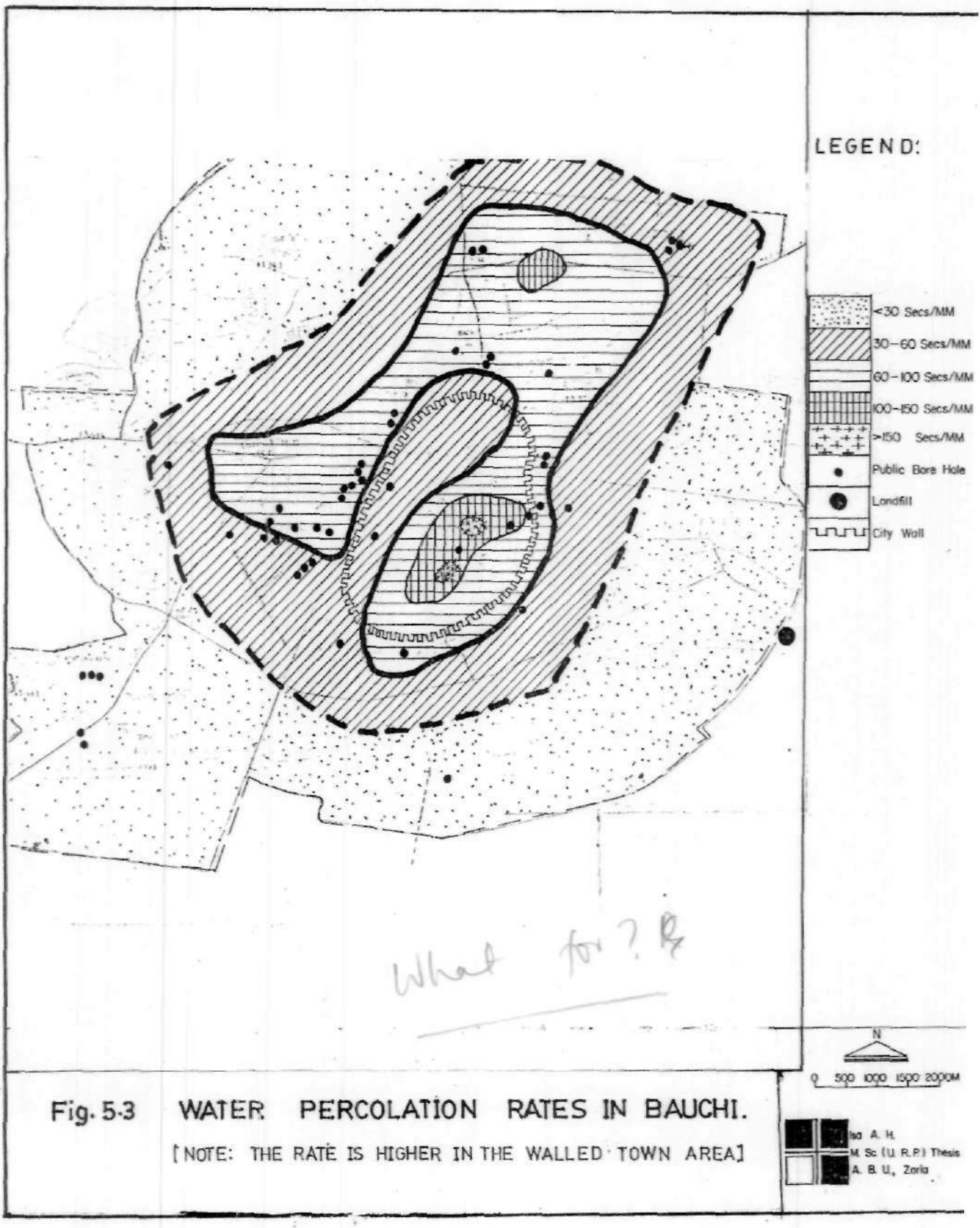


Fig. 5.3 WATER PERCOLATION RATES IN BAUCHI.

[NOTE: THE RATE IS HIGHER IN THE WALLED TOWN AREA]

5.11 Location and Physical Characteristics

i. Location

Bauchi town is located on the water shed of two drainage regimes: the Gongola basin to the South-east and Lake Chad basin to the North-west (Figure 5.2). Water-table varies with the seasons: about one metre during the wet season (SWK - AIC, 1990) and about 18 metres (Waziri, 1985) during the day season.

The underlain geology in ancient continental shelf of heavily weathened basement complex rocks. The lithology is dominated by coarse crystalline rocks (SWK-AIC, 1990).

The combination of underlain geology and ground water regime gives Bauchi town a high rate of water percolation of between 30 Seconds per millimetre and 150 Seconds per millimetre (Figure 5.3). This implies a high possibility of waste water infiltration to contaminate surrounding reservoirs, especially shallow wells. This possibility is greater within the traditional (walled) area of the town where the percolation rate is up to 150 Seconds per millimetre (Figure 5.3).

ii. Topography

The landscape (in Bauchi town) is gently undulating with heights of between 500 and 600 metres above sea level. From the central area of the town, terrain slopes gently

in a radial pattern towards the sorrounding areas. Hills with heights up to 750 metres above sea level are within the vicinity of the town. This topography is a potential for the location of storage tanks and routing of utility corridors. The integration of those topographical features in planning utility distribution network will facilitate flow by gravitation and reduce the operation cost of the distribution system.

The combination of geology and topographical features in Bauchi has restricted water acquifers to limited areas. The ground water basins have little storage capacity with high seasonal variation of water recharge rate. This is a constraint for the use of ground water resources as sources of water supply in Bauchi town.

iii. Climate

In Bauchi, rainfall sets in between April and May, and it lasts for about 150 to 160 days. The early rains are turential with stormy winds, hightening and thunder. Average annual rainfall is up to 1000 millimetre and average wind speed is about 48 kilometre per hour. However, wind speed can be up to 98 kilometre per hour at peak periods. Speedy wind and rain storm disrupts over head electricity distribution system. For instance, it can bring down the wooden poles in which the cables are borne or create contact between the transmission cables. This introduces inefficiency in the system.

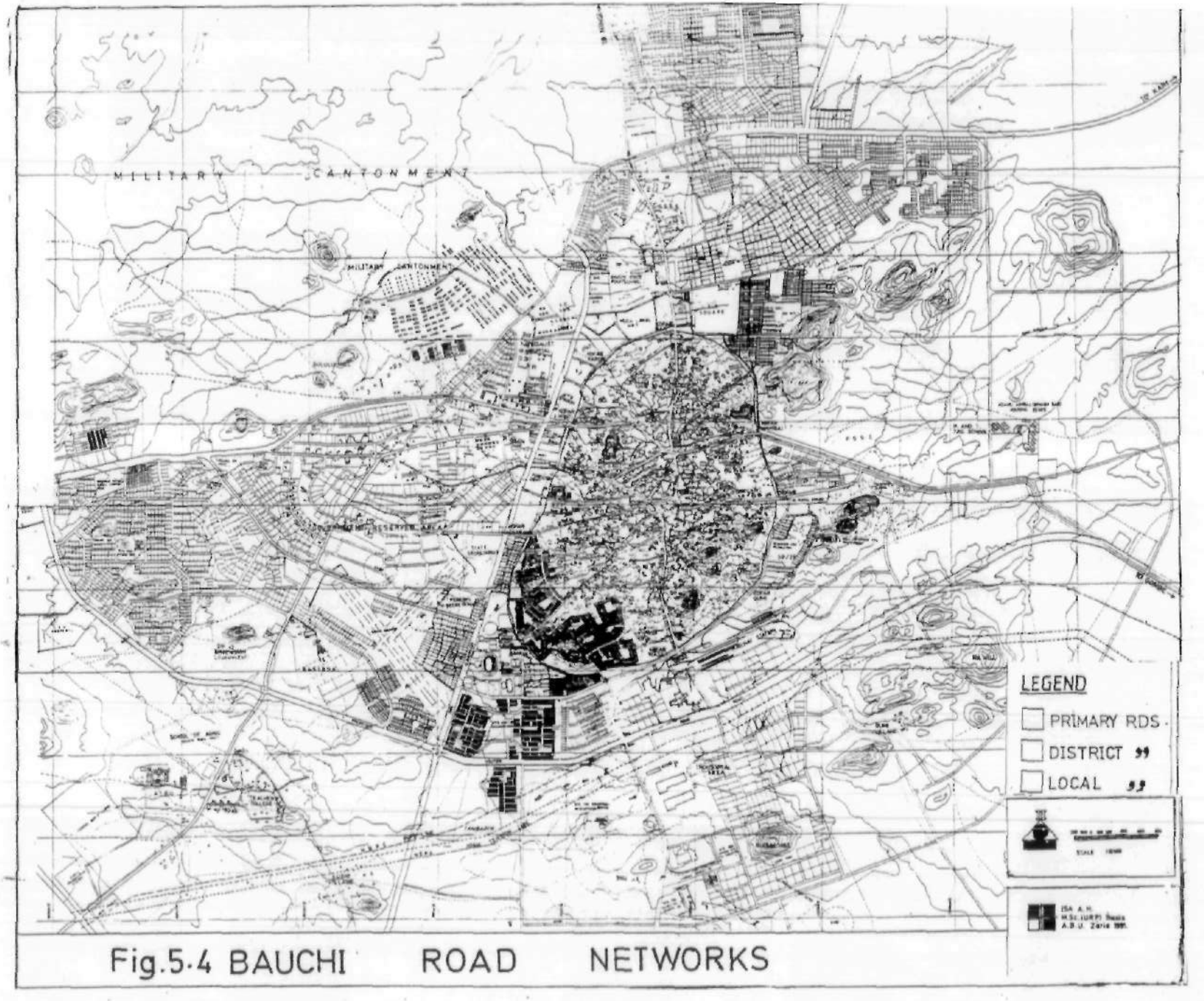


Fig.5.4 BAUCHI ROAD NETWORKS

5.20 UTILITY CORRIDORS IN BAUCHI

The availability and adequacy of space provided to serve as utility corridors in Bauchi are examined in this section. It is along roads that utility lines are usually laid.

The road system in Bauchi forms a combination of radial and looped or concentric pattern (Figure 5.4). The radials originate from the Emirs Palace and radiate outwards to areas of recent developments outside the wall. However, in the recent planning areas looped and grid network are dominant. Loop network is an efficient pattern for water distribution system as is grid pattern for electricity.

5.21 Utility Corridors in the Traditional (Walled) Area of Bauchi Town

In these area there are three categories of roads or access ways. They include the district roads (Figure 5.5), the local access ways (Plate III) and the pedestrian alleys (Plate IV), like Kobi, Ran, and Wunti Streets.

i. The District Roads

The district roads like Kobi, Ran, and Wunti Streets are the highest in the hiararchy of roads within the traditional (walled) area. These roads are reconstructed to have light of way of between 24 metre to 30 metres. However, adequate reservation for utility easement was not

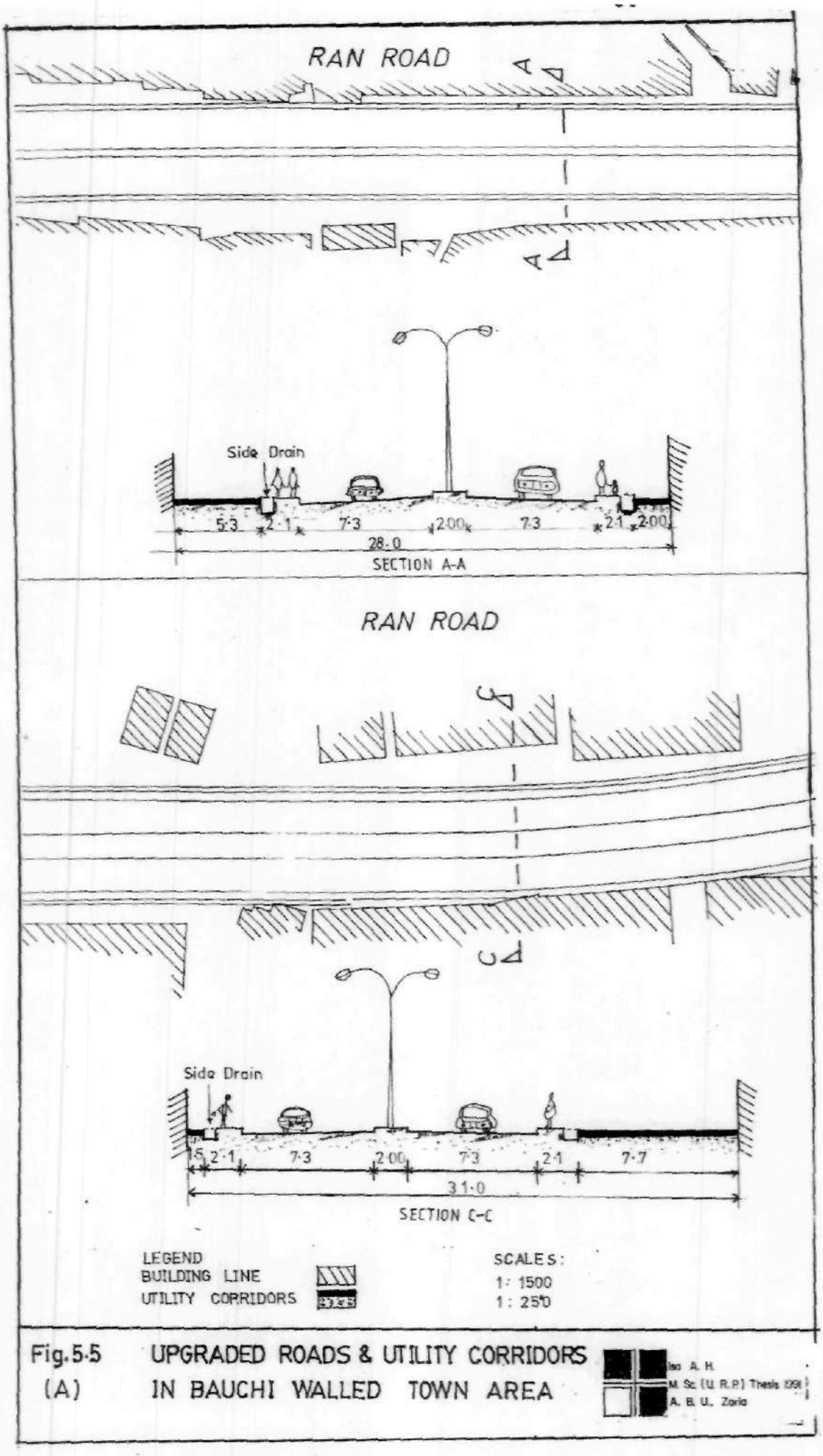


Fig.5.5 (A) UPGRADED ROADS & UTILITY CORRIDORS IN BAUCHI WALLED TOWN AREA

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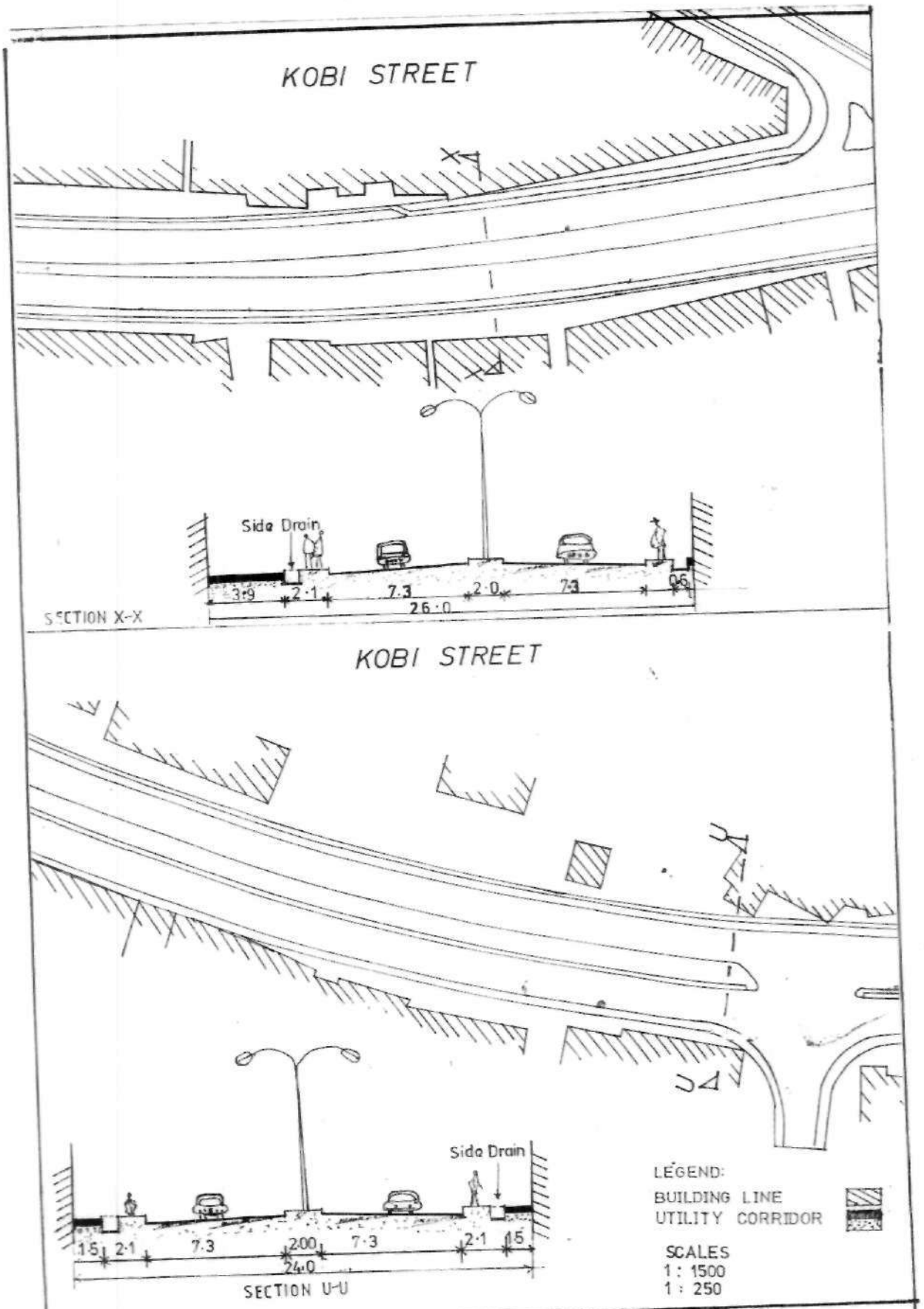


Fig. 5.5 UPGRADED ROADS & UTILITY CORRIDORS (B) IN BAUCHI WALLED TOWN AREA.

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integrated in their construction. As indicated in (Figure 5.5) utility easements are below standard requirement. For example, in some areas (Cross Section xx in Figure 5.5) only about 0.6 metre is reserved for utility networks.

ii. The Local Accessways

The local accessways are the passages linking the district roads with pedestrian alleys. They vary in width: 3.5 metres to 6 metres (Plate III). Most of these routes are used mainly by motorcycles, bicycles and pedestrians. Motor cars use them only on some rare occassions.

iii. The Pedestrian Alleys

The pedestrian alleys are the lowest heirarchy of passages in the walled area, (Plate IV). These routes link the local accessways with individual houses. The alleyways range from 1.5 metres to 2 metres in width and are mainly used by pedestrians.

The local accessways and the pedestrian alleys hamper the efficient delivery of utilities within the walled area because of their narrow width and irregular and winding pattern. Therefore, there are no organised utility corridors along these routes. Drainage channels are available only along the district roads. Thus, pools of waste water are common along passages in the traditional



PLATE - III: A Local Accessway in the Traditional (Walled) Area in Bauchi Town

NOTE: - A drainage channel constructed through community effort.

- Electric cables passed over houses.



PLATE - IV: A Pedestrian Alley in the Traditional (Walled) Area of Bauchi Town.

NOTE: The narrowness of the width and the winding pattern of the path.



PLATE - V: Passages and waste water disposal problems in the traditional (Walled) Area of Bauchi Town.

NOTE: The accummulation of waste water along roads constituting environmental pollution and obstruction to pedestrian traffic.

(walled) area (Plate V), with potentials to pollute ground water. Furthermore, the narrow width and the unflicting uses of these routes as pedestrian paths, motorcycles, bicycles tracks and utility lines, results in haphazard utility networks. For example, electricity cables often pass over and across houses (Plate V) and the water mains are subjected to constant removal and fracture due to physical development activities and pedestrian and motorcycle traffic.

5.22 Utility Corridors in Planned Layouts

Roads in planned layouts in Bauchi outside the "wall" are designed and constructed to have enough right of ways including adequate reservations for utility lines. However, housing developments enchroaching into roads has taken up utility reservations in some areas or reduced them to below minimum standard as indicated in Figure 5.6. These encroachments are more pronounced along primary and district roads that pass through commercial and low density residential areas. As indicated in Figure 5.6 and cross sections 1 to 4 in Figure 5.7, in some of these areas fence walls have reduced utility reservations to about 1.5 metres wide, (Sections - xx and uu). This has constrained the delivery of utilities. For instance, in the Bauchi Water supply project of 1990, water mains had to be laid under the road carriage ways in such areas, despite the anticipated traffic problems that may arise when repairs

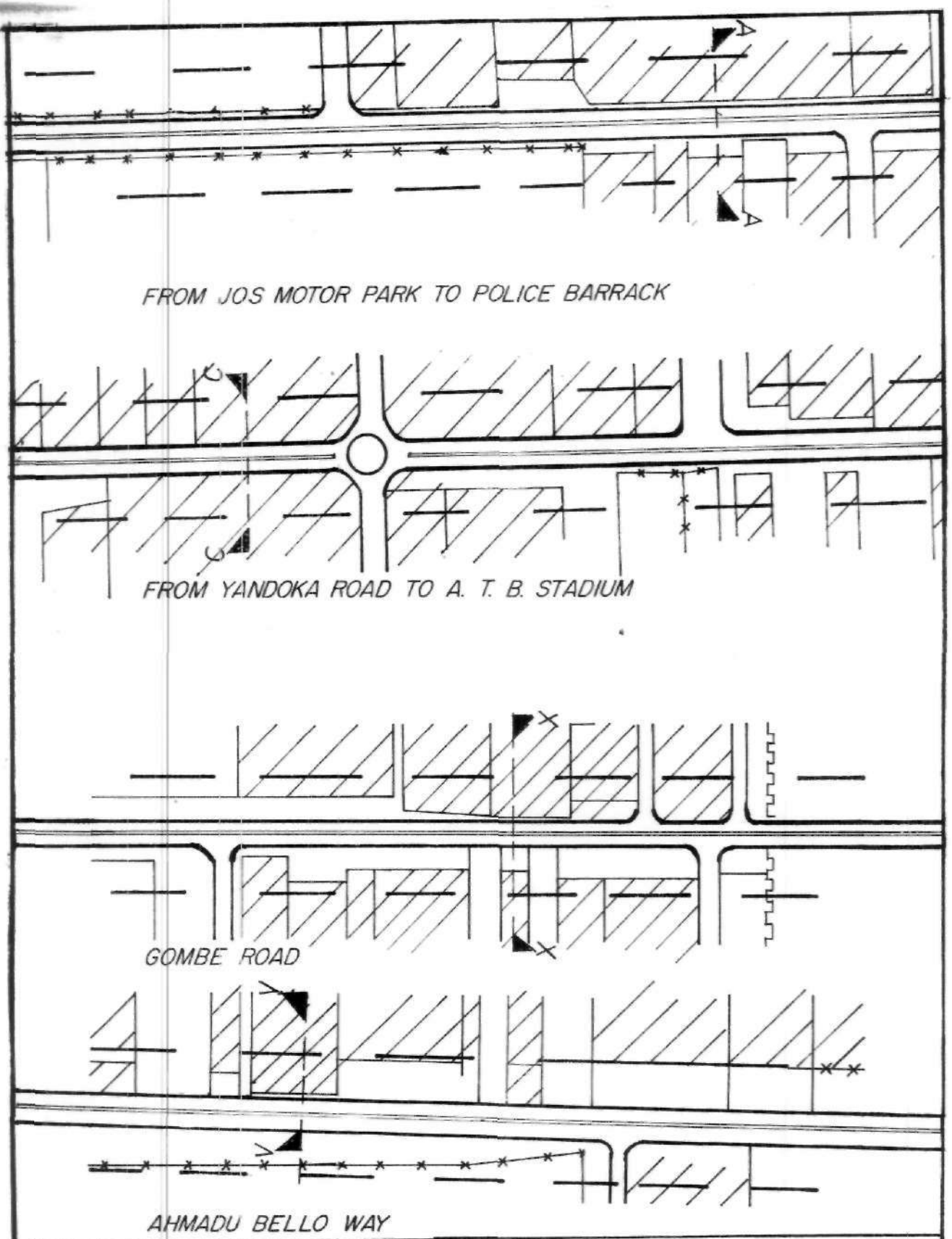


FIG. 5·6 ENCROACHMENT ON UTILITY CORRIDORS IN PLANNED LAYOUTS

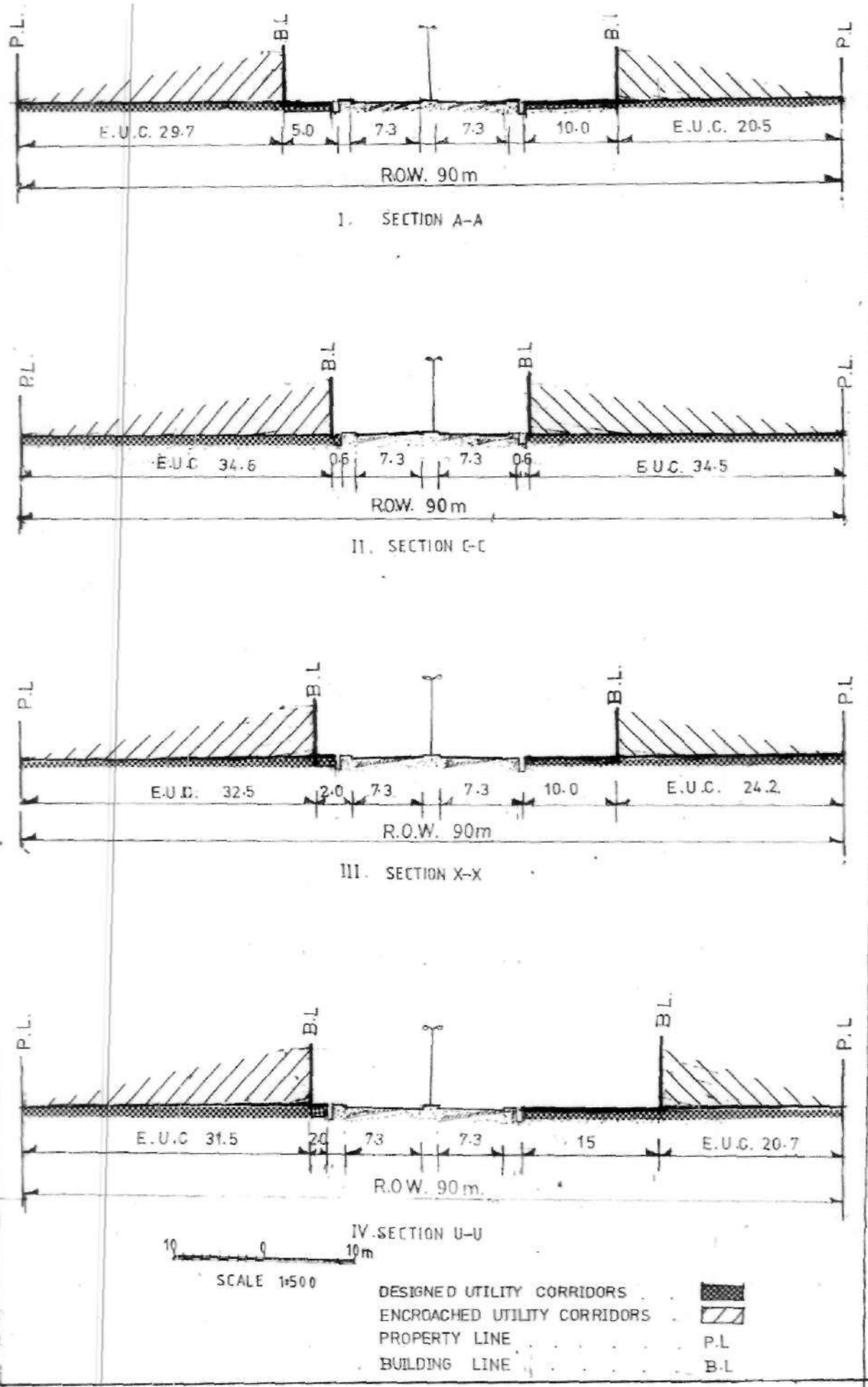


Fig.5.7 CROSS SECTION OF ROADS SHOWING DEVELOPMENT ENCROACHMENT ON UTILITIES CORRIDORS IN BAUCHI.

need to be effected on the system. Furthermore, these areas are associated with the problem of broken poles by vehicles due to the narrowness of set back between poles and carriageway. Therefore, lack of effective development control is one of the factors militating against the efficient distribution of utilities in these areas of Bauchi town.

As was noted earlier, in the traditional (walled) area of Bauchi town, lack of adequate space and organised utility reservations due to the narrow, irregular and winding roads is one of the major problems besetting the effort (of physical planners) to create easements for utilities delivery. Although, physical planners are not to blame for this development in the traditional (walled) area due to its mechanical growth, the encroachment into roads (utility reservations) in recent (planned) areas is mainly the fault of physical planners.

5.30 LANDUSE PLANNING AND UTILITY PROVISION IN BAUCHI TOWN

Although the rapid increase in urban population accounts to a large extent for the shortage of utilities supply in most developing countries, the weak urban economic base and the fast rate of spatial extension of towns have also contributed to the inability to extend network facilities to deliver utilities to all areas and

population. For instance, while increase in population introduces additional production cost due to more demand for utilities, the spread of physical development determines the cost of providing utility facilities in town and the rate of spatial expansion of these developments decides the cost of network extension to deliver utilities to new areas. The effects of population growth and urban spread on the efficiency of utility provision in Bauchi will be examined in this subsection.

5.31 Population Trend and Utilities Provision in Bauchi

There have been no accurate population figures for Bauchi town. However, different estimates have indicated a rapid rate of growth over the years, especially since 1976 when the town become a State Capital. The annual growth rate has been estimated at 5 Percent by Bauchi State Ministry of Economic Planning. This is considered unreliable because it is based on the average growth rate for urban areas in Nigeria. Dal Al-Hamdasah (1978) also estimated the annual population increase in Bauchi town, to be about 5.25 Percent between 1978 and 1987 and 4.25 percent as from 1988 to 1990. However, these analysis were based on demographic survey of only a single ward (Makama) within the traditional (walled) area. This cannot be a fair representation of the entire Bauchi town. Moreso, when the socio-economic dessimilarities between the walled area and the areas of recent developments are

considered. Another estimate, based on a town wide sample coverage and the adjustment in growth rate from 5.75 Percent to 7.5 Percent is rational when the expected increased immigration due to the new political states of the town is considered.

TABLE - 5.1: Bauchi Population Projection (1976 - 2000)

Year	Population	Percentage Growth Rate
1963	38,014	5.75
1965	42,511	5.75
1970	56,222	5.75
1975	75,250	7.5
1980	108,031	7.5
1985	155,091	7.5
1990	222,653	7.5
1995	319,647	7.5
2000	458,895	7.5

SOURCE: Max Lock, 1976; Part 9.2:P.18

The population figures in Table 5.1 shows that Bauchi town had a population of 38,014 in 1963; 75,250 in 1975 and 155,091 in 1985. These shows an increase of about 98 Percent in 12 year period (1963 to 1975) and 106 Percent in the 10 year period (1975 to 1985)

respectively. They indicates that the population of Bauchi town increases by about 100 Percent (two fold) in every decade. This implies a rapid increase in the demand for utilities and consequently the need for investment in production and distribution of facilities to cover more people and areas. However, the cost could be reduced where physical planning measures are properly instituted to organise the population and landuses into minimum thresholds densities and to control the rate of spatial expansion or growth. For example, investment in network distribution system depends on expansion of urban space while landuse densities determine the unit cost of utility provision when expressed as cost per person. Therefore, landuse planning is very essential, for utility systems to be cost effective and for the products to be accessible to the urban population.

5.32 Expansion of Urban Space and Utilities Provision

i. Trends in Spatial Expansion in Bauchi Town (1976 to 1982)

Bauchi town had a population of about 78,000 and a land area of about 4,925 hectares in 1976, with 462.5 hectares devoted to residential uses (Table 5.2). This gives a population density of about 16 persons per hectare town wide and 168.6 persons per hectare for residential area. By 1982, the population had increased to about

TABLE - 5.2: Bauchi Landuse, 1976 and 1982

Type of Use	Area (HA)	% Total	Area (HA)	% Total	Differences
Residential	462.5	9.4	2,944	31.3	+2481.5
Public	100.0	2.0	762	8.1	+662
Administrative	37.0	0.8	263	2.9	+226
Industrial	50.0	1.0	158	1.7	+108
Commercial	50.0	1.0	171	1.8	+121
Open/Agric.	4,225.0	85.0	5,098	74.2	+873
	4,925	100	9,396	100	4471.5

Source: Max Lock Group, 1976: p2.2.5 and Muhammad 1982:p30

TABLE - 5.3: Bauchi Existing and Proposed Landuse (Year 2000)

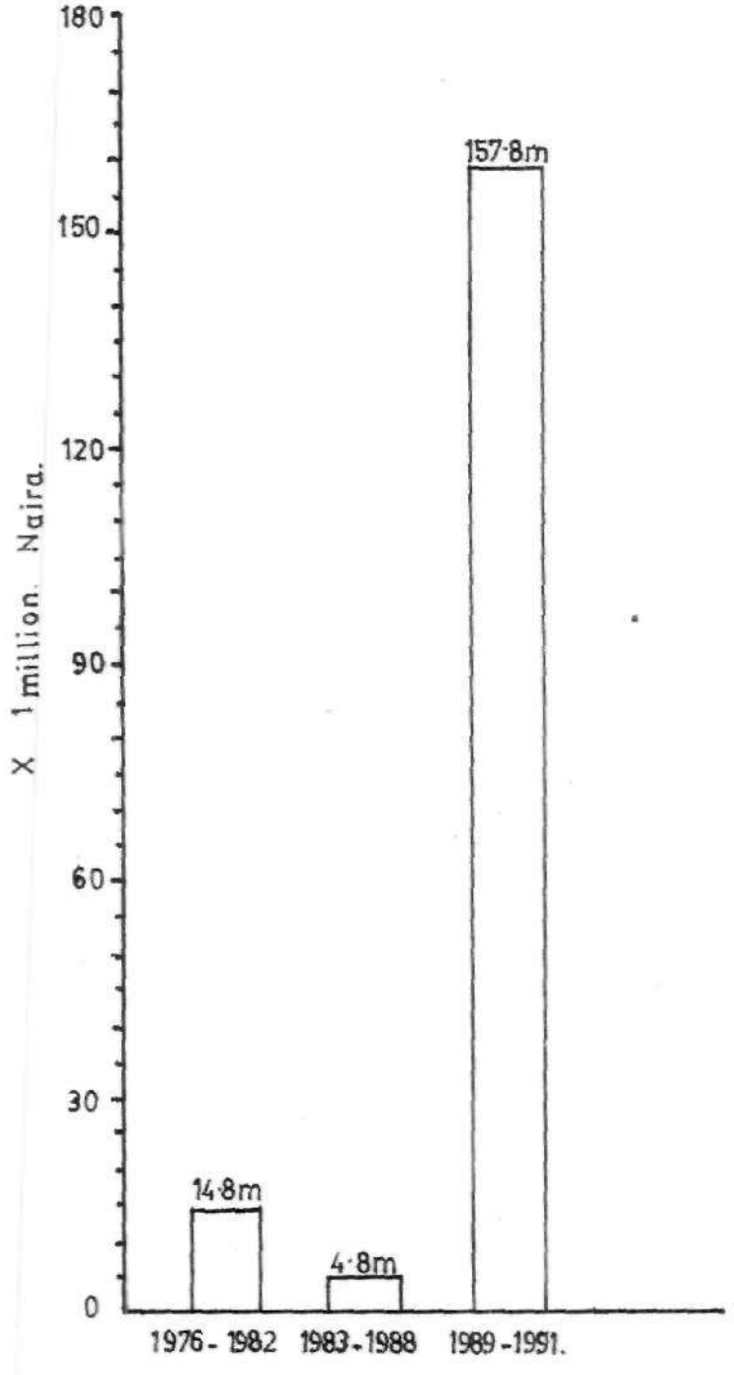
Categorised Uses	Existing (1991)		Pronosed (2000)		Diffs.
	Area (HA)	% of Total	Area (HA)	% of Total	Area (HA)
Residential	4,500	32.18	8,500	48.31	+1,000
Public	3,300	23.59	1,275	7.24	-2,025
Roads and Utilities	2,135	15.27	3,825	21.74	+1,690
Agric./Green Open Space	1,100	7.87	1,700	9.66	+600
Undevelopable Open Space	900	6.44	170	0.97	-730
Industrial	800	5.72	850	4.83	+50
Commercial	550	3.93	425	2.42	-125
Recreation	700	5.00	850	4.83	+150
Total	13,985	100	17,595	100	3610

Source: BSUDDB, 1991.

120,000 and landuse area to 9,396 hectares (Table 5.2). This shows an increase of about 8,933.5 hectares (90.8%) over that of 1976 and also 1,488.9 hectares (15.1%) rate of landuse expansion per annum between 1976 and 1982. However, the gross population density town wide decreased from 15.8 persons (in 1976) to 12.8 persons per hectare in 1982, and from 168.6 to 40.8 persons per hectare for gross residential landuse. This trend of landuse growth clearly indicates a deliberate policy of population dispersion. Although, the policy may find justification in provision of more land area, to accommodate growth in physical development at the take off of a new State Capital in 1976, however, the landuse expansion policy was over emphasised when the gross population densities of 15.8 persons per hectare in 1976 and 12.8 persons per hectare in 1982 are compared to the minimum desirable density of 60 persons per hectare for most urban areas in Nigeria. Therefore, there was over provision of land area in Bauchi within this period. This is moreso that the 15.1 Percent annual rate of landuse expansion far exceeds the population growth rate of 7.5 Percent per annum in Bauchi for the same period. These rapid increase in population and landuses not only exorts pressure on utility management agencies to expand production capacity to size up with demand but also to provide extensive network facilities to cover areas of new landuse

development. The foregoing analysis have been provided to show that physical planning practice contributed to the failure to achieve efficiency in utility provision in Bauchi. For example, between 1976 and 1982, the average cost of water supply facilities per gross hectare was ₦2,582:00 (Dar Al-Handasah, 1978:P.99). This implies that a total sum of about ₦23 million (8,933.5 hectares multiply by ₦2,582:00) was required to integrate the proposed activity areas into the then existing water distribution system. This figure far exceeds the ₦14.8 million budgetary allocation for capital expenditure for water supply projects in Bauchi for the same period (Figure 5.8).

It is also important to note the decrease in population density in Bauchi in this period, increased the unit cost of utility provision per person. This would influence the accessibility of utilities to the urban dwellers. For example, the shared cost of network facilities per capita depends on the number of persons per hectare in each landuse area. As the number decreases, the cost per person increases. If this rate of density decrease exceeds the rate of economic growth in towns, inefficiencies are introduced because too much subsidy may be required to off-set the effects of this increase cost of utility provision per person, otherwise charges may go beyond the affordable limits to some of the urban



Source: B.S.W.B. 1991.

Fig.5.8 BUDGETARY ALLOCATIONS TO WATER PROJECT IN BAUCHI 1976 to 1991.

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residents. This confirms a postulate made earlier that landuse management determines to a large extent the ability to provide efficient utilities in towns. For example, over provision of land for housing creates difficulties for utilities provision by spreading the few willing and able developers to get their houses built over too many sites. This sets into motion a circle of inefficiency: Land title holders fail to develop the plots because utilities are lacking, the utilities are not provided because of the too few developments to form minimum threshold at each sites, and the government and its agencies are economically incapacitated to extend network facilities because of too much land expansion due to this over provision and disperse developments.

ii. Trends in Spatial Expansion in Bauchi Town (1982 to 1991)

Table 5.3 shows that by 1991 urban land in Bauchi had increased by about 4,589 hectares over the 1982 figures. This represents 6.1 Percent annual rate of expansion. Based on the estimated population of about 240,000 in 1991 the gross density per hectare was about 17 persons town wide and about 53 persons per gross residential hectare. This indicates that physical planning measures are required to minimise horizontal growth and increase densities in built up areas, with the added advantage of reducing the cost of utility provision and its burden to the management

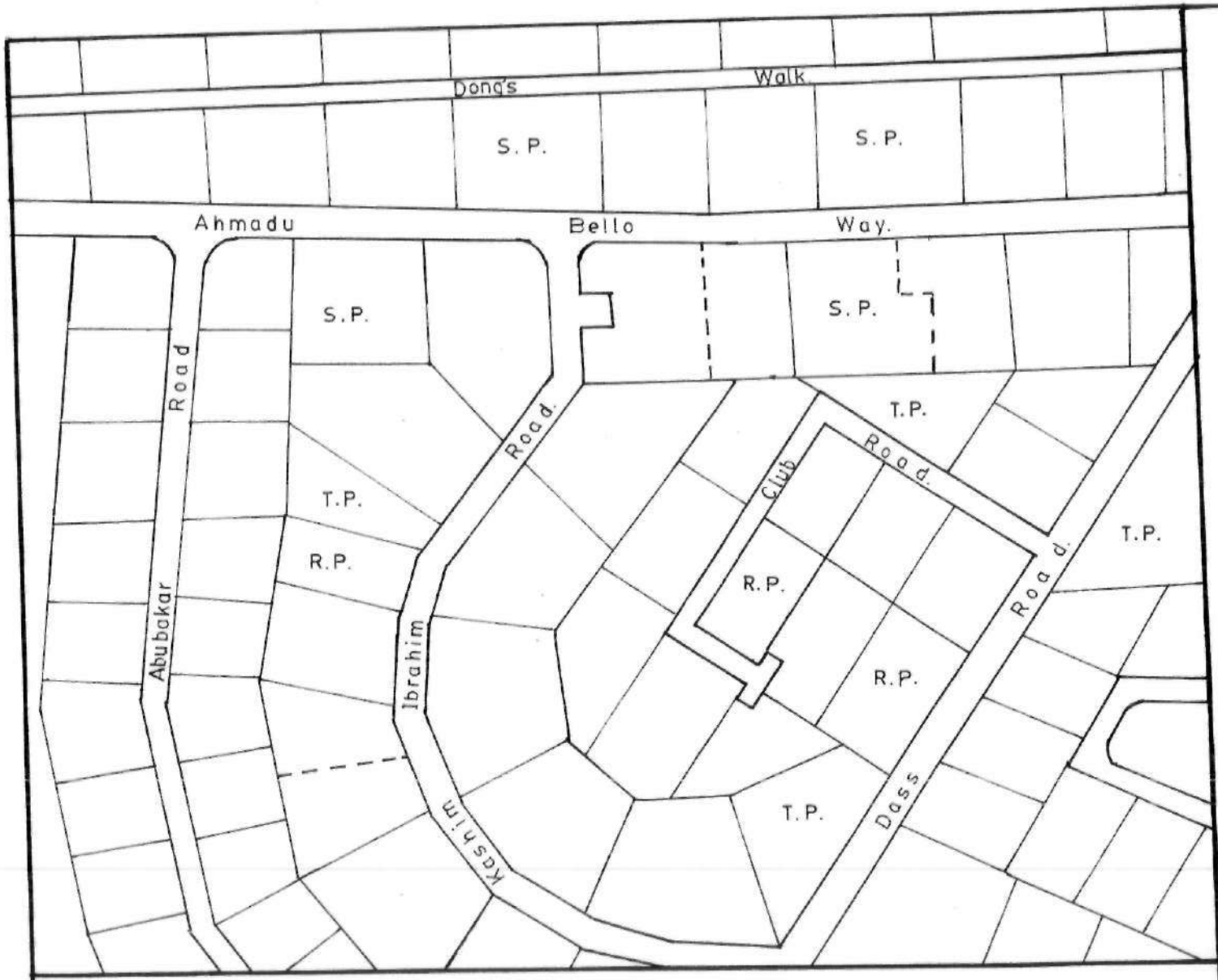
Table 5.4: The Status of Development of Residential Layouts in Bauchi Town as at September 1988

No.	Title of DPS	Status of Development: No. of Plots	Year Approved by Governor	No. of Developed Plots	% of Total
1.	TPO/NEP/91	70	1975	70	100
2.	TPO/BA/6A	312	1979	78	25
3.	TPO/BA/7	110	1976	110	100
4.	TPO/BA/8	86	1976	96	100
5.	TPO/BA/10A	122	1981	73	60
6.	TPO/BA/14	41	1977	18	45
7.	TCP/BA/38	56	1978	48	85
8.	BSDB/EPD/DP/8	833	1980	42	5
9.	BSDB/EPD/DP/5	660	1983	297	45
10.	BSDB/EPD/DP/9	76	1980	38	50
11.	BSDB/EPD/DP/10A	1528	1980	535	35
12.	BSDB/EPD/DP/15	70	1980	39	55
13.	BSDB/EPD/DP/17A	120	1982	54	45
14.	BSDB/EPD/DP/22A	111	1985	44	40
15.	BSDB/EPD/DP/23	423	1981	148	35
16.	BSDB/EPD/DP/29	359	1985	18	5
17.	BSDB/EPD/DP/30	41	1982	7	18
18.	BSDB/EPD/DP/31	205	1982	32	15
19.	BSDB/EPD/DP/32	358	1985	286	80
20.	BSDB/EPD/DP/34	930	1985	0	0
		6,521	-	2,032	31.2

Source: Environmental Planning Division, B.S.U.P.D.B., Bauchi, in Abubakar (1990: p.99 - 100).

agencies and the inhabitants in Bauchi. This need is further strengthened by the low rate (about 31 Percent) of physical development plan implementation in Bauchi town (Table 5.4).

By the year 2000 Bauchi is proposed to cover an area of about 17,595 hectares. In this proposal 4,000 hectares is allocated to residential use representing about 88.9% increase over the 1991 figure. This will bring the residential density to about 54.1 persons per hectare. The economic implication of these proposals in utilities provision is great. For example, about ₦12,349 is required to provide water distribution facilities per gross residential hectare in Bauchi (Appendix I). This shows that about ₦49.396 million (minus inflation cost) would be required to implement the (4,000 hectares) proposed residential development for the period 1991 to the year 2000, and average expenditure of about ₦7.0 million per annum. Based on the 240,000 population, domestic water consumption of 89 litres per person per day (JWK-AIC, 1991:P. 122-125), and water production cost of ₦0.0017 per litre (Appendix II), an annual estimate of about ₦13.25 million is required to produce water for residential purposes in Bauchi. This gives a total of about ₦20.29 million (₦13.25 million plus ₦7.044 million) as the cost requirement for efficient water supply to all residential areas in Bauchi town in 1991. This indicate the need to



LEGEND.

SP	SQUARE PLOTS
RP	RECTANGULAR PLOTS.
TP	TRIANGULAR PLOTS.
- - -	LINE OF PLOT SUB-DIVISION.

DENSITY ANALYSIS

TOTAL AREA.	=	106.25Ha.
TOTAL NO. OF PLOT.	=	72
DWELLING DENSITY.	=	1-4 Du/Ha.
POPULATION DENSITY.	=	16.8/Ha.

SCALE :

50 0 50 100 150 200M

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Fig.5.9 BAUCHI G.R.A. LAYOUT (Part of T.P.O. NEP 80).

Source: Mins. of Lands Survey Bauchi 1991.

integrate the economic cost implication of utility provision to the management agencies and the urban dwellers in physical planning proposals. Land management policy with emphasis on minimum plot size allocation based on user demand and affordability is necessary to reduce the cost of utility facilities per person and also ease implementation of development plans. This is to increases the accessibility of utilities to the population.

5.33 Plot Design and Utility Provision

The size (extent) and physical orientation of plots determine the densities in each landuse area. These elements and their contribution to the density situation in Bauchi and the effects as utility provision is examined in this subsection.

Table 5.5 shows the current plot sizes (allocated) for landuse activities in Bauchi town.

In Bauchi plot fragmentation is observed in some residential areas (Figure 5.9), and in some instances part of residential plots are used for agricultural purpose. In the low density residential areas, the plots are larger, with enough area for habitation including landscaping. However, due to water shortages and increase in the cost of labour employment to maintain gardens and green open spaces, the beautiful greens of the old days are taken over by weeds, rice and maize farms, in these areas. This

TABLE - 5.5: Plot Size and Building Specifications in Bauchi Town

		Area in (metre square)	Percentage Coverage
1.	Residential		
	(a) Low Density	1,500	30 to 33
	(b) Medium Density	800	40 to 45
	(c) High Density	450	50 to 55
	(d) Special Density	1,800 and above	30 to 33
2.	Commercial	5,000 - 10,000	40 to 45
3.	Industrial	15,000 and above	35 to 40

SOURCE: Bauchi State Urban Planning Development Board, 1991.

constitute breeding space for mosquitoes and snakes in addition to the negative effects on environmental quality and aesthetics. In one of these low density housing areas, the population density is about 16 persons per hectare (Figure 5.9) and plot coverage is between 20 and 25 Percent. This is lower than the 30 Percent minimum desirable standard (Table 5.5), while in the high density residential areas, the coverage is higher than the 55 Percent maximum desirable standard. In the latter residential areas the coverages are up to 75 Percent due to plot subdivision. In some of these are as instances of under-supply of electricity caused by low current as a result of over loaded transformers have been experienced (National

Electric Power Authority, 1991). The use of backyard area for farming and the subdivision of plots implies over provision of land for residential use in Bauchi. Furthermore, the analysis of space requirement for habitation and other domestic chores (Appendix III) compared to existing plot sizes (Table 5.5) also shows these over provision of land.

The design of some plots with square, triangular, and pentagonal shapes and orienting plot depths (as against widths) along utility lines as depicted in Figure 5.9 have increased the average length of utility network facilities per plot in Bauchi and by extension higher cost of utility provision when expressed as cost per plot or per person. For example, in Warinje (mixed density) residential layout (Figure 5.9), 144 plots exists (with sizes as varied as shown in Table 5.5) in an area of 46.418 hectares. The amount cost of utility network facilities shows that about ₦573,215:00 (₦12,349 multiply by 46.418 hectare) is needed for water supply facilities and ₦1,048,211:00 (₦10,233 multiply by 46.418 hectare) for electricity supply facilities. This gives a total of about ₦1.6 million or ₦11,259.9 per plot cost of water and electricity facilities. The cost could have been less if the plot sizes were smaller. The foregone discussion shows that layout design has contributed to the inefficiencies of utility provision in Bauchi.

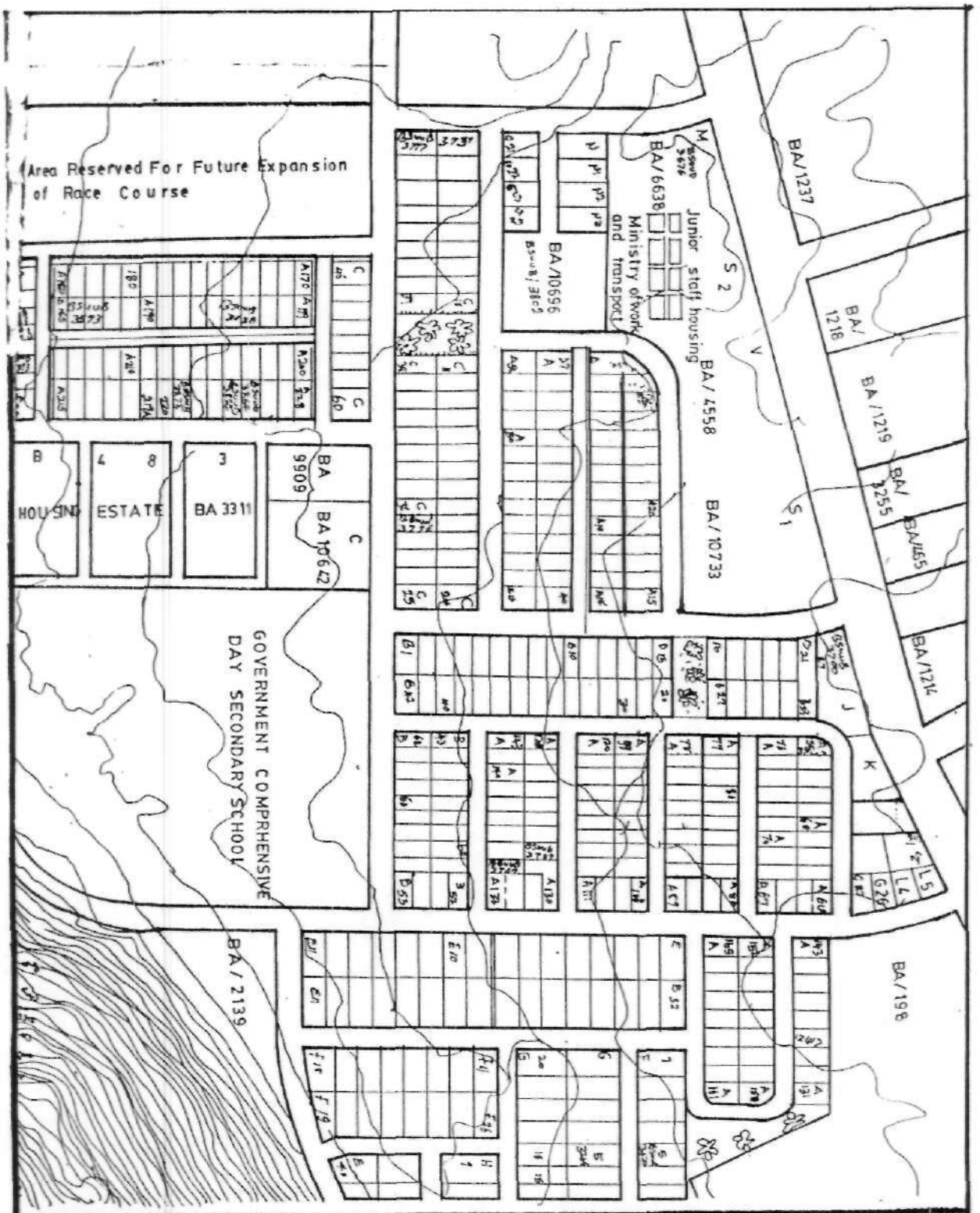


Fig. 5·91. WARINJE LAYOUT IN BAUCHI.

SOURCE: B.S.U.P.D.B. 1991.

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5.40 UTILITY PLANNING PRACTICE IN BAUCHI TOWN

The process of planning the supply of utilities in Bauchi is traced so as to examine the level of co-ordination of activities between the physical planning, engineering and management components within the system.

Bauchi State Urban Planning and Development Board (B.S.U.P.D.B) is the sole agency empowered to formulate physical planning policies for the control of development in all declared urban areas in Bauchi State. Therefore, it is responsible for co-ordination of activity systems to produce a umprehensive document for efficient urban development.

In Bauchi, the Town Planning Division of the Bauchi State Urban Planning and Development Board (B.S.U.P.D.B) is makes physical development plan proposals (layout plans). This is based on the designated planning districts in the Bauchi urban master plan. These area development plans are prepared and submitted to the State executive for approval, without the details of the cost and strategies of providing each subject like water, electricity, drainage and roads. After, approval the final draft is submitted to the Ministry of Land and Survey for plot allocation to individuals and organisations. It is these property developers that approach utility agencies for the extension of utilities to their areas. This shows that utility

agencies feature in the process only at the plan implementation stage. In this process physical planning contribution to the provision of utilities stops at the provision of utility corridors; that is, road reservations. The organisation of population into optimum desirable densities to reduce the cost of utility provision to the people and the management is not considered. Furthermore, the detailed design and allocation of the preserved space is unco-ordinated. For example, the detailed design and construction of roads are carried out by the engineers in the Ministry of Works and Bauchi State Urban Planning and Development Board without consultation with the utility agencies or approval by the physical planners. Therefore, sufficient consideration are not given for the provision of utility reservations.

Lack of co-ordination is one of the major problems of utility planning and management in Bauchi town. There is no managerial framework for inter-agency interaction at the policy formulation level. The utility agencies exists as vertical organisations without horizontal linkages between them and the Physical Planning Authority. Therefore, activities within the planning process are fragmented between engineer concerned with the provision of single utilities like water, electricity and sewerage disposal systems. Planning proposals are formulated independently, often without adequate consideration for

the interest of sister agencies and that of the public at large. This has created unrelated developments between physical planning proposals and the plans for utility provision. The agencies prepare their plans without adequate data on spatial growth rate and direction of physical development. Therefore, most utility plans fall short of physical development requirements. On the other hand, the physical planners are not aware of the capabilities and constraints of utility management agencies, hence, in many areas, development proposals face the problem of utility supply at the implementation stage.

This independent operation of utility planning components in Bauchi, have failed to produce a comprehensive subject plan for urban utilities. Thus, there are conflicting actions between agencies. These include the unearthing of buried utility facilities by repair staff of sister agencies, and the routing of utility mains not in allignment with physical development plan provisions. For example, in the Bauchi Urban Water Project, 1991; the trunk main from Gubi dam was constructed or laid across thirty plots in some proposed layouts. Similar cases were experienced with the National Electric Power Authority (N.E.P.A) in the routing of electric supply networks in Bauchi.

5.50 UTILITY DELIVERY IN BAUCHI TOWN

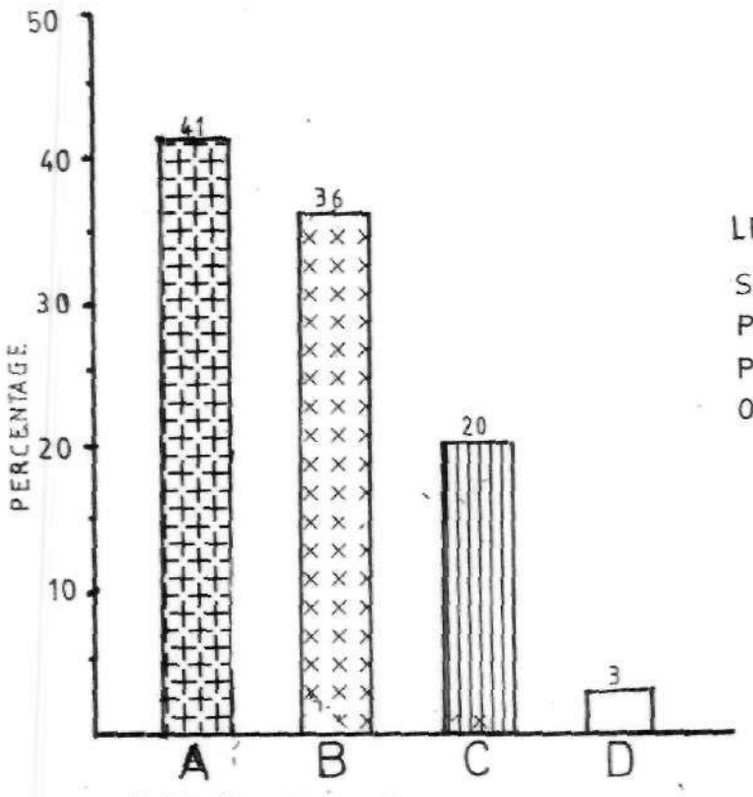
5.51 Water Supply

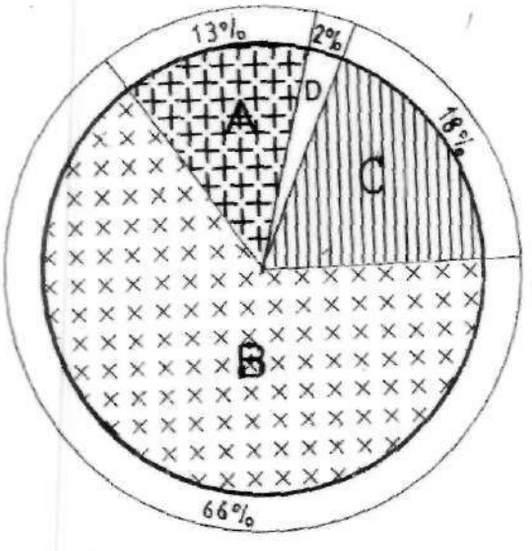
i. Water Demand and Supply

The water requirement for all activities in Bauchi is estimated at 43.2 million litres per day. This is based on the projected population of 240,000 in Bauchi and an estimated demand requirement of 180 litres per capita per day (Bauchi State Water Board, 1991). However, the existing supply capacity is about 8 million litres per day. This is distributed to the various areas in Bauchi as shown in Table 5.6. This quantity compared to the estimated demand of 43.2 million litres, shows water shortage of about 35.2 million litres of water in Bauchi town.

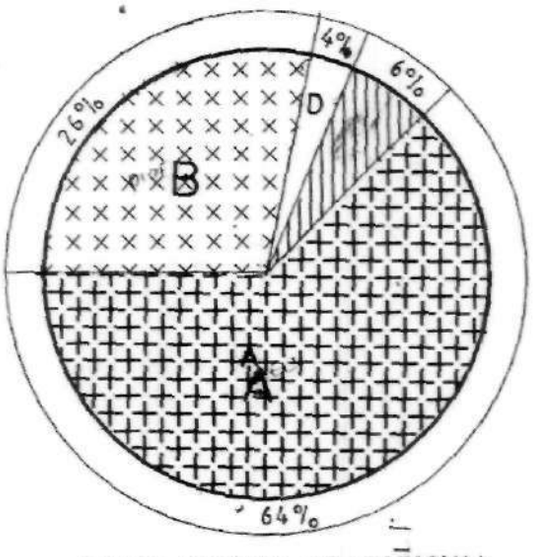
ii. Sources of Water

The principal source of public water supply in Bauchi is Gubi dam. This is supplemented by 97 boreholes. However, at the time of the survey, only 40 boreholes were functional with an output of 1.6 million litres of water per day. Although, the dam has a storage capacity of about 7.5 billion litres, the installed treatment plant capacity is 6.4 million litres. Water extracted from these sources amount to 8 million litres per day. This is rationed between the landuse areas in Bauchi. It is important to note that small capacity of the treatment plant (6.4 million litres a day) is one of the major factors for the shortages





AREAS OF RECENT DEVELOPEMENT



AREAS WITHIN TRADITIONAL (WAL LED) TOWN

Fig.5.92 SOURCES OF WATER SUPPLY IN BAUCI

SOURCE: FIELD SURVEY 1991.

of water (in quantilative terms) in Bauchi. However, the 1991 Bauchi Urban Water Project proposed to increase the capacity of the treatment plant to supply about 48 million litres of water per day by December, 1992.

iii. Water Distribution

Water from Gubi dam, is pumped into storage reservoir's located on hills in the various segments of Bauchi town. The main storage reservoirs serving the town are positioned on Wainje hill about 750 metres above sea level (Figure 5.93). This location is higher than those of the other subsidiary reservoirs and also all points in the distribution system. Therefore, water flow is mainly by gravitation. This strategy has reduced to four the total number of boosters used to aid the flow of water in the distribution system in Bauchi.

The distribution network consists of pipes of diameter between 200 and 800 millimetres. The extent of network coverage is however, limited both within and outside of the traditional (walled) area. For example, the industrial areas, some new residential areas and all the sattellite settlements in Bauchi (like Gwallameji, Yelwa, Triwun and Wuntin Dade) are not covered. This creates difficulties and constrained growth for commercial and industrial activities as well as discomfort for human living in the area.

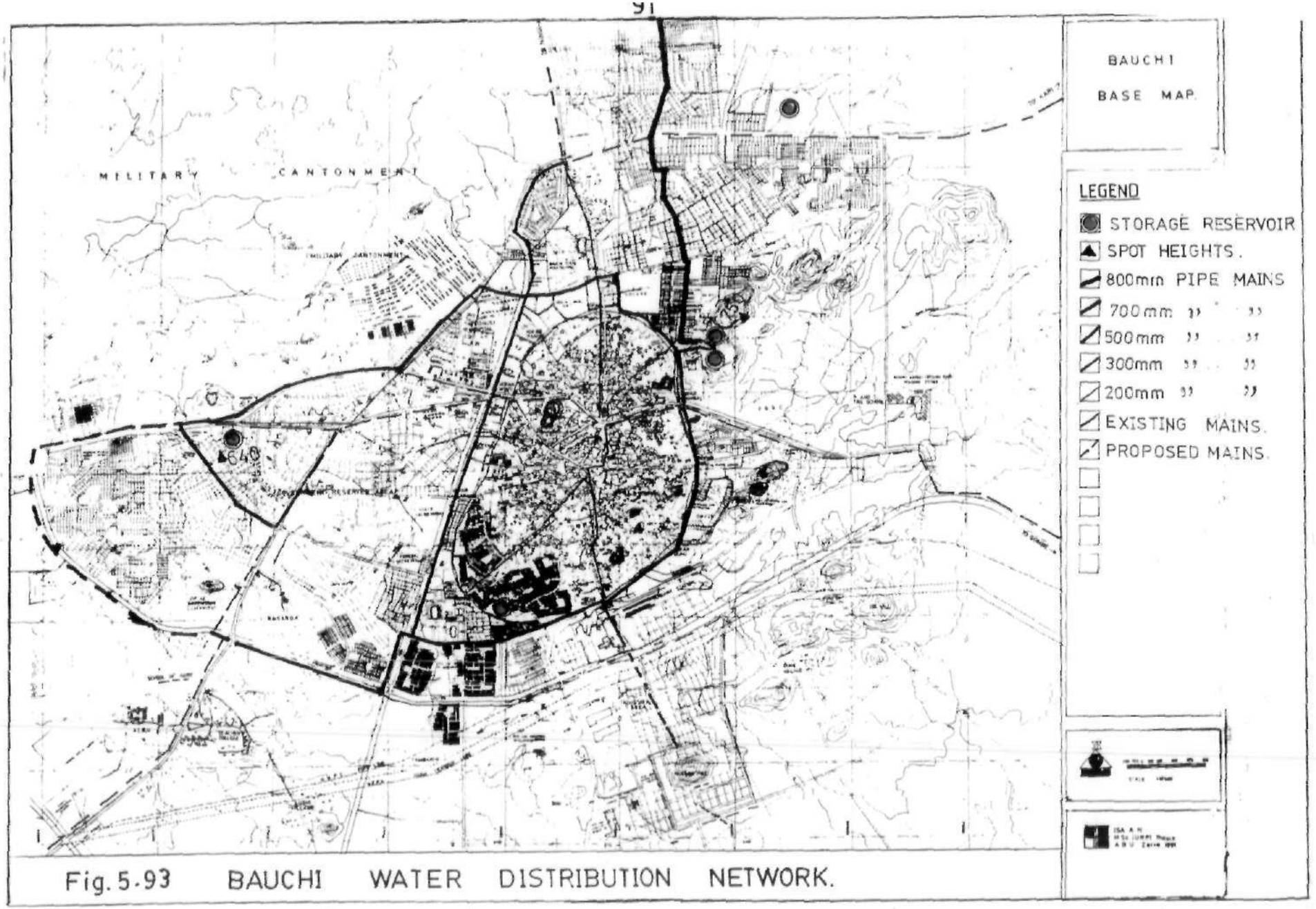


Fig. 5-93 BAUCHI WATER DISTRIBUTION NETWORK.

Another feature of the water distribution network is the duplication and unplanned proliferation of pipe works. This has created conflict in the use of space and also increased the width of utility reservations. This situation could have been avoided through the installation of a number of shallow wells and boreholes provided on individual basis (for residential, industrial and commercial purposes) are used as complementary source of water supply to the public system. Within the traditional (walled) area, the survey revealed that 64 Percent of compounds rely on shallow wells, 6 Percent have piped water connection, while 26 Percent use piped water in addition to wells (Figure 5.2).

TABLE - 5.6 Bauchi Water Distribution by Landuse

Type of Use	Litres Per Day (x 10^6)	Percentage of Total
Residential	7.2	90.0
Industrial	0.2	2.5
Commercial	0.4	5.0
Public	0.2	2.5
Total	8.0	100.0

SOURCE: Bauchi State Water Board, 1991.

In areas of recent development (outside the wall) about 66 Percent of the compounds have piped water connections, 18 Percent use well water and about 13 Percent

connections, 18 Percent use well water and about 13 Percent use both well and piped water (Figure 5.92).

The use of shallow wells for water supply in Bauchi is seasonal, most of the wells dry up during the dry season because of the high rate of fluctuation of underground water regime (refer to Section 5.11). This creates acute shortage of water and the cost of water charged by vendors increases. For example, while a four litre can of water costs 20 kobo it increases to 50 kobo in the dry season. Similarly, the cost of 2,000 litres of water from tankers increases from ₦70:00 to ₦100:00 therefore, residents in Bauchi spend much of their income on water during this season (Table 5.7).

One major problem of the current practice of the use of wells and boreholes, is the potential pollution of ground water by sewage and sullage waste. As indicated in table 5.7, the minimum desirable 15 to 30 meter protection setback between wells and sewage disposal pits is hardly observed in Bauchi. The survey revealed that the average setback town ande is 12.7 meters. This is more pronounced in the high density residential areas of the town. For example, in the traditional (walled) area, where 93% of compounds use pit latrines, this average setback is only 9.92 meters (table 5.7).

Another feature of the water distribution network is the duplication and unplanned proliferation of pipe works. This has created conflict in the use of space and also increased the width of utility reservations. This situation could have been avoided through the installation of a single pipe main of adequate size to cover the demand in each area (along the streets), for individual household connections.

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TABLE - 5.7: Household Monthly Expenditure on Water Supply in Bauchi

W a r d s	Average Expenditure on Water Per Month (₦)
Government Reservation Area	26.10
Gombe Road	20.00
Maiduguri Road	27.00
Wantin Dada	18.50
Gwallameji	19.30
Railway	23.70
Makama	9.30
Dan Amar	13.80
Sarkin Baki	10.10
Dan Iya	30.00
Dan Kadai	21.90
M e a n	19.96

SOURCE: Field Survey, 1991.

TABLE 5.8: Setback Between Wells and Pit Latrine in Bauchi Town

Wards	Average Setback in Metre
G. R. A.	10.0
Maiduguri Road	20.0
Gombe Road	12.1
Railway	11.5
Makama	10.9
Dan Amar	9.3
Sarkin Baki	7.5
Dan Iya	8.6
Dan Kadai	13.3
Wuntin Dada	19.4
Gwallameji	17.2
Total Average	12.7 Metres

* Average = 9.92 (*areas within the traditional walled town).

Source: Field Survey, 1991.

Similarly, the use of boreholes is associated with this problem of setback maintenance. Development encroachments on the 50 meter development free zone are observed in most built up areas in Bauchi (Fig. 5.94) This is due to lack of effective development control and also the rising cost of urban land rent. However, it is important to note that boreholes are often drilled in

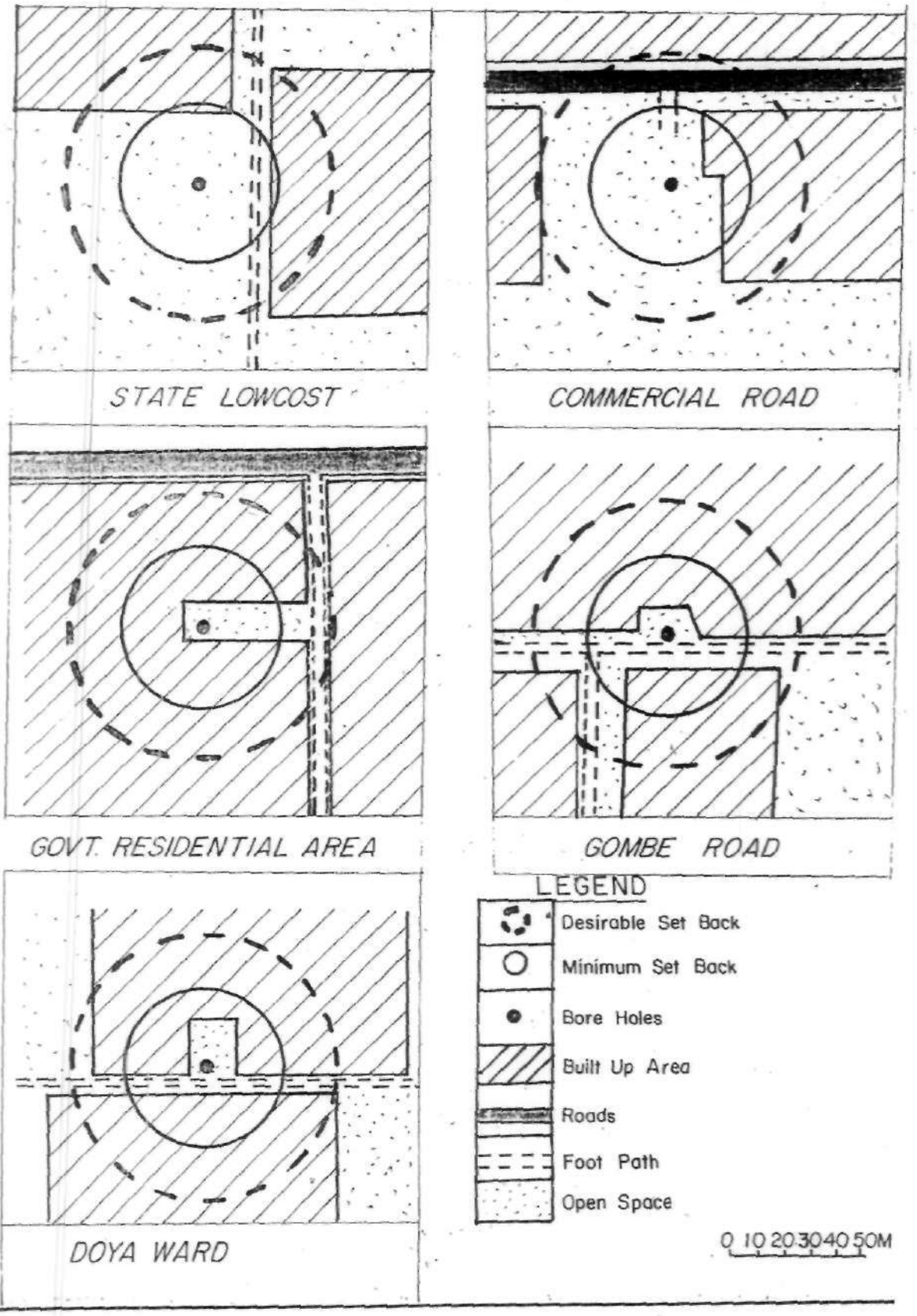


Fig.5.94 SITE PLANS OF SOME BOREHOLES IN BAUCHI TOWN. (FIELD SURVEY 1991)

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A.B.U. Zaria.

already developed areas without consideration for this 50 meter setback. Furthermore, the coarse grained soil and the rate of water infiltration in Bauchi (section 5.11) favours the rapid rate of ground water movement. Therefore, the use of ground water reservoir as sources of water supply in Bauchi has possible health risk through pollution. . Furthermore, accidental removal and damages of buried pipes is common in Bauchi during repair by utility staff or physical development work by inhabitants. This is due to the laying of multiple pipes and lack of subject plan to indicate their locations. These are contributing factors to the irregularity and frequent interruption of water supply in the town.

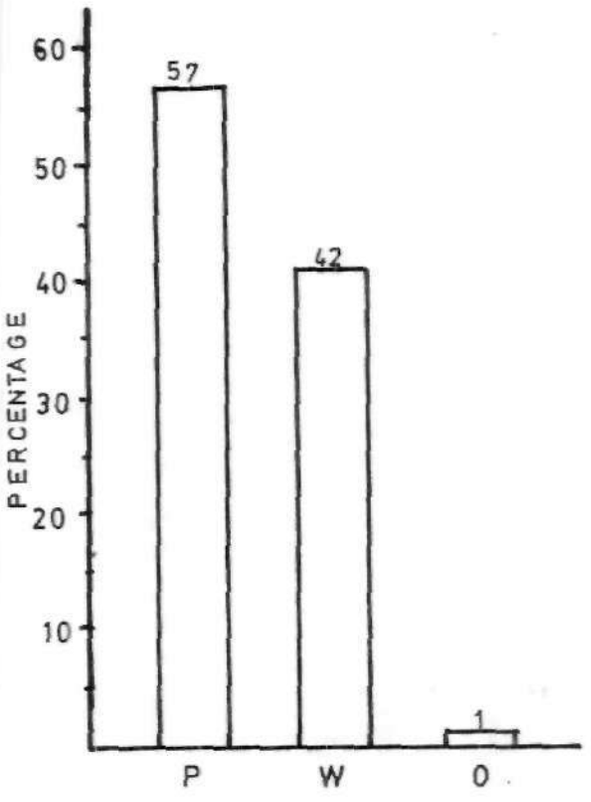
Variation in the frequency of water supply is observed between residential areas in Bauchi. Supply is more frequent in the low density residential areas than in other parts of the town. In the G.R.A., for example, a minimum of about 6 hours supply is enjoyed daily and often tankers are used as supplementary. However, in the walled town, supply is rationed between the wards, two hours for two days in a week. Furthermore, it is not uncommon in these areas to experience dry pipes for a period of one or more weeks. This variation may

be due to the social and economic differentials between these residential areas. Moreso, the new planned areas have more access and organised space to accommodate pipe network, hence fewer incidence of broken pipes (to disrupt supplies) are experienced.

5.52 Sewerage Disposal System:

Bauchi town has no communal or network system of sewerage collection and disposal. Both sewage and sullage waste is disposed on individual household arrangement. In the existing systems of sewerage disposal in Bauchi, pit latrine accounts for about 57%, water closet 42% and others 1%.

In areas within the traditional (walled) town,, the household survey revealed that 93% of compounds have pit latrine, and 7% have water closet, while in areas of recent development 76% have water closet and 22% have pit latrine(Fig. 5.95: II and III). The W.C system is adequate and effective because it caters for both sewage and sullage waste. The problem with the existing practice is that pit latrine has no provision for sullage waste disposal and drainage system is not provided as alternative especially in the traditional (walled) area. In this area, waste water is thrown into open spaces (within the compound) or allowed to flow into "catch-pit"



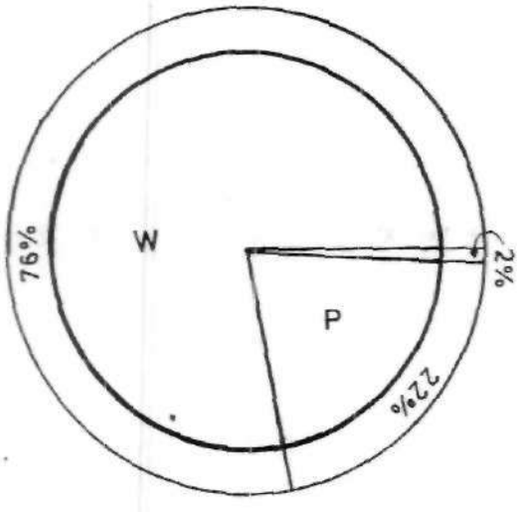
LEGEND:

PIT LATRINE ..... P

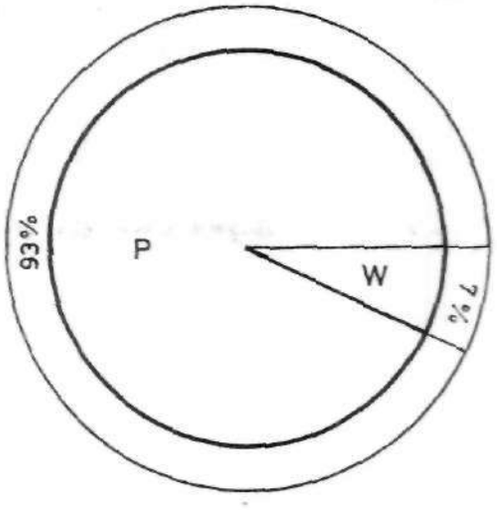
WATER CLOSET . . W

OTHERS ..... O

I. BAUCHI TOWN WIDE.



II. AREAS OF RECENT DEVELOPEMENT.



III. AREAS WITHIN THE TRADITIONAL WALLED TOWN.

Fig. 5.95 SEWERAGE DISPOSAL SYSTEMS IN BAUCHI.

Isa A.H.
MSc. URP Thesis
A.B.U. Zaria 1991.

outside the compound. The catch-pits are expected to be emptied regularly by individual families. This is rarely done, hence, water overflows the pits and accumulates as stagnant pools along alleys in this area (Plate V). Furthermore, the simultaneous use of pit latrine for sewage disposal and wells for water supply is associated with the possibility of ground water pollution as discussed in section 5.11 and 5.31.

5.53 Electricity Supply System:

i. Demand and Supply

Bauchi town is supplied with electric power from the 330 KV national grid through Jos and Gombe. The existing power supply capacity is 15 mega watts, while the demand for electricity at peak load period is 12 mega watts (N.E.P.A., 1991). Therefore, the existing supply capacity is adequate in quantity to cover the demand for all landuses in Bauchi.

ii. Distribution Network

The distribution system is overhead with cables borne on wooden poles and a series of transformers of between 100 - 500 KVA capacity located in various activity areas in the town. The network is extended to cover most parts of the town. These include the pheripheral settlements like Yelwa and Wantin Dada (Fig. 5.9B). Electric power supply in Bauchi is fairly

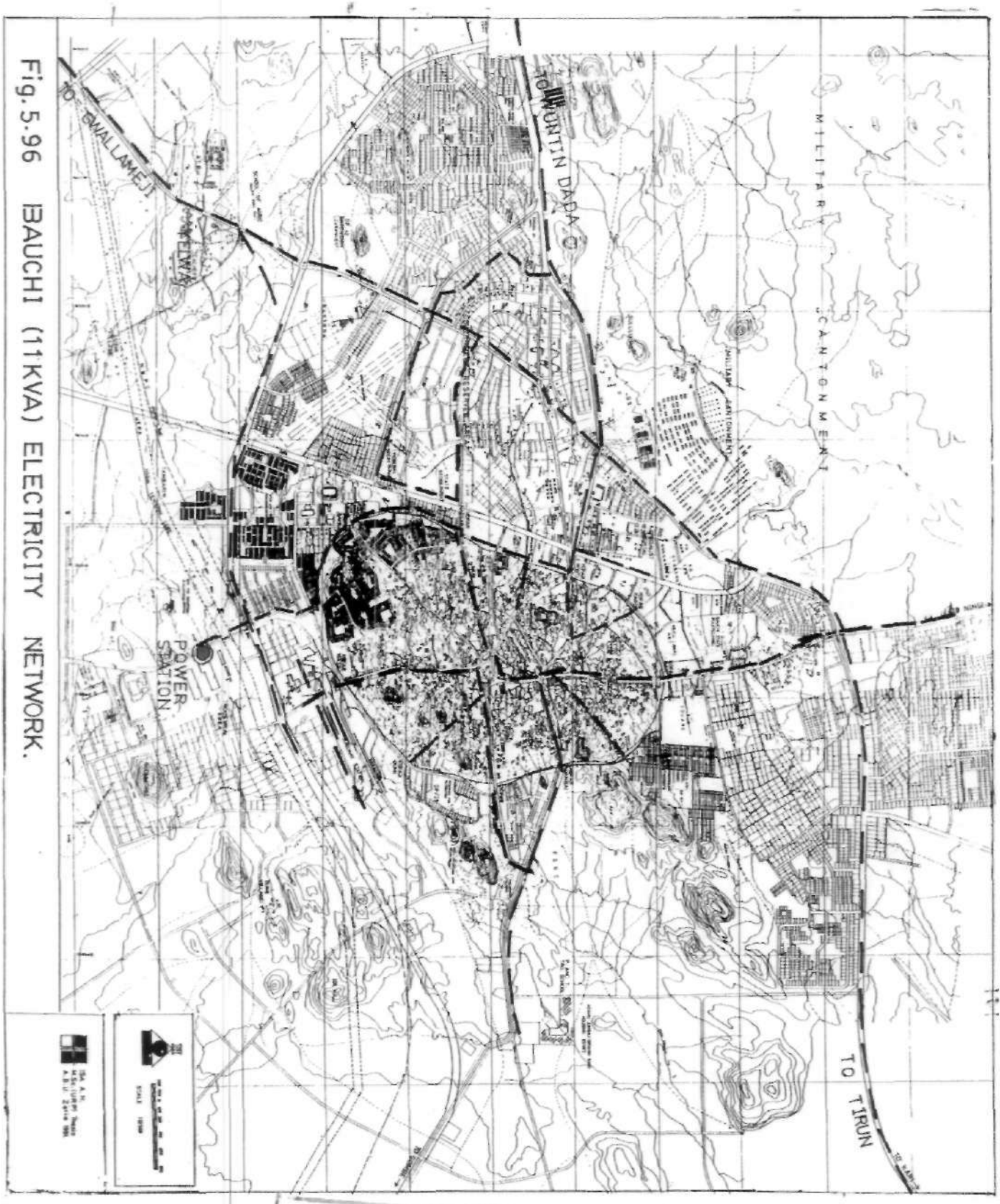


Fig. 5.96 BAUCHI (11KVA) ELECTRICITY NETWORK.

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regular and has about 91% level of household connection.

The major problems of electric power supply in Bauchi are traced to the overhead distribution system and the haphazard distrubution network within the traditional (walled) area. In this area, due to the irregular, narrow and winding nature of roads and passages, electric cables including the 11KVA lines are run close to or over houses to effect connection. This has reduced aesthetics value of the traditional area and also it is a potential danger to lives and property in the area. For instance, when electric poles are knocked down by rain or wind storm. To avoid this ugly situation, total power supply blackout are observed during heavy rains or speedy winds. This is one of the factors for irregularity of supply.

The compound survey indicates that about 91% of the houses are connected to electricity power supply. This is associated with the policy of N.E.P.A. to provide network facilities along all streets to a minimum distance of 100 meters of residences. The cost of which is normally recovered by charging consumers connection fees. The fairly regular supply of power is also an additional reason for this level of patronage. Therefore, the main problem of electric supply in Bauchi is associated with the overhead network system.

CHAPTER - SIX

MANAGEMENT OF UTILITIES IN BAUCHI TOWN

In Nigeria, the provision of utilities like water, electricity and sewage disposal system is conceived as a social service by both the Government and the citizens. Public corporations are formed to provide these utilities on direct Government subsidisation. This chapter examines the effectiveness of this management approach in achieving co-ordination and economic viability of management agencies and their outcome on utility delivery in Bauchi town.

6.10 MANAGEMENT OF WATER SUPPLY

Bauchi State Water Board (B.S.W.B), is a State Urban based Government corporation. It is the sole agency responsible for the provision of water in all declared urban areas in Bauchi State. These towns include Bauchi, Gombe, Azare and Misau (Figure 5.1). Bauchi State Water Board has its headquarter in Bauchi town and also zonal area offices in Bauchi, Gombe and Azare. These area offices and the public relations office at the headquarters are expected to liase between management and other utility agencies and members of the public in matters relating to water supply operations. However, the survey shows little co-ordination between the operations of Water Board with

other utility agencies and the Bauchi State Urban Planning Development Board (B.S.U.P.D.B).

6.11 Cost of Water Supply in Bauchi

It costs Bauchi State Water Board (B.S.W.B) about ₦0.0017 to produce one litre of water and about ₦12,439 to install water distribution facilities per hectare in residential area in Bauchi (Appendix I and II). Based on the estimated water demand of 43.2 million litres per day (Section 5.31) about ₦73,440 is required by Water Board to produce sufficient treated water per day in Bauchi town in 1991. This further, implies that total of ₦26.8 million will be expended on water production per annum in Bauchi town. The implication of this cost to the management operations has not been considered in the physical planning proposals in Bauchi town as described in Section 5. Another problem that introduces inefficiency in the management of water supply is the rapid increase in the cost of procuring inputs like chemicals, lubricants, and network facilities due to inflation. For example, the average cost of water supply facilities per residential hectare was about ₦2,582 in 1978, this has increased to about ₦12,439 in 1991. However, despite this increase in the cost of water provision, Water Board charges a flat rate of ₦5:00 per domestic tap connection per month since 1979.

6.12 Water as a Social Service

The efficient provision of water in Bauchi has also been hampared by the concept of social service provision. The provision of water is regarded by both the Government and the inhabitants as a social right of all citizens. Therefore, massive subsidisation has been maintained despite the rising cost of operations and the dwindling incomes to the Government. The State Water Board charges a flat rate of ₦5:00 per domestic tap connection per month. This has been so since 1979. This massive subsidisation and the declining flow of resources from the Government has constrained the ability of management to provide sufficient quantity of water in Bauchi over the years.

In response to this water scarcity, the inhabitants use bore-holes, shallow wells and water tankers as alternatives sources of water supply. The use of shallow wells is greater in the low income traditional (walled) area while bore-holes and water tank are mostly used in the high income residential areas and in the industrial area in Bauchi. These alternative sources are either associated with health risk or high cost of provision as described in Section 5.

The existing management approach has proved ineffective. This is because of the problem of high cost of operations and lack of sufficient funds. Furthermore, lack of proper co-ordination between physical planning and

management and the conception of water supply as a social service are the major factors responsible for the inefficiencies. Therefore, there is need to redefine this social service concept and also improve the level of co-ordination.

6.20 MANAGEMENT OF ELECTRICITY SUPPLY

The National Electric Power Authority (N.E.P.A) is the only agency in charge of electric power supply in all urban areas in Nigeria since 1971. In Bauchi State, the Authority has a district headquarter in Bauchi town and area offices in Gombe, Azare, and Bauchi. The district headquarters is responsible for long term policy planning state wide, while the area offices take charge of plan implementation and local management operations. Although, the National Electric Power Authority (N.E.P.A) has a public relation office for co-ordination of activities, however, the survey shows that little co-ordination exists between the management and sister utility agencies and also with the Town Planning authority in Bauchi. Therefore, the agency lacks data on landuse planning proposals to guide their fiscal plan policy proposals. This is responsible for the delays in the extension of network facilities to new development areas experienced in Bauchi town.

6.21 Cost of Electricity Supply

It costs the National Electric Power Authority (N.E.P.A) ₦6.10 to produce 1 Kilowatt of electric power nation wide. In Bauchi it costs about ₦10,233 to produce electricity distribution facilities per residential hectare (Appendix III). However, the cost of network facilities is recovered from consumers through connection charges.

6.22 Electricity Supply as a Social Service

The supply of electricity is conceived as a social service. However, there exists differences in the level of subsidisation according to the type of consumer. This is highest for domestic consumption, where ₦0:18 kobo is being charged per kilowatt per hour of electricity consumed and ₦2:00 monthly demand charge. In the average about 65% of the cost of electricity supply is subsidised. Although, the National Electric Power Authority (N.E.P.A) has the problem of lack of sufficient funding, however, electricity supply is adequate and fairly efficient in Bauchi as discussed in Section 5.33(ii).

6.30 MANAGEMENT OF SEWERAGE DISPOSAL SYSTEM

The Environmental Sanitation Division of the Bauchi State Urban Planning Development Board (B.S.U.P.D.B) is responsible for the provision of sewage and sullage disposal systems in Bauchi. However, the Department provides water closets for sewage disposal in public places like markets,

parks and gardens due to insufficient funding. Therefore, individuals make provisions for the disposal of sewage and sullage wastes on private basis.

In response to this situation, about 57% of households use pit latrine, 42% use water closets and 1% other systems to dispose sewage and sullage waste in Bauchi town. The compound survey revealed that pit latrine is used by majority (93%) of the households in the low income traditional (walled) area, while 76% of the inhabitants outside the walled area used water closet (Figure 5.95). The problem with this practice is the possibility of water pollution as discussed in Section 5.32. Although, the cost of installing a sewerage system is high, the use of effective development control to ensure that adequate set back are maintained between pit latrines and wells will minimise the possible pollution effects of the existing practice.

CHAPTER - SEVEN

PROPOSALS AND RECOMMENDATIONS

This study has revealed a number of inefficiencies in the planning and management practices for the provision of utilities in Bauchi town, (Chapters 5 and 6). A recapitulation of the problems and their conceived planning and management solutions are presented in this last chapter of the study.

7.10 PLANNING OF UTILITIES

The existing planning practice for the provision of utilities in Bauchi has the following problems:

i. Provision of Utility Corridors

There is lack of adequate space to accommodate utility distribution networks due to the narrow, irregular and winding roads and passages in the traditional (walled) area. Although, some of the passages in this area have been upgraded (Figure 5.5) however, sufficient consideration for the provision of utility reservations was not integrated in their construction. In areas outside of the walled town there is encroachment on utility easements by property developers along primary and district roads.

ii. Landuse Planning Problems

The provision of more land area to accommodate the development of a new State capital in Bauchi as from 1976 has been over-emphasised. This has lowered the population densities to about 17 persons per hectare across the board and an average of 53 persons per hectare for residential areas in Bauchi town. This is associated with the following problems of utility provision:

(a) Rapid expansion in physical extent of Bauchi town beyond the available resources to provide and extend utility facilities to cover all landuse areas.

(b) Over provision of land for residential (plot) development resulting in high cost of utility facilities per person in newly developed areas due to low population densities, while in the other parts of the town it encourages plot subdivision and infilling. This (plot subdivision) has introduced inefficiency in utility delivery by allowing demand to grow in excess of the capacity of installed facilities.

iii. Utility Delivery

(a) The use of shallow wells and bore-holes is a potential health risk to the people in Bauchi due to inadequate set-back between these water sources and private toilets (in houses).

(b) The use of pit latrine for sewage disposal by majority (93%) of compounds in the traditional (walled) area of Bauchi town has left the household waste water (sullage) uncattered for, and the unavailability of surface water drainage system in most parts of this area to be used as alternative disposal system for the sullage waste has further compounded the problem.

(c) The existing overhead electricity supply network is a potential danger to life and property due to inadequate set-back from houses in the traditional (walled) area and broken down of poles by (accident) vehicles along most primary and district roads in areas of new development outside the town wall.

iv. Co-ordination of Utility Planning Operations

There is no defined framework for consultative and integrated planning approach to bring together the varied components of the utility planning family within the existing planning process in Bauchi town. This has created conflicting actions and proposals between the operations of utility agencies and that of physical planning in Bauchi town.

7.20 MANAGEMENT OF UTILITIES

The problems associated with the existing management of utilities in Bauchi town are:

i. Lack of Adequate Finance

The utility management agencies lack adequate funding due to massive subsidisation of utilities and the declining flow of resources from the Government due to economic recession. This has created shortage of water supply and the inability to extend network facilities to new development areas.

ii. Lack of Data Base

The management agencies have no information about the trend in physical expansion of the town nor physical development plan proposals. Therefore, the evaluation of financial requirements of management agencies for the provision of utilities is not based on sound information and most often it falls short of requirements for a development plan period. This has also added to the problem of meeting their financial requirements as discussed in (i) above.

iii. Rapid Expansion of Land Area

The rapid extension of land area coverage as encouraged by the landuse planning practice (Section 7.10(1) has resulted in low population densities in landuse areas hence, increase cost of utility provision to the management and to the people. This creates inefficiencies and reduces accessibility of utilities to the population.

iv. Lack of Co-ordination

There is lack of proper co-ordination of activities between the management and agencies and, most regretably between them and the town planning authority in Bauchi town. Although, each of the management agencies has a public relation office to effect co-ordination, the degree of inter-agency interaction is low, especially at the policy formulation level. Therefore, the management agencies lack horizontal linkages.

7.30 PLANNING AND MANAGEMENT RECOMMENDATIONS

These proposals are addressed to the problems highlighted in the earlier discussions (7.1 and 7.2).

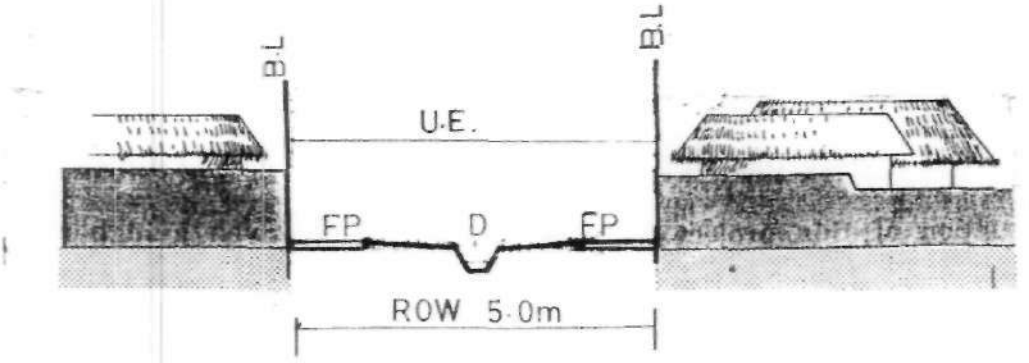
7.31 Planning Proposals

i. Upgrading of Passage-ways in the Traditional (Walled) Area

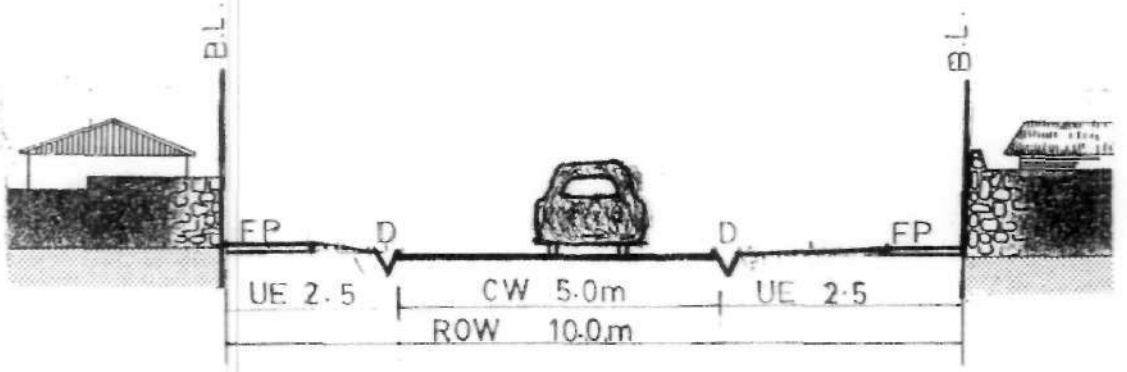
A partial upgrading exercise is proposed to widen the local accessways and pedestrian alleys as shown in Figure 7.1. This will create utility easements and also facilitate the re-organisation of utility networks in the walled area to resolve the problems of utility supply discussed in Section 7.1(b).

In line with this proposal it is recommended that:

(a) Bauchi State Government should take the responsibility of paying compensation for the right of way to be acquired to the owners of property to be affected.



(I) DESIGN PROPOSAL FOR PEDESTRIAN ALLEYS.



(II) DESIGN PROPOSAL FOR ACCESS WAYS.

DRAINAGE . . . . . D
BUILDING LINE . . . . . B L
UTILITY EASEMENT . . . UE
CARRIAGE WAY . . . . CW
FOOTPATH . . . . . FP

SCALE 1:100

Fig·7·1 PROPOSED ROAD UPGRADING FOR THE TRADITIONAL (WALLED) AREA IN BAUCHI.

(b) The State Government should be responsible for the construction of roads and drains along the local access ways while Bauchi Local Government should take charge of drain construction along the pedestrian alleys. It is expected that community members and social clubs will assist with free labour for construction works while each utility agency be responsible for the provision and reorganisation of network facilities as required.

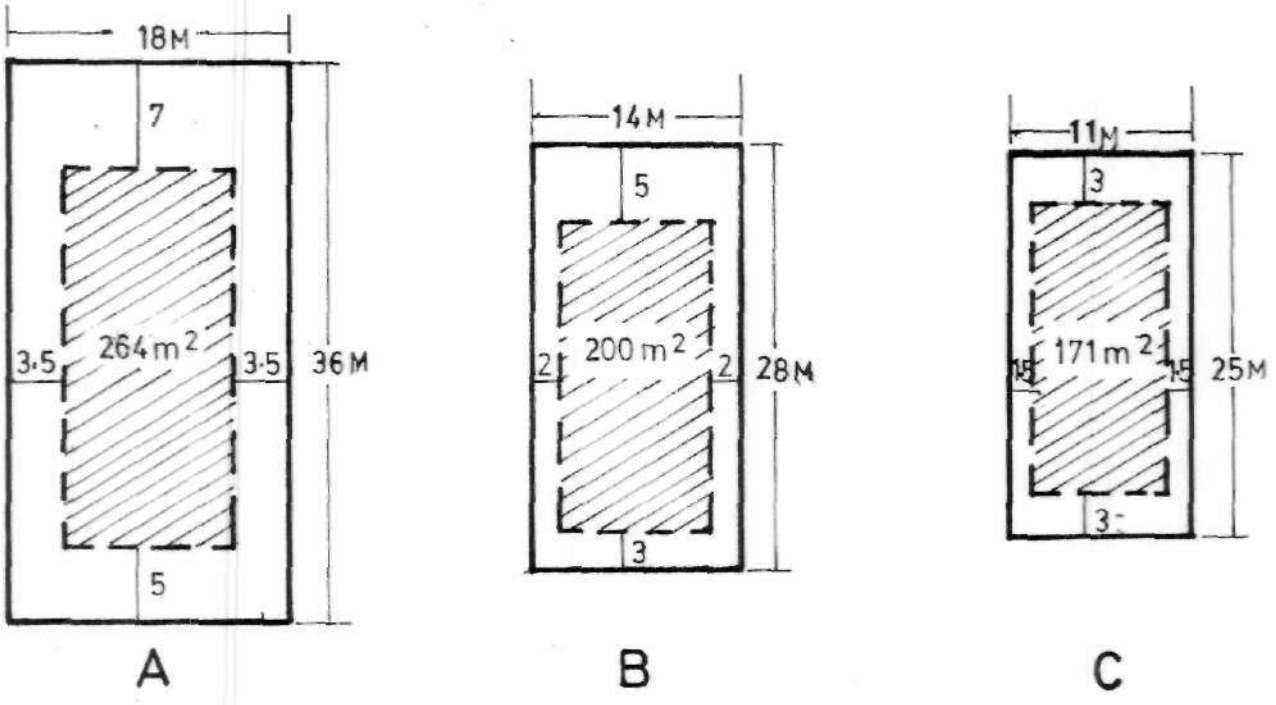
To minimise the cost of compensation to acquire right of way and the disruption of social relationship, it is recommended that the local access ways be upgraded to about 10 metres wide, while the pedestrian alleys are widened to a right of way of about 5 metres only (Figure 7.1).

ii. Recovery of Encroached Utility Easements

The Town Planning Authority (B.S.U.P.D.B) should embark on an exercise to recover the parts of utility reservations that have been encroached upon in areas of recent development (Figure 5.7, Cross Section I to IV). Property owners should be served with removal notices to make available utility easement which is at least a minimum of 5 metres wide. This is to minimise the cost to be associated with this exercise.

iii. Proposed Plot Size

In Figure 7.2 are the proposed residential plots sizes for housing development in Bauchi town. These plots are designed to achieve the following objectives:



LEGEND

LOW DENSITY PLOT . . . A
MEDIUM DENSITY PLOT . . . B
HIGH DENSITY PLOT . . . C
MAXIMUM PLOT COVERAGE . .
ALL DIMENSIONS ARE IN METER

TABLE - 7.3: Plot Coverage and Setback Recommendation

PLANNING SPECIFICATIONS						
Plot Category	Plot Area	Setbacks			Plot Coverage	
		Front	Sides	Back	Area	% of Total
A	648m^2	5m	3.5	7m	264m^2	41%
B	392m^2	3m	2m	5m	200m^2	51%
C	275m^2	3m	1m	3m	171m^2	62%

Fig.7.2 : PROPOSED PROTOTYPE RESIDENTIAL PLOTS FOR BAUCHI.

iii. Proposed Plot Size

In Figure 7.2 are the proposed residential plots sizes for housing development in Bauchi town. These plots are designed to achieve the following objectives:

(a) To elliminate plot sub-division.

(b) To facilitate the achievement of standard set back between water sources and pit latrine.

(c) To optimise population density and minimise cost of utility provision per person.

The plot sizes are evaluated based on the following analysis.

The average household size (5.4 Persons) and the range of 1 to 16 persons per household revealed by the survey (Table 7.1) are slightly below the figures of 6 Persons for average household size in 1976 (Max Lock, 1976) and the range of 1 to 18 persons per house hold in 1978 (Dar Al Handasah, 1978). Furthermore, the number of families per compound has also declined from 3 families per compound (Max Lock, 1976) to about 2 families in 1991 (Table 7.2). These demorgraphic dynamics indicate a fall in household size and number of families per compound. Therefore, it is assumed that household size of more than six persons and families in the excess of two per compound are unlikely to continue in areas of new residential development in Bauchi town.

Table 7.1: Average Household Size in Bauchi

Household Size	No. of Sampled Households	Total No. of Persons	% of Total
1	28	28	1.3
2	24	48	2.2
3	32	96	4.3
4	56	224	10.1
5	100	500	22.6
6	68	408	18.4
7	28	196	8.8
8	12	96	4.3
9	8	72	3.3
10	12	120	5.4
11	4	44	2.0
12	8	96	4.3
13	4	52	2.3
14	8	112	5.0
15	4	60	2.7
16	4	64	3.0
Total	400	2,2216	100.0

Average Household Size $= \frac{2216}{400} = 5.5$ Persons.

Table 7.2: Average Number of Households Per Compound in Bauchi

	Wards	Average No.of Households per Compound
A.	G.R.A.	1.1
	Submean	1.1
B.	Gombe Road	1.3
	Maiduguri Road	1.1
	Wuntin Dada	1.8
	Submean	1.4
C.	Gwallameji	2.2
	Railway	2.6
	*Makama	2.1
	*Dan Amar	2.5
	*Sarkin Baki	2.6
	*Dan Iya	3.8
	*Dan Kadai	1.7
	Submean	2.5
	Grand Mean	1.9 Households per Compound.

A = Low density residential area.

B = Medium density residential area.

C = High density residential area.

* = Traditional (Walled) areas.

Based on these finding on household size and number of households per compound, it is proposed that two families (households) of six persons each are to inhabit a plot in new residential areas in Bauchi. This gives a total of 12 persons per plot. Based on this number, and the landuse characteristics in residential areas in Bauchi, space requirement for habitation and other domestic chores are evaluated as shown in appendix III. This has been translated into plot size for the low, medium and high densities residential areas as indicated in Figure 7.2.

The proposed coverage in each plot is flexible because in each density category the floor area exceeds the minimum area requirement (compare values in Figure 7.3 and appendix III). For example, the low density (type 'A') plot is proposed to have a maximum area of 264 metres square at about 41% coverage. This compared to the area requirement of 183.5 metre square in the existing situation shows an excess of about 80.5 metre square in land provision.

The plots are designed with depths of about twice the width (Figure 7.2). This is to facilitate the achievement of the minimum 15 metre set back requirement between shallow wells and pit latrines in new housing areas.

The recommended plots are smaller in sizes than the existing practice. This is to increase densities in residential areas and reduce the average length of utility facilities per plot and consequently increase accessibility of utilities to the population.

A minimum of 3 metres set back is recommended between building line and property lines (or utility corridors) in new development areas. This will give adequate set back for houses to be protected from the dangers of over-head electric network (in an event of broken poles).

iv. Proposed Layout Design Concept

The layout design concept (Figure 7.3) is conceived to resolve the following problems of utility provision in Bauchi: The encroachment of development on roads and utility reservations and the incidence of knocking down of electric poles by vehicles:

(a) Roads and Utility Lines

Because of the problem of development encroachment on roads and utility lines, and the knocking down of electric poles by vehicles discussed in section 7.1(ii)a three road dual carriage way is proposed for primary and district roads in Bauchi (Figure 7.3 and Fig. 7.4). This design concept is recommended especially in areas where these roads pass by or through intensive human activity areas.

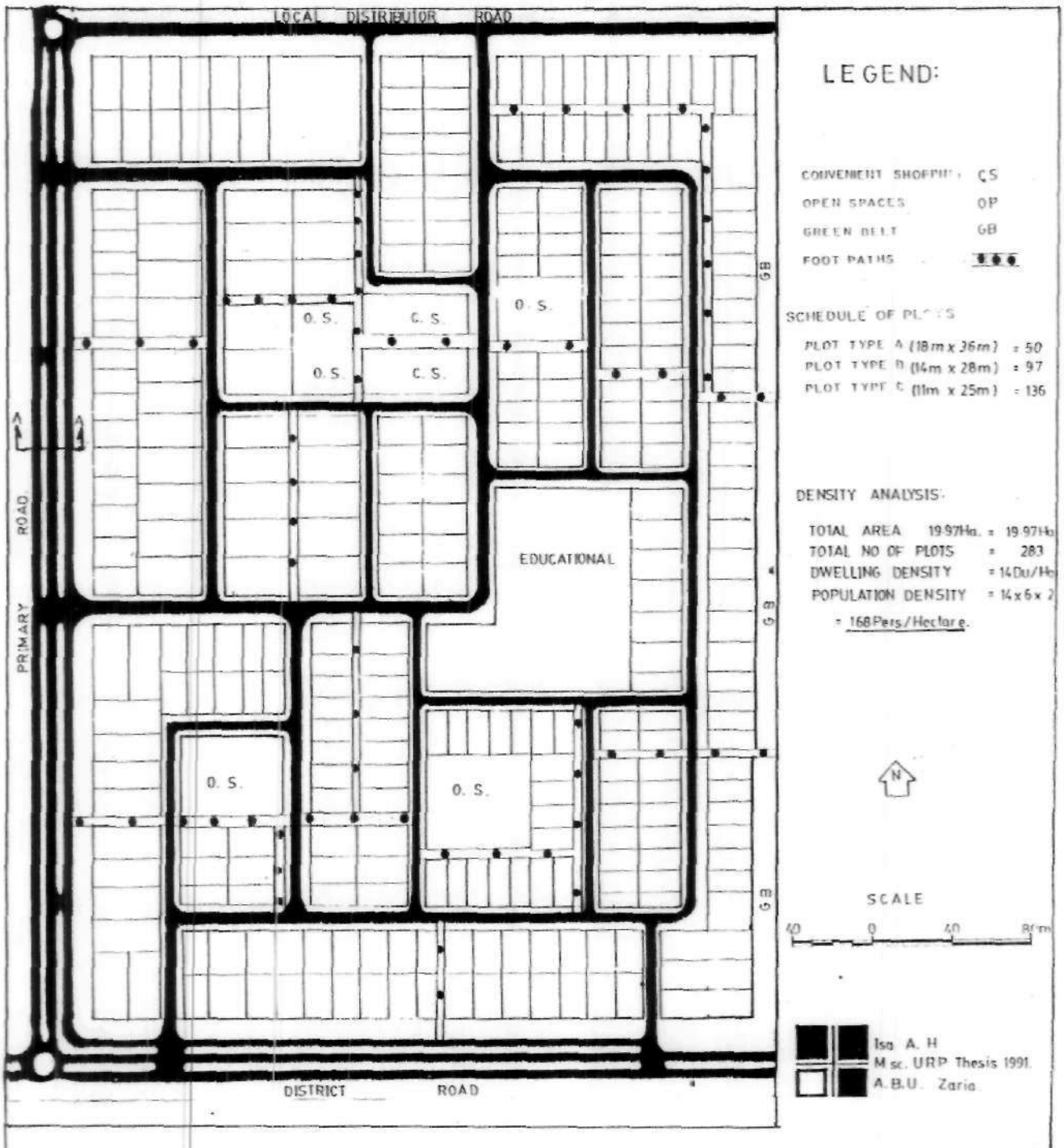
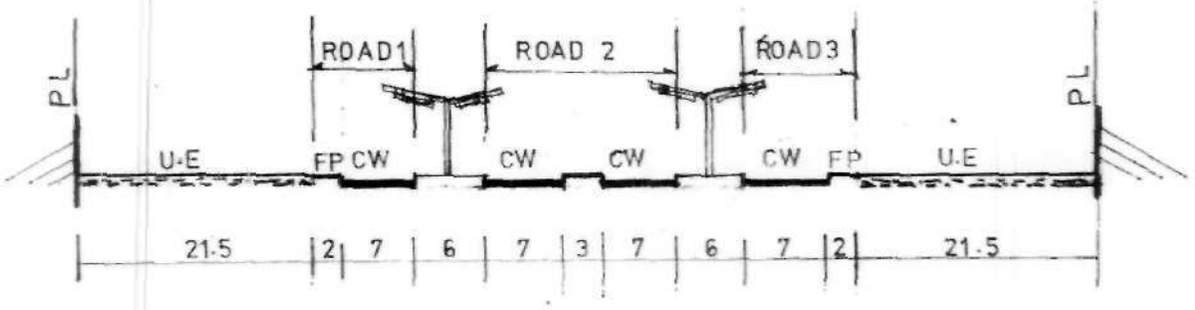


Fig.7.3 PROPOSED PROTOTYPE RESIDENTIAL LAYOUT FOR BAUCHI.

CROSS SECTION "AA"
(From Page 122)



LEGEND

UTILITY EASEMENT. . . U·E
RIGHT OF WAY. . . . . .ROW
PROPERTY LINE . . . . .PL
CARRIAGE WAY . . . . .CW
FOOT PATH. . . . . .FP

SCALE. 1: 125

Fig. 7·4 PROTOTYPE DESIGN PROPOSAL FOR PRIMARY AND DISTRICT ROADS IN BAUCHI.

Iso A. H.
M. Sc. (U.R.P.) Thesis E
A. B. U., Zaria

One of the roads is to accommodate high speed traffic and the other two (the closest to utility locations) are for slow speed traffic moving into or out of the activity area. This is expected to prevent the knocking down of electric poles by traffic.

In the layout, the high density residential plots are about utility locations. This will assist to prevent encroachment on utility corridors, common to the low density (high income) residential areas in Bauchi as discussed in Section 5.22. Strict development control measures is also recommended to accompany this layout design strategy so as to ensure the maintenance of standard set back between building lines and utility lines and also between utility lines and high speed traffic to lessen the incidence of breaking down poles by vehicles.

The pattern of the proposed road network is a combination of loop and grid systems. This will provide a suitable frame to accommodate the installation of looped distribution network for water and grid distribution network for electricity. This is to take advantage of connection from more than one end to ensure continuous supply in an event of damage to one part of the system.

(b) Plot Orientation

In the proposed layout plots are oriented with their width (shorter sides) facing utility lines. This in

addition to the recommended plot sizes will minimise the length of utility facilities per plot and reduce the cost of their installation by more than half the existing situation as shown in Table 7.4.

(c) Population Density

In the proposed layout there are about 14 dwelling units per hectare. Based on the average household size of 6 persons and 2 families per plot in Bauchi.town, there would be about 168 (14 x 6 x 2) persons per hectare in the layout. This will reduce the cost of utility provision per person and ease affordability of utilities to the people.

(d) Density Integration

The integration of low density, medium density and high density residential plots in the proposed layout concept is expected to increase social interaction between these social groups so as to utilise political influence of the elites and beaurocrats and the economic advantage of the high income population to extend utilities to the less able low income population in Bauchi town. Furthermore, this strategy is designed to minimise the uneven distribution of utilities between residential area which are segregated on the basis of socio-economic status as revealed in Section 5.41(iii). The layout design has enough open spaces for recreation activities. This is to

TABLE - 7.4: Cost of Utility Facilities in the Proposed Layout Compared to Existing Situation in Bauchi

1. Proposed Layout

Plot Category	Cost of Utility Installations Per Plot in ₦			
	Water	Electricity	Drainage	Total
A ($648m^2$)	1519.1	1258.8	550.5	3328.4
B ($392m^2$)	920.3	762.6	352.0	2034.9
C ($275m^2$)	645.9	532.2	234.1	1415.2
2. Existing Layouts				
A ($1800m^2$)	4101.3	3494.4	1485.0	9080.7
B ($800m^2$)	1840.0	1565.0	704.0	4099.0
C ($450m^2$)	1032.0	856.0	374.4	2262.4

make it attractive to the high and medium income earners, who may require such space for games and sporting activities.

v. Proposed Utility Plan Preparation Strategy

The major problem with the current utility plan preparation process in Bauchi is lack of proper co-ordination between the physical planning, the engineering and the management professionals. These units of utility planning are like members of a family, each with individual ambitions, potentials and constraints as well as methods of operation. Therefore, co-ordination and integration is essential in order to achieve the common goal of general well being of the family, that is efficiency in utility provision in this study. Therefore, higher degree of co-ordination is suggested between the various sectoral activities for utility plans to be feasible and comprehensive. To make this effective, given the existing situation an administrative machinery is required. A Utility Planning and Management Committee is suggested. This is aimed at inter-coporate approach to the planning of urban utility development in Bauchi. Both long term and short term plan proposals are to be a co-product of physical planners and utility agencies. For example, layout plan is to be jointly scrutinised and also comprehensive to include all utilities, so as to tackle problem and integrate the requirements of each agency at

the design stage. In this way, each participating unit is committed to implementation of the plan. Thus, problems of conflicts in interest becomes minimal. Moreso, this will ensure that utility resources are geared towards a common goal for efficient growth and physical development.

To achieve this aim, it is recommended that the membership of the proposed Utility Planning and Management Committee should include the Bauchi State Urban Planning Development Board (B.S.U.P.D.B) with the Chief Executive or Chief Town Planning Officer as Chairman , all managers of utility agencies, Bauchi Local Government Chairman as members and at least one representative of Bauchi State Executive Council. However, other members are to be co-opted as may be required.

This Committee is to convene at least twice a year. One before the financial year begins. This is to allow agencies include in their fiscal expenditure estimates of the cost implication of their role and responsibilities in the implementation of the physical development plan for that financial year. The second meeting should be in the middle of each financial period, so as to review progress and obstacles.

7.32 Management Proposals

In Bauchi as in many towns in Nigeria, reliable figures of income and expenditure are difficult to obtain.

This is because informal sources of income and expenditure to households make reliable estimates difficult. For instance, it was observed during the survey that in one family of 6 persons, the household head is a messenger in the civil service, and a barber during his spare time. His two wives are potters while their 3 children engage in hawking after school hours. This is a common example of many households in Bauchi, especially within the traditional (walled) area. These and other informal sources of income are difficult to evaluate and most often not included in the income declared by many households, despite their importance as source of subsidies especially to the low income families. Therefore, the aggregate income of household per month may be slightly above the figures presented in Table 7.5 and Appendix IV.

Housing studies in Nigeria show that between 20 and 25 Percent of family incomes are expended on housing, including utilities (Abuja Master Plan, 1979, Pp174; and Dar Al-Handalah, 1978, P.14). Dan Alhamdasah (based on housing studies in Bauchi) alloted 5% of monthly income to expenditure on utilities in Bauchi town in 1978. This 5 Percent allocation is considered inadequate in this study due to the increased demand for utilities and the rising cost of utilities provision. Besides, there is financial constraints of the management agencies due to insufficient funding by Government which have resulted

to shortages and inefficiency of utility systems in Bauchi. Moreso, that the present expenditure on utilities in Bauchi exceeds 5 Percent of household income (Table 7.5) despite the inconveniences and the possible health risk associated with the various alternative means adopted as a result of inefficient utility systems. Based on these situations there is need to redefine the present social concept of utility provision to ensure economic viability of management agencies to cope with the existing demand and cost of utility provision in Bauchi. However, due to lack of accurate data on income and expenditure as earlier noted, it is considered rational to use the existing expenditure of about 9 Percent on utilities (Table 7.5) as a basis to determine the ability of the inhabitants to pay for utilities in Bauchi town.

The cost of utilities provision per month shown in Table 7.6 exceeds the recommended 9 Percent expenditure on utilities in all the three income groups. Thus, there is need for subsidisation.

In line with the forgoing analysis the followings are recommended:

(a) A combination of cost recovery and minimum subsidisation approach is recommended for the management of utilities in Bauchi town.

TABLE - 7.5: Household Income and Expenditure on Utilities in Bauchi Per Month

Income Group	Average Income Per Month	Average Utility Expenditure	% of Total
Low Income	₦496.3	48.71	9.8
Medium Income	₦743.9	55.25	7.43
High Income	₦1309.5	110.87	8.47
Mean	849.9	71.61	8.56

Source: Field Survey, 1991.

TABLE - 7.6: The 9% Income Alloted to Utilities and Cost of Utilities Provision Per Month in Bauchi

Income Group	Cost of Water (₦)	Cost of Electricity (₦)	Total Cost	9% Income - Total Cost
Low Income	27.23	76.02	103.25	44.67 - 77.23 = -32.56
Medium Income	33.66	83.55	117.21	66.95 - 88.16 = -21.21
High Income	42.84	211.92	254.76	117.8 - 183.0 = -65.20

i. Water Supply

Water distribution facilities should be installed by management and the cost recovered from consumers through connection charges, while a 55 Percent subsidy is recommended for water consumption. This will raise the water charges from the present ₦5:00 flat rate per month to about ₦12:00 in the low income, ₦15:00 in the medium income and ₦20:00 in the high income residential areas to give management more financial resources for efficient operations.

ii. Electricity Supply

The existing management strategy is fairly efficient, however, the subsidy should be reduce from 60 Percent to 55 Percent to increase the financial viability of the agency for efficient operations.

This 55 Percent subsidy for water and electricity supply will bring the total cost within the 9 Percent income expenditure suggested for utilities in Bauchi as shown in Table 7.7.

iii. Sewage Disposal

The implementation of recommendations in (i) above should be accelerated to make potable water accessible to all areas and population in Bauchi. This is to be accompanied by development control measures to ensure that 15 metre set back between water sources and pit latrine is

TABLE - 7.7: 9% Monthly Income and Cost of Utilities at 55% Subsidy

Income Group	Cost of Water (₦)	Cost of Electricity (₦)	Total Cost in ₦	9% Family Income (₦)
Low Income	12.52	32.21	44.73	45
Medium Income	15.15	37.60	53.75	66
High Income	19.28	95.36	114.64	117

maintained. Public enlightment campaign through news media and public health inspectors should be mounted to inform people about the health risk associated with the simultaneous use of pit toilets for sewage disposal and shallow wells for water supply without standard setback. While it is recommended that drainage channels be provided for waste water disposal in already developed areas (Section 7.31), Bauchi State Government (through the Engineering Divisions of the Bauchi State Urban Planning Development Board and the Ministry of Works) should provide drainage channels in proposed development areas and the cost recovered instalmentally from the inhabitants.

In line with these recommendations for the installation of utility facilities and the recovery of the cost from property developers it is expected that Federal Mortgage Bank and the proposed Urban Infrastructure Development Bank will assist management agencies with soft loans to make this policy effective.

(b) Mapping of Underground Utility Mains

The positions of existing underground utility networks in Bauchi should be marked especially within the traditional (walled) area and accurately mapped out. A copy of the map is to be made available to all utility agencies to facilitate easy repair work and reduce incident of damaged mains caused by repair staff and construction workers.

7.40 CONCLUSION

Although a number of problems have contributed to lack of efficient utility systems in Bauchi town, the origin of these problems have been traced mostly to lack of proper co-ordination of activities between the various units of utility planning and management. It is therefore, concluded that efficient provision of utilities in towns depends on the level of co-ordination in planning and management operations to utilise resources and skills of the professionals involved and overcome the socio-economic problems of urban utilities provision.

APPENDIX I

ESTIMATED COST OF WATER PRODUCTION IN BAUCHI

1. Dam Operation Cost (₦)		Duration of Use in Days	Average Cost Per Day (₦)
Construction or Fixed Cost:	₦10,000,000	36,500	273.97
Chemicals	1,140,000	365	3,123.29
Lubricants	237,868	365	651.69
Electricity	51,009	30	1,700.00
Operation Staff	60,000	30	2,000.00
Sub-Total			7,748.95

Total water production per day = 6,400,000 litres.

Average cost per litre = 7,748.95 - 6,400,000 = ₦00.12

2. Borehold Operation Cost (₦)			
Construction or Fixed Cost:	₦100,000	9,125	10.91
Lubricants	59,467	365	162.92
Electricity	13,922	240	58.01
Operation Staff	68,268	30	2,275.60
Sub-Total			2,507.44

Total water production per day = 1,600,000 litres

Average cost per litre = ₦0.0016.

3. General Operation Cost (₦)			
Staff Salaries	₦92,731	30	3,091.03
Others	10,000	30	333.33
Sub-Total			3,424.36

4. Total Overhead Cost (₦)

Grand Total Operation Cost = ₦13,680.75

Total Water Production Per Day = 8,000,000 litres

Average Production Cost Per Litre = ₦1580.75 -

8,000,000 = ₦0.0017 per litre.

SOURCE: B.S.W.B. 1991.

APPENDIX II

COST ESTIMATES FOR WATER DISTRIBUTION FACILITIES PER HECTARE IN BAUCHI (1991)

	Item Description	Qty	Rate	N K
	Town Cost			
1	1325m of 150m pipe	1	135/m	178,875=00
2	900m of 100mmpipe	1	100/m	90,000=00
3	Sluice Value 150mm	1	420	420=00
4	Sluice Value 100mm	1	380	380=00
		Sub-Total		179,765=00
	Area Cost			
1	700m of 25mm pipe	1	20/m	14,000=00
2	2260m of 50mm pipe	1	30/m	67,800=00
3	950m of 75mm pipe	1	58/m	55,100=00
4	Sluice Values 25mm	5	500	2,500=00
5	Sluice Values 50mm	9	600	5,400=00
6	Sluice Values 75mm	4	800	3,200=00
7	Tees 150/25	3	250	750=00
8	Tees 150/50	5	280	1,400=00
9	Tees 150/75	4	350	1,400=00
		Sub-Total		151,550=00
	Local Cost			
	Tee Reducers 100/25	2	60	120=00
	Tee Reducers 100/50	5	75	375=00
1	6250m of 26mm pipe	1	20/m	125,000=00
2	1875m of 50mm	1	30/m	56,250=00
3	Tee Reducers 50/25	588	55	32,340=00
4	Tee Reducers 75/24	5	75	395=00
5	Tee Reducers 25/25	75	40	3,000=00
		Sub-Total		369,010=00
		GRAND TOTAL		700,325

Total area of layout = 56.3ha.

Cost of facilities per ha. = 700,325 - 56.3 = N12,439.17

SOURCE: B.S.W.B. Hqs. (1991).

APPENDIX III

DETERMINATION OF PLOT SIZES

A residential plot should provide enough space to cater for habitation and other domestic activities. These elements are analysed and appropriate area requirements arrived at:

A. Habitable area (or Bedroom area)

Habitable area is a product of room area per person X average Household size X Number of households per plot.

Specifications	Residential Densities			
	Low	Medium	High	Group Average
Room Sizes	15.75M^2	13m^2	9m^2	12.58m^2 = 13m^2
Room Occupants	1.5pers.	2.2	3.3	2.3

1. Room area per person = 13 ~ 2 = 6.5m^2
2. Average Household size 5.34 persons (refer to Table 7.1)
3. Average number of households per plot 1.9 (refer Table 7.0)

Habitable area = 6.5m^{2}X 6 persons X 2 households = 78m^2.

B. Type of Activities and Area Requirements:

	Type of Use	*Area M^2	Residential Densities: Low No.	Low Total Area	Medium No.	Medium Total Area	High No.	High Total Area
1.	Kitchen	3	1	3	1	3	1	3
2.	Bathroom	6	3	18	2	12	2	12
3.	Living Room	16	2	3	1	16	1	16
4.	Store	6	1	6	1	6	1	6
5.	Dining Room	6	1	6	1	6	-	-
6.	Study	4.5	1	4.5	-	-	-	-
7.	Garage	18	2	36	1	18	-	-
8.	Shop/Zaure	4.5	-	-	1	4.5	1	4.5
	Sub-Total (B) =			105.50		65.50		41.
	Sub-Total (A) =			78.00		78.00		78.
	Total Area Required (A+B)=			183.50m^2		143.50m^2		119.
	Proposed Plot Coverage			41%		51%		62
	Proposed Plot Area			648m^2		392m^2		275

APPENDIX IV

Average Monthly Expenditure on Utilities in Bauchi Town

		Average Expenditure on Utilities per Month		
	Wards	Electricity	Water	Total
A.	G.R.A.	84.77	26.10	110.87
	Submean	84.77	26.10	110.87
B.	Gombe Road	39.00	20.00	59.00
	Maiduguri Road	44.75	27.00	71.75
	Muntin Dada	16.50	18.50	35.00
	Submean	33.42	21.83	55.25
C.	Gwallameji	18.20	19.30	37.50
	Railway	28.00	23.70	52.70
	Makama	42.50	9.30	51.80
	Dan Amar	12.00	13.80	25.80
	Sarkin Baki	40.90	10.10	51.00
	Dan Iya	42.30	30.00	72.30
	Dan Kadai	28.00	21.90	49.90
	Submean	30.41	18.30	48.71
	Aggregate Mean	49.50	22.07	71.60

A. Low density (high income) residential area.

B. Medium density (medium income) residential area.

C. High density (low income) residential area.

BIBLIOGRAPHY

Abubakar, S. S.(1990): "The Problems and Prospects of Physical Plan Implementation in Bauchi State: A Case Study of Bauchi Master Plan". Unpublished M.Sc(URP) Thesis, Department of Urban and Regional Planning, Ahmadu Bello University, Zaria, Nigeria.

Akinade, E. M. A.(1988): "An Overview of Planning Law in Nigeria", Presented at the 19th Annual Conference of the Nigerian Institute of Town Planning, Abuja, 17th - 29th October, 1988.

Burbery, P.(1970): Environment and Services, B. T. Bastford Limited, London.

Dar Al-Handasah Consultants (1978): "World Bank Nigerian States Urban Development Programme", Feasibility Study for Site and Services and Residential Upgrading in Bauchi and Gombe, Volume 2:3.

Dar Al-Handasah Consultants (1986): "World Bank Nigerian States Urban Development Programme", Gongola State Urban Development Project Recommendations, Volume 2.

El-Hinnawi and El-Gohary (1981):in United Nation (1982) (eds): The World Environment Natural Resources and the Environment Series, Volume 8, Published by United Nation Environment Programme, Dublin.

Escritt, L. B.(1969): "Sawer and Water Main Design Tables", Maclalen and Sons Limited, London.

Fadamila, T. A.(1983): "Planning and Management of Utilities and Services in a City, Case Study of Ilesha", Unpublished M.Sc.(URP) Thesis, Department of Urban and Regional Planning, Ahmadu Bello University, Zaria, Nigeria.

Farris, M. T. and Sampson, R. J.(1973): Public Utilities: Regulation, Management and Ownership; Houghton Miffin Company Boston.

Feachem, R.(1977): Water and Health in Hot Climate, John Wiley and Sons, London.

Graeser, H.(1978): "Safe Drinking Water: Current and Future Problems" in Clifford S. Russel 1988(eds) Proceedings of a National Conference on Resources for the Future, in Washington D.C.

Grieve, R.(1972): "Infrastructure in the Planning Process": Town and Country Planning Summer School, Report of Proceedings, University of St. Andrews, 2nd - 13th September, 1972.

Max Lock Group Nigeria Limited (1973 - 1976): "Bauchi Surveys and Planning Reports".

Max Lock Group Nigeria Limited (1973 - 1976): Surveys and Planning Reports for North Eastern State Governments, Pp.5.4.1 - 5.5.2.

Manasa, E.(1991): Commercialisation of Operations in the Mass Transit Ventures: The Example of Plateau Express Services Limited, a Paper Presented at the 10th National Association of Town Planning Students Week, Ahmadu Bello University, Zaria, Nigeria, 6th to 9th March, 1991.

Mohammed, B.(1981): Planning the Provision of Water and Electricity in Urban Areas: A Case Study of Kaduna Town, Unpublished H.N.D. Project, Department of Town Planning, Kaduna Polytechnic, Kaduna.

Mohammad, N. S.(1982): Provision of Recreational Facilities in Bauchi Town, Unpublished H.N.D. Project, Department of Town Planning, Kaduna Polytechnic, Kaduna.

Mabogunje, A. L.(1969): Urbanisation in Nigeria, University of London Press, London.

Mckeever, J. R.(1970): Utilities and Facilities for New Residential Development: A Survey of Municipal Policy, Urban Land Institute, Washington, D.C.

Ogbonna, D. O.(1982): "Urban Population Growth and Problems of Water Sunply in Nigeria", a Paper at Zaria Water Resources and Environmental Engineering, Workshop on Water Distribution System - Analysis and Design.

Olawale, F.(1988): "Information Requirement for Basic Utilities Planning", A Paper at the Workshop on Data Aquisition for Urban Planning in Nigeria, Obafemi Awolowo University, Ile-Ife, September, 1988.

Oluwande, P. A.(1978): Cheap Sewage Disposal in Developing Countries, Ibadan University Press Limited, 1978.

Onokerhoraye, .(1980) in Sani, K. M.(1990)(eds): "Utilities and Services in Malumfashi Local Government Area: A Case Study of Storm Water Drainage in Malumfashi, An Unpublished M.Sc.(URP) Thesis, Department of Urban and Regional Planning, Ahmadu Bello University, Zaria, Nigeria.

Punch Newspapers Limited (1991): "Cholera Out Break in Zambia" (eds) February, 16th 1991, P.8.

Riddel, R. S.(1975): Urban Land Operations: Cambridge Course on Development and Land Policy, University of Cambridge, P.10.

SWK - AIC Bakolori Nigeria Limited (1990): Bauchi Township Water Supply: Environmental Impact Assessment, Final Report, September, 1990.

United Nation (1982): The World Environment, Natural Resources and the Environment Series, Volume 8, United Nations Environment Programme, Dublin.

United Nations (1991): Access to Basic Infrastructure by the Urban Poor (ed) Aurelio Monendez: Anedi Policy Seminar Report Number 28, The Workd Bank Washington, D.C.

Vagale, L. R.(1976): "Metropolitan Cities of Africa: The Challenges and Opportunity for Planning and Development Unpublished Course Paper, Number 10, Department of Town Planning and Estate Management, The Polytechnic, Ibadan.