PLANNING FOR FEDERAL UNIVERSITY OF TECHNOLOGY, BAUCHI

M.Sc. (U.R.P) Thesis

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CERTIFICATE

This is to certify that this Thesis has been submitted in partial fulfilment of the requirments for the award of the Degree of Master of Science, Urban and Regional Planning.

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DEDICATION

Dedicated,

To, the Almighty God - God of all nations and mankind for his grace, faithfulness, mercy, love and truth.

To the family of Sajo Bwinang Jabungo

To late Hon. Ahmadu Tela Talasse - December 1981.

To late Salihu I. Musa - 23/4/82.

To Educationists, Philantrophists and Planners.

To ECWA Church No. I Youth Fellowship, Bauchi.

To comfort loving people who are always thirsty of righteousness all over the world.

MESSAGE TO THE PHYSICAL PLANNER

"Forecasts of the future in higher education are notoriously inaccurate. The one trend which can be identified with any certainty is that the delivery of continuing education to a greater number of the people will be an ambition of an increasing number of countries. There will therefore be an increasing demand for flexible, open ended and innovatory further education systems."

Edward D. Mills (ed), 1976, PLANNING: Buildings for Education, Culture and Science, Published by Newnes Butterworths.

"For whatever, Profession, your inner devotion to the task you have set yourself must be so deep that you can never be deflected from your aim. However, often the thread may be torn out of your hands, you must develop enough patience to wind it up again and again ... Act as if you were going to live forever and cast your plans way ahead. By this I mean that your must feel responsible without time limitations, and the consideration whether you may or may not be around to see the results should never enter your thoughts. If your contribution has been vital, there will always be somebody to pick where you left off and that will be your claim to immortality.

Walter Gropius
A letter to a group of Students
14/1/1964

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The researcher is grateful to all who have assited him in one way or the other throughout the period of this research, particularly the University Authorities.

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A.B.U., Zaria
July 1982

Masoyi B. Bwilwa

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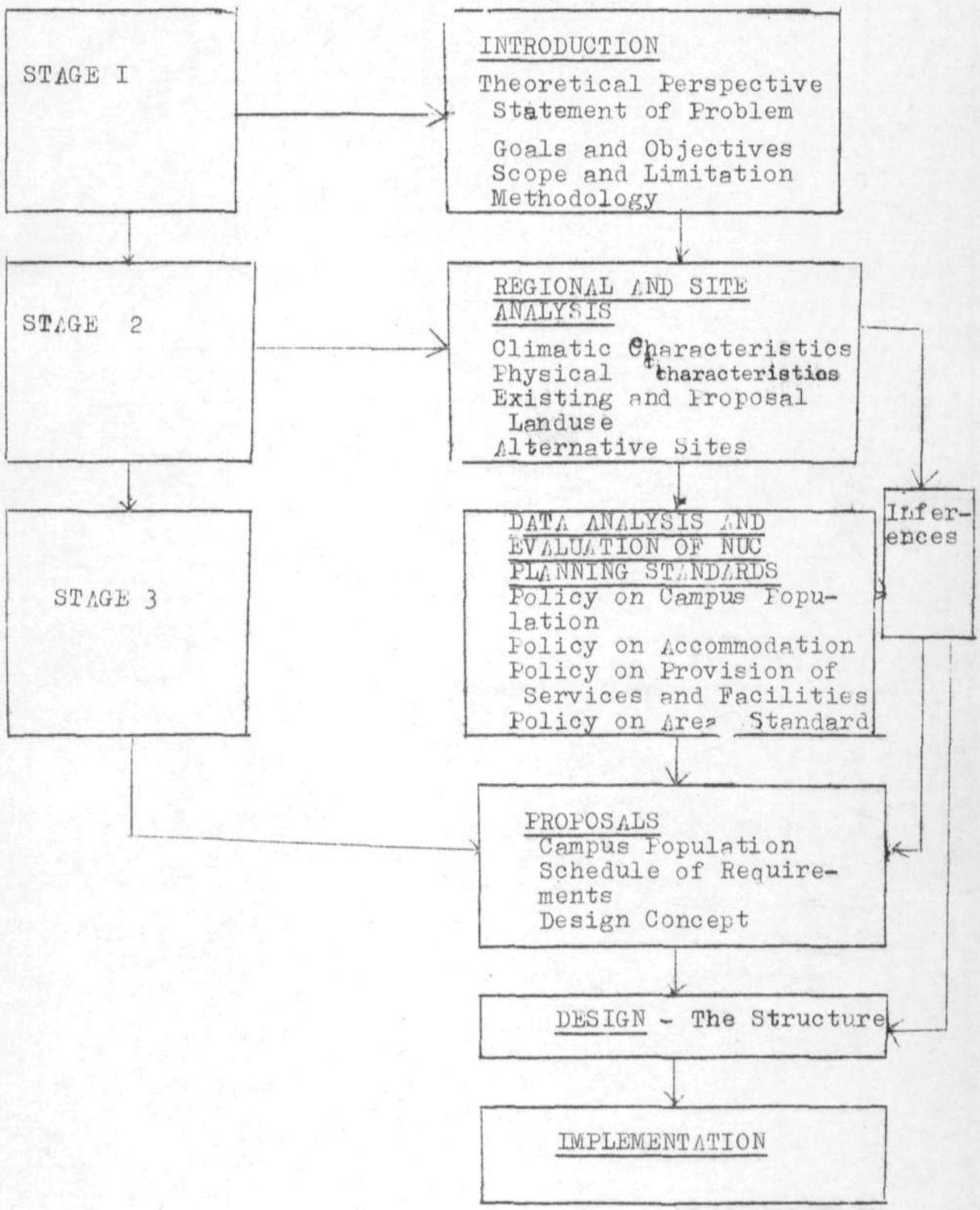
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THE CONCEPTUAL FRAMEWORK OF THESIS.



CHAPTER ONE

1.00 INTRODUCTION

1.10 Theoretical Perspective

The problem of University development and planning can be traced from the tenth century. The century recorded the establishment of the first University in Italy. This was followed by the establishment of more Universities in the eleventh and subsequent centuries in Europe, America, Australia and the developing world. The early Universities started initially as single buildings situated near the centre of the Medieval Cities. With time, other colleges were gradually founded and affiliated to the early Universities which grew with the cities. These additional institutions were located fairly close to the city centres, but later, especially with the rapid growth of cities, the new colleges were further flung away from the city cores and students had to travel over some distances from one part of the city to another to attend lectures necessary for their courses of study. The twentieth century and particularly the last half of this era, posed enormous challenges to planners in the planning and design of Universities because "The number of propective students is growing faster than the places available. To meet the demand, plans

have been put forward to establish new Universities, to raise the status of other colleges to University level and to expand existing institutions well beyond their present enrolments."[1]

Tony Birks observed that the number of Universities in Britain grew from 22 to 46 in the decade 1960 to 1970, while student enrollment rose from 100,000 to 222,000. The new Universities in Britain were asked to plan for student places of between 8,000 and 10,000. It is on record that the total student enrolment into institution of higher learning in America in 1900 was 238,000, by 1930 the number rose to 1,1000,00 while in 1950 the figure was placed at 2,659,872 and reached the mark of 7,608,000 in 1970.[2] Today the enrolment of Universities in America in general range from 15,000 to more than 58,000 per University.[3]

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1. Dober, R.P. (1975) The New Campus in Britain, Ideas and Consequences for the United States, Educational Facilities Laboratory, New York, p.5.

2,3 W.T. Furniss (Ed., 1973) American Universities and Colleges (eleventh edition), The American Council on Education, Washington D.C. 20036, pp. 4-5.

With the establishment of the first University Collge (1948) and subsequent Universities in (1960-62) in Nigeria, there has been a considerable increase in University admissions. Nigerian Universities now enroll about 70 times more students than they did twenty years ago.[4] Infact student enrolment for degree courses in Nigerian Universities during the past twenty years (1960-1980) has increased from approximately 1,400 to more than 70,000.[5] The number of Universities in Nigeria grew from 1 in 1960 to 19 in 1982 and it is likely that the number will increase by 1986. For the 1984/85 academic session enrolment of 180,000 students has been forecasted for Nigeria.[6] Considering the expected participation rate of 5% in University education by relevant age group, enrolments in "... 1990/91 could be as high as 450,000 ..."[7]

4,5 Bwilwa, M.B. (1982) Concepts of University Planning in Nigeria, Unpublished Urban Field Seminar Paper, Department of Urban and Regional Planning, A.B.U., Zaria.

6. Ayorinde, M.A. (1980) University Planning and Design Concept, Unpublished Urban Field Seminar Paper, Department of Urban and Regional Planning A.B.U., Zaria.

7. Bulletin of the National Universities Commission Vol. II No 1 January-March 1980, p.54.

Problems associated with campus planning and development include in extreme situations the drastic removal of campus from the city core to an open area at the periphery. It has been observed that "throughout the United States, there are colleges imprisoned on campuses that are too small, often surrounded by decaying neighbourhoods; their buildings frequently are old, dilapidated, poorly located and expensive to maintain."[8] "Due to the campus's (the University of Califonia San Francisco) geographic position (poor location within close proximity to down town), transportation access has long been a serious problem. The campus is divided by a major thoroughfare. Auto traffic generated by the campus also has a disruptive effect on the immediate neighbourhood."[9] In America and Australia, the lack of adequate land area for expansion of Universities was not without the accompanying problem of proliferation of campus in search of land within the large city-scape. The problem of space inadequacy led many Universities to expand to surrounding developed areas, and the cost

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8. S.B. Zisman and Catherine Powell (1958) The New Campuses for Old Educational Facilities Laboratory Report, p. 1.

9. Planning for Higher Education, vol. 10, No. 1 Fall (1981) Journal by the Society fo 'College' and 'University' Planning, p. 1.

of compensation is always great. The other problem of the University has been that of inadequate provision of facilities, services and accommodation for its growing campus population. To cope with the rapid increase in population it is appropriate to provide suitable academic programmes to meet students needs in the light of manpower requirements of the nation and supply the related physical facilities all in accordance with national objectives; it is also necessary that Universities are established within the framework of well-co-ordinated programmes that ensure steady growth of campus population in relation to available infrastructure.

1.2 Statement of the Problem and Justification of Study Area.

With the introduction of free primary school education in Nigeria (1973-1975) the country saw a rapid proliferation of not only primary schools but also post primary institutions. This has brought about the existence of large number of qualified students awaiting University education. Considering that the population of Nigeria is about 80 million and the University going age is 12% and the participation rate of 4% in University education, enrolments in Nigerian Universities may be placed at 384,000.

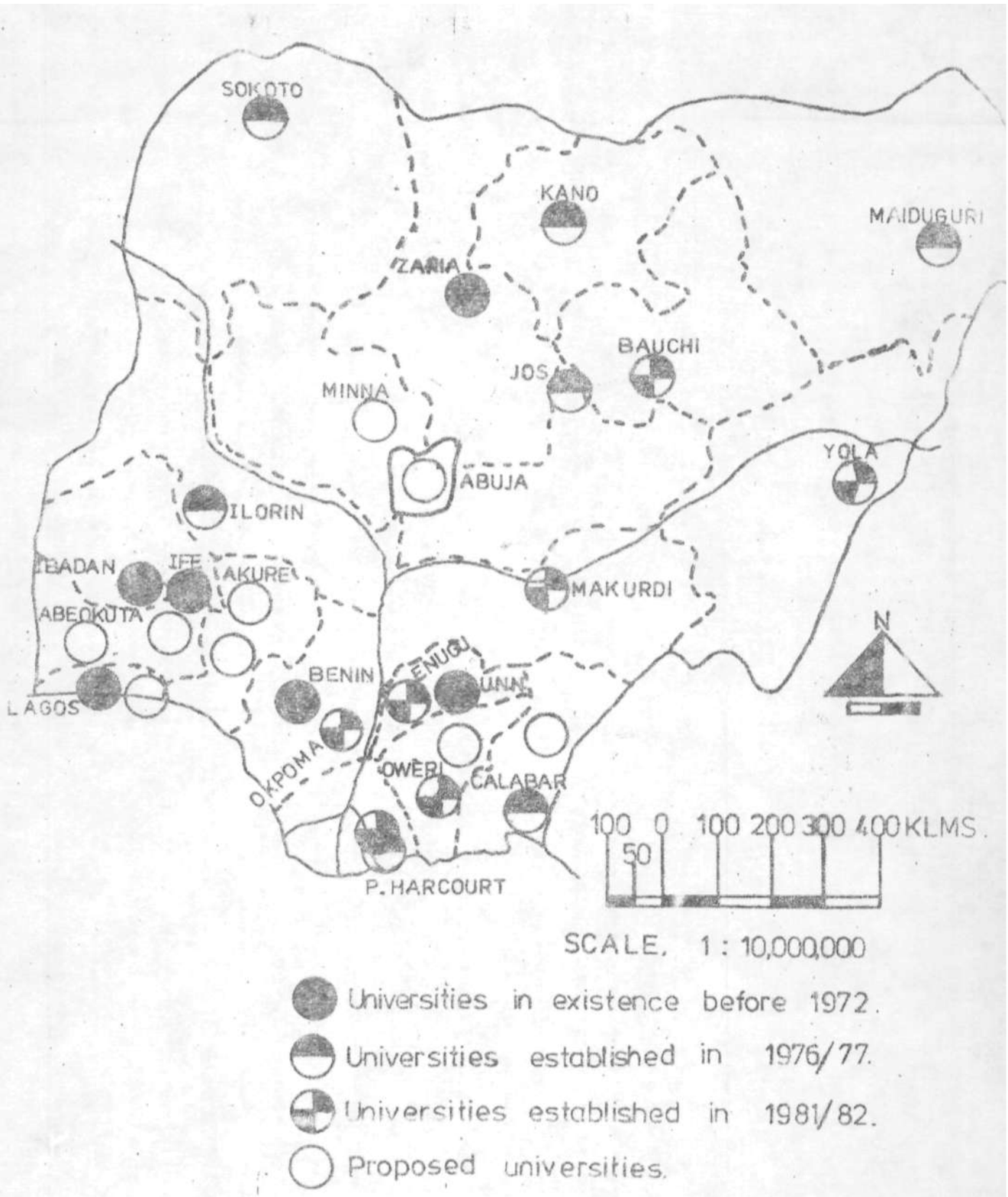


FIG. 1.2.1 LOCATION OF UNIVERSITIES IN NIGERIA.

source : Data from fieldwork.

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This will imply the establishment of many Universities in the country right now. The Federal government on recognition of this need established more conventional Universities in the country in 1976/1977 session, thereby raising the number from six to thirteen (Fig. 1.2.1. and 1.2.2.). Further more on recognition of acute shortage of technological manpower "Early, June 1980, a decision of the President-in-Council approved the establishment of a University technology in each of the following States: Bauchi, Benue, Gongola, Imo, Ogun and Ondo (Fig. 1.2.1) Each of the states at present has no University in the geographical areas. The Federal Government has also decided that the National Universities Commission should implement this decision begining in October 1980 with the Universities approved for Bauchi, Benue and Imo States".[10] The stand of the Federal Government on the establishment of the Universities of Technology indicates that "... These Universities are not just additional Universities, not just an expansion of University opportunity: they must be different from the traditional Universities which we inherited from our colonial past. We have an acute shorte of technological man-power at all levels. They must aim at not merely imparting theoretical knowledge but at giving greater

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10. National Universities Commission (June 1981) Preliminary Report of the Seminar on the Establishment of New Universities of Technology, Dec. 8-11, 1980, Lagos, Nigeria, p. xv.

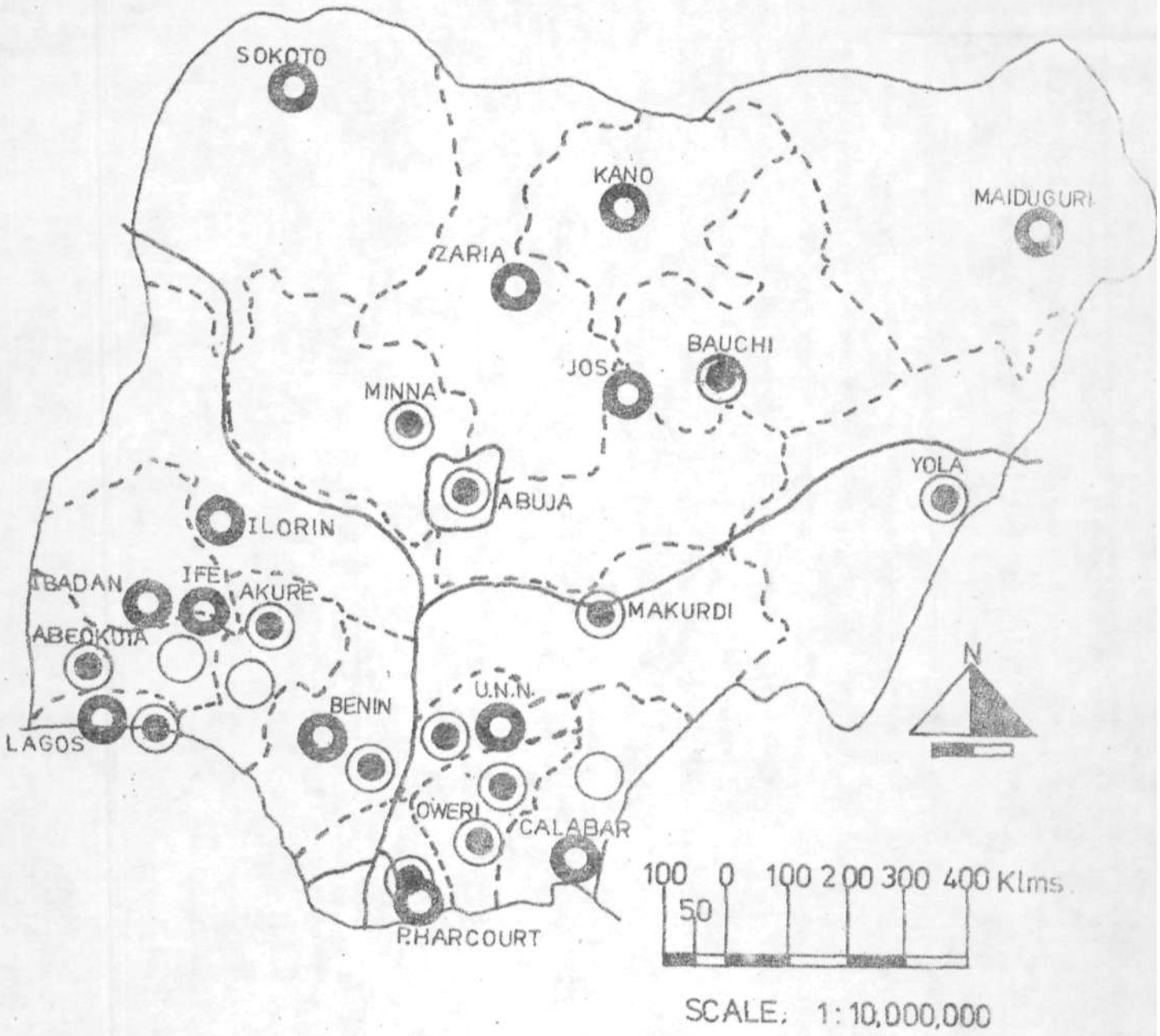


FIG. 1.2.2 DISTRIBUTION OF UNIVERSITY TYPES IN NIGERIA.

source: National universities commission kaduna.

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emphasis to practical experience in the field and development of appropriate skills by students.[11] The Federal University of Technology, Bauchi has taken off this session (1981/82) with initial enrolment of about 500 on a temporary site at Yelwa - Bauchi (the permanent site of Bauchi State College of Arts and Science, Bauchi).

If the experiences of pioneers in the development of University (highlighted in the proceeding section) are matters to go by, planning of Nigerian Universities is mandatory for the following reasons.

(i) The needs to ensure well-coordinated growth that accommodates the growing needs of dynamic University community and the inhibition of spantanous growth of Universities and their attendant problems.

(ii) To cater for the spatial and special needs of each University and the insurance of gradual evolution of humane, aesthetics and functional University environment for learning, living and recreation.

(iii) The justification and effective utilization of enormous investment in higher education in Nigeria.

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11. ibid 10, p.vi.

1.3.10 Goals and Objectives

Goals: The aim of the study is to design a campus for Federal University of Technology, Bauchi with a view to providing a conducive environment for learning and living.

1.3.20 Objectives: The following objectives are deemed instrumental to the achievement of the afore-stated goal:

(i) To identify several alternative sites for the University of Technology in relation to Bauchi town and evaluate them with a view to identying the most appropriate site.

(ii) To assess space requirements of the University based upon recommendations proceeding from a critical analysis of National Universities Commission's area standards guide for planning of Universities in Nigeria.

(iii) To evaluate various University Planning concepts and identify the most suitable for Federal University of Technology Bauchi.

(iv) To prepare a flexible and functional structure plan based upon space requirements and concept identified above.

(v) To prepare a detailed design of the public area within the framework of structure plan.

(vi) To suggest policies and programmes for implementation of the plan.

1.40 Scope and Limitations

The study is confined to the preparation of campus structure plan based on a selected concept.

It is within the scope of this study to prepare detail design of the central area (public area) of the campus.

For area calculations, proposals emanating from a critical analysis of National Universities Commission's area standard, for University Planning in Nigeria have been used.

No attempt has been made to apprase the academic standards of National Universities Commission.

The author does not intend in any way to produce the detail design of buildings and other structures.

As regards the project, no attempt or effort has been made towards estimating its cost.

Some problems associated with the theme of study include the paucity of literature on campus planning and design in Nigeria. However maximum efforts were made to make the best use of whatever little literature or data was available during the period of study. With this consideration in mind, the writer regrets whatever shortcomings are inherently eminent in this work; the author hopes that this very little contribution will challenge more scholars to conduct detailed research

on campus planning and design in Nigeria.

The base maps collected from different sources were not up-to-date in informaton content. It is admitted that the aim of my field work was to up-date the information, however these exercises were not without their problems and short-comings.

Campus Planning and Design is a field for a team of different professionals, wherefore no one planner within a specific spell of time could be exhaustive in his treatment of the subject. And more over, given the Nigerian situation, it is quite difficult to provide a fairly accurate focus of events due to sudden explosion of such parameters like population. However it is the contention of the writer that the flexible nature of the structure plan and the generous space allocation will accommodate sudden and unexpected future requirements.

And finally, the imposed inability to prepare the detail design of each component of the whole campus environment is a problem which has been made difficult to solve by the limited time available for this project. However it is the opinion of the author that the flexible structure plan can be used effectively in detail design proposals for the logical manipulation of buildings, vehicles and people with regards to topography, climate and functional needs of the University to evolve a useful complex.

1.50 Methodology

The study, being design oriented started with the understanding and analysis of existing situation in terms of climatic and physical characteristics (topography, soil, geology, drainage, vegetation) of the area and human impact on the environment. Apart from the importance of these characteristics (particularly the climatic and physical ones) on planning and design, they are instrumental to the selection of the most suitable alternative site for the University and the analysis of the selected site. Base maps and data collected in the field, departments and institutions form a base for the understanding of the region in which the project is to be sited.

This is followed by the determination of area needs per person for both the academic and allied facilities and housing based on the analysis of existing situation in some Nigerian Universities and peculiar needs of some uses as compared to the National Universities Commission's space standards guide for the planning of Nigerian Universities. The National Universities Commission's staff/students ratio standard have been used to calculate the campus population.

For the academic and communal facilities and requirements, the total projected students' population

has been used in the light of usable area per student. The number of students and staff to be accommodated on campus housing, has been utilized for calculation of area requirements for residential uses. Further more, water requirements for campus population has been projected on pro-rata basis for both the resident and non-resident University population.

A critical evaluation and appraisal of alternative concepts of University Planning and Design in Nigeria has been attempted with a view to identifying the most suitable to Federal University of Technology Bauchi.

The area requirement of different uses and the concept identified, form the basis for the design of campus structure plan for the University of Technology Bauchi.

CHAPTER TWO

2.00 REGIONAL AND SITE ANALYSIS

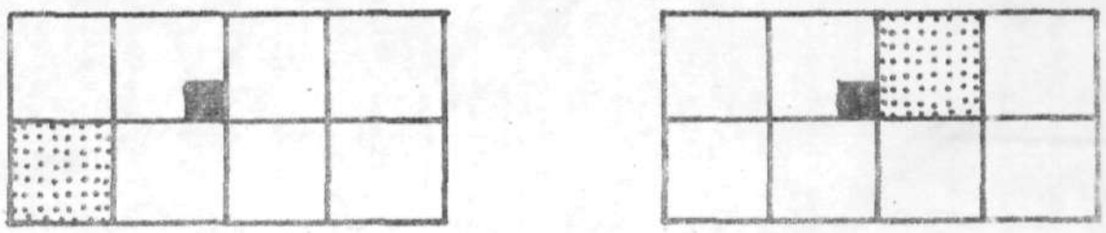
2.10 Literature review on city - campus locational models

Essential in University planning are the requirements of the various elements and the relative space each should occupy in relation to the function of the University. One of the major problems of siting a new University is always whether an adequate area can be acquired within the city or in the open country. Campus - city locational models are shown in Figure 2.1.1. In Nigeria most of the Universities are located remote from the city (Table 2.1.1).

Table 2.1.1: CAMPUS-CITY LOCATION IN NIGERIA.

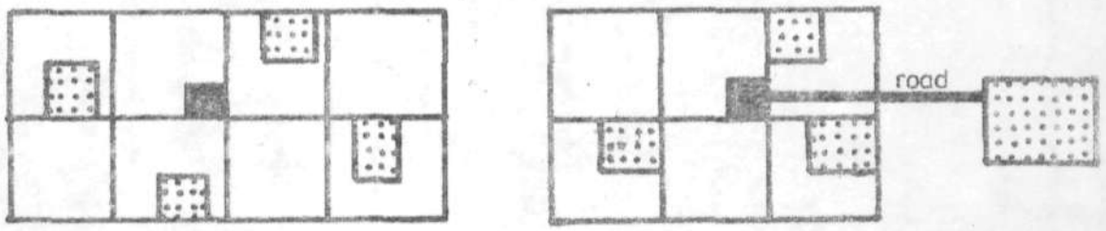
University	Distance from the city (kms)	University	Distance from the city (kms)
Ibadan	within city	Calabar	8.0
Lagos	within city	Bayero Kano	12.0
Nsukka	2.0	A.B.U.	12.0
Maiduguri	5.0	Sokoto	12.0
Jos	5.0	Port Harcourt	20.0
Benin	6.4	Ilorin	22.0

Sources: Analysis from Base Maps.



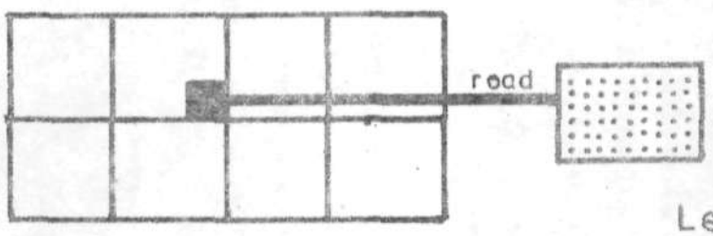
(a) Within city location ,
(eg uni. lagos)

(b) City centre location .
(e g uni. lagos partially)



(e.g uni. ibadan)
(c) Multi campus location within city .

(e.g a.b.u)
(d) Within city remote multi campus location .



(e.g uni. sokoto)
(e) Remote or peripheral campus location .

Legendry
City centre
Campus
City district

FIG. 2.1.1 CAMPU CITY LOCATIONAL MODELS

sources NWODO C I (1980) P 53 AYORINDE MA (1981) PP 38 40

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The first four models have the advantage of promoting interaction between the two communities. The two communites can benefit from each other's services and furthermore centrally provided facilities, services and utilities could be extended to the University at minimal cost. On the other hand the first four models are disadvantaged by lack of space for expansion, traffic congestion, duplication in the provision of central facilities and services.

Where a University is sited in open country there is the risk of remotenesss and isolation, which some, however, might regard as an advantage. It is envisaged that space for playing fields, adjacent to the University, and adequate area for futute expansion, is more likely to be secured outside the town The need for available space for expansion played a dominant and decisive role in siting of Universities in Britain between 1948 and 1973 and in Nigeria as from 1976.
It is recommended that the location of a University should be as close to the city as feasible.

2.20 Locational Analysis of Bauchi:

The city lies approximately on latitude $10^{\circ}17'$ North and longitude $09^{\circ}50'$ East. It is on an elevation of about 600 metres (2,000 feet) above sea level. It is linked to other parts of the country by, rail and road network (Figures 2.2.1 and 2.2.2.).

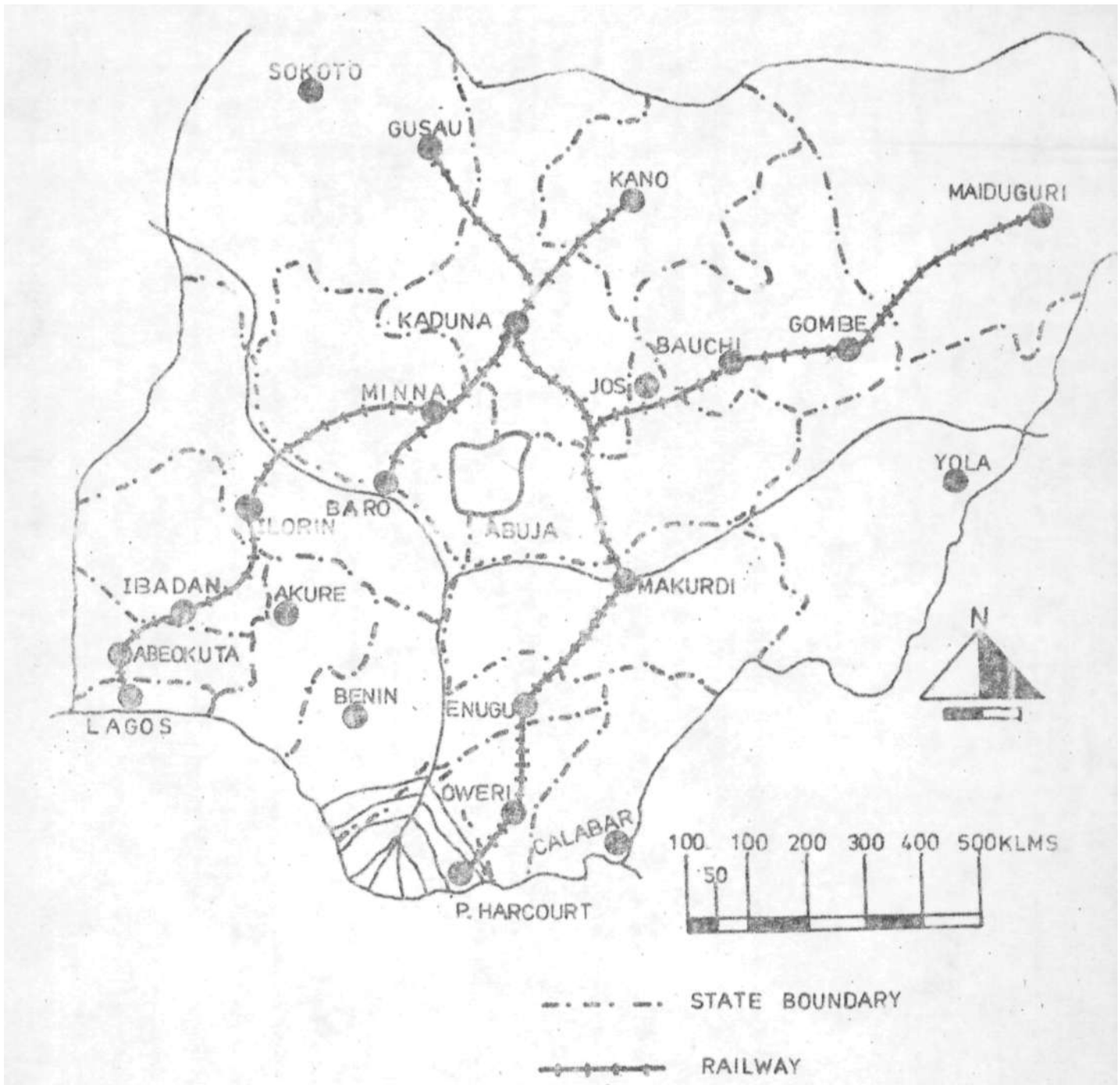


FIG. 2.2.1 LOCATION OF BAUCHI IN NIGERIA .

source : Administration map of Nigeria

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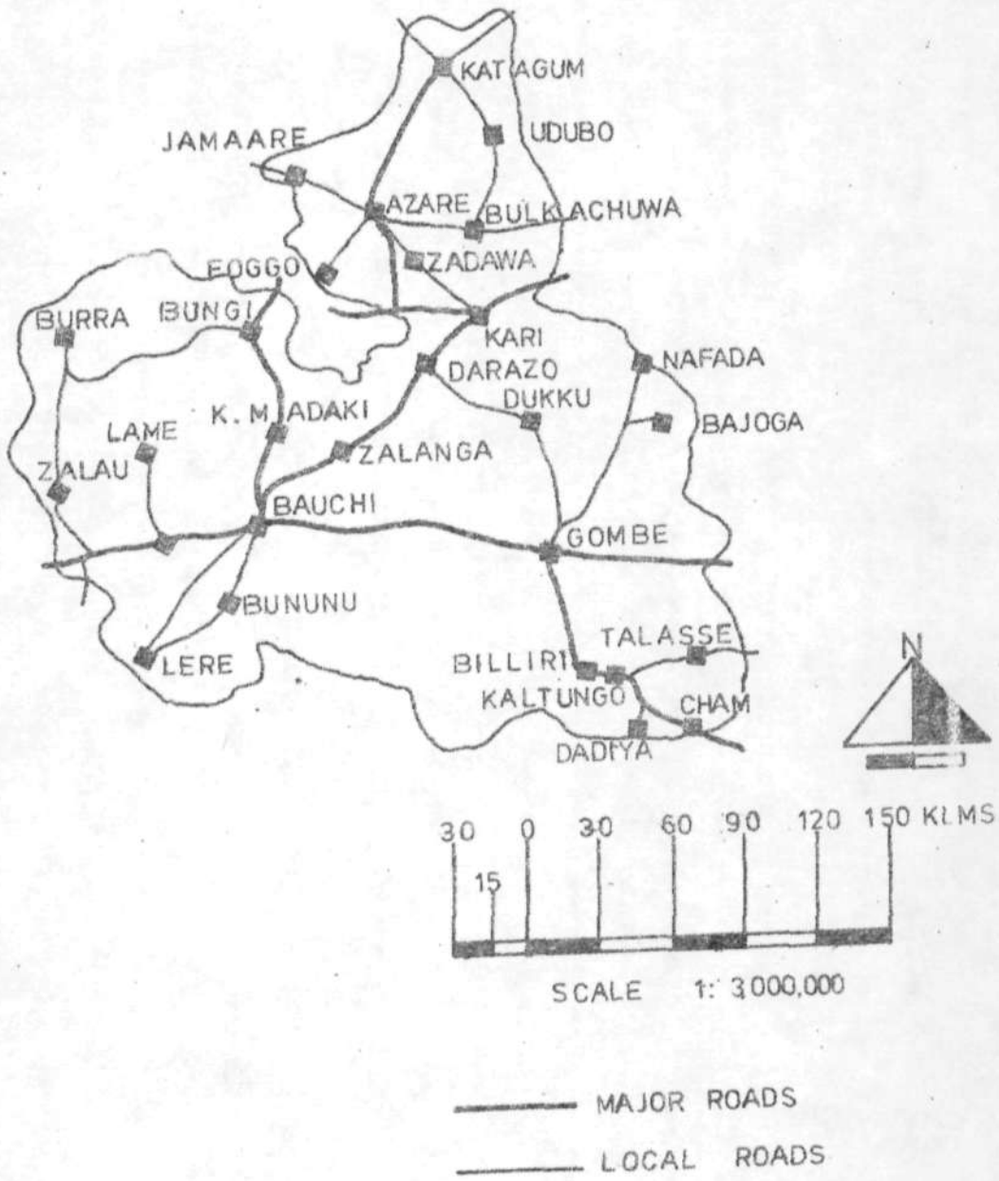


FIG 2.2.2 LOCATION OF BAUCHI IN BAUCHI STATE.

source: Administration map of Bauchi state

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2.30 Climatic Characteristics:

2.3.1 Climate - Rain fall.

The area is characterised by long dry season which lasts from October to March, while wet season regime lasts from April to September, reaching its peak in the mongh of August. The mean annual rainfall is about 1075 millimetres (43 inches) (Figure 2.3.1).

2.3.2 Climate - Temperature and Humidity:

During the dry period of the year, temperatures are generally high reaching its peak in April, the hottest month of the year. In April maximum shade temperature of 40°C (104°F) has been recorded. Air temperatures are generally lower in the months of November, December and January. Solar radiation is generally intense and severe throughout the year. It is on record that maximum daily relative humidity decreases slightly about the middle of rainy season but drops more drastically from about 94% in the month of August to less than 10% during the harmattan spell. Evapotraspiration rates are higher during the hottest period of the year (Figures 2.3.2 and 2.3.3).

2.3.3.Climate - Winds:

The prevailing winds in this region are the North-East trades and the South Westerlies. The

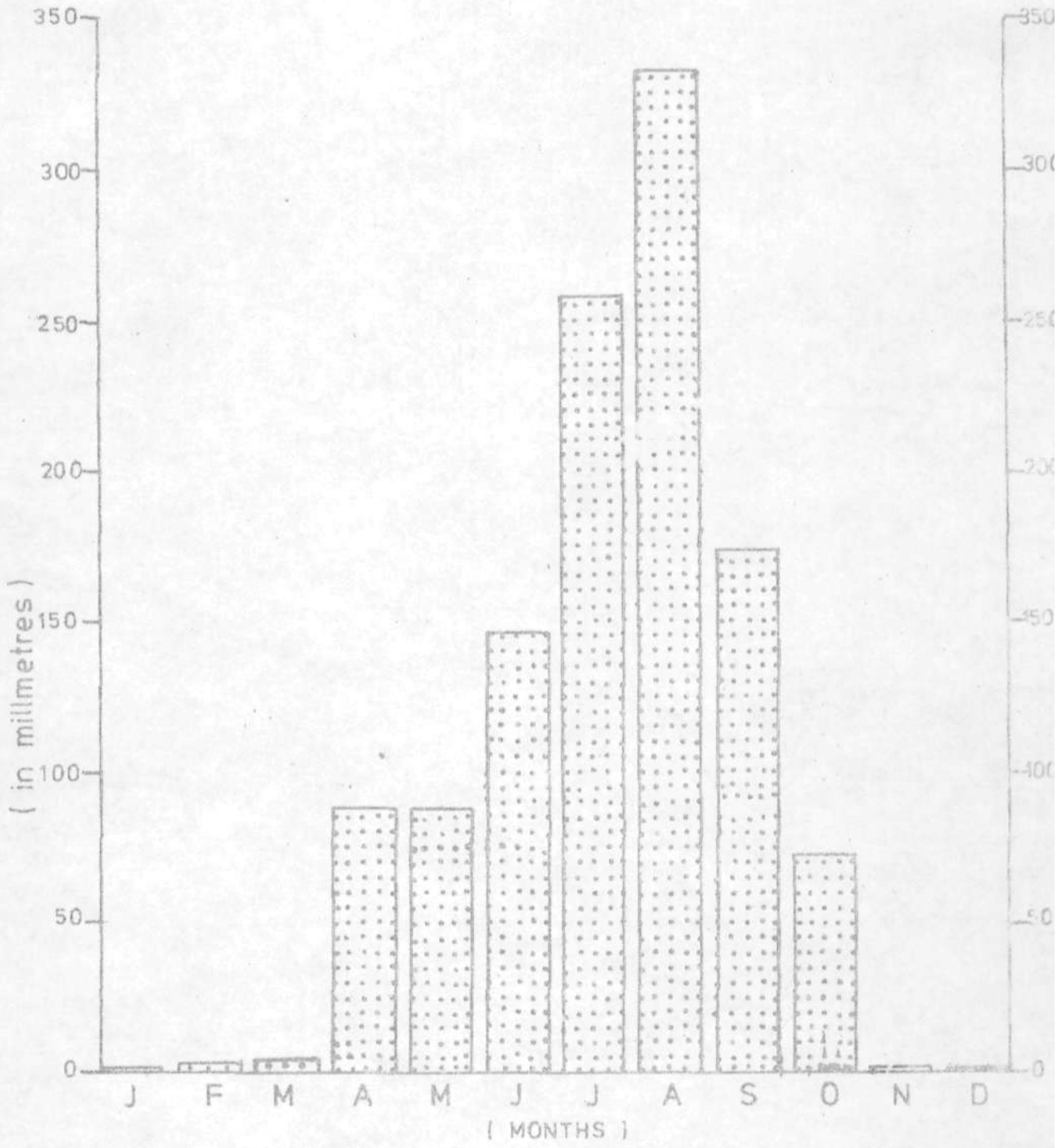


FIG. 2.3.1 : RAINFALL AVERAGE IN MILLIMETRES, 1908-1980

source : AERODROME METEOROLOGICAL OFFICE BAUCHI.

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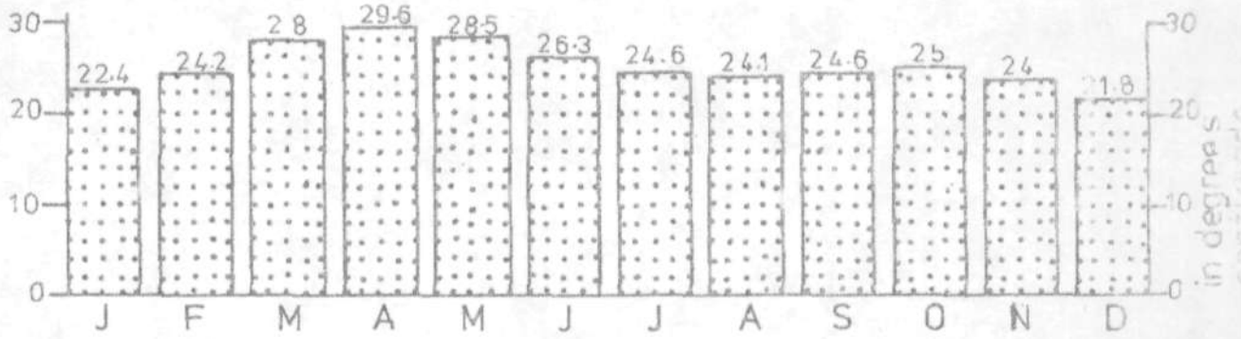
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former, is a dry, cold and dust laden wind which blows across the land between November and March bringing in dry conditions. The Westerlies on the other hand is a warm and moist wind that blows across the ocean into the land between April and October accompanied with heavy monsoon rains. Heavy thunder and dust storms are experienced during the early period of the rainy season. The storm winds, moving east-west at an average speed of 48 kilometres per hour and sometimes reaching a maximum of 96 kilometres per hour, bring in great destruction to properties.

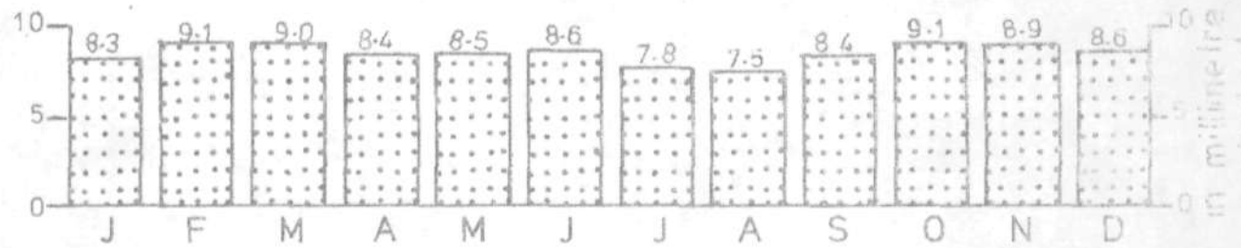
2.3.4 Climatic Consideration in Planning and Design of the Campus:

The Campus structure plan zoning regulations and sector planning may promote the SW/NE winds to pass through building units to help the ventilation of buildings. It is important to note that a system of green belts with high trees does not restrict the wind with lower speed but checks the storms. Where it is feasible,green belt system could be employed in campus design.

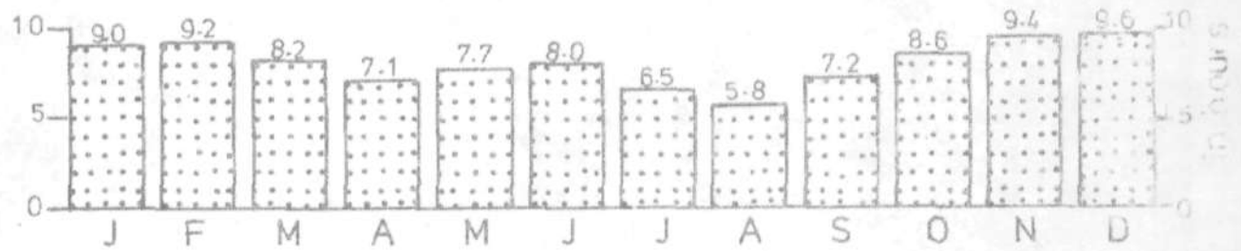
In the layout design it is necessary to ensure that the buildings are oriented on a west-east axis the long elevation should face north and south thereby



(a) Mean monthly temperature - 1910_61 (in degrees centigrade



(b) Mean solar radiation, 1910_61 (in mm. eouivalent)



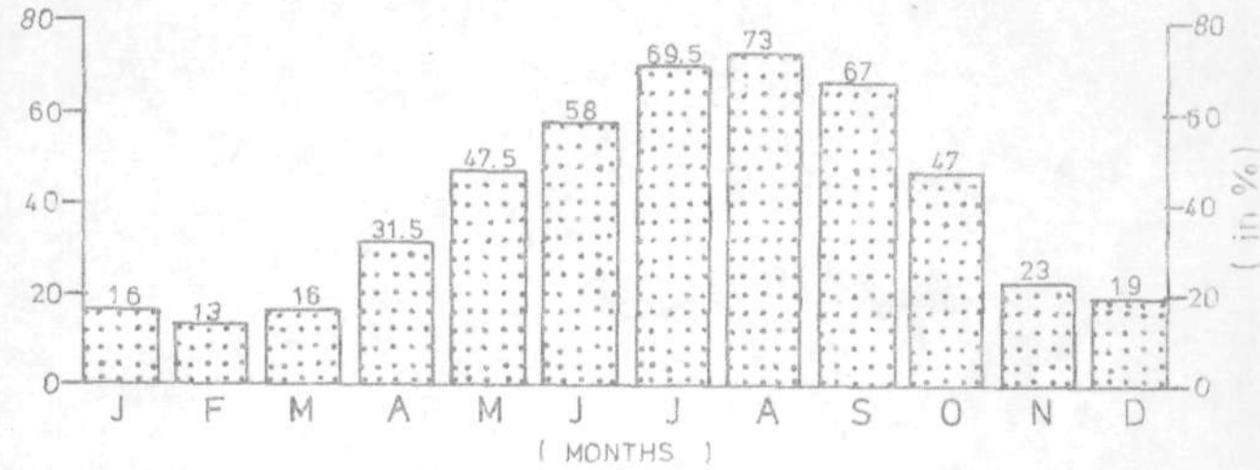
(c) Mean sunshine duration, 1910 61 (in hours/day)

FIG 2.3.2 TEMPERATURE CHARACTERISTICS BAUCHI .

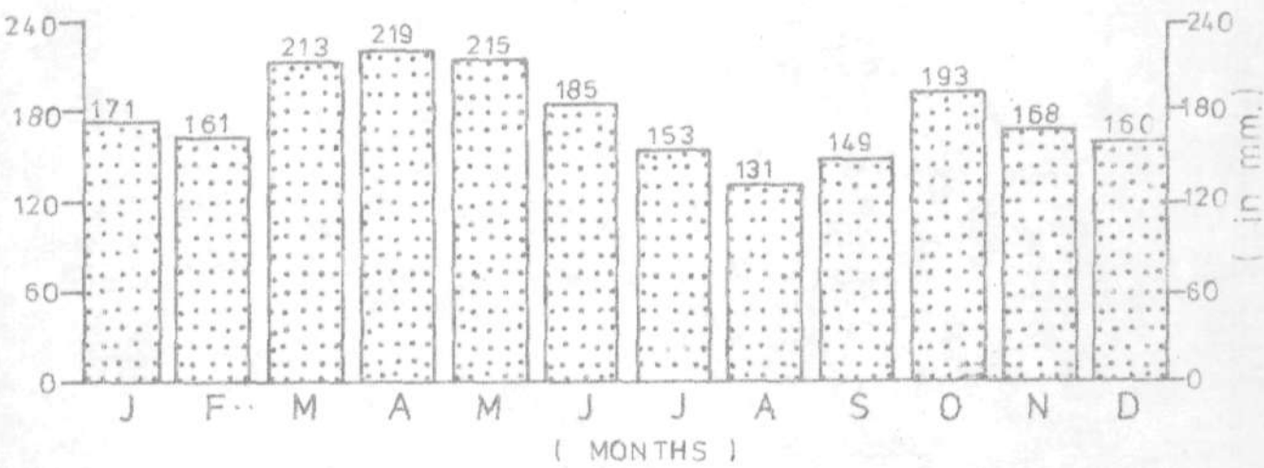
source : AERODROME METEOROLOGICAL OFFICE BAUCHI .

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(a) Relative humidity monthly mean (for twenty four years at 0900 and 1500 hours) in %



(b) Penman evapotranspiration (in millimetres / month) based on monthly data .

FIG 2.3.3 HUMIDITY AND EVAPOTRANSPIRATION CHARACTERISTICS OF BAUCHI .

sources : OLUONYE ATKINS ; AERODROME METEOROLOGICAL OFFICE BAUCHI .

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reducing exposure to intense solar radiation and avoiding the destructive effects of East-West violent storm winds. The other alternative orientation is NW/SE axis.

The erection of buildings should ensure a reasonable degree of compactness so that such structures are naturally shaded.

Parking spaces, passges and foot paths should be shaded or covered to protect vehicles and pedestrians from direct solar radiation. Open spacing will be necessary for breeze prenetration, however some screening protection should be its accompanying component.

The environment should be supported with fairly dense vegetation cover and especially in dwelling areas many small green areas are preferred to a few large ones. In this connection, in the design of the campus, it may be advisable to avoid unnecessary large open spaces, because they are usually not cared for or as a result of intense sun radiation are unlikely to be used.

The choice of plant species for campus greenery, shading and insulation should be a function of ecology and climate.

Sources of noise should be insulated because during the dry season the presence of dry and still air presents serious noise problem by the uninterrupted

transmission of sound over great distances.

Considering the movement of sun and the angle of declination, the major roads may be oriented in north-south direction if possible; otherwise they can be within the limit of north-west and south-south east to eliminate sun glare while moving on the road. Minor roads may then be oriented north-east and south-west direction.

Similarly in terms of wind considerations, major highways may be kept north-west/south east to check the flow of dusty winds along the roads which may cause serious accidents and interruption in vehicular movements. On the other hand, minor roads may be laid in the direction of prevailing winds (North-East and South West) tc promote the ventilation of adjoining buildings.

The design of surface water drainage channels should satisfy peak rainfall conditions and where feasible should be slab - covered for sanitary purposes and easy repairs and maintenance.

The walls of the buildings should be massive and the use of asbestos roofing sheets and such heavy roofing sheets with substantial thermal capacity should be employed.

Openings should be of medium size and designed to exclude direct sunlight while windows should be

positioned in the north and south walls to make for air movement by means of adequate cross ventilation.

It is usually very hot between March and May and people prefer to sleep in the open. Verandahs and Patios should therefore be provided in buildings for outdoor sleeping.

The University should be shielded from the effects of undesirable winds mostly in the form of dust storms, which usually give a disented look to the built environment and make movements difficult, by a system of green belts. Considering the East-West direction of wind storms, green belts in north-south direction comprising 15metres height tree raws may be provided at 800 metres intervals thereby protecting the leeward side from intense dust storms, and creating a conducive area for development.

2.40 Physical Characteristics

1.4.1 Topography and Drainage:

The area is composed of upland plains and rocky outcrops (Figure 2.4.1 and plates 2.4.1 and 2.4.1). The topography is uneven. Featuring as a dome, the upland on which Bauchi town situates constitutes a water-shed from which several streams descend in all directions. In this upland area,



Plate 2.4.1 Topography - the upland plains

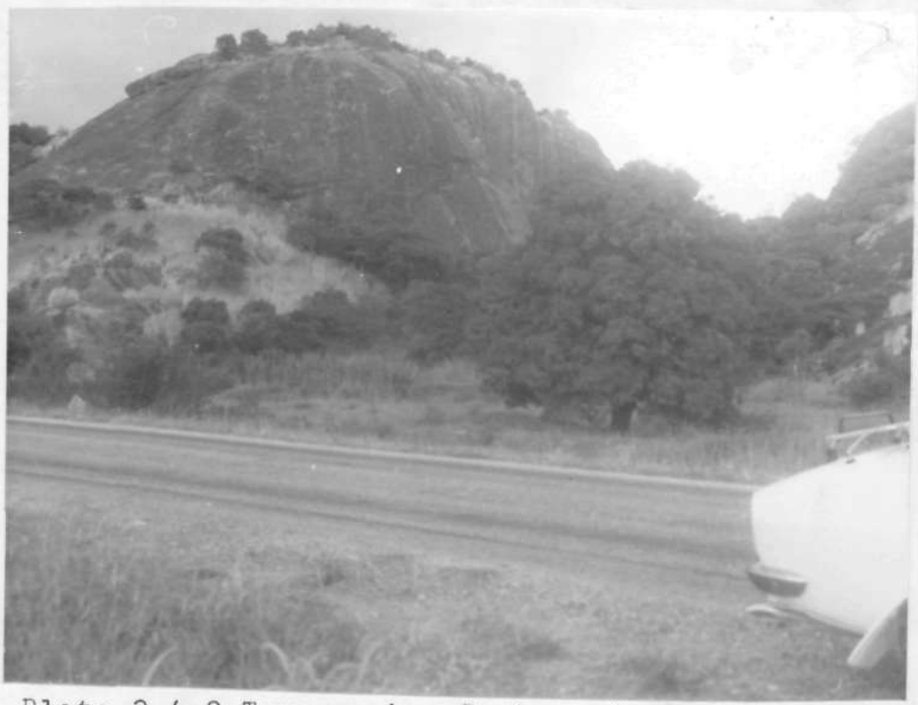


Plate 2.4.2 Topography, Rocky outcrops - Gubi Hills.



Plate 2.43 Geology, varying depths of weathered basement complex rocks.



Plate 2.4.4 Savanna Vegetation.

heights of 600metres and above are not uncommon.

2.4.2 Geology, Soils and Hydrogeology:

The region is made up of an ancient crystalline basement complex rocks, being remnants of igneous and highly metamorphosed sedimentary rocks of cretaceous and tentiary era (Figure 2.4.2 and 2.4.3). The rocks have been heavily weathered giving various soil textures, and varying depths of weathered rock (plate 2.4.3), which in hydrogeological terms determine permeability and water holding capacity of the rocks. The depth and thickness of the decomposed rocks vary from about one metre to thirty metres.

2.4.3 Vegetation:

Bauchi is situated within the belt of northern guinea savanna climax vegetation, with its characteristic flora of thick wood land with trees growing to a height of seven (7) metres or more. However the area has been severely subjected to intense human interference through cultivation, animal grazing and incessant burning and clearance. Consequently the vegetation cover is a secondary climax flora characterised by open Savanna, with short scattered trees, acacia scrub and shrubland (plate 2.4.4).

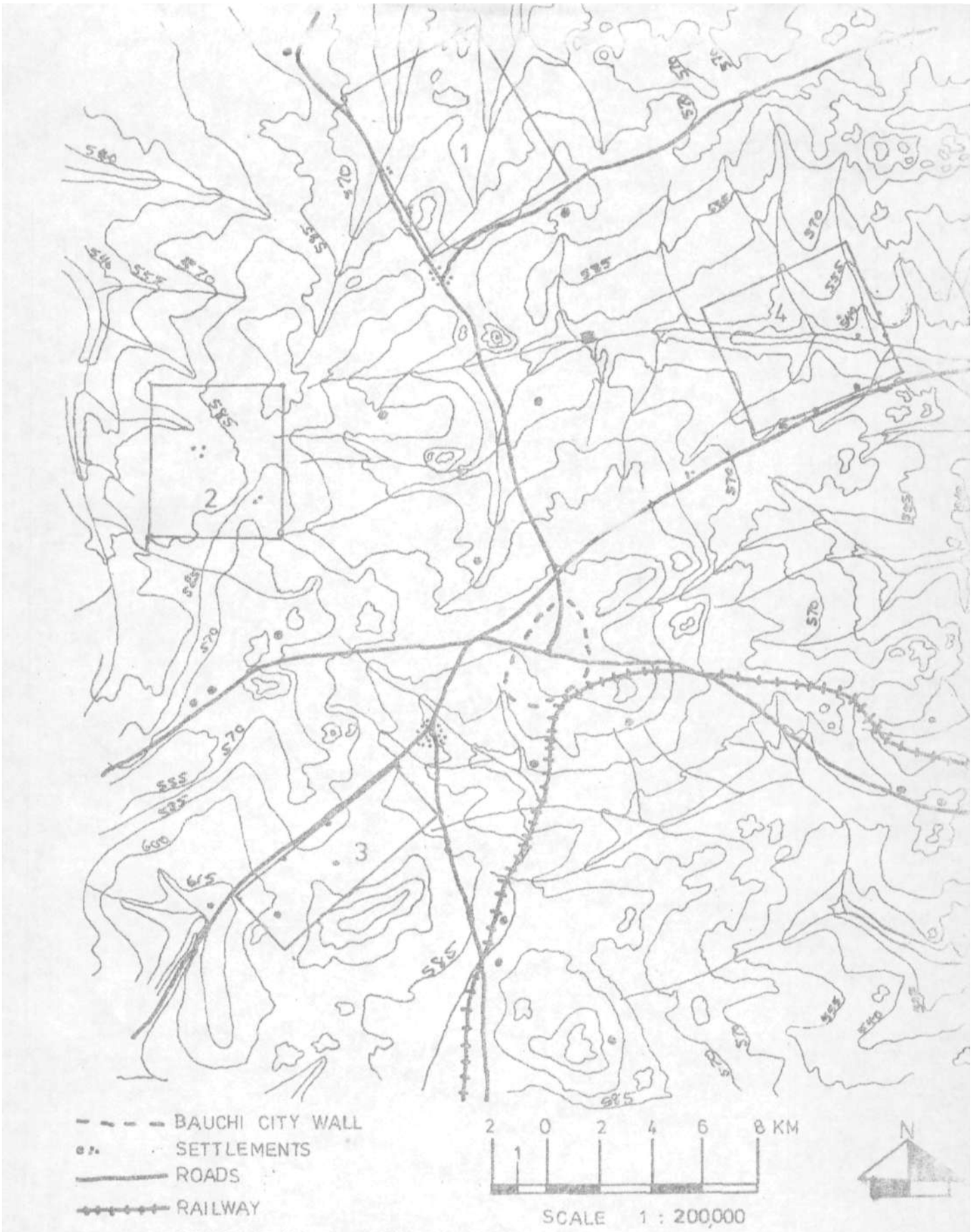


FIG 2.4.1 BAUCHI TOPOGRAPHY AND DRAINAGE

source : topo sheets 128/149 and field work

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2.4.4 Physical Characteristics of Bauchi - Planning/ Design and Development Implication:

The uneven nature of the topography of Bauchi demands a close study of a suitable site for the University of Technology.

The geology and soils will facilitate the construction of heavy buildings and vertical development. The vegetation cover will be easy to clear for immediate construction work and local tree variety can be used for landscaping, insulation as well as wind-breakers.

The location, design and construction of water mains, storm water drains, and refuse system should be a function of topography, geology and soils.

2.50 Existing and Proposed Greater Bauchi Land Use

Figure 2.5.1 shows the existing urban land use of Bauchi town. The population of Bauchi is placed at about 125,000[1], which is composed of people of different ethnic groups from all parts of the Federation. This urban cosmopolitan population is mostly moslem by religion, whose impact on the urbanscape is great, particularly the traditional wall city.

In terms of housing the rate of construction does not meet the corresponding increase in popula-

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1. Max Lock Nigeria Limited, (1973-76) Bauchi - Surveys and Planning Reports for North Eastern State Government of Nigeria, p. 9.1.18.

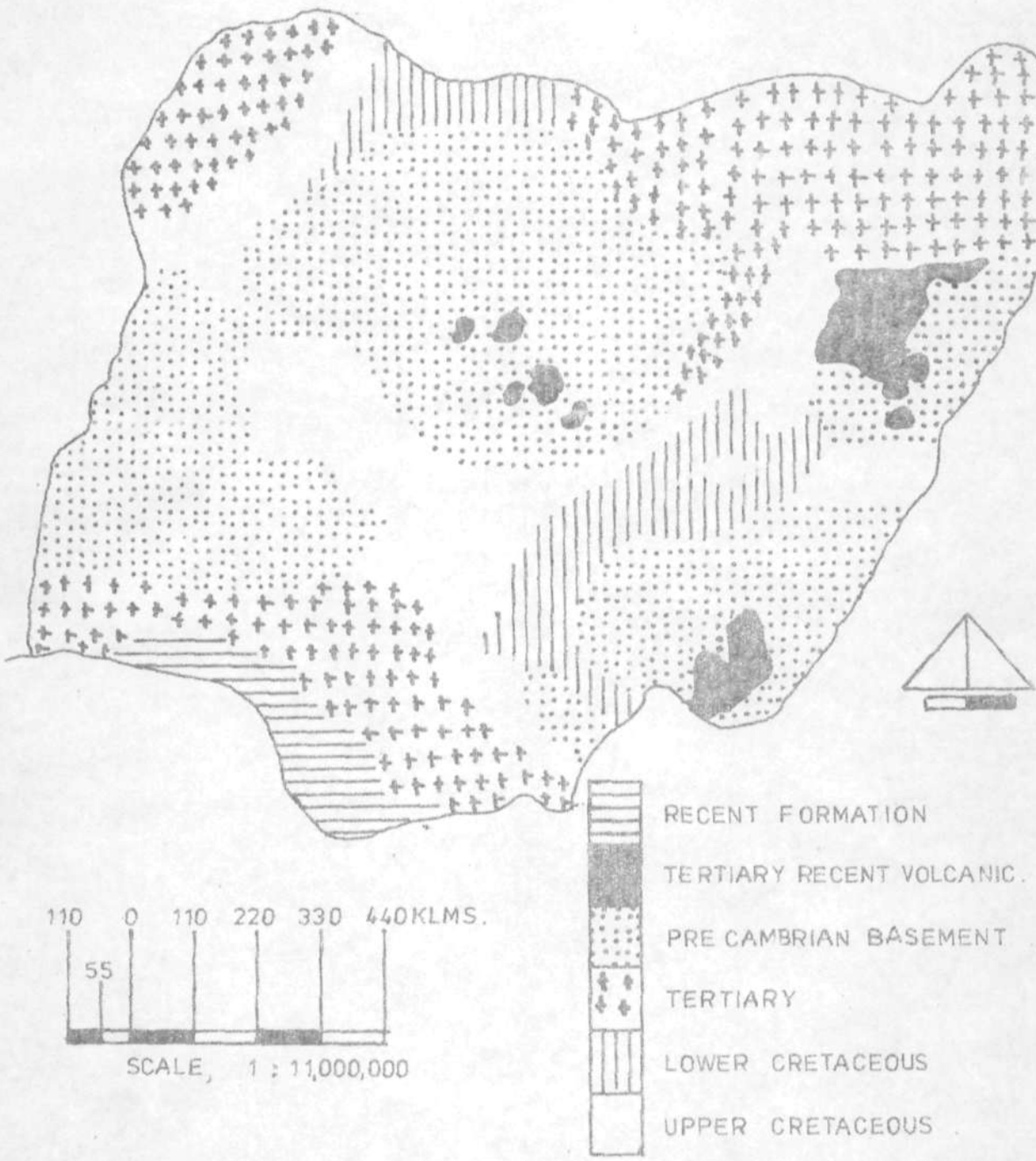
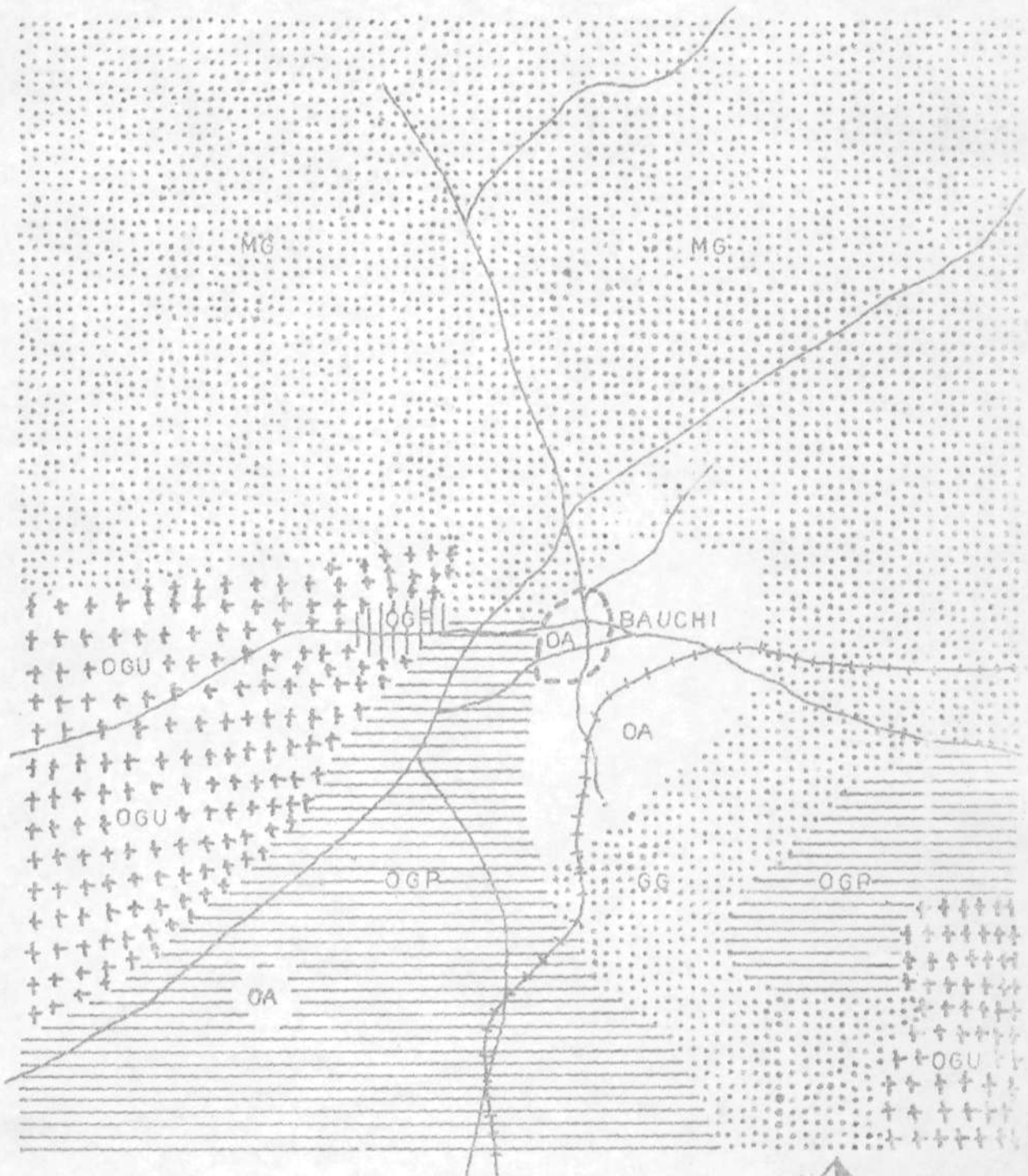


FIG. 2.4.2 GEOLOGY OF NIGERIA .

source; MAX LOCK AND PARTNERS.

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GG = GRANITE GNEISS ; MG = MIGMATITIC.

QA = QUARTZ MONZONITE WITH QUARTZ DIORITE.

OGF = FINE TO MEDIUM GRAINED GRANITE.

OGP = MEDIUM TO COARSE GRAINED PORPHYROBLASTIC GRANITE.

OGU = UNDIFFERENTIATED OLDER GRANITE.

SCALE 1:200,000

FIG. 2.4.3 GEOLOGY OF BAUCHI AREA.

source FEDERAL GEOLOGICAL DEPARTMENT KADUNA.

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lation. This particularly becomes evident when one considers that the rate of population growth of this State Capital is 7.5%.[2] Housing accommodation in Bauchi is a serious problem, which with the siting of more projects and institutions by both Federal and State Governments, has left much to be desired. Occupancy ratio in Bauchi has been placed at 6 people per room, by Max Lock.

The commercial areas cover major streets and the markets.

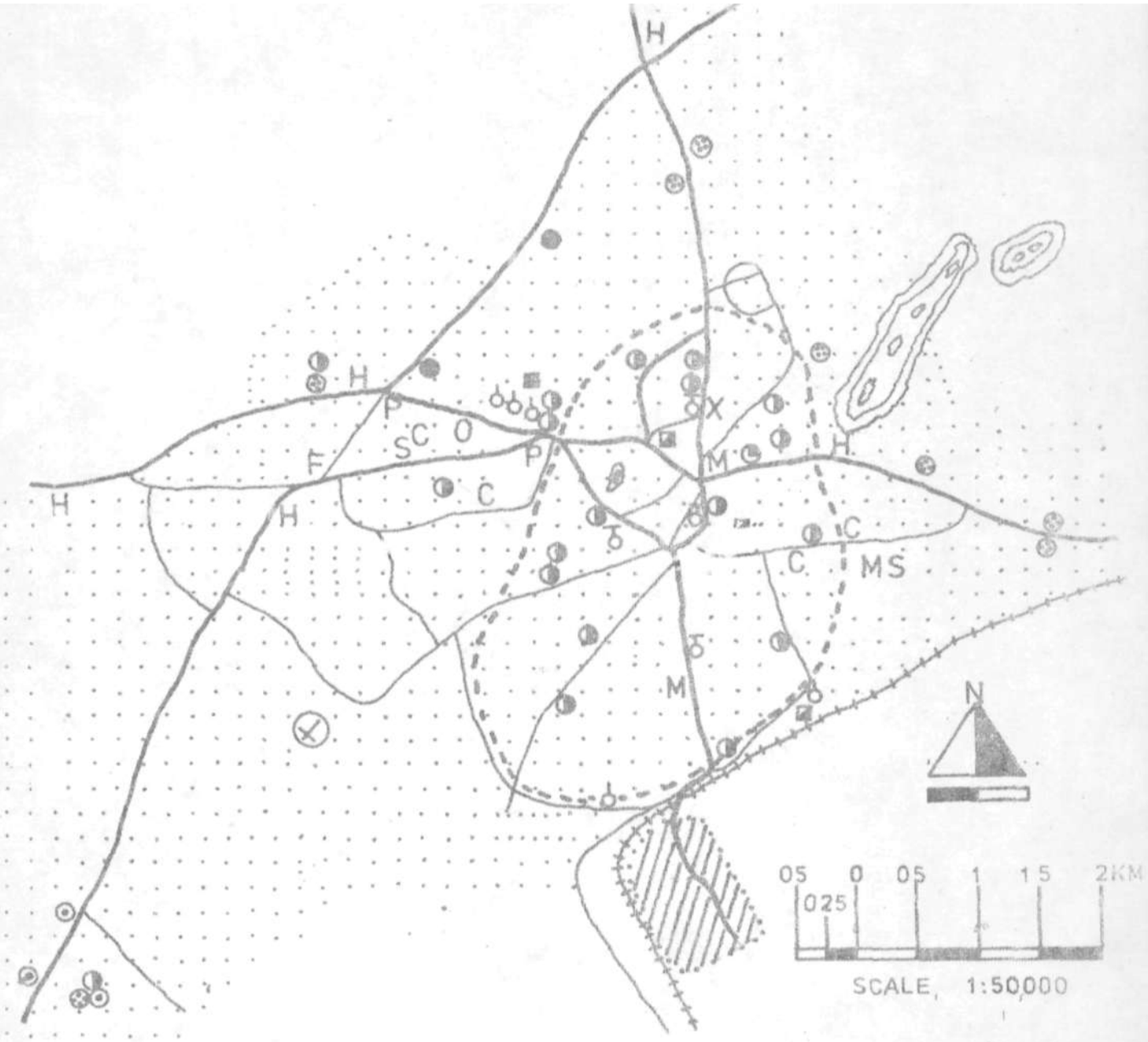
In the industrial area, meat canning, asbestos company and Steyr Nigeria Limited (which assembles vehicles for commercial and agricultural purposes) are the dominant industries. There are many public, semi public and religious establishments (Figure 2.5.1).

The national grid for the supply of electricity from Kainji Dam passes through Bauchi. At Bauchi 132 KV station has been established to cater for the electricity requirement of the growting metroplis.

As regards water supply in 1980 a total of about 61 boreholes were in operation, supplying a total quantity of 6.0 million litres per day. This amount is augumented by treated water abstracted from the temporary dam at Gubi (Table 2.5.1).

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2. Max Lock Nigeria Limited, (1973-76) Bauchi - Surveys and Planning Reports for North Eastern State Government of Nigeria, p. 9.1.18.



LEGENDRY

- INDUSTRIAL AREA
- RESIDENTIAL/COMMERCIAL
- NURSERY SCHOOL
- PRIMARY SCHOOL
- SECONDARY SCHOOL
- POST SECONDARY SCHOOL
- PUBLIC LIBRARY
- CHURCH
- MOSQUE
- HOSPITAL
- CLINIC/ MATERNITY
- AERODROME
- C COURT
- F FIRE FIGHTING SERVICE
- H STANDARD HOTEL
- M MARKET
- MS IDI PRAYER GROUND
- O POLICE HEADQUARTERS.
- P POSTAL SERVICE
- S STATE SECRETARIAT
- X T. BALEWA MEMORIAL TOMB COMPLEX

METROPOLITAN BAUCHI - EXISTING LAND USE (FIG 2.5.1).

source: Fieldwork

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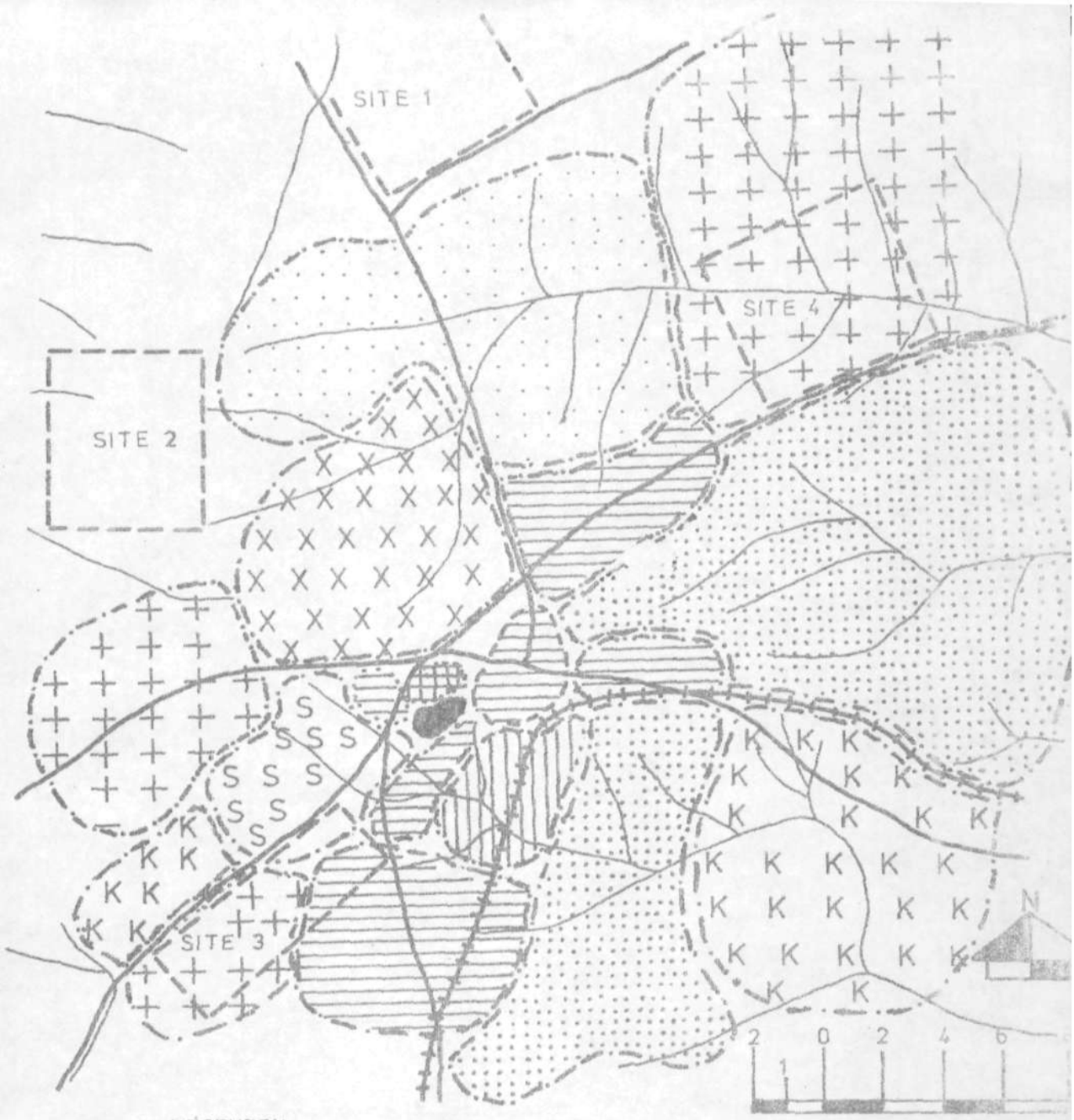


FIG. 2.5.2 BAUCHI PROPOSED LAND USE IN RELATIO TO ALTERNATIVE SITES LOCATION .

source : Max Lock, 1973-76.

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This does not meet the water needs of the populace. It is expected that before 1985 the Gubi Dam water supply scheme under construction will be brought into use and the quantity of water to be made available for consumption will be increased.

TABLE 2.5.1: WATER SUPPLY PROGRAMME - BAUCHI TOWN (1976-2000)

Year	Population	Proposed Rate of supply (ltres capita per day)	Actual Water demand litres per day)	Water Suply Sources			
				Borehole (million litres per day)	Surface (million litres per day)	Total (million litres per day)	Actual (litres per capita per day)
1976	86,000	120	12.0	1.2	-	1.2	12.0
1979	100,190	120	14.4	6.0	-	6.0	48.0
1980	108,031	120	15.12	6.0	6.0	12.0	96.0
1985	155,091	160	25.6	8.0	24.0	32.0	200.0
1990	222,653	160	32.0	8.0	24.0	32.0	160.0
1995	319,647	180	57.2	8.0	48.0	56.0	176.0
2000	45,895	180	82.6	8.0	60.0	68.0	148.0

Source: Bauchi State Water Board, Bauchi.

The proposed urban landuse of Greater Bauchi, incorporating the developed area is shown in Figure 2.5.2. The location of the University will be considered in the light of this structure plan zoning regulations.

It may be mentioned that around Bauchi, are many scattered villages whose main occupation is farming. The location of the University will have far reaching negative and positive effects in the region. Paramount amongst these will be the displacement of villagers and their farmlands, immigration and slum development and expanding opportunities for employment and development.

2.60 Selection and Evaluation of Alternative Sites:

Figure 6.6.1 shows the location of alternative sites for Federal University of Technology Bauchi; while figure 2.6.2 shows the extent of development of Bauchi city in relation to the location of alternative sites. For the selection of a suitable site for the establishment of the University, the following criteria have been used.

A. Availability of well drained-flat land suitable for the needs and functions of the University and adequate area for its future expansion.

B. Accessibility of site to urban and surrounding communities.

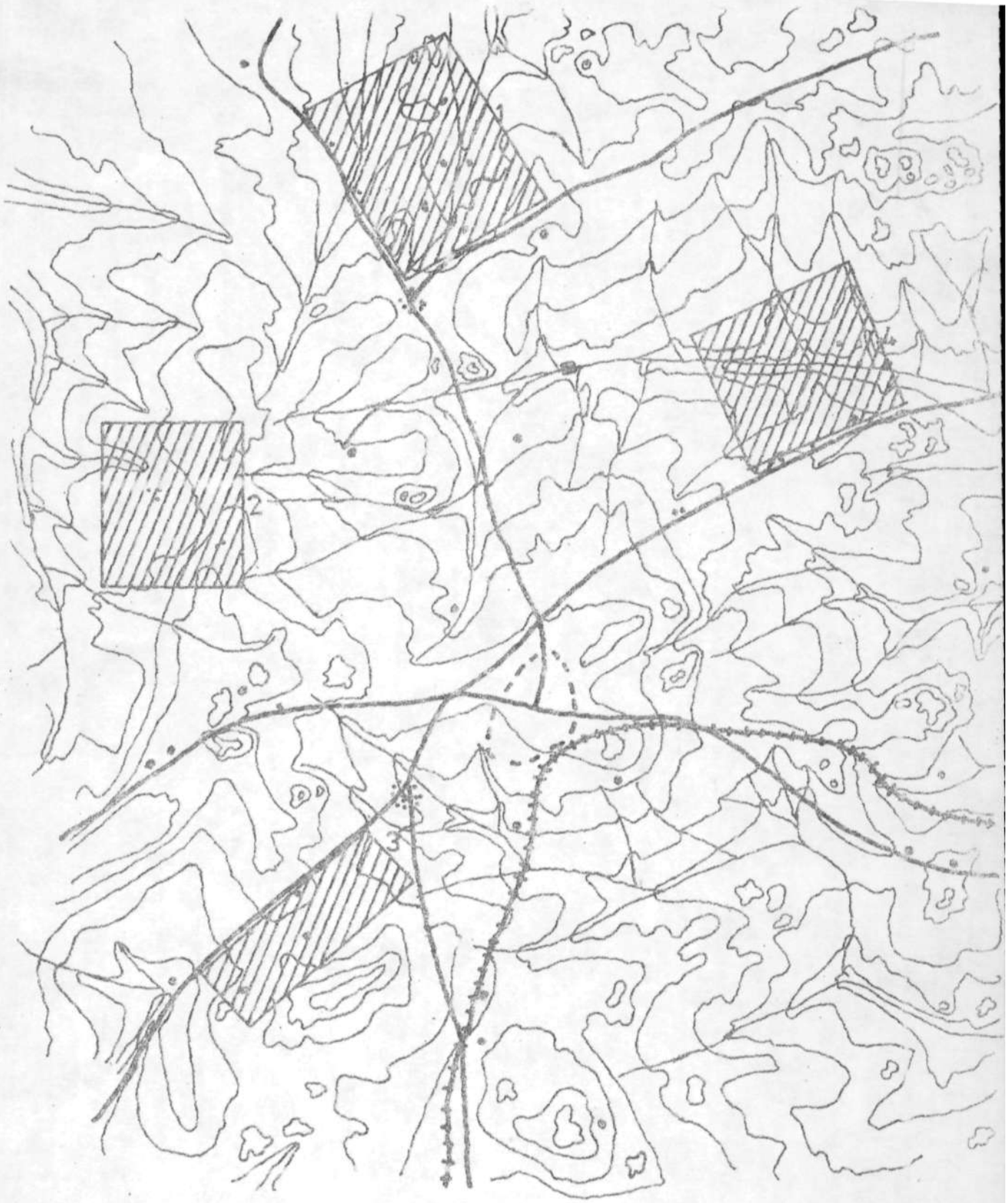


FIG. 2.6.1 ALTERNATIVE SITES LOCATION .

source : Fieldwork / topo sheets 128, 149

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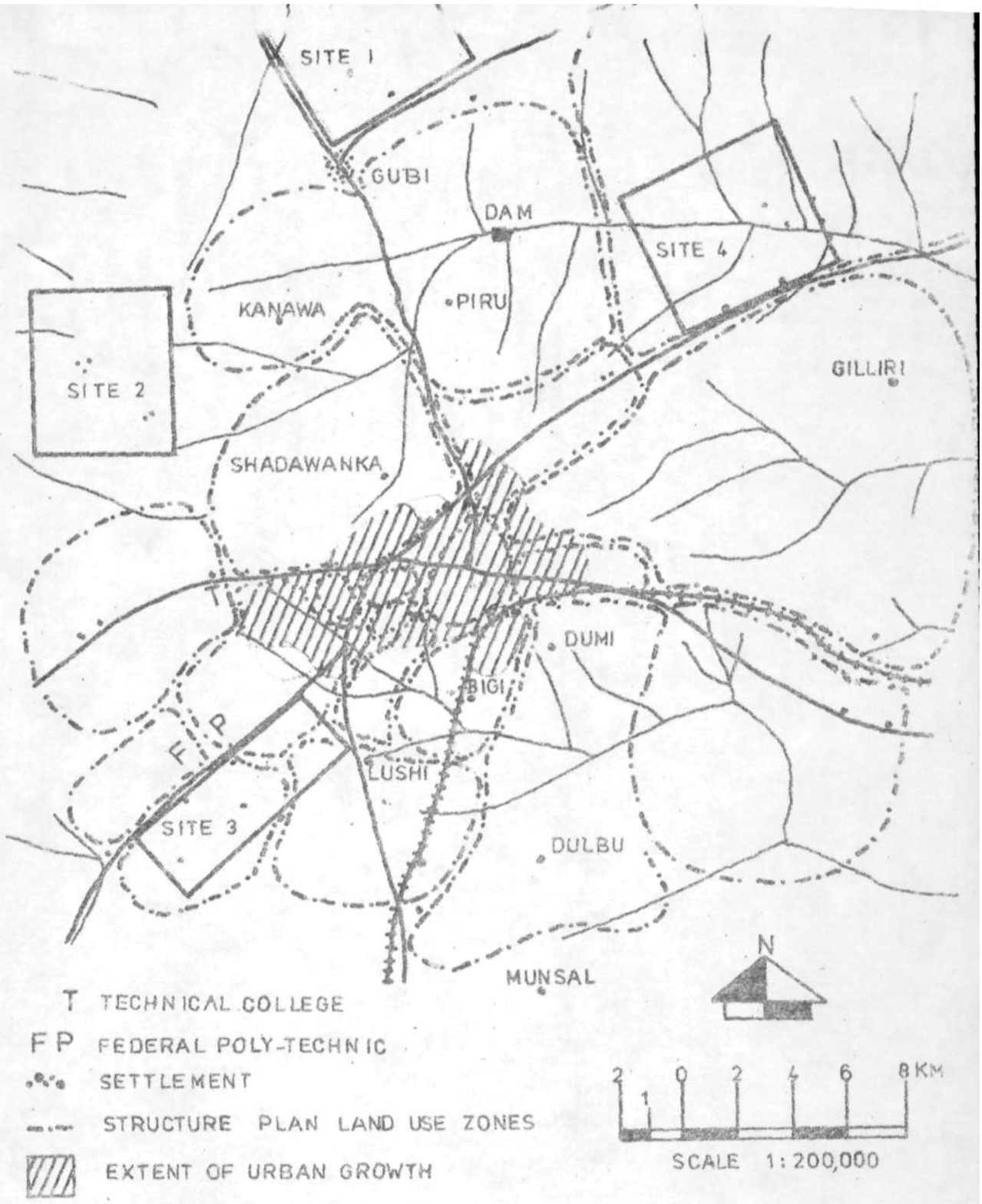


FIG. 2.6.2 DEVELOPED URBAN AREA — RELATIONSHIP WITH ALTERNATIVE SITES AND STRUCTURE PLAN ZONING.

source : Max Lock, 1973-76

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C. Geological, Soils and Topographical considerations that promote institutional development.

D. Availability of facilities, services and utilities in the city which may assist in the smooth take-off of the University.

E. Close proximity to urban centre.

F. Minimal displacement of existing buildings, villages and villagers' farms.

G. Distance from Police and Military establishment and heavy manufacturing industries.

H. Conformity to regional on urban development plans.

I. The relationship of site to other educational institutions.

J. Distance from sources of pollution and noise like air crafts and trains, etc.

K. Site's potential for generation of traffic, and congestion.

L. Legislations affective the site and its development like height restriction where airport is close by.

M. Potentials for the development of surface water supply scheme.

N. Consideration of the city's growth balance ~~depends~~ towards feasible directions.

For the objective selection of the mostly suitable site given the above considerations, weights have been assigned to the factors and the site which scores the highest total values is the most suitable site. These alternative sites numbered 1 to 4 are shown in figure 2.6.1.

On the basis of total scores from the criteria for site selection, the fourth site is the most suitable. The inherent advantages of this site are accessibility and close proximity to the town. It has suitable land for development and future expansion. It is also the closest site to Gubi Dam, the source of urban water supply for Greater Bauchi. At its initial stages of development, the campus can enjoy the services, facilites and utilities centrally provided by the city authority. Information gathered from the Ministry of Land, Housing and Environment Bauchi revealed that the State Government has allocated an area at Gubi, opposite the proposed International Airport, as the Campus Site (Figure 2.6 alternative site 1). The problems with this site include the enormous noise which will be generated by air crafts flying and landing at this airport. Such noise will be a great nuisance to the University community whose role is

Table 2.6.1: THE SELECTION OF ALTERNATIVE SITE FOR THE UNIVERSITY OF TECHNOLOGY BAUCHI.

Symbol of Criteria	Weight	Score			
		Site 1	Site 2	Site 3	Site 4
A	3.0	3.0	3.0	3.0	3.0
B	2.5	2.5	0	2.5	2.5
C	3.0	3.0	3.0	3.0	3.0
D	2.0	2.0	2.0	2.0	2.0
E	Radius of 10 kms = 2.5 Radius of 11-15kms 2.3 Radius of 16-20kms=1.8	1.8	2.5	2.5	2.5
F	10	1.0	1.0	1.0	1.0
G	⩽2kms = -2 3-5kms = -1.5 6-8kms = -1.0 9-10kms = 0.5	0	-2	-1.5	0
H	2.8	0	0	2.8	2.8
I	1.5	0	0	1.5	0
J	⩽2kms = -2 3-5kms = -1.5 6-8kms = - -1.0 9-10kms = -0.5	-2	-1.0	-1.5	0
K	-0.8	-0.8	-0.8	-0.8	0
L	-1.0	-1.0	0	0	0
M	0.5	0.5	0.5	0	0.5
N	1.5	1.8	1.8	0	1.8
TOTAL		11.8	10.0	15.3	19.1

studies and research which requires a calm and noiseless environment. Further more the juxtaposition of Airport and University Campus on either side of a regional road has the great potential of noise, and traffic generation and consequent congestion with its attendant negative problems on development. In addition to these problems, there is restriction to the height of storey buildings that will be allowed in an area very close to an airport. It also means the University will grow horizontally which will not only amount to a waste of space but also lead to the investment of colossal amount of money which may not be affordable within the scarce resources of the Government. This will even conflict with the need to develop a compact campus core for conducive learning and research. The site is also located far from the city and there will be serious problems as regards the extension of facilties, services and utilities centrally provided by the city authority to the campus site.

Furthermore being in a rural location, there will be more serious problem of getting houses at the initial stages of development to accommodate the staff and students. Students and staff may therefore be accommodated in Bauchi, and to travel

everyday to the campus, over a distance of 15-16 kilometres will only generate traffic congestion on the road and inconveniences to both the staff and the students..

Finally the site does not conform to the zoning regulations of the Structure Plan prepared by Max Lock Nigeria Limited, for development of Greater Bauchi.

2.70 Site Analysis and Major Landscape Impression:

2.7.1 Site Analysis:

The site for Federal University of Technology Bauchi is shown in figure 2.7.1. Generally the land is characterised by rolling topography. There are no major relief outcrops. In similar manner there are no major distinct valleys. Plate 2.3.1 shows a general over view of the landscape. The soils are mainly sandy-loam but deeper down the strata, we have the clayey soils. The area is fairly well drained. The geology of the area fits into the framework of our earlier discussion about the geology of Bauchi and its environment. The vegetation found in this area is the secondary climax - savanna vegetation (plate 2.4.4). The site is generally dotted with farm lands, whose coverage and intensity decreases away from the settlements in the site.



Plate 2.5.1 Settlements and Farmlands.



Plate 2.7.1 Access to the Campus Site, Bauchi-Maiduguri Highway.

The farm lands and fallow lands are dotted with economic trees and the buildings constituting these scattered settlements ~~the buildings~~ are made up of mud walls and thatched roofs. In few cases the roofs are made up of corrugaged zinc sheets. These must be assessed and compensations paid to the occupants and alternative sites for both residence and agricultural practices planned and allocated to them. The site is situated on the left hand side of Bauchi - Maiduguri road and major access (or accesses) to the campus can be tapped from the major road (plate 2.7.1).

Becuase of the rolling topographic qualities of this site, there are no bold landscape features of dramatic influence (both negative and positive) on planning. However Gubi River system flows through the site. The major landscape is reinforced on either side of its valley by tree gallery that gives the area a beautiful scene. Its banks are floodable during the rainy season and the soils along the baks are rich in clay content. The Gubi dam is located upsteam of the river, a distance of about 3.5 kilometres from the Campus Site. The significance of this landscape in planning the campus includes the anple opportunity it provides for the location of University teaching and commercial

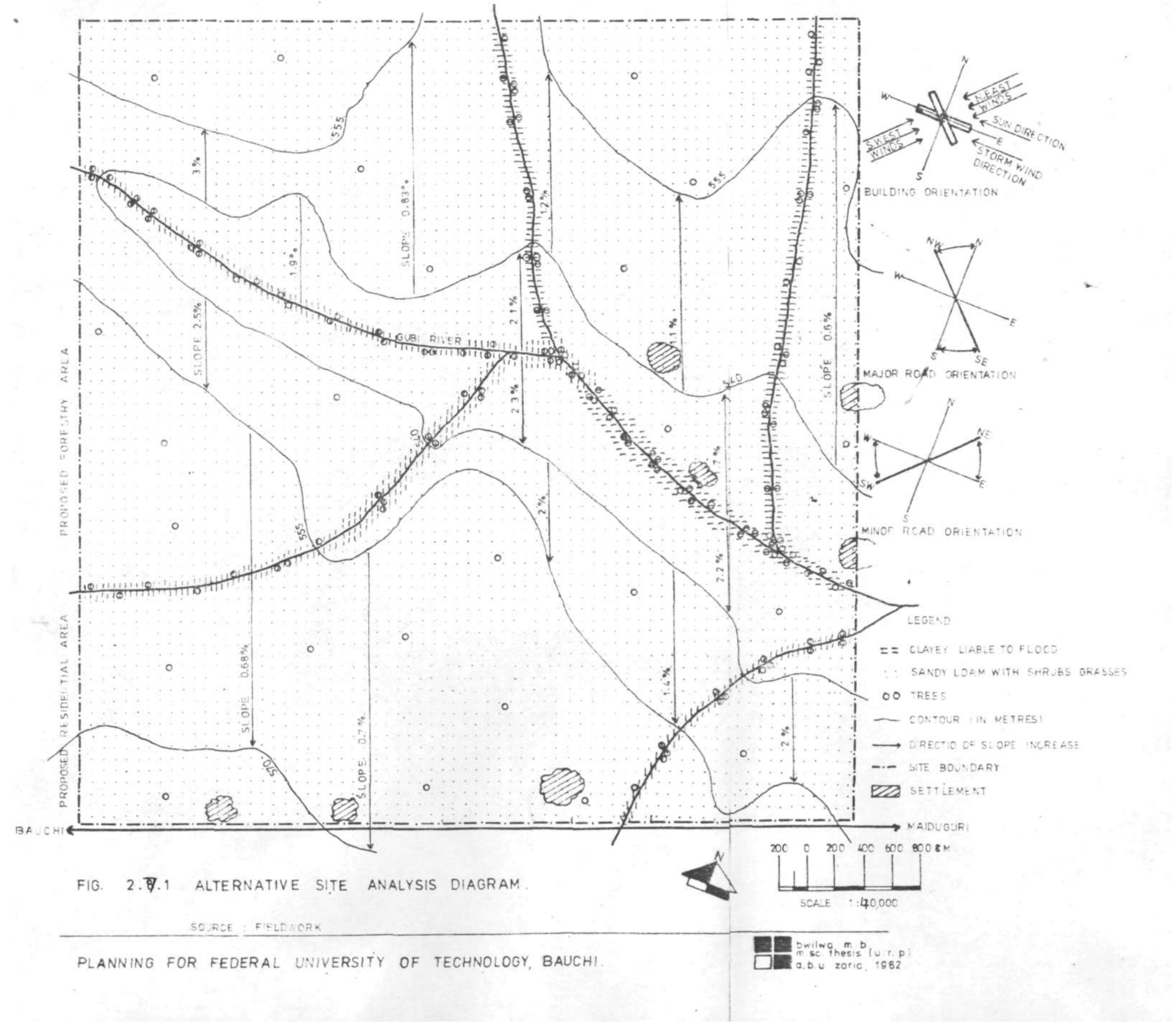


FIG. 2.8.1 ALTERNATIVE SITE ANALYSIS DIAGRAM.

SOURCE : FIELDWORK

PLANNING FOR FEDERAL UNIVERSITY OF TECHNOLOGY, BAUCHI.

bwilwa, m. b.
m.sc. thesis (u.i.t.p.)
a.b.u. zaria, 1982

Table 3.5.3: POPULATION PROJECTION FOR THE CAMPUS (1982-2002)*

Session	Students	Academic Staff	Senior Admin.	Senior Tech.	Junior/ Intermediate
1981/82	500	50	17	17	350
1982/83	750	75	25	25	525
1983/84	975	98	33	33	683
1984/85	1219	127	42	42	853
1985/86	1463	156	52	52	1024
1986/87	1902	178	59	59	1331
1987/88	2378	258	86	86	1665
1988/89	2973	322	107	107	2081
1989/90	3568	387	129	129	2498
1990/91	4103	445	148	148	2872
1991/92	4595	500	167	167	3217
1992/93	4963	542	180	180	3473
1993/94	5360	588	196	196	3752
1994/95	5735	632	210	210	4015
1995/96	6079	672	224	224	4255
1996/97	6444	714	238	238	4255
1997/98	6766	759	253	253	4736
1998/99	7037	786	262	262	4926
1999/2000	7248	813	271	271	5074
2000/2001	7450	839	279	279	5215
2001/2002	7600	860	287	287	5320

* Projections based on NUC Staff-Student ratio.

Source: University Authority.

Bauchi, consideration has been given to other Universities which are offering similar courses for meaningful production of manpower not in excess of demand.

The students population has been used for the calculation of academic, senior administrative and technical staff, and junior and intermediate staff population based on NUC stipulated ratios (Table 3.5.2) . These figures have been used for the calculation of land requirements for the design of the University (Tables 3.5.3 - 3.5.6).

The usable area standards used for calculation of area requirements are based on proposals that were made in the preceeding discussions of this chapter.

Furthermore, 1,200 hectares and 600 hectares are for commercial and teaching forms respectively.[5] It is reasonable to have such parcel of land for development of agriculture to enable the University find other sources of revenue for its development. A total area of about 317.6 hectares has been calcu lated for academic, support services and facilities, students halls of residence and staff housing.

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5. National Universities Commission (June 1981) Preliminary Report of the Seminar on the establishment of new Universities of Technology, December 8th-11th 1980, Lagos Nigeria, p. 18.

farms. Another planning implication is that the location of sewage and solid waste disposal, towards this water caurse must be carefully considered in fear of their polluting effects on the water and the danger that will pose to the settlements down - stream which use the water for domestic and other purposes.

The analysis diagram of the site also shows the possible orientation of buildings, roads and green belts considering the climatic parameters characteristic of Bauchi, as discussed earlier in this chapter.

CHAPTER THREE

3.0 A CRTITICAL EVALUATION OF NATIONAL UNIVERSITIES COMMISSION STANDARES GUIDE FOR CAMPUS PLANNING IN NIGERIA.

"The National Universities Commission (NUC) was constituted in 1975 in order to meet the increased demand for higher education in Nigeria. Broadly the functions of the commission are related to those of co-ordination, development and financing of Nigerian Universities."[1] "These are approval of academic and space requirements within the context of academic and physical master plans and action plans of each University;setting cost limits and ~~pro~~progress generally."[2] " ... Nuccon Group is to co-ordinate and monitor the entire physical master planning programme for the entire University system. This brief has also been extended into assisting and monitoring the implementation of the physical planning programme for the new Universities and a master planning updating exercise of all the older Universities."[3]

1-3 National Universities Commission, Nigeria Annual Report, July 1977 - June 1978, p.1 and 13.

As part of its task, the NUC has drawn up policies, guidelines, space standards and other miscellaneous provisions[4] to streamline the planning of Universities. Whether these standards are realistic or unrealistic is quite difficult to assert in precise terms. It may be noted that the author's verbal discussion with the Director of Works (who is also a Physical Planner) Bayero University Kano, revealed that the space standards for academic and students residences are not only deficient but also fail to meet the needs of some uses like departmental requirements, lecture theatres and central library. Similar observation has been made by the Physical Planner of the University of Jos. It may be difficult to agree with such expressions wihouth digging into the existing situation.

This chapter sets out to evaluate the provisions and space standards in the light of existing trends and the peculiar needs of the users. It will also, amongst others, propose space standards for the calculation of schedule of land requirements by the Campus population for the design of the Campus Structure Plan.

3.10 Policy on ultimate student population on each campus.

The commission stipulates that the ultimate

population in each University should be 10,000. Considering that the population of Nigeria at present is about 80 million and University going age of 12% (9,6000,000) and the assummed University going population of 4%, the projected number that is available for University education now is 384,000. The NUC has projected a figure of 450,000 for the session 1990/91.

It may be noted that the number of existing Universities in Nigeria is now 19 and more Universities have been proposed for take off (Fig. 1.2.1 and 1.2.2.) and it is likely that more Universities will be proposed. It may be noted also that the student population of the existing Universities is fast growing (Table 3.1.1) while Ahmadu Bello University has exceeded the 10,000 ultimate campus population by about 53% (Fig. 3.1.1.). The presence of many Universities in Nigeria, justifies the ultimate 10,000 student population per University as proposed by NUC. This may be true, particularly, for the specialized technological Universities where admission must be based on man power needs and available infrastructure. It may be mentioned that the proliferation of Universities in Nigeria is unnecessary because the existing ones have not been

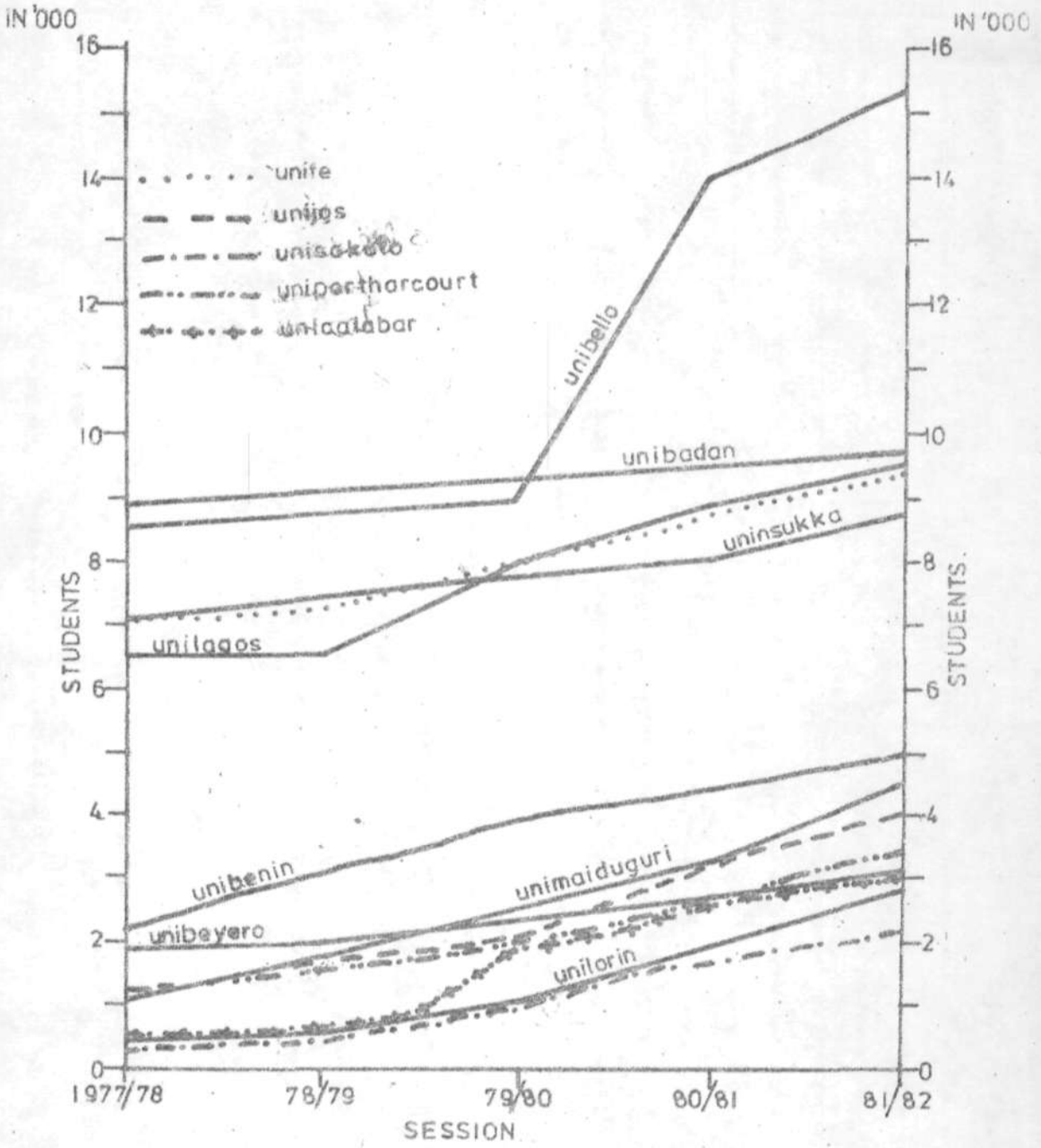


FIG. 3.1.1 STUDENTS POPULATION GROWTH IN NIGERIAN UNIVERSITIES .

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bwilwa, m.b.
m.sc. thesis (u.r.p)
a.b.u. zaria, 1982.

Table 3.1.1: GROWTH OF STUDENTS POPULATION IN NIGERIAN UNIVERSITIES 1977-1982 AND PROJECTIONS TO 2000

University	STUDENTS POPULATION DURING THE YEAR									
	77/78	78/79	69/80	80/81	81/82	84/85	86/87	88/89	95/96	99/2000
Nsukka	7124	7445	7808	8060	8754	9647	11137	13247	14459	15000
Ibadan	8865	9065	9368	9598	9788	11537	13512	14248	16023	18014
A.B.U.	8520	7672	8959	14091	15317	26355	29055	319982	40492	45493
Ife	7117	7249	x	8771	9215	9918	1196	13480	15890	16624
Benin	2257	3000	x	3890	4980	6025	6914	7897	8558	9895
Lagos	6509	6584	8000	8894	9522	10687	12507	15665	17802	20005
Calabar	1336	1585	1875	2751	3432	3988	5426	6012	6428	6983
Jos	1339	1600	2337	3293	3924	4485	5886	6387	6798	7014
Ilorin	472	x	x	2042	2981	3564	4023	4696	5014	5497
Bayero	1857	x	x	2775	2997	3582	4046	4681	5005	5489
Maiduguri	1184	x	x	3393	4502	5016	5504	6014	6605	7675
Port-Harcourt	382	400	x	1976	2521	2998	3561	4115	4702	5284
Sokoto	194	500	x	1717	2314	2887	3688	4428	5018	5886
TOTAL	47186	45180	38347	71251	80247	100689	106455	132852	152795	168859

Sources: 1. Federal Republic of Nigeria, NUC Annual Review of Nigerian Universities (1969, 1974, 1975, 1978). Federal Ministry of Information Printing Division, Lagos.

2. Europa Puboications Limited 1978 and 1979.

3. Nwodoh, C.I. (1980).

properly developed in terms of provision of necessary infrastructure for conducive learning and living.

The problem of congestion on the campuses as highlighted by the different University authorities visited is a function of inadequate provision of infrastructure for learning and living. There is therefore the need to coordinate the activities of the Universities to ensure the provision of infrastructure for the University community. Such coordination should also ensure that the activites of the different Universities are tailored to the man power needs of the nation in the various sectors of the economy.

3.20 Policy on Residential Accommodation on Campus:

The policy guideline provides that 75% of total students population should be accommodated on campus. It also stipulates that all senior staff should be accommodated on campus, while for Intermediate and Junior Staff a range of 10-60% could be accommodated. Table 3.2.1 shows the existing situation as regards students accommodation in the Universities. The table establishes the following inferences. The new Universities accommodate more students than the old ones in terms of expressed percentages; while in absolute terms the old Universities accommodate greater number of

Table 3.2.1: STUDENTS ACCOMMODATION IN THIRTEEN NIGERIAN UNIVERSITIES/EXISTING NUC STANDARDS AND PROPOSALS.

University	1977/78 Session			1980/81 Session			1981/82 Session			NUC standard (in % total to be accomodated	Recommendation % of total. to be accomodated
	total students	students accom.	% accom.	total students	students accom.	% students accom	total students	students accom.	% students accom.		
Nsukka	7124	5058	71	8060	5575	69	8754	5575	64	75 of total University students population to be accommodated	50% to be accommodated for the liberal Universities. 75% to be accommodated for the Tech. Universotes.
Ibadan	8865	6028	80	9598	6335	66	9788	5673	58		
A.B.U.	8520	7243	85	10396	7708	74	15317	9996	65		
Ife	7117	4450	63	8771	5701	65	9215	5701	62		
Benin	2257	1684	75	3890	2840	73	4980	3386	68		
Lagos	5709	3632	54	8894	4745	53	9522	4745	50		
Calabar	1336	1322	99	2751	2283	83	3432	2574	75		
Jos	1339	1275	95	3265	2285	70	3924	2698	69		
Ilorin	472	470	99.5	2042	1736	85	2981	2236	75		
Bayero	1857	1407	76	2097	1573	75	2997	2188	73		
Miaduguri	1184	960	81	3393	2375	70	4502	3061	68		
Port Harcourt	382	362	95	1976	1347	75	2521	1765	70		
Sokoto	194	194	100	1717	1288	75	2314	166	72		
Total	47156	34085	-	66850	45791	-	80249	51259	-		
Average	-	-	81.7	-	-	71.8	-	-	68.8		

students. Second, there is a gradual decline in the percentage of the students accommodated on campus in both the new and the old Universities, from where I was informed that there are no plans to construct students hostels. However this trend may not be true as regards the new Universities, (Jos, Bayero, Maiduguri, Ilorin, Calabar and Port Harcourt) where additional hostels for students are under construction.

Since the resources of any nation are appropriated to different competing uses it is likely that the resources meant for the development of Universities in Nigeria may not be adequate. The tendency will be to emphasise the provision of academic and allied facilities. It is therefore recommended that for conventional or liberal Universities, 50% of total students population may be accommodated on campus in the place of 75% recommendedby NUC. However for technological Universities, 75% may be accommodated on campus considering the special academic demands on students of technology disciplines in terms of need for close proximity to laboratories for praticals, and required standard drawing studios, supervision and other facilities which will not be provided outside the campus and daily trekking will not promote the pursuance of their academic work.

A reasonable number of senior staff is accommodated on campus as shown in table 3.2.2. It is evident that the number accommodated falls short of the NUC stipulated standard of 100% accommodation for senior staff. Considering the fact that the level of staff accommodation is gradually falling and the inability of the Universies to provide more housing on the one hand and the need to accommodate more staff on the campus for the promotion of research and academic work it is recommended that 60% of senior staff should be accommodated on the campus. The remaining will be in the satellite villages around the University. The accommodation of senior staff in terms of percentage (60%) is higher than that of Junior Staff (20%). This is reasonable because in absolute terms the number of senior staff will be less than that of junior staff on accommodation. The issue against the accommodation of staff (both junior and senior) is the use of large University area for housing. This may be reduced by high-rise buildings which occupy comparatively smaller area than the low-rise buildings.

Residential accommodation for junior and intermediate staff is shown in table 3.2.3. In the table one observes great deficiency in the provision of

Table 3.2.[2]: SENIOR STAFF ACCOMMODATION IN THIRTEEN NIGERIAN UNIVERSITIES (EXISTING NUC STANDARDS AND PROPOSALS).

University	1978/79 Session			1981/82 Session			NUC Standard	Recommendation
	Total Staff	Staff Accomm-dated	% of Accom.	Total Staff	Staff Accom.	% of Accomm.		
Nsukka	1286	617	48.0	1552	714	46	100% of staff to be accommodated on Campus	60% of total staff to be accommodated on Campus
Ibadan	1464	615	42.0	1698	645	38		
A.B.U.	1525	865	57.0	2004	955	48		
Ife	945	558	59	1322	687	52		
Benin	759	478	63	1186	664	56		
Lagos	1188	570	48	1403	631	45		
Calabar	234	176	75	457	297	64		
Jos	184	147	80	325	235	72		
Ilorin	215	155	72	427	290	68		
Bayero	260	182	70	481	309	64		
Maiduguri	150	128	85	306	230	75		
P. Harcourt	110	86	78	208	156	75		
Sokoto	76	76	100	236	175	74		
Total	8396	4653	-	12605	5988	-		
Average %	-	-	67.5	-	-	51		

Source: University Authority, NUC.

accommodation for this class of staff, compared to the senior staff accommodated. While it is admitted that the number of junior and intermediate staff in a University in higher than that of senior staff, but what is accommodated is far below expectation. For this category of staff it is recommended that 20% of the total may be accommodated in the place of 10-60% NUC's recommendation. It is necessary to accommodate a reasonable number of junior staff for close access to the University and particularly for junior staff whose functions demand proximity to the University academic area like catering, cleaning and security services. As revealed in the table, the recommendation here does not relate closely to the existing situation of about 4-5 % of total junior and intermediate staff accommodated on campus; this is because the author strongly considers that the junior staff housing issue on campus is not given serious attention.

3.30 Policy on the Provision of Facilities, services and Utilities:

The National Universities Commission stresses the need for greater emphasis to be paid towards the provision of academic and allied facilities and services for the smooth take off of the new Universities. this may be interpreted in the light of

problems we are facing in our existing Universities, a situation whereby the students population far exceeds the available academic facilities and services necessary for conducive learning. Considering water provision the NUC stipulates that 400 litres and 100 litres per day should be made available per residential and non-residential population respectively. (Table 3.3.1). Furthermore 2,500 litres/minute for a four (4) hour period of fire fighting purposes be provided. In table 3.3.1 the analysis of water supply in some Nigerian Universities is shown. The figures reveal that an average of 145 litres per head is supplied daily. When this is compared with NUC standards a sharp difference is seen (Table 3.3.1).

At the time of data collection, my discussion with the authorities of the Universities visited, pointed to the problem of water shortage experienced in the Universities. However the figures recommended for the resident population by the NUC is very high. It is hereby recommended that 200 litres per resident population per day should be used for the calculation of water requirements for resident campus population. The recommendation takes into consideration the water problem experienced in these Universities. The recommendation also admits that

Table 3.2.3: INTERMEDIATE AND JUNIOR STAFF ACCOMMODATION IN THIRTEEN NIVERIAN UNIVERSITIES (EXISTING, NUC STANDARD AND PROPOSALS).

University	1978/79 Session			1981/82 Session			NUC Standard	Recommendation
	Total Staff	Staff Accom.	% of Staff	Total Staff	Staff Accom.	%of Staff Accomm.		
Nsukka	6083	60	1.0	6910	138	2.2	1-60% be Accommodated on Campus.	20% be Accommodated on Campus.
Ibadan	4852	55	1.0	5745	86	1.5		
A.B.U.	6516	87	1.3	8013	160	2.0		
Ife	3498	64	2.0	4067	65	1.6		
Benin	1167	53	4.5	1776	62	3.5		
Lagos	3410	73	2.0	4026	60	1.5		
Calabar	1076	56	5.0	1751	70	4.0		
Jos	727	50	6.8	2794	56	2.0		
Ilorin	374	34	9.0	998	50	5.0		
Bayero	1124	58	5.0	1414	57	4.0		
Maiduguri	260	24	9.0	783	47	6.0		
P. Harcourt	368	35	10.0	977	63	6.4		
Sokoto	310	32	10.0	870	52	6.0		
Total	29765	681	-	40124	966	-		
Average	-	-	5.10	-	-	3.5		

Source: University Authority and NUC.

400 litres per resident population per day is grossly in excess, considering that in industrial towns figures ranging between 200-250 litres per head per day are used. And less importantly, the water supply authorities in some of these University towns indicated their inability to measure to this high figure due to scarcity of resources. And finally my discussion with Professor B.Z. Diamat of the Department of Water Resources and Environmental Engineering (ABU, Zaria) revealed that 200 litres per capit per day for resident population is appropriate. And the other provision of NUC for non-resident population and fire fighting purposes have been accepted and all these are used in the calculation of water demand of the University community.

3.40 Policy on Area Standard:

Table 3.4.1 shows the usable area per full time equivalent student in the academic area. The figures are higher for Veterinary Medicine, Agriculture, Human Medicine and Engineering. This group is followed by Pharmaceutical Sciences, Sciences, and Environmental Design. The group with the least usable area, embraces, Arts and Social Sciences, Law, Education and Administration. These differences can be explained in terms of the peculiar area needs of

each of these classification based on their academic functions. For Agriculture, its functional requirements include, Laboratories area, plants area for grafting, animals and poultry areas, while Veterinary Medicine requires area for Laboratories, Clinics, Surgical Theatres, poultry and animal colonies or sheds. Engineering requirements cover laboratories, Workshops and Studios for Design. Human Medicine area requirements include laboratories, surgical theatres, clinic, and embalment theatres.

In the second group, Pharmaceutical and Natural Sciences need more space for laboratories, while Environmental Design needs more space for large drawing studios.

The last group (made up of Arts and Social Sciences, Law, Education and Administration) needs space for lecture theatres, classrooms, offices and reading rooms. The requirements of the third group are also necessary for the preceding groups.

In the older Universities, from where data on usable area per student was collected there is gross scarcity of space. In fact the first impression one gets on visiting any of the academic areas of these Universities is that many of the University buildings are in chronic space shortage resulting into the

Table 3.3.1: NIGERIAN UNIVERSITIES, WATER CONSUMPTION (EXISTING, NUC STANDARDS AND PROPOSALS).

University	Water Consumption Per head in(litres)	NUC Standards in litres per head	Proposals (Litres per head.
Nsukka	146	400 litres per head/ resident population	200 litres per head per resident population
Ibadan	155		
A.B.U.	145		
Ife	150	100 litres per head per non-resident population	100 litres per head per non-resident population
Benin	148		
Lagos			
Lagos	160		
Jos	130	2,500 litres/minute for a 4 hour period of fire fighting purposes	2,500 litres per minute for a 4 hour period of fire fighting purpose
Bayero	125		
Ilorin	150		
Average	145		

Source: University Authority.

Table 3.4.1: ANALYSIS OF USABLE AREA PER FULL TIME EQUIVALENT STUDENT IN SIX NIGERIAN UNIVERSITIES (1981/82)* AND PROPOSALS FOR ACADEMIC AREA.

Description	Students Enrollment	Existing Usable Area (in m^2)	Usable Area per student (in m^2)	NUC Standard (m^2/ student	Recommendation (m^2/ studnet)
Arts and Social Science	12048	313225	2.6	2.8-8.3	4.0
Agriculture	3380	18928	12.6	12.0	14.0
Administration	5812	14530	2.5	3.4	5.0
Education	5215	17210	3.3	5.5	5.0
Engineering	3844	38440	10.0	10.6	14.0
Environmental Design	3464	22163	6.4	9.5	9.0
Law	3388	8131	2.4	3.4	5.0
Human Medicine	3280	9512	10.9	15.0	14.0
Pharm. Science	1719	15403	7.0	9.0	9.0
Veterinary Medicine	1773	37942	20.4	15.0	18.0
Science	10345	74484	7.2	9.0	8.5
Teaching Hospital	57576	143940	2.5	0.05	3.5
Outdoor Theatre	57576	1215	0.025	0.06	0.035
Large Hall	57576	4861	0.2	0.2	0.25

* These Universities are, Nsukka, Ibadan, A.B.U., Ife, Lagos, Benin.

Source: University Authority.

Table 3.42: ANALYSIS OF USUABLE AREA PER FULL TIME EQUIVALENT STUDENT IN SIX NIGERIAN UNIVERSITIES (1981/82)* AND PROPOSALS FOR CENTRAL ADMINISTRATION AND SUPPORT SERVICES AND FACILITIES

Description	Student Enrolment	Existing Usable Area (m^2)	Usable Area per Student (m^2)	NUC Standard (m^2/Student	Recommendation (m^2/student
Central Administration	57576	34556	0.60	0.40	0.80
Convocation Square	-	-	-	-	-
Shopping Centre	57576	10207	0.21	0.25	.25
Auditorium	57576	7291	0.15	0.10	0.14
Library	57576	38885	0.8	1.25	1.20
Central Storage	57576	9721	0.2	0.15	0.13
Student Centre	57576	25761	0.53	0.76	0.55
Computer Centre	57576	2430	0.05	0.06	0.035
Estate Department	57576	15554	1.15	0.43	1.40
Staff School	57576	17012	2.35	0.24	0.25
Filling Station	57576	8636	0.15	0.25	0.20
Power Station	57576	1458	0.03	0.04	0.035
Central Laundry	57576	2430	0.05	0.03	0.045
Telephone Exchange	57576	778	0.016	0.01	0.016
Conference Centre	57576	6805	0.14	0.10	0.05
Staff Centre	57576	11179	0.23	0.35	0.25
Indoor Sports	57576	14582	0.3	0.20	0.15

* These Universities are, Nsukka, Ibadan, A.B.U., Ife, Lagos and Benin

Source: University Authority.

overcrowding of offices, classrooms, lecture theatres, and laboratories with resultant congestion and over loading of available infrastructural facilities. The building density is very high.

Table 3.4.2 shows usable area per full time equivalent student for certain facilities and services, and Table 3.4.3 shows the space use for students and staff housing. Generally except staff housing there is shortage of area. The library, central administration, and student housing experience the greatest space scarcity than other facilities and services. The academic and students residential areas have high building density, while very low building density characterises the staff housing areas (particularly senior staff). The data collected and my discussion with University authorities visited revealed that the problem of congestion on our campuses is attributed to rapid population growth which is far greater than available facilties can accommodate. The existing usable area, the congestion on our campuses, peculiar area needs of these facilties and services as regards their functions, and NUC recommendations have been considered in evolving feasible area proposals for these uses. These proposals will be used for area calculation in

the light of the needs of Federal University of Technology Bauchi.

The general area use of the major elements of the University is shown in Table 3.4.4. These figures are expressed as percentage of total area of each University excluding the farm areas. The table establishes the following:

First: The least percentage of total developed area is under central administration, and

Second: we have the student housing. These are followed by support services and facilities, Teaching and research and staff residence in this increasing order.

These findings have been compared with NUC standard and in the light of expressed space demands in the academic areas, students residences and support services and facilities. These percentages have been adjusted Table 3.4.4. The staff residential area has been reduced and this recommendation takes into consideration that existing staff housing areas are in excess of utilizable demand. It also takes into consideration the provision for high-rise buildings in some staff housing to accommodate the expected number of staff on campus.

Table 3.4.3: ANALYSIS OF USABLE AREA PER STUDENT AND GROSS PER STAFF FOR RESIDENTIAL PURPOSES 1981/82* (EXISTING SITUATION, NUC STANDARDS AND PROPOSALS)

Description	Number Students	Existing Usable area	Existing Usable area per per student	NUC Standard m^2/ student	Proposal m^2/ STudent
Students					
i. Common rooms	57576	21873	0.45	0.57	.55
ii. Dinning rooms	57576	19442	0.4	0.55	.50
iii. Kitchens	57576	16526	0.34	0.45	.50
iv. Living area	51259	410072	8.00	10.20	12.3

Description	Number	Gross Area in hectare	Gross plot area/ staff in hac.	NUC Stadard in hect/ staff	Proposal in hact/ staff
Senior Staff	4296	1288.8	0.30	1-0.2	0.18
Junior and Intermediate Staff	571	34.26	0.06	0.03	0.05

*Analysis based on data collected from the following Universities - Nsukka, Ibada, A.B.U, Lagos, Ife and Benin.

Table 3.4.4: AREA USE BY MAJOR CAMPUS ELEMENTS (EXISTING, NUC STANDARD AND PROPOSALS

Description	Campus Elements				
	Central Admin. (%)	Support Services (%)	Teaching/ Research	Students Housing (%)	Staff Housing (%)
Nsukka	1.8	6.5	9.8	3.8	78.1
A.B.U.	2.0	8.6	13	3.2	73.2
Ife	1.0	5.8	11	4.0	78.2
UniBenin	1.5	6.2	10	5.5	79.3
Unilorin	2.0	6.4	11.4	4.8	74.7
Unijos	2.4	8.0	12.4	4.2	72.3
Unisokoto	2.0	7.0	13	3.7	73.8
UniPort Harcourt	1.8	5.8	12	3.8	76.7
Average of Existing Situation	1.8	6.8	11.6	4.0	75.8
NUC Standards	1.0	2.0	10.0	14.0	73.0
Recommendations	2.0	8.0	15	5.0	70.0

Source: Fieldwork and NUC Standards.

3.50 Campus Population and Schedule of Requirements:

7,600 student population has been used for the planning of the University. However, the campus can expand to 10,000 or more if it becomes necessary in the future. The computation of the students population is based on the colleges or schools to be established in the University as revealed in the brief made accessible to the writer during the process of data collection. The colleges or schools listed in Table 3.5.1 are based on information gathered from the University of Technology Bauchi and the NUC Office Kaduna. However the departments listed here are based on consultations with the NUC, University of Technology Bauchi and data collected from existing Universities. The basic rational of the students population calculation is a function of the needs of man power in the various areas in relative terms. The growth of University population will have to be gradual (Table 3.5.2). Consideration has been given to NUC provision of 200 students per department, however this has not been used in absolute terms. The problem here is that at the time of data collection, the University could not provide academic brief in terms of all the departments that may be established. However the University has taken off with a school for Preliminary Sciences (and about 500 students enrolled) which has been taken

care of in the steady growth of the Universtiy students population. As regards the allocation of students to the schools and colleges of University Technology Bauchi, ~~consideration has been given to other~~

Table 3.5.1: UNIVERSITY OF TECHNOLOGY BAUCHI.

List of proposed Schools and Departments.

School	Number of Students
College of Agriculture	800
School of Health Sciences	600
School of Veterinary Medicine	400
School of Earth and Mineral Sciences	600
i. Geological Sciences	
ii. Marine Engineering	
iii. Hydrogeology and Water resources	
iv. Minerals and Mining Engineering	
v. Geography	
vi. Petroleum Engineering.	
School of Science Education	1600
i. Biological Sciences	vi. Mathematics
ii. Biochemistry	vii. Microbiology
iii. Chemistry	viii. Physics
iv. Computers Science	ix. Vocational and Technical Education.
	x. Textile Technology.
School of Engineering	800
i. Mechanical Engineering	ii. Civil Engineering

iii. Chemical Engineering
iv. Electrical Engineering
v. Agricultural Engineering.
vi. Land and Quantity Surveying
vii. Electronics
viii. Environmental Engineering.

College of Art and Design

i. Architecture
ii. Buiilding Technology
iii. Estate Management
iv. Indstrial Art
v. Landscape Architecture
vi. Urban and Regional Planning.

School of Management Sciences 1000

Accounts
Economics
Law
Administrative Studies
Business administration

School of Preliminary Sciences 1000

i. Chemistry
ii. Biology
iii. Mathematics
iv Physics

Table 3.5.3: ACADEMIC AREA REQUIREMENTS (9182-2002).

Description	Student Population	Accom. Staff population	Usable Floor Area/ Student (in m^2)	Total Usable Floo Area (in m^2	Balancing Area (in m^2)	Total Floor Area (in m^2
Agriculture	800	80	14	11200	55	24889
Engineering	800	80	14	11200	55	24889
Base Area Engr.			730 sq. metres	2920	25	3893
Art and Design	800	80	9.0	7200	55	16000
Health Sciences	600	120	14.0	8400	55	18667
Management	1000	100	5.0	5000	55	11111
Vet. Medicine	400	80	18.0	7200	55	16000
Science Education	1600	160	8.5	13600	55	30222
Preliminary Studies	1000	100	8.5	8500	55	18889
Earth and Mineral Sc.	600	60	8.5	5100	55	11333
Teaching Hospital	7600		3.5	26600	50	53200
Outdoor Theatre	7600		0.035	266	55	591
Large Halls	7600		0.25	1900	50	3800
Zeological Garden	7600					50000
Botonical Garden	7600					50000
Industrial Area						100000
Research Institutes	7600					50000
Teaching farm	7600					6000000
Total						6483484

Source: University Authority.

Table 3.5.4: CENTRAL ADMINISTRATION, FACILITIES AND SERVICES AREA REQUIREMENTS (1982-2002)

Description	No. of Students	Usable Area/ in m^2)	Total Usable in m^2)	Balancing Area (in %)	Net Total Usable (in m^2)
Central Admin.	7600	0.8	6080	55	13511
Conv. Square	7600	-	-	-	12500
Shopping Centre	7600	0.25	1900	15	1135
Auditorium	7600	0.13	988	65	2823
Library	7600	1.2	9120	35	14031
Central Storage	7600	0.15	1140	10	1267
Student Centre	7600	0.55	4180	50	8360
Computer Centre	7600	0.05	380	.40	.633
Estate Department	7600	2.4	18240	15	21459
Staff School School (2)	7600	2.5	19000	50	380002
Waste treat-ment plants	7600	-	-	-	100000
Church/ Mosque	7600	-	-	-	50000
Petrol Filling Station	7600	.25	1900	15	2235
Power Station	7600	0.035	266	15	313
Central Lundry	7600	0.045	342	50	684
TelephoneExc.	7600	0.016	122	15	144
Conference Centre	7600	0.14	1064	45	1935
Staff Centre	7600	0.25	1900	50	3800
Sports/Play Fields	7600	-	-	-	140000
Indoor Sports	7600	0.25	1900	30	2714
Commercial farm	7600	-	-	-	1200Hac.

Source: University Authority.

Table 3.5.5: SCHEDULE OF RESIDENTIAL AREA REQUIREMENTS (1982-2002)

Description	Student Enrol-ment	Usable Area (m^2)	Total Usable (m^2)	Balanc-ing Area (%)	Net Total Usable Area (m^2)
Students	5700				
i. Common rooms	5700	0.55	3135	50	6270
ii. Dinning rooms	5700	0.50	2850	50	5700
iii. Kitchens	5700	0.50	2850	50	5700
iv. Living area	5700	12.3	7000	50	140000
Total Area					157670
	No. of Staff	Gross plot Area per Staff (in hac)			Net Area (in hec).
Senior Staff	860	0.18			154.8
unior and Interm.	1064	0.05			53.2
Total	-				208

Table 3.5.6: SCHEDULE OF LAND REQUIREMENTS BY MAJOR CAMPUS COMPONENTS (1982-2002).

Description	Area in Hectare
Central Administration	5.5
Teaching and Research	55.9
Support Services and Facilities	32.4
Students Residences	15.8
Staff Residences	208
Farms	1800
Reserve Area for Expansion	1000
Total	3,118.9

Source: University Authority.

An additional area of 1000 hectares is reserved for expansion needs. This provision takes into consideration the fact that the University has been planned for 7600 students., but can expand to 10,000 or more if need be.

For the calculation of water requirements of the University the stipulated family sizes of 5 and 4 by NUC for senior and junior staff respectively have been used. The water requirement of the campus population is shown in Table 3.5.7. It may be noted that the provision for non-resident population is to cater for their water requirements while on campus during the day time. It will also be available for use in the laboratories, and other areas of needs which have not been adequately taken care of in this report.

Table: 3.5.7: CAMPUS WATER REQUIREMENTS.

Description	Total Number	Litres/ head/day	Quantity Water/day (Litres)	Quantity of water required per annum including water for fire fighting purposes
Campus Population	12356	200	2471200	———
Off Campus Population	23694	100	2369400	
Total	36050	-	4840600	1.8m cublic litres

CHAPTER FOUR

4.00 AN APPRAISAL OF PRINCIPLES AND CONCEPTS FOR CAMPUS PLANNING AND DESIGN IN NIGERIA.

4.10 Literature review on University Planning Prin-Principles.

The understanding of the principles of University Planning will be facilitated by a brief discussion on the factors governing the principles of Campus planning. These factors (or criteria/characteristics) and principles offer both the planner and designer some basic challenges that tend to suggest the physical form the University may assume.

4.1.10 Factors governing University Planning and design Principles

4.1.1.10 Social heterogeneity.

The University system is termed "a society of individuals living together for the advancement of learning and dissemination of knowledge" [1] at the highest level of spiritual attainment and intellectual achievement. The society should therefore embrace the academic staff, students and non-academic staff who work to extend the limits of knowledge and it is equally important that it promotes interaction and contact between all

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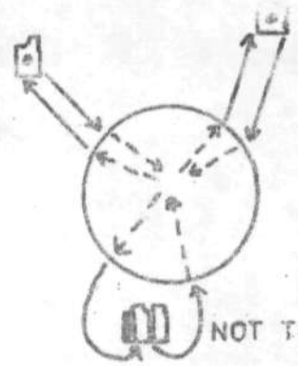
1 Richard P. Dober (1965). The New Campus in Britain, Ideas and Consequences for the United States; Educational facilities Laboratory, New York p. 48.

sectors of the University community (Fig 4.1.1). In planning terms this will require that the most functional areas of the campus should be housed within a limited area and also at the same time ensuring a clean hierarchy of groups from individuals to the whole which can have strong force of cohesion to operate as a society. In planning terms, the factor will require the prevalence of harmonious integration of both living and work place rather than treating these as isolated and unrelated functional areas; the factor also requires that a great number of staff and students should be accommodated and facilities, services and utilities provided to ensure conducive atmosphere for learning and living. It has been rightly expressed that "The plan must be compact, have good internal communication to encourage contact between people, be capable of growth without disintegration and provide for a clear hierarchy of identifiable and related groups from the individual to the whole so that each person and group can identify its own unique position in the University. Without this the University could never have sufficient cohesion to operate as a community but would remain merely a mass of isolated individuals". [2]

2 Richard P. Dobar (1975) The New Campus in Britain; Ideas and Consequences for the United States; Educational facility laboratory, New York pp 48-49.



THE UNIVERSITY

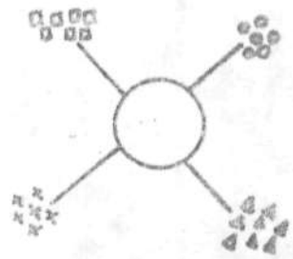


NOT THE UNIVERSITY

The university —— "a society of individuals living together for the advancement of learning and dissemination of knowledge."



THE UNIVERSITY

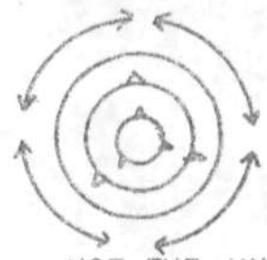


NOT THE UNIVERSITY.

(b) The university —— "a meeting place for different aptitudes, skills and specialisations."



THE UNIVERSITY



NOT THE UNIVERSITY.

(c) For the university —— "provision for easy growth and flexibility is vital."

CRITERIA FOR UNIVERSITY DESIGN PRINCIPLES (FIG. 4.1.1)

source; Dober R.P (1965) pp36 , 48

4.1.1.2 Socio-academic.

The University is rightly regarded as "a meeting place of different aptitudes, skills and specialization." [3] Such academic attributes must interact with each other for the enrichment of the Universal body of knowledge (fig 4.1.1b). In planning and design language, thisfactor requires that the University core should be compacted without congestion, and should ensure an ease of dialogue and communication between component parts of the University. It requires the provision of socialization points and strong campus core to enhance both deliberate and casual meetings and also the stimulation of maximum interactions without causing congestion.

4.1.1.3 Flexibility

This factor recognises the dynamic and changing role of a University as a living organism expressing itself in space. Considering the fact that the University academic programmes change to meet the emerging needs of the society, embracing cultural, technological changes of the society and shifts in

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3 Richard P. Dober (1975) The New Campus in Britain; Ideas and Consequences for the United States; Educational facility Laboratory, New York pp 48-49.

manpower needs, it is necessary in planning and design of a campus to ensure the "provision for easy growth and flexibility of use ....." [4] for the University system. This, in planning and architectural interpretation, requires that the University development plans and the details of their constituent parts should be adaptable to change when the situation so warrants. (Fig. 4.1.1c).

4.1.1.4 Direct relevance:

This factor demands that a University should not be a proto-type imitation of an alien campus, but should rather be adaptable to the local conditions. Consequently, the University milieu is expected to be the product of the total environment (social, cultural, economic and physical) in which it is sited. The planning implication of this is the need for considerable investigation into the socio-cultural and geographical context of the region, district, or town in which the project or University is to be located. The factor will also require sound analysis of forms and building relationships in their setting which must be in

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4 Richard P. Dober (1975) The New Campus in Britain; Ideas and consequences for the United States; Educational facilities Laboratory, New York pp 48-49.

congruance with the academic and social ideals of the University. It will also require research into the local vegetation and adaptable exotic breeds with a view to incomparating these plant species into the campus landscaping strategy.

4.1.20 Principles of University Planning and design.

The preceding section has highlighted some characteristics and demands of University system. Based on these factors or forces or criteria, planners, over the years, evolved some basic principles governing the Planning and design of Universities. It is the concern of this section to briefly highlight these principles.

4.1.2.1 A twenty four hour University principle.

A rational manipulation and juxtaposition of the various elements that constitute a campus should ensure the continuous use of the campus core. Some of the University plans that were designed over the years embraced the concept of "ghost core a situation where the University becomes dead" after the normal working hours. Admittedly this unhealthy situation is not in conformity to the characteristics or factors governing the principles of University Planning and design highlighted in the preceeding

section, hence the need to embrace the twenty-four hour University principle, successfully used in the University of Essex Development Plan 1960 - 1963. In the application of this principle, it becomes necessary to avoid where feasible rigid split between academic, residential and social activities. In the planning and design stages of the University and implementation there of, residences may be located close to the academic area, and further more 24 hour library services and facilities for leisure pursuits are integrated with the academic buildings, commercial and other community services and facilities to achieve the twenty four hour principle.

4.1.2.2 Continuous teaching and design principle.

According to Casson and Conder "Every building and each layout so optimistically and thoroughly designed seems to become within a decade not only out of date but physically hampering in the future." [5] The importance of this rational assertion need not be over-emphasised. It is therefore very significant that the continuous teaching environment should resolve "these dilemas (that are physically hampering in the

---

5 Canson and Conder, 1958, University of Birmingham Development Plan Report.

future) by taking a physical form that allows accreted growth and internal change while encouraging maximum communication among the constituent parts of the institution." [6] In order to achieve this the following have been suggested. [7]

(i) Do not spread unnecessarily - a University should express itself as an entity by means of a compact and coherent layout.

(ii) Keep open the access to possible long term sites.

(iii) Use the principle of the Joker: allow indifferentiated space within areas set aside for specialized activities, this for sudden and previously unknown expansion.

(iv) Use the principle of Courtyard planning: Complete space by space, contrasting space by space.

(v) Use the natural given personality of the site; demand that each building contribute to the special quality of the whole and not be something apart.

4.1.2.3 Ten-fifteen minute principle.

This principle is concerned with the convenience of the pedestrian, within the campus core. The

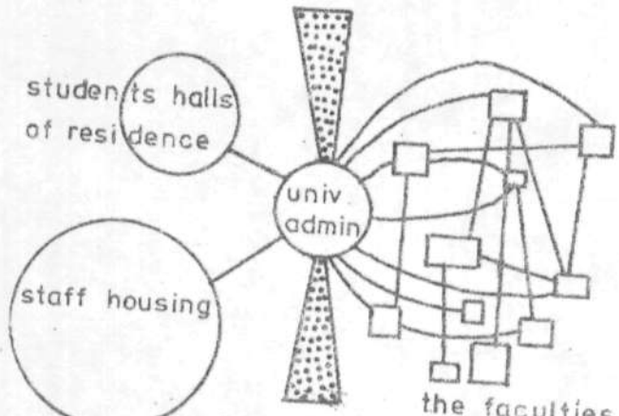
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6 - 7 Richard P. Dober (1965) The New Campus in Britain; Ideas and Consequences for the United States; Educational facilities Laboratory, New York p. 35.

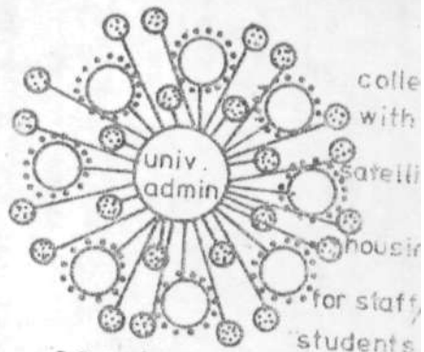
principle in design terms, seeks to ensure that it does not take more than ten - fifteen minutes to walk from one part of the University Core to another, including students residences. Considering the fact that within the Campus core movements will generally be by the pedestrian, between halls of residence and teaching areas and central service and facilities and socialization points, it is important that during the design stages reasonable attention is given to the ten - fifteen minutes principle. The principle could be reasonably employed by planning to ensure compactness (without congestion) and high degree of vertical integration of uses.

4.20 Alternative concepts of University Planning and design and the evaluation of the concepts for their suitability to Federal University of Technology, Bauchi.

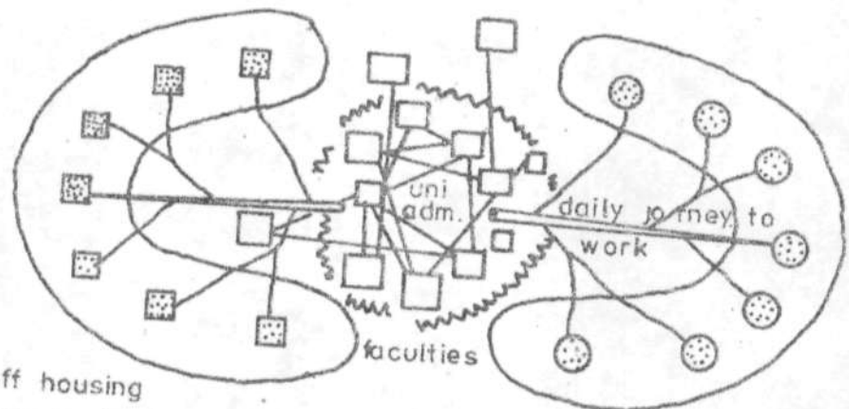
The concepts under discussion in this section show the relationship in spatial terms between the major elements of the campus (fig 4.2.1). These major elements include public area; academic and facilities; students and staff residences.



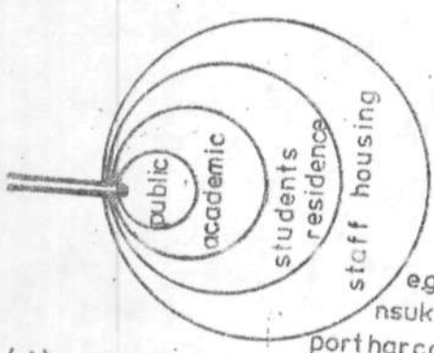
Loose tie concept



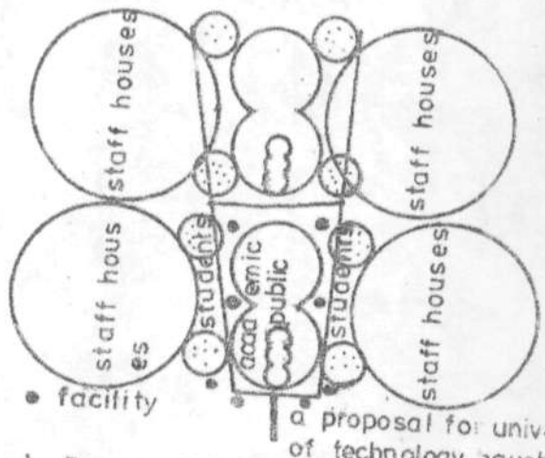
(b) Close knit concept



(c) Segregated concept



(d) Concentric concept



(e) Dynamic linear concept.

FIG. 4.2.1 CONCEPTS OF UNIVERSITY PLANNING/ DESIGN.

source : Dober R.P.(1965) p49 ; Nwodo C.I. (1980) p.9.

PLANNING FOR FEDERAL UNIVERSITY OF TECHNOLOGY BAUCHI.

bwilwa, m.b.
m.sc. thesis (u.r.p.)
a.b.u. zaria, 1982.

4.2.1 The loose Tie concept.

The concept depicts the central location of administration building, while the residences and faculties are positioned at the opposite sides of the administration block (fig 4.2.1). This model gives rise to a rigid distinction between teaching/ research, communal and residential buildings and thereby creating a condition of limited interaction and inadequate mixing. Furthermore this tendency towards separation of elements may impose unnecessary walking distance to the students and other pedestrians visiting the central administration and other parts of the University system. It may be noted that little attention has been given by this concept to the factors governing principles of University planning and design, admittedly also little attention has been given to the principles of planning and design of campus highlighted in Section 3 of this chapter. In this model, however, the various elements can grow independently but not necessarily ensuring the demand that each building contribute to the special quality of the whole. Furthermore, in this model, the whole system is capable of initial functioning with minimum investment.

4.2.2 Segregated concept.

The model embodies the central location of teaching and administration area, while students and staff housing are located on the opposite sides of the central area of the campus (fig 4.2.1). The basic segregation between the core and residential areas enhances a low level of staff/student interaction. Further more the need for daily journey to place of work by both staff and students is a great inconvenience, particularly to the students who may not afford transport cost.

Another disadvantage is the likely danger of disrupting the basic concept or model in a situation where the possibility of expansion of central administration is inhibited by surrounding teaching and research buildings, necessitating the expansion location elsewhere. This problem may be true also for teaching and research and communal buildings, particularly in a situation where need for expansion arises. Generally this conceptual framework is in conflict with factors governing principles of University planning and design and the principles of campus planning earlier highlighted.

4.2.3 The Close-knit concept.

In this conceptual framework of University design, both students and staff are organised into the collegiate system creating a situation whereby each college is apparently self sufficient on its own (fig 4.2.1). It is apparently obvious that the level of interaction between them becomes inevitably low. It has been correctly noted that "the tag 'closely-knit' refers more to the positioning of the buildings relative to each other. Infant each of the colleges look inwardly into itself and interaction is (consequently) very low." [8] This may be typified by the separate campuses constituting Ahmadu Bello University. In this conceptual framework the investment required for development is very high: This is particularly true when one considers that central communial facilities, services and utilities must be provided for each collegiate system. The collegiate system, however has the advantages of the campuses being easily incorporated into a city structure in the form of dispersed campuses, which promotes mutual interaction between the University and City communities and the effective use of centrally provided services, facilities and utilities for the town population.

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8 Nwodoh C.I. (1980) Nsukka Campus of the University of Nigeria, in the 2,000 A.D. A Development plan. Unpublished M.Sc thesis, Dept. of Urban & Regional Planning, ABU Zaria p.56.

4.2.4 The Concentric or ring concept 4.2.1

The model is characterised by an impressive and bold approach which leads directly to the public area in which common facilities (central administration, bookshop, theatre, library, Postal services, banks etc) that are shared with the general public are located (fig 4.2.1). Adjoining the public area (in a 'ring' form) is the teaching and research area, followed by students and then staff housing areas. The concentric concept is rigid and lacks the elements of flexibility and dynamism.

4.2.5 The Dynamic Linear Concept.

The concept is characterised by a bold and impressive approach which leads to the public area (Fig 4.2.1). In the public ara, the following are found - central administration, bookshop, Postal Services, bank, central cafeteria, computer centre, student centre, main library and convocation square/ open air theatre. The public area is supported on both sides by the academic and facilities area, then followed by students and staff residences.

This proposed concept to be used for the design of the University of Technology, Bauchi, is not only dynamic, flexible, but also offers ample provision for accessibility and interaction between the component parts of the University system. Infant apart from its

provision of public area constituting the hub of the campus for interaction, the model enhances mobility that ensures high degree of social and academic contacts between students and staff of different departments, faculties and colleges. The concept demands the location of a campus on one site; while this appears to be a weakness of the concept, particularly where land availability is scarce, to the favour of the close knit concept, it may be noted that this seeming weakness is the very strength of the concept for it seeks to ensure, maximum interaction between parts of the campus and promotes the physical development of University academic and social programmes with minimum cost of investment, hence under this model duplication of infrastructure is inhibitted.

Further more the concept embraces the principles of University Planning and design and their governing factors, than any other concept discussed above.

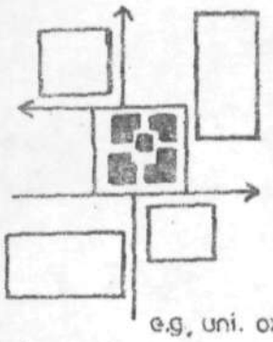
4.2.60 Core concepts of University planning and design.

Having discussed the concepts depicting the relationship between the major elements constituting the overall campus environment, one turns to what happens in the University core. The discussion will

therefore be centred on the relationship between the elements that constitute the hub of the University, namely teaching and research, administration buildings, communal facilities and services and student residences. It is important to note that the concepts under discussion here can operate within the framework of earlier concepts discussed which depict the whole University environment as one functional organism. These concepts include:

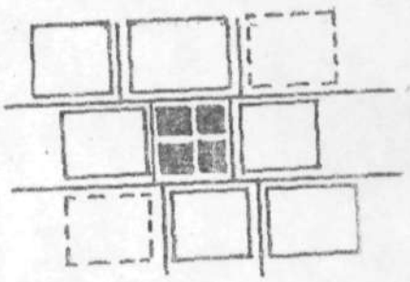
(i) Molecular or medieval quadrangle concept
(ii) Centralized or Neoclassical concept
(iii) Free standing or dispersed concept
(iv) Matrix or Network concept
(v) Orthogenal concept
(vi) Contiguous or Composite concept
(vii) Linear concept.

It may be noted that the first three to be discussed are concepts organised on the basis of spatial relationships while the remaining four are concepts organised largely on circulation patterns. These concepts are illustrated in figure 4.2.2.



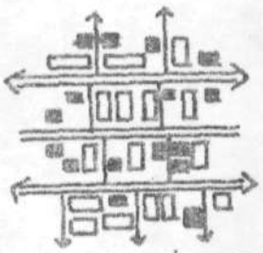
e.g. uni. oxford, havard

Molecular concept



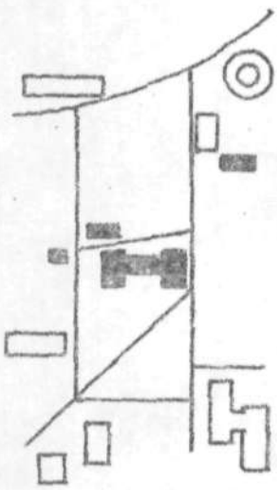
eg, uni. columbia, virginia.

(c) Centralized concept



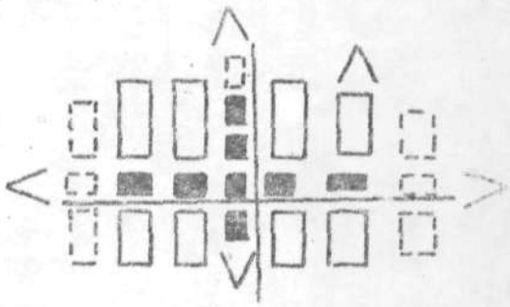
e.g. uni. essex.

(d) Matrix concepts



eg. unibadan, unibello

(c) Dispersed concept



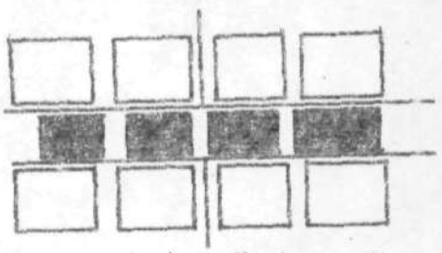
eg. uni. rhur, regensburg.

(e) Orthogonal concept



eg unibayero

(f) Composite concept



eg uni. jos; ilorin; portharcourt.

(g) Linear concept.

FIG. 4.2.2 UNIVERSITY CORE DESIGN CONCEPTS.

source Dober R.P. 1965; Ayorinde, M.A. 1981; university plans.

PLANNING FOR FEDERAL UNIVERSITY OF TECHNOLOGY BAUCHI.

bwilwa, m.b.
m.sc. thesis (u.r.p)
a.b.u. zaria, 1982.

4.2.6.1 Molecular or Medieval quadrangle Concept

The molecular concept has the following characteristics.

(i) It is made up of parts that are virtually autonomous but fit into a suitable structure of the University core system.

(ii) It has low overall building density but the density of the individual buildings is high.

(iii) Within the framework of this concept, large scale expansion is inhibitive while small scale expansion depends mainly on areas occupied by the units.

(iv) The linear or orthoginal concepts can be used to minimize the problems posed by the concept and thereby promote the achievement of a reasonable degree of mutual spatial arrangement of the units, but this may lead to the disruption of the initial concept used in the core area planning.

(v) While the plans may be attractive, the major problem of the molecular concept is the fact that the plans are usually difficult to modify in terms of departmental and faculty requirements for growth and expansion.

4.2.6.2 Centralized or Neoclassical Concept

The nature of the Centralized model include the following.

(i) It is characterised by central location of common facilities with high building concentration.

(ii) There is high degree of interaction between the centre and faculties due to minimized distances between them and also the concentration and radial arrangement of facilities.

(iii) As a result of circular arrangement of buildings, it is characterised by efficiently organised traffic.

The problem associated with this model is the large amount of investment required at the initial stage of establishment. In addition when the need for expansion at centre arises, the teaching facilities will be encroached. Another problem associated with this concept is that the extension of teaching facilities will only be possible externally and thereby disrupting the initial concept of concentration.

4.2.6.3 Free standing or Dispersed Concept.

The concept prevails where there is large tracks of fairly flat available land and it is characterised by the following.

(i) Building density is low.

(ii) Buildings are unnessarily dispersed over long distances.

(iii) It lacks any sense of spatial organisation.

(iv) It imposes on the pedestrian, unnecessary walking distance between different parts of the campus.

(v) Creates unnecessary extension of services lines over long distances and hence its cencommitant cost implication.

(vi) The degree of interaction between staff/ students is low.

4.2.6.2 Matrix or Network concept.

The concept has the following attributes.

(i) Common facilities and student residences are found amidst educational facilities.

(ii) It has high building density.

(iii) Green areas can be provided in the form of courts due to high building density.

(iv) High degree of vehicular circula-tion network to the detriment of the pedestrian.

(v) Its compacted nature ensures a reasonable degree of both academic and social contacts between staff and students.

(vi) In terms of visual expression and configuration it may be unusually monotonous in quality.

4.2.6.5 Orthogenal concept.

The Orthogenal concept has the following characteristics.

(i) Its outlook is the centralized form of organisation.

(ii) The educational facility zones are parallel.

(iii) The common facilities are located perpendicular to educational facility areas.

(iv) The nature of its composition ensures a reasonable degree of both academic and social contacts between staff and students.

(v) Small and to a reasonable degree large scale extensions are possible by simple addition of facilities.

(vi) Common facilities may also grow independently.

At the initial stage of development the concept cannot achieve optimum functioning. Further more any major expansion is likely to disrupt the concept due to its rigidity.

4.2.6.6 Contiguous or Composite Concept.

The nature of the composite concept include the following.

(i) Central or communal facilities are centrally dispersed.

(ii) Distribution of staff and students within its framework guarantees minimal walking distances.

(iii) It promotes a reasonable level of social and academic contacts and mixing of staff and students.

(iv) The spatial organisation of buildings is chaotic.

(v) Functioning at its optimal is only possible at early stages of development of the campus core.

(vi) Channels of growth and future development are not given proper sense of direction.

4.2.6.7 Linear Concept.

The nature of the linear concept include the following.

(i) Common facilities are arranged along narrow central area or spine.

(ii) Building density is high.

(iii) Increasing walking distances go hand in hand with continuous expansion which is always possible.

(iv) Expansion may take place in opposite direction.

(v) Walking distances are unnecessarily increased where the density of the buildings is low.

(vi) The central location of communical facilities induces both deliberate and casual social contacts, while the compacted nature of development not only promotes academic but also social contacts between staff and students.

4.30 Suitable structure plan concept for planning and design of the University of Technology, Bauchi.

The suitable concept is characterised by the following.

(i) An impressive and bold approach which leads directly to the public area in which common facilities that are shared between University community and the general public are located (see fig 4.2.5). This is very essential because the University must interact with the surrounding community. The two communities must benefit from each other services. It may be noted that the loose tie, segregated and close-knit concepts are robbed of this very necessary advantage.

(ii) The major land use elements constituting a University are arranged in a flexible linear form. This model ensures a reasonable degree of co-ordination and proper intergration of uses thereby ensuring functional relationship. This minimizes the distances to be covered by the pedestrian

between place of work and living. The segregated, close-knit and loose tie concepts, are disadvantaged by long walking distances and lack of integration between uses like the administration area, teaching and research, residential and communal facilities. On the other hand the concentric model has the disadvantage of being too rigid.

Apart from its provision of public area as the hub of the campus for interaction, the model enhances mobility that makes way for high degree of social and academic contacts between students and staff of different departments, facilities and colleges. This obvious advantage is not adequately catered for by the other concepts.

The dynamic linear concept demands that the University site should be located in one place, and this is not the case with the other concepts (except concentric concept). The advantages of locating a campus in one place include the provision of common facilities in one place thereby avoiding duplication of the same in a situation where there are many campuses constituting one University as examplified by Ahmadu Bello University.

The concept embraces the principles of University planning and design and their governing factors, than any other concept highlighted above.

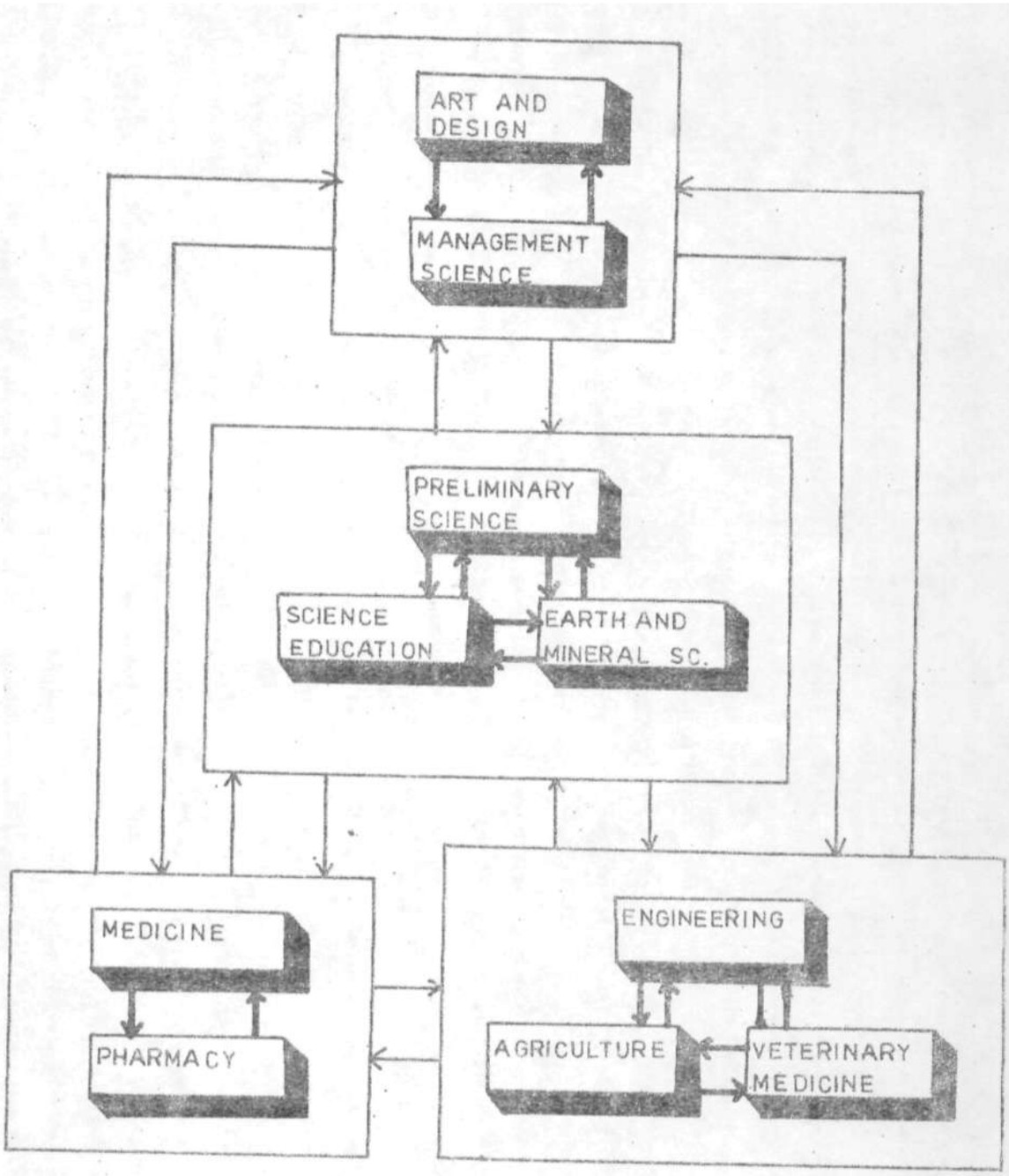


FIG 4.3.1 INTERACTION MODEL ON CAMPUS.

PLANNING FOR FEDERAL UNIVERSITY OF TECHNOLOGY BAUCHI.

bwilwa, m.b.
m.sc. thesis (u.r.p.)
a.b.u. zaria, 1982

Schools and colleges constituting a University of technology is expected to be together to share many facilities of common use to them - equipments, and staff alike (see fig 4.3.1); and since the linear concept embraces the idea of University development on one site, it consequently caters for the peculiar needs of a University of technology.

The linear concept will also be used for detail planning of the public area.

CHAPTER FIVE

5.0 THE STRUCTURE PLAN

5.1 The aims and objectives of the structure plan.

5.1.1 Aim - The central aim is to design a flexible structure plan for Federal University of Technology, Bauchi, with a view to providing conducive environment for learning and living.

5.1.2 Objectives.

(a) To prepare an efficient and flexible structure plan which is capable of accommodating future development and expansion of the University without adversely affecting the basic concept of the plan.

(b) To provide efficient link between the University and City for harmonious and integrated development and to promote academic and social interaction and contacts between the two communities.

(c) To provide green belts around and within the campus with a view to improving the ecological and climatic conditions of the campus, preservation of area for future expansion and the enhancement of quiet and healthy environment protected from dust, noise and other pollutants.

(d) To organise the campus activity areas like place of work, living and recreation in a well integrated manner, efficiently connected by an economic system

of road network giving special attention to climatic, geological and topographic considerations of the area.

(e) To provide an aesthetic environment where the community can relax and derive pleasure.

(f) To provide for required facilities, services and utilities for the use of campus and city communities.

5.20 The alternative structure plan, land use, circulation, infrastructure, and greenery.

5.2.1 Proposed land requirements for various land uses.

Table 5.2.1 shows the area needs of the campus for various land uses. For more detials about the basis of area calculation, the reader is referred to chapter three of this work. It is important to note that the open spaces, and greenery and roads, referred to in chapter three as balancing area are integral parts of the major uses.

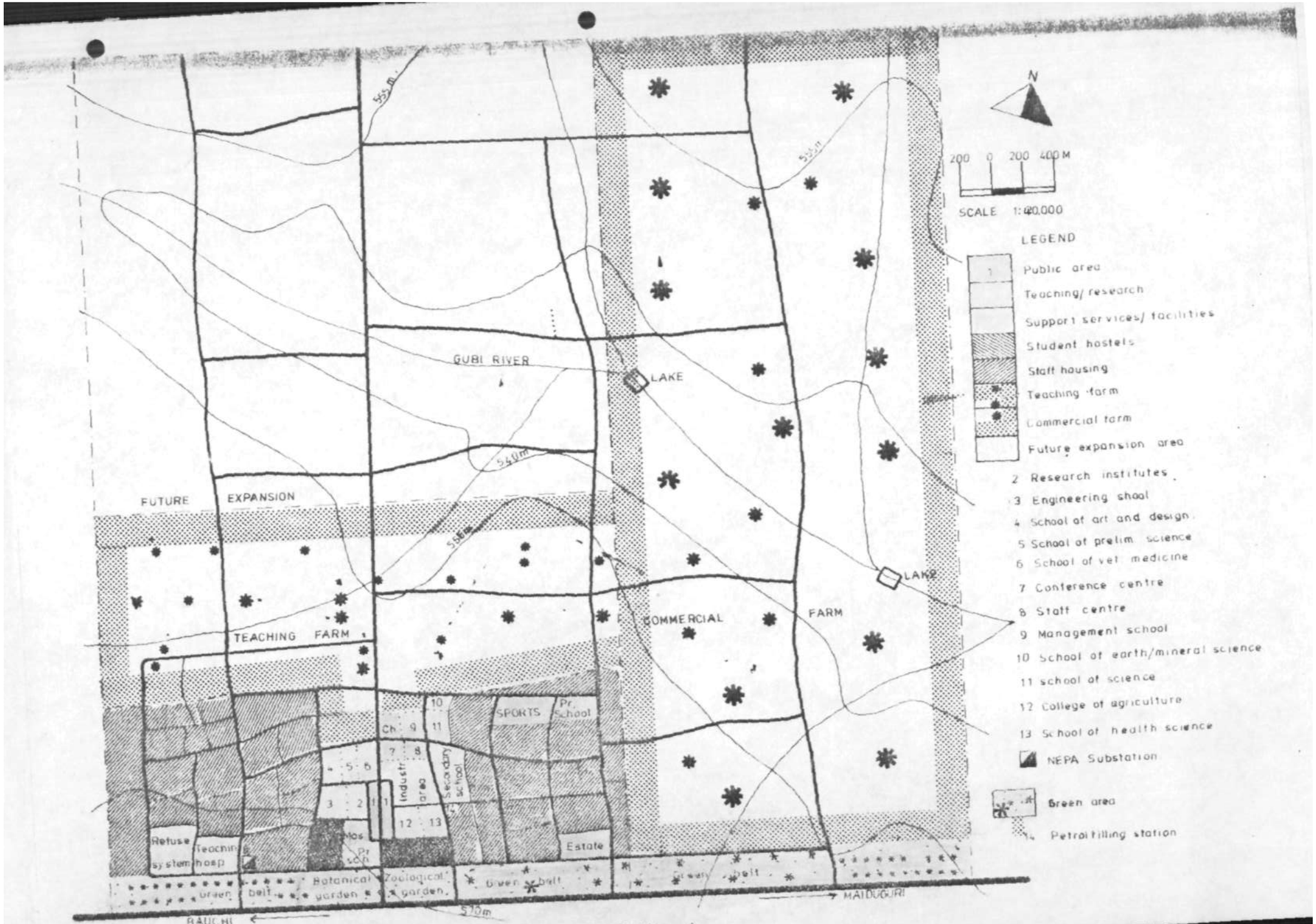


FIGURE 5.2.1 ALTERNATIVE STRUCTURE PLAN A

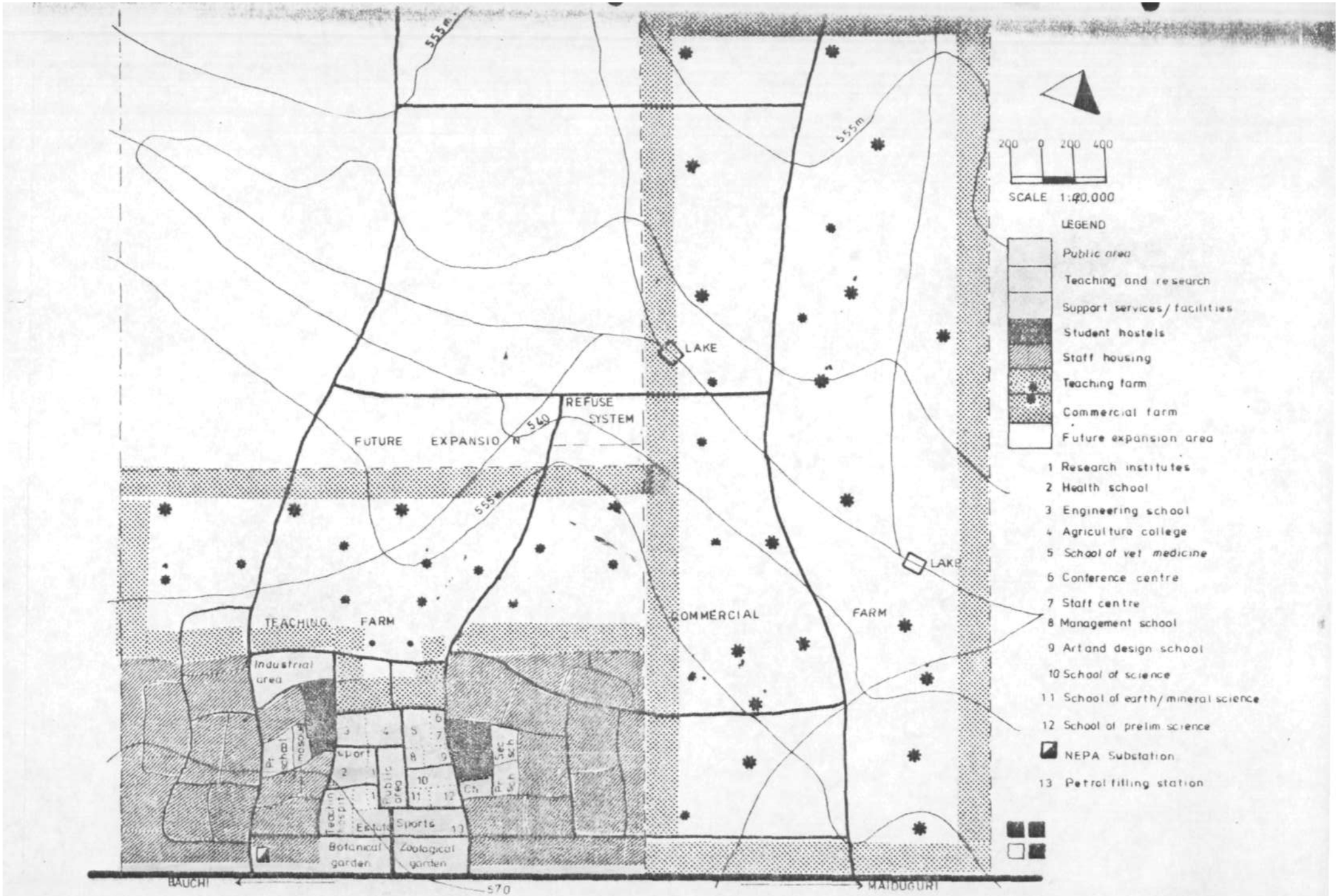


FIGURE 5.2.2 ALTERNATIVE STRUCTURE PLAN B

Table 5.2.1 Proposed land requirement for various uses.

Description	Area in hectares
Central administration	5.53
Teaching and Research	55.9
Support Services and facilities	32.4
Students Residences	15.8
Staff Residences	208.0
Farms	1800.0
Reserve area for future expansion	1000.0
Total	3118.93

The schedule of area requirement forms the basis for the design of alternative structure plans (figures 5.2.1. and 5.2.2). Since only one of these plans will be implemented it is therefore desirable and necessary to evaluate the two alternative structure plans so that the best alternative plan can be identified and consequently implemented.

5.2.2 The alternative Structure plans.

In a nutshell, the alternative structure plans (Figures 5.2.1 and 5.2.2) show the different land uses, circulation pattern, the green areas and infrastructure. It is important to note that the alternative structure plans have been prepared using the same statistical base to allow a comparative

evaluation to be made. The basic objectives underlying the preparation of the structure plans will be used to evaluate the best alternative for implementation.

For the purposes of evaluation of the best alternative plan for implementation, weights have been assigned to the objectives (A. - F) that form the basis for the preparation of these structure plan alternatives. The weights given to these objectives are as follows:- A = 3.0; B = 2.0; C = 2.5; D = 2.7; E = 1.0; F = 1.8. The scores of each plan against each objective have been tabulated (Table 5.2.3) and sumed up. The alternative plan with the highest score is the best for implementation.

Table 5.2.3 Evaluation of alternative Campus Structure Plans.

Objective	Alternative PLAN A	Alternative PLAN B
A	3.0	3.0
B	2.0	2.0
C	0.0	2.5
D	0.0	2.7
E	1.0	1.0
F	1.8	1.8
Total Score	7.8	13.0

The analysis of the scores of each alternative structure plan reveals that alternative "B" with highest score is the preferred structure plan for implementation. It satisfies maximum number of objectives. The selected alternative plan gives ample room for expansion, and at the same time ensuring the continuity of the design concept. Further more it provides effective link with the City community which will undobtedly promote social and academic contacts and a desirable level of interaction. This alternative has a particular advantage over the other alternative in that it employs green belts to enhance the quality of the environment, improving the ecological and climatic conditions and the protection of community from pollutants and other environmental nuissance. The preferred structure plan emphasises the concept of integration of all activity area by an efficient road network.

The unpreferred structure plan provides for too many roads and numerous traffic conflict points. The road system may not only be uneconomic to implement, but may eventually convert the campus into a scheme of road corridors and make the campus increasingly unsafe for the pedestrian. The

unpreferred alternative has not succeeded in integrating the different land uses in the light of climatic, and physical characteristics of the area. This may eventually lead to the creation of a chaotic environment to the discomfort of the community. It also fails to maximize the pedestrian use of the campus; particularly the public area, which is bisected by a major road which infact divides the campus into two distinct and unrelated parts. The wide greenery area along the major Bauchi - Maiduguri road is too large and it cannot be economically and efficiently maintained.

In a nutshell, the alternative structure plan will not only be too costly to implement but will create an unhealthy chaotic and unpleasant environment for the campus community. The Preferred Structure Plan is consequently best suited for the needs of the University and one strongly recommends that it should be implemented.

5.30 The Preferred Structure Plan land use.

The land use system of the structure plan is composed of the following - The academic on teaching and research area, support facilities and services; residential; and agricultural uses and a system of green belts. And within this flexible land use

system is the circulation network which functions as a powerful integrating force for all the land use elements. Access to the campus is restricted to a number of roads which have direct link with major Bauchi - Maiduguri road.

5.3.1 The Campus core.

As depicted in figure 5.2.2 an impressive and bold road leads to the public area where facilities used by both the University community and people from outside are located.

(i) Dominant in the public area are, the administration block, convocation square and landscaped University garden, auditorium, central cafeteria - student centre complex, bookshop, main library, computer centre, shopping centre and a water tower.

(ii) Immediately surrounding this area is the academic zone, where the departments and faculty buildings are to be constructed. The teaching hospital, teaching farm and other facilities and services are located close to these uses.

(iii) The students residential areas are located within the support and services and facilities areas, adjoining the academic area.

5.3.2 The Campus periphery.

The uses immediately adjoining the campus core include the following:

(i) The staff housing area is located with a view to minimizing travel distance between the area and the academic and student residential areas for easy interaction.

(ii) The sewage and solid wastes treatment and disposal plants are located with special consideration to environmental sanitation and slope, (fig 5.2.2).

(iii) The University lakes are located with the aim of intercepting water and consequently storing it for irrigation purposes during the dry season.

(iv) The commercial farm of the University is located at one end of the campus. (fig 5.2.2).

5.3.3 Road network and hierarchy.

Figure 5.3.1 shows the pattern and hierarchy of road network of the campus. The network system provides accessibility to different activity areas on the campus and also offers an effective link with the town through the Federal Government highway, (Bauchi - Maiduguri).

The hierarchy of road proposed in the structure plan include the following. Thefirst category is the major road which leads directly to the public area from the Federal highway. A right of way of 45 metres has been proposed for this category. The next hierarchy is the distributor road network

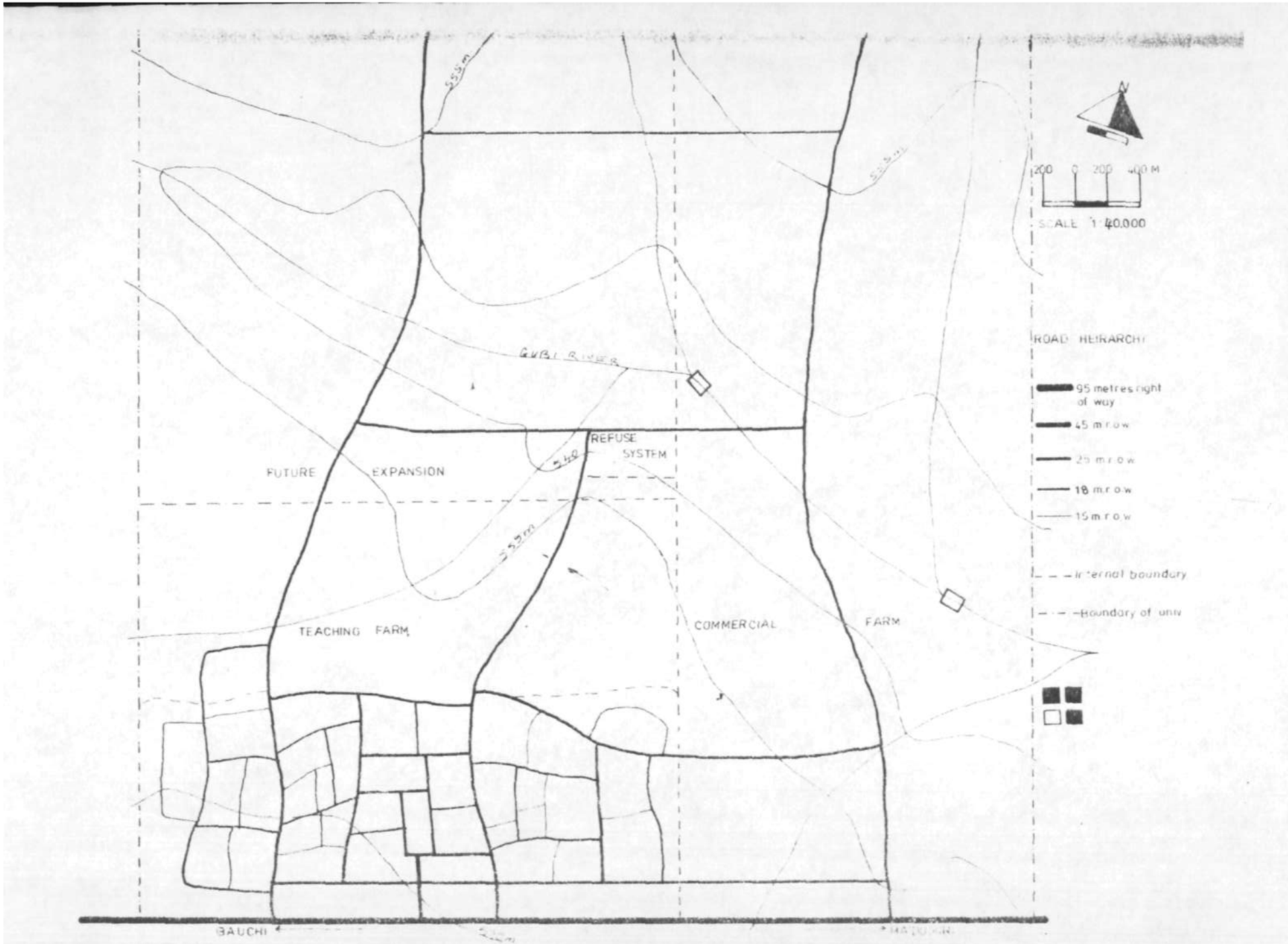


FIGURE 5.3.1 ROAD HEIRARCHY UNIVERSITY OF TECHNOLOGY BAUCHI

connecting primary areas within the campus. This category of road is proposed to have 25 metres right of way. The third category is the collector streets network and a right of way of 18 metres has been proposed for this system. The fourth road hierarchy, (the service roads) has 15 metres right of the way.

In addition, access roads should be provided during the preparation of detail layouts. These roads should provide access to the individual buildings or group of buildings. A 9 metre right of way is suggested for this category. This could be a loop or cul-de-sac with provision for turning at the other end, however its lenght should not exceed 150 metres.

The pedestrian circulation network should be provided along major roads during the detail layout design. It is recommended that main streets are to be provided with street lighting and other road furnitures of aesthetic quality on the environment. The main streets and pedestrian paths should be protected from destructive effects of weather parameters.

5.3.4 The green system.

There is wide range of provision for greenery (Figure 5.3.2); these include the University teaching

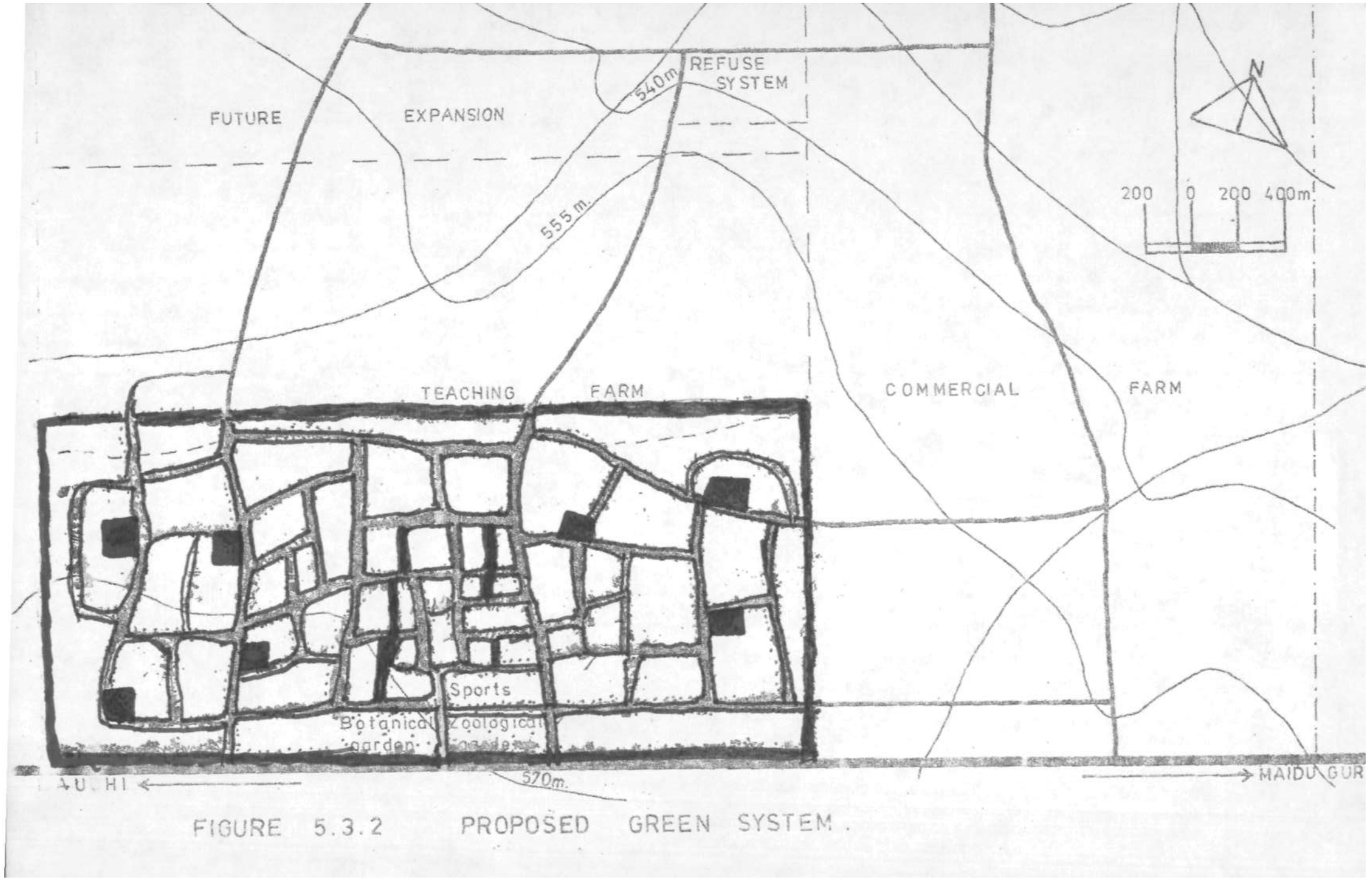


FIGURE 5.3.2 PROPOSED GREEN SYSTEM.

and commercial farms. These are for agricultural purposes. The other system of greenery is provided with the following objectives:

(i) The enhancement of the quality of the total environment by upholding the ecological balance and improving micro-climate and providing space for immediate expansion needs.

(ii) The protection of learning and living areas from the destructive effects of storm winds.

(iii) The interception of harmattan dust-pollutants and scorching sun heat at such appropriate seasons.

(iv) The protection of motorists and pedestrians from sun glare and heat.

(v) The landscaping of recreational areas, for the comfort and pleasantness of the campus community.

(vi) The provision of shade in parking areas and along pedestrian walkways.

(vii) The insulation of noise sources.

(viii) The provision of contrasts and variety in the campus landscape.

One would suggest that emphasis should be laid on the use of evergreen plant species. This is not to say that the deciduous plant species should not be used, hence the need for beauty and variety. For beautification or landscaping purposes, it is

important to consider the texture of the tree, leaves and nature of the flowers. It is important to note that evergreen and drought tolerant - resistant plant species are preferrable. For shading and street trees, it is important to consider the height of the trunk, the crown, and in addition the evergreen and drought resistant variety may be considered. As regards insulation, the dense shrubs interspersed with tall trees may be harmoniously planted close to the source of noise.

Based upon the preceding discussion the following trees and shrubs are recommended for specific areas. The trees and shrubs to be planted in the strip of greenery along Bauchi - Maiduguri road include - Kyaya Senegalensis, Azadirachta indica, Bixa Orellana, Dodonea - Viscosa and Nerum Oleander. For roads within the campus, the following are recommended - Kyaya Senegalensis, Azadirachta indica, Borassus Aethiopum, and Palmyra Palm. The trees along the roads may be planted at varying distances of between 2 and 5 metres depending on the crown and the image to be created in the campus landscape. As regards the botanical garden a variety of plant species may be used. For the zoological garden one recommends different species of bautinia, preferrably Bautinia

Gulpcini, Butyrospernum paradoxu and Pelto-phorum Africanum.

For car parking area the following are suitable - Tamarindus indica, Azadirachta indica, Kyaya Senegalensis, Peltophorum Africanum. Open spaces in staff houses and students halls of residence and academic buildings should be planted with suitable Mangifera indica, Kyaya Senegalensis, Jacaranda, Eucalyplus, Allamanda, Harmattan Jewel and Azadirachta inidca. For screening purposes, Bixa Onellana, Dodonea Viscosa, and Nerum Oleander, are most suitable.

The greenery in the staff residential area is for play fields and recreation and should be maintained for these purposes and similarly the sports and play fields meant for students.

5.3.5 Water supply.

Figure 5.3.5 shows the proposed distribution network of water supply to the campus community. A University reservoir is also shown close to the administration building. It may be noted that Gubi dam is the source of treated water supply for the University community. The daily requirement of water on the campus is placed 4,840,600 litres. This is detailed in chapter three ofthis report. The closed circuit system is recommended for water supply in

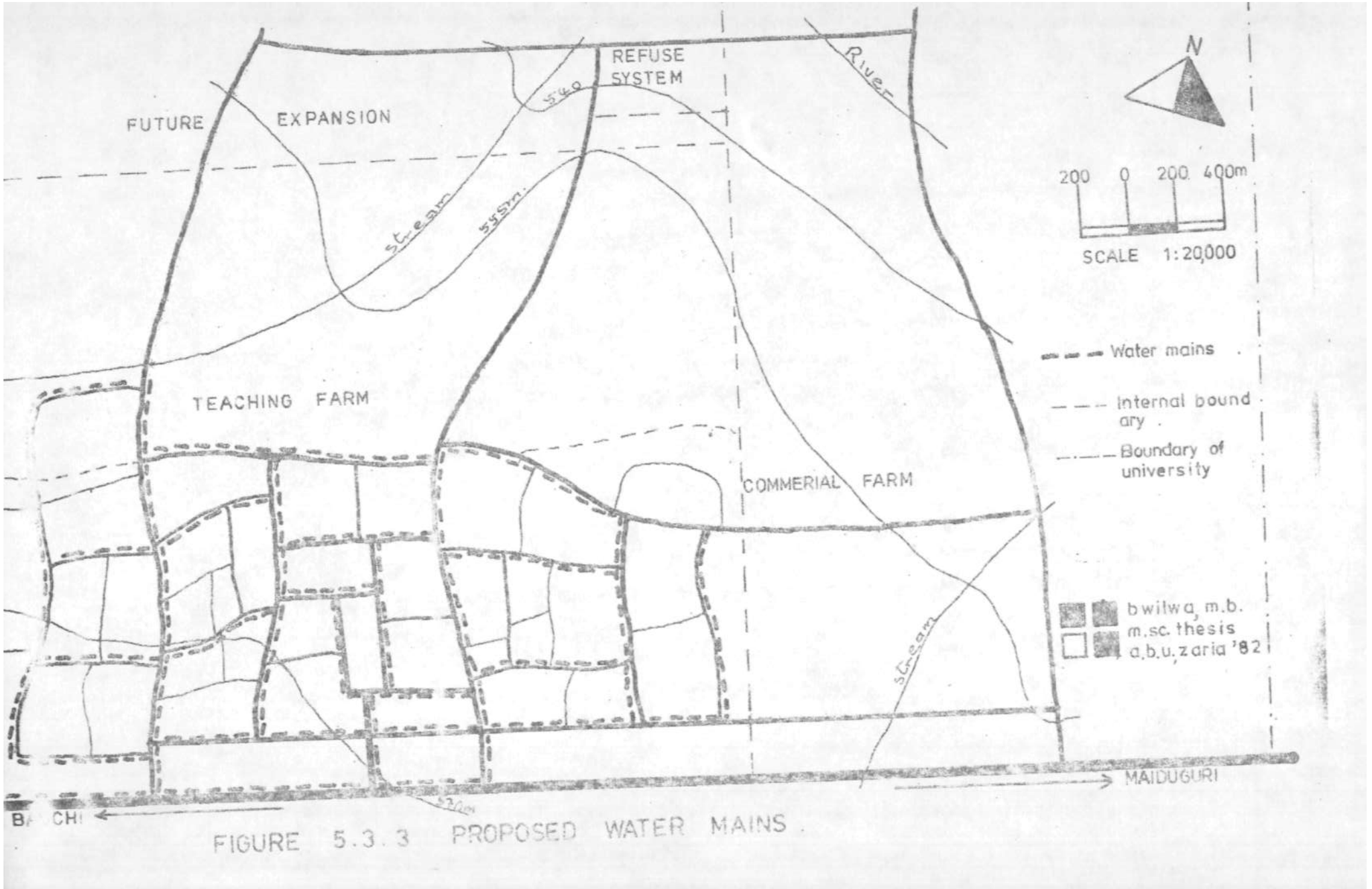


FIGURE 5.3.3 PROPOSED WATER MAINS.

the campus. The water mains system should be independent of local supply.

5.3.6 Electricity Supply and Telephone Services.

With the extension to Bauchi of hydro-generated 132 KV line from Kainji, it is expected that electric power to the University site will be supplied by National Electricity Power Authority (NEPA) at high voltage of 33KV or 11 KV. The injector station is located in the University and it is strongly recommended that the supply should be independent of local network in an effort to minimize overloading. The network lines should be under the ground. It is suggested that stand-by generator should be made available to meet the needs of sensitive areas like teaching hospital, computer centre, library, administration building, (etc) in the event of power failure. The electricity supply network is shown in figure 5.3.4.

The telephone services network is shown in Figure 5.3.4.

5.3.7 Storm drainage, and solid and sewage collection treatment and disposal.

(i) Solid waste.

The sources of solid waste in the University include the residential, and academic areas. Such



FIGURE 5.3.4 ELECTRICITY AND TELEPHONE NETWORK.

waste must be collected and disposed of so that it does not constitute environmental and sanitary problems. It is therefore necessary that buildings should be provided with covered refuse bins, which are to be emptied into larger covered bins to be located along the road corridors. It is further recommended that the University authority should handle its refuse collection and disposal internally. Refuse vans should run round, collecting the solid refuse and delivering the same to the refuse treatment and disposal area shown in the structure plan (Fig 5.3.5). The collection points are also shown in Figure 5.3.5.

It is recommended that controlled tipping (sanitary land filling) should be adopted with the result that such land could also be used for agricultural purposes. However, it is recommended that in the long run, the central system of disposal by incinerators may be used. The system is however costly but more effective.

(ii) Storm drainage and sewage disposal.

Storm run-off in Bauchi may be alarming, depending on the nature of rainfall. Where the rainfall is sudden and torrential, the sub-surface soil structure is disorganised leading to an instantaneous lost of its seepage property. This brings about great

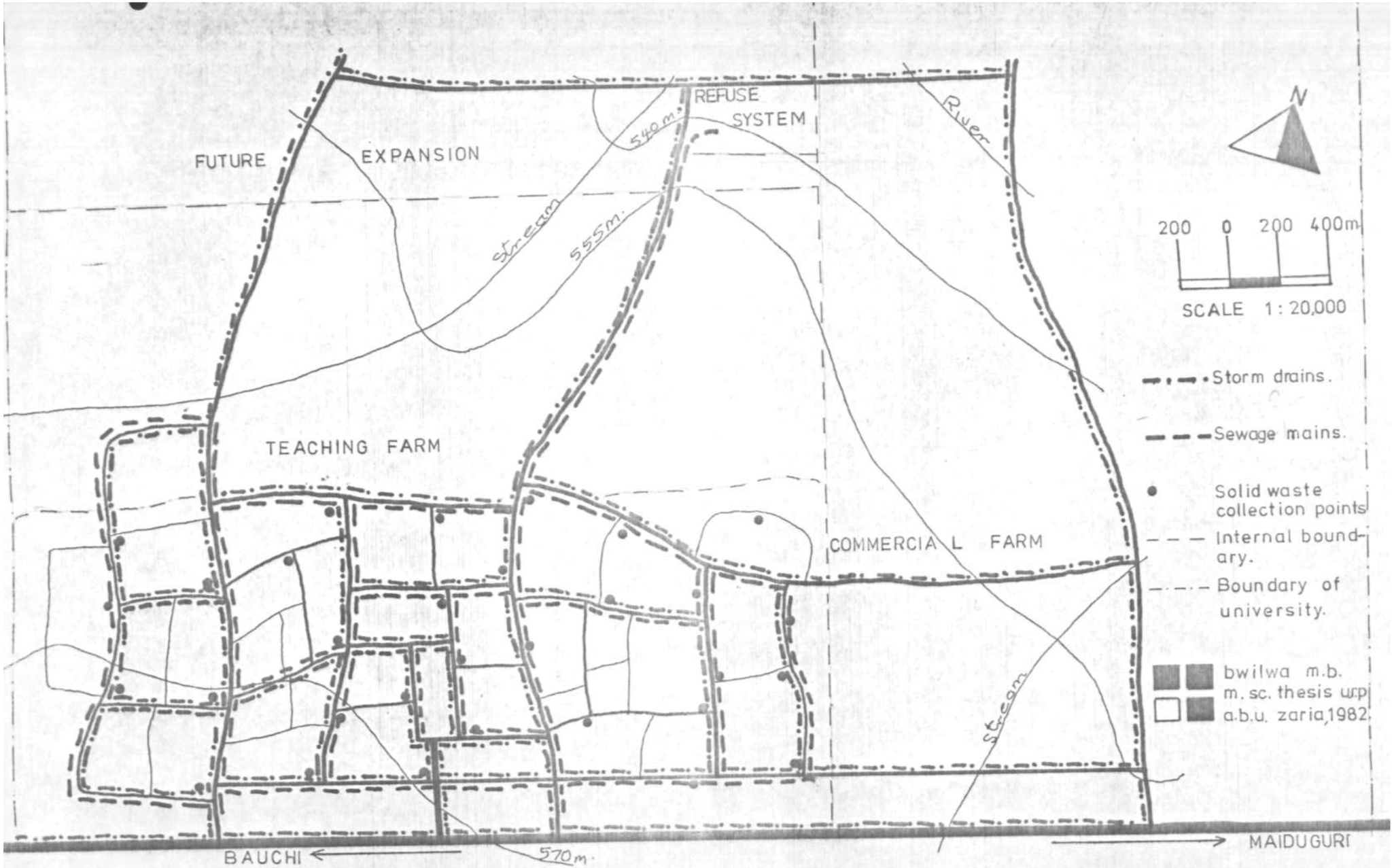


FIGURE 5.3.5 REFUSE SYSTEM AND DRAINAGE NETWORK .

surface run-off. It is therefore recommended that the drainage scheme should be perfectly integrated with the road system. Such channels should be covered by cement slabs to eliminate any possibility of misuse and secondly, to make for easy maintenance. The network should be streamlined to the main drainage channel leading down to the agricultural farm, where dams for irrigation purposes will be constructed to intercept such run-off and stored for dry season irrigation (Fig 5.3.5).

The rate of sewage can be calculated from the water consumption figures. It isrecommended that a minimum of 85% of the water consumption rate should be used. It is also recommended that sanitary drainage pipes from buildings should be linked to the sewage collection system. The sewer system should cover the high density areas like students halls of residence and academic areas. The staff residential areas may be linked to the sewer mains too (Fig 5.3.5).

In the design of sewage mains, it is considered necessary to maintain a flow speed of not less than 0.6 metres per second in order to prevent settlement of sewage solids. It is recommended that sewage waste should be treated before disposal. Here the oxidation ponds is recommended because of its low operation cost, minimum level of maintenance and

suitability to the climate of this area. However where financial feasibility allows, the activated sludge treatment plant should be used in the long run. In the treatment of sewage waste, every effort should be made to ensure that a minimum of 95% of the sewage impurities is reduced.

All treated sewage effluent should not be emptied into the nearby Gubi river but could be used as fertilizer in the University commercial farm while the treated sewage (water) can be used for irrigating landscaped areas, gardens, sports fields, commercial and teaching farms of the University.

5.40 Detail design of the public area.

The concept for the design of the nucleus of the campus is the linear concept which seeks, through juxtaposition of uses to produce a dominant centre to which all members of the University community and their neighbours relate and respond; thereby providing basis for greater interaction - both academic and social wise. It may be noted that the parking areas, open spaces, and pedestrian network area, are integral parts of the components of public area. The schedule of land requirement is shown in table 5.4.1. In the core sector layout (Figure 5.4.1) the traditional concept of integration

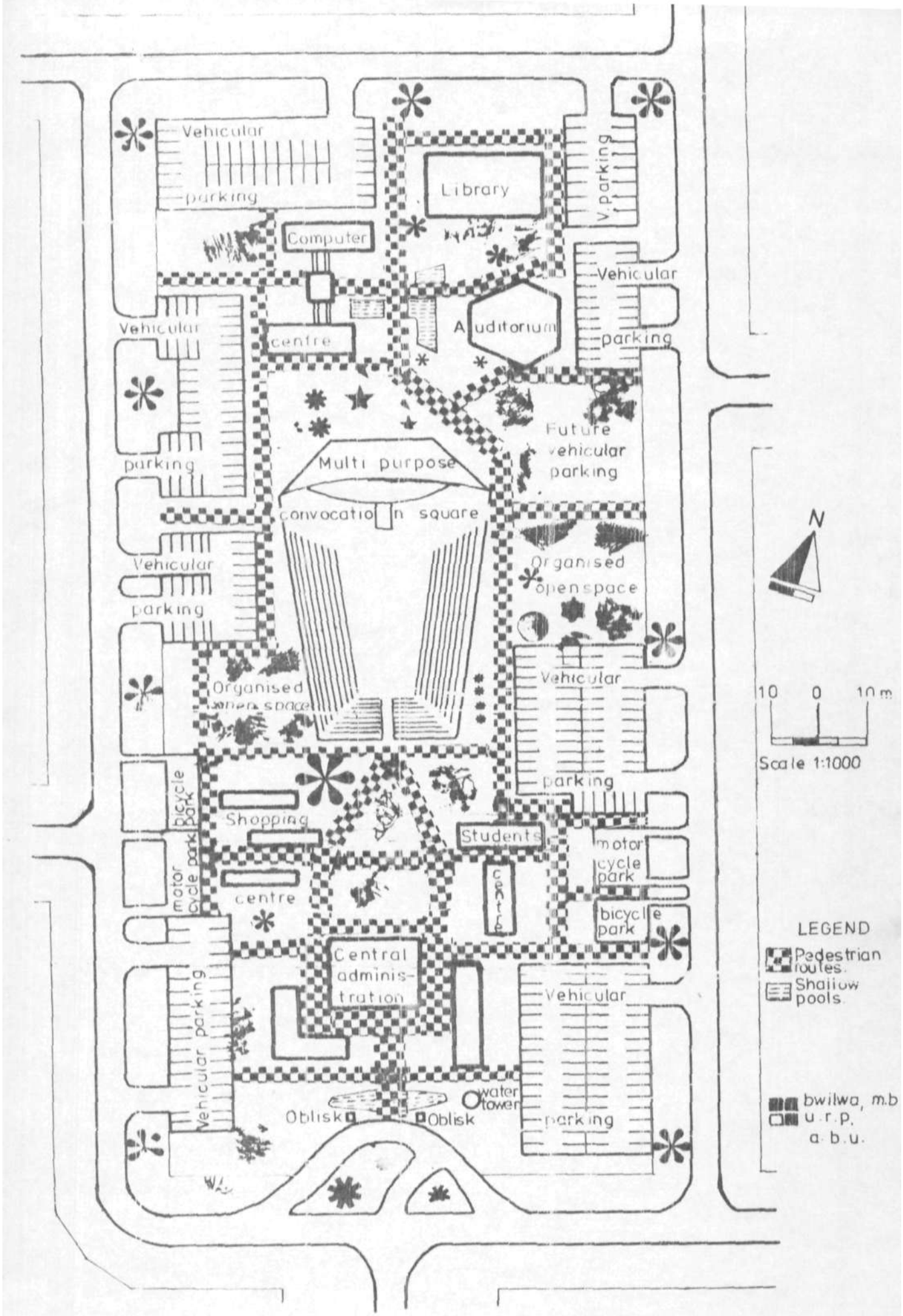


FIG 5 3.6 DETAIL LAYOUT OF PUBLIC AREA .

of open spaces and major public buildings has been embraced.

The buildings like central administration, central library, auditorium, cover a small proportion of total plot area in order to ensure adequate open spaces and parking area.

Table 5.4.1 Schedule of land requirement - Public area.

Description	Area in Hectares
Central administration	1.35
Central storage	0.13
Convocation square and garden	1.25
Computer centre	0.06
Students centre	0.84
Main library	1.40
Auditorium	0.28
Commercial/Shopping	0.22
Total	5.53

Source: analysis in chapter 3 of this report.

These communal facilities and services have been concentrated along narrow central spine, around which the academic and other uses are arranged. The reasonably compact nature of the layout ensures high degree of integration between components of the University

core and minimizes walking distances. The pedestrian network is neatly interwoven into the system to ensure that the core is predominantly a pedestrian area. It is recommended that pedestrian routes may be paved and this should reflect their various hierarchy. Vehicular and bicycle parking spaces have been provided adjacent to the various uses to enhance their functions and accessibility. The incidental open spaces, pedestrian passage way, vehicular and bicycle parking areas and organised University garden should be planted with suitable trees (Fig 5.3.6). The following are recommended trees for planting ~~in the~~, Stenolobium Stans, Flamboyant Flame Bauhinia purpurea, Lagerstroemia Flosreginae and Spathodea Campanulata. Within the landscaped area, trees may be planted in clusters to provide effective shade and cooling effects for recreation and relaxation. Shallow pools are also provided at strategic entrances to the public area.

CHAPTER SIX

6.0 POLICIES AND IMPLEMENTATION PROGRAMMING.

6.1 Implementation Authority.

Development and Implementation Committee and Physical Planning Unit should be established. The Physical Planning Unit should be headed by an Architect - Planner and directly under the Vice-Chancellor's office. The Development and Implementation Committee should be headed by the Vice-Chancellor.

The Development and Implementation Committee will be directly responsible to the University Council - the supreme governing body of the University. The responsibility of the Development and Implementation Committee shall rest on awarding the contracts for major aspects of capital development and construction to reputable firms. The committee should also explore means to generate local resources for the implementation of the development projects, to supplement Government efforts.

The Physical Planning Unit should be responsible for day to day implementation of details in the structure plan. It will be responsible to the Development and Implementation Committee and work in full cooperation with firm(s) working on development project(s), and providing data, physical

guidelines and such other information that the firm(s) may from time to time require. It should also monitor the performances of such firms to the Development and Implementation Committee. The Physical Planning Unit must prepare detail layout for any area to be developed within the framework of the provisions of the structure plan.

The Development and Physical Planning Unit, must ensure that the structure plan is implemented. The structure plan may be reviewed when it becomes apparent to do so. The Physical Planning Unit should review the structure plan with the approval of the Development and Implementation Committee. The relationship between the Implementating authority and other organisations is shown in Chart 6.1. There must be strong relationship between the Implementation authority and the National Universities Commission which finances the development of Universities in Nigeria.

For the efficient development and implementation of the campus structure plan, within its geographical location, it is strongly suggested that the Physical Planning Unit of the University should work in cooperation and consultation with Bauchi State Development Board. This will ensure coordinated

approach towards the development of the University and its environs. Bauchi State Water Board, NEPA, Ministry of Education, Post and Telecommunication, private individuals, groups and firms must be brought in because of the crucial role they will play in the implementation of the structure plan.

6.2 Land acquisition and Village Relocation.

The total area to be acquired is 3118.9 hectares It is recommended that the land shouldbe acquired right away to facilitate the immediate implementation of the development plan.

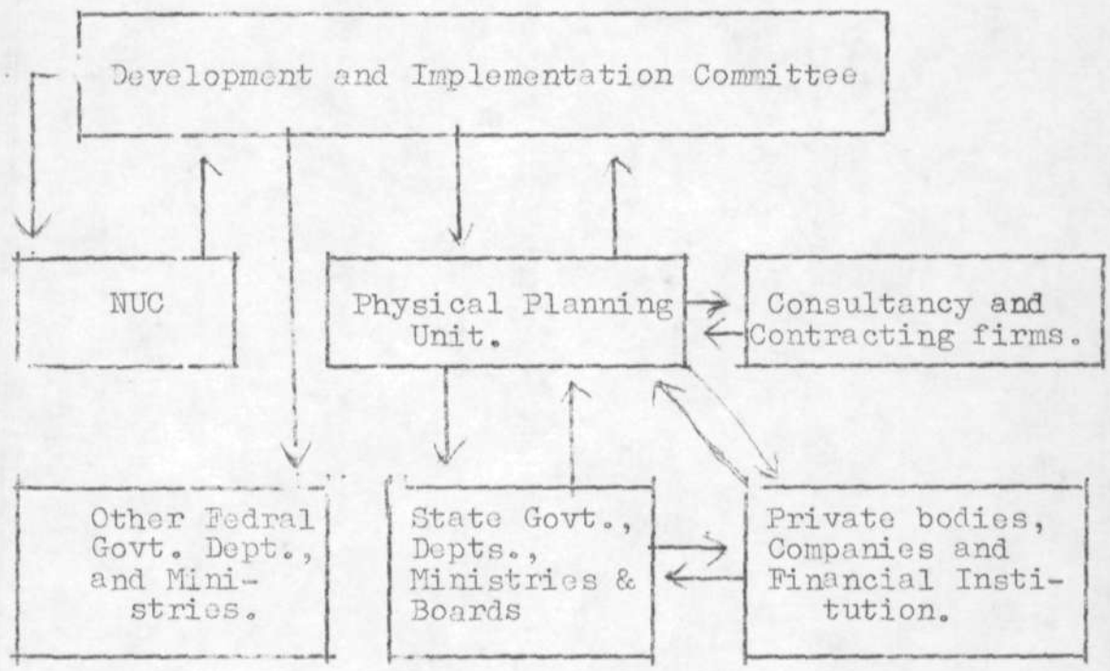


Chart 6.1 Relationship between Development and Implementation Authority and other organisations.

The area to be acquired is dotted with few settlements as shown in the site analysis diagram. It is necessary that the villagers affected should be relocated and resettled. As regards the relocaion and resettlement of the villagers, it is essential to conduct preference survey for any of the following options.

(i) Relocation of settlements away from the University in pursuance of agriculture as major occupation.

(ii) Relocation of settlement in close proximity to the University in pursuance of agriculture as major occupation including employment in the University.

(iii) Relocation of settlements within the immediate vicinity of the University in pursuance of secondary or tertiary occupation.

For the first and second options it is necessary that large tracks of land is acquired and developed for agricultural purposes and be relocated to the farmers. Such settlements should be planned and provided with some basic amenities and facilities.

6.3 Satellite Villages.

In the case of the last option, it is recommended that land around the University site should be acquired and developed as Satellite villages for the resettlement of the displaced persons. In addition such

Satellite villages should be developed to absorb the migrants population in search of jobs in this new and expanding opportunity area. The villages should also cater for residential needs of the off campus staff and students of the University as recommended in Chapter Three of this report.

It should be emphasised that the University should not take direct part in the provision of such accommodation for staff and students. Housing Corporations, companies, wealthy individuals and State Governments direct and indirect involvement will be solicited for on this matter of off campus accommodation and the development of Satellite villages adjoining the University. Since such area will be outside the area of the University, the Bauchi State Development Board should be the body directly responsible for planning and coordinating the development of such Satellite villages. This must be seen done, in fear of the impending danger of evolution of squatter settlements and slum development. In addition to the role of the housing corporation, firms and individuals, the efforts of Federal and State Governments in development of Satellite villages may be channelled through Bauchi State Development Board for implementation in the University district.

It is also forwarded that the University and its surroundings should be accorded the status of a district by the Bauchi State Development Board, who should also see that necessary facilities, services and utilities are provided for the livability of the district community. The Bauchi State Development Board should make efforts to ensure that there exists a reasonable degree of integration in the Satellite villages between off campus staff and students and the other populace.

6.4 Housing, Academic facilities and services and utilities.

The development of academic and administration area and support services is the responsibility of the University, and similarly the development of students and staff residences and their support services within the campus. However, the development of other infrastructure like electricity, water mains, banks, main cafeteria, shopping facilities, bookshop and staff school(s) requires the cooperation of other bodies. Industrial area will be developed by the University and Bauchi State Government. An agreement to this effect has been finalised. However, it is also required that industrialists and financial

institutions must come in. The commercial farm, teaching farm and green belts should be the responsibility of the University and Federal Ministry of Agriculture and Forestry. Sewage and solid waste system, requires the cooperation of the Municipal authority (Bauchi State Development Board). It has however been stressed earlier that Bauchi State Development Board is not equiped to play this role, it is therefore recommended that the University authority should make its internal arrangements for waste collection, treatment and disposal.

6.5 Transportation and Communication.

The four categories of road network system is to be developed by the University. The development of these roads must keep pace with the development of other infrastructure - academic, residential, and communal services and facilities. The major roads should be open - ended to allow for gradual development and expansion of the University.

Postal services and telecommunication systems are to be developed and installed by Federal Ministry of Post and Telecommunication, to link the campus and the outside community.

A further means to ensure efficient communication

between the University and the city is bus services which should be provided by the Municpal authority.

6.6 Phasing Programming.

In order to ensure the gradual implementation of the structure plan, the development of the campus is phased in four stages.

6.6.1 Phase I (1982/82 - 1986/87).

It is proposed that the first phase starts with the development of central administration, library and other facilities. This will cover an area of about 15.6 hectares (Table 6.6.2). During this period some departments in the colleges and schools of the University will be developed. This will take an area of about 4.02 hectares. The particular departments to be established under this phase are shown in Table 6.6.2b. The development of Veterinary medicine, Agriculture and Human medicine will start in phase I, and will continue to the last phase. During this peiod the first phase of staff and students housing will be developed. This will accommodate 1427 resident students, while 178 resident senior staff will be accommodated in an area of about 35.6 hectares. About 266 junior staff housing will be built in an area of about 13.3 hectares. The area to

Table 6.6.1 Services and facilites development phasing (1982 - 2002)

1st Phase(1982-87)		2nd Phase (1987-92)	
facility	area in hec.	facility	area in hectares
Library	1.4	Student Centre	0.84
Maintenance Workshop	2.15	Staff Centre	0.38
Central administration	1.35	Teaching/Comm. farms	1800.0
Central storage	0.13	Shopping Centre	0.22
Auditorium	0.28	Computer Centre	0.063
Power Station	0.03	Central laundry	0.068
Telephone exchange	0.014	Staff School	2.5
Petrol filling station	0.22	Convocation Square	1.25
Sewage/solid disposal	10.0	Industrial area	5.0
Water tower	—	Sports/Play field	5.0
Total area	15.574	Total area	15.32/1800.
3rd Phase (1992-97)		**4th Phase (1997-2002)**	
Research Institutes	5.0	Staff School	2.5
Botanical garden	5.0	Sports/Play fields	4.0
Health Centre	5.32	Secondary School	3.5
Church/Mosque	5.0	Total	10.0
Industrial area	5.0		
Conference Centre	0.19		
Zoo	5.0		
Sports and Playfields	5.0		
total area	35.51		

Table 6.6.2a Academic area development phasing (1982 - 2002).

School	Phases							
	1st Phase 1982-89		2nd Phase 1987-92		3rd Phase 1992-97		4th Phase 1997-2002	
	Student popu.	area reqd. in hec.	Student popu.	area reqd. in hec.	Student popu.	area reqd. in hec.	Student popu.	area reqd. in hec.
Vet Medicine	50	0.2	100	0.4	250	1.0	400	1.6
Human "	100	0.27	300	0.8	450	1.2	600	1.6
Agriculture	200	0.63	484	1.5	678	2.1	800	2.5
Earth, M.Sc.	150	0.28	363	0.67	509	0.93	600	1.1
Sc. Edu.	400	0.75	967	1.81	1357	2.54	1600	3.0
Engineering	200	0.73	484	1.75	678	2.46	800	2.9
Art/Design	200	0.4	484	0.97	678	1.36	800	1.6
Management Science	250	0.28	605	0.67	848	0.93	1000	1.1
Prelim. Sc.	250	0.48	605	1.15	848	1.63	1000	1.9
Total	1800	4.02	4392	9.72	6296	14.13	7600	17.3

Table 6.6.2b Academic departments phasing (1981/82 - 2001/02)*

1st Phase (1982-1987)	2nd Phase (1987-1992)
Hydrogeology and Water Resources	Geological Sciences
Geography	Petroleum Engineering
Biochemistry	Physics
Biological Science	Microbiology
Chemistry	Computer Science
Land surveying	Industrial Art
Quantity surveying	Landscape Archited
Environmental Engineering	Health Sciences
Estate Management	Chemical Engineering
Building technology	Mechanical Engineering
Accounting	Civil Engineering
Health Science	Law
Vet. Medicine	
Preliminary Subjects	
Agriculture	
3rd Phase (1992-1997)	**4th Phase (1997-2002)**
Business administration	Economics
Administrative studies	Architecture
Urban planning	Agric Engineering
Electrical Engineering & Electronics	Textile technology
Mathematics/Educational administration.	Vocational/technical

* The areas of these departments are shown in table 6.6.2a.

Table 6.6.3 Residential area development phasing (1982 - 2002).

Description	Phases							
	1st Phase 1982-1987		2nd Phase 1987-1992		3rd Phase 1992-1997		4th Phase 1997-2002	
	Population	area reqd. in hec.	Population	area reqd. in hec	Population	area reqd. in hec.	Population	area reqd. in hec.
Resident Students	1427	3.96	3446	9.55	4833	13.4	5700	15.8
Resident Senior Staff	178	32.04	500	90.0	714	128.52	860	154.8
Resident Intermediate & Junior Staff	266	13.3	643	32.21	851	42.5	1064	53.2
Total resident Staff & Students	1871	49.48	4589	131.76	6398	184.42	7624	223.8

be covered by student housing in the first phase is 3.0 hectares.

The roads to be built in this period, include the major access road to the public area and the roads that will provide access to the areas to be developed in the first phase. Electricity distribution lines, Telephone network, water mains, drainage channels and sewage system will be developed to keep pace with the other developments.

6.6.2 Phase II (1987/88 - 1992)

In this phase, the teaching and commercial farms (1800 hectares) development will start and it is expected that these will continue to the last phase. Other projects to be implemented during the second phase are shown in Table 6.6.1, covering a total area of about 15.32 hectares. The development of Sports fields and industrial area is expected to continue to the next phase. In this phase about 5.7 hectares of academic area is to be developed (Table 6.6.2). The departments to be established are Mechanical, Civil, Chemical, Physics, Law and a few more (Table 6.6.2b). It is expected that the development of Health Science, Agriculture, Veterinary medicine will continue in this phase. At the end of this phase total developed

academic area, right from phase I wi'l amount to 9.72 hectares and will accommodate 4,392 Student population.

For students housing an area of about 4.3 hectares will be developed for an additional 2019 Students. At the end of the phase 7.3 hectares should have been developed for 3,446 Students on resident. During this phase an additional 64.4 hectares should be developed to accommodate 322 Senior Staff, while 18.8 hectares will be developed for additional 377 Junior Staff. Road infrastructure, waste system and service lines will be developed to keep pace with these developments.

6.6.3 Phase III (1991/92 - 1996/97).

The new departments to be established are shown in table 6.6.2b and a total area of 4.41 hectares will be developed. At the end of the peiod, total academic area developed right from Phase I will be 14.13 hectares for 6,296 Students. Facilities to be developed during this phase are shown in table 6.6.1. This will take an area of about35.5 hectares. For housing, additional area of about 3 hectares will be developed for 1,387 Students; 42.8 hectares for 214 Senior Staff and 10.4 hectares for 208 Intermediate and

Junior Staff. At the end of this period developed infrastructure should cater for 11,889 Staff and Students.

6.6.4 Phase IV (1996/97 - 2001/02).

In the final phase new departments to be established are shown in table 6.6.2b and this will cover an area of about 3.2 hectares; while facilities and services to be developed (Table 6.6.1) will require 10.0 hectares. An additional 1.8 hectares will be developed for 967 students. An area of about 29.2 hectares will be developed for 146 Senior Staff, while 10.7 hectares will be developed for 213 Intermediate and Junior Staff. Where necessary succeeding phase may accommodate spill-over project(s) from preceding phase.

It is expected that at the end of this phase the campus will be fully developed for a Student population of 26,000, Senior Staff population 860 and Intermediate and Junior Staff population of 5,320. However there may be orderly review of implementation in line with changing goals and priority of the University.

6.7 Financing the Structure Plan Development

The funding of the Structure plan implementation will be the direct responsibility of the Federal Government, through its agent, the National Universities Commission (N.U.C.). It must be expressed that caution should be exercised such that the NUC does not interfer with the administration of the University to the detriment of Structure plan implementation.

Federal Government ministries and agents like NEPA, Ministry of Post and Telecommunications, and Federal Ministry of Housing should assist and partly finance the development of postal services and installation of electricity and telecommunication network and construction of Satellite villages.

Bauchi State Government and its agents and de departments like Education, Bauchi State Water Board, Bauchi State Development Board, and Housing Corporation should partly assist and finance the installation of water mains and development of industrial area, schools, and other facilities including residential development of Sattelite villages and on the campus considering that the University is an integral part of the city.

Other sources of financing the Structure plan

implementation, are, loans, companies, financial institutions or private individuals. It is necessary for the University and the Federal Government to give incentives to such bodies so that they can willingly finance the development of industries, housing, Satellite villages and support facilities. Such incentives could include tax holiday, free site and services, delayed payment of sites and services, guaranteed loan, industrial credit scheme and procurement of local raw materials for the construction works.

The University authority should also explore other avenues of financing the Structure plan to supplement the Federal Government efforts. On this line of arguement, the University can strengthen its financial position for developmental purposes by soliciting for endowment funds and other donations. Funds from the Consultancy services and research efforts of the University should be made readily available for developmental purposes. It is further recommended that the University should offer, on commercial basis some of its services to the community. It should also operate a fully fledged commercial farm so that dividends accruing from this source could be re-invested for development purposes.

The Church and Mosque should be financed by the communities concerned. However the University may assist where feasible.

6.8 Guidelines and Policies on buildings and other Structures.

In order to avoid unnecessary duplication of buildings and cost thereof, it is strongly recommended that all buildings to be constructed right from the beginning must be sound and solid structures that can last long. It is consequently necessary to avoid unnecessary hurry in the process of the development of the University, so that Pre-fabricated buildings are not built. At the moment the University can conveniently stay in its temporary site at Yelwa (the permanent site for Bauchi State College of Arts and Sciences) for a period of three or more years, while construction work continuous on the permanent campus site. It is strongly suggested that efforts should not be made to convert Bauchi College of Arts and Sciences site into one of its campuses. The University should be compact and built on one site based on the dynamic linear concept used for the design of its Structure plan.

The building structures to be erected in the University core and Students residential areas should be compact without congestion and properly linked to

one another by pa-ved corridors to ensure interaction. The structure of administration block should be such that it attracts the attention of visitors to the focal point of the campus. It is recommended that in its construction a floor area ratio of 200% may be used. The use of architectural extravaganza in the design of administration block and any other building on the campus should be discouraged. For the main library, faculty and conference centre buildings, a floor area ratio of 150% should be used. The Staff School(s), large lecture theatres, Student centre, Staff centre, bookshop and shopping centre should be built on the basis of recommended floor area of between 50 - 100%.

A floor area ratio of 200% is recommended for the building structures constituting the Students residential areas, however the kitchens and dinning halls may attract a floor area ratio of 50%. In the Staff residential areas, a wide range of floor area ratio may be employed. A floor area ratio of 50% could be used in building about 30% of the total Staff quarters to be built on campus, 100% for the next 30% of Staff houses to be built and 150% for the remaining 40% of the Staff houses to be built. It is strongly recommended that residences to be built

on the basis of 150% floor area ratio should be placed immediately surrounding the University core, to be followed by buildings with 100% floor area ratio and at the periphery, buildings with floor area ratio of 50% are to be located. The first two categories of these buildings (those with floor area ratio of 100% and 150%) should be composed of a series of blocks of flats or apartment houses. The last category will be made up of detached and semi detached houses. The Students residences will be made up of a series of storey buildings connected to one another and organised around the central facilities in each hall of residence. It is recommended that buildings should cover a gross ground area of not more than 50% of its plot size.

The water mains, sewage mains, electricity distribution lines, and if feasible the telephone lines should be the underground network system with a view of enhancing the aesthetic outlook of the environment and protection of these service lines against external hazards. However adequate measures may be employed to ensure feasibility of repairs whenever a fault is detected.

The location and distribution of Street lihgitng and other road furniture should enhance the quality of the environment and ensure the desired security.

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