PROBLEMS OF FLOOD DISASTERS IN HADEJIA:
A PHYSICAL PLANNING PROPOSAL

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

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DEDICATION

This work is dedicated to you OH ALLAH! and my beloved mother and father. It is also dedicated to my wife and all the inhabitants of Hadejia who live under the constant fear of being flooded!

DECLARATION

It is with deep sense of responsibility that I hereby submit that this report is made up of my personal contribution to the task of coping with flood disasters in physical planning. It is a pioneering thesis project the same of which was never presented for award of a degree previously. As humanly as possible credit was given to all sources quoted either in the text or in the compiled list of references at the back of the report.

NAME - ALHAJI GARBA ISA

DATE - JULY, 1990

CERTIFICATION

This Thesis entitled:"PROBLEMS OF FLOOD DISASTERS IN HADEJIA: A physical planning proposal", meets the regulations governing the award of the degree of Masters of Science Urban and Regional Planning of Ahmadu Bello University; and is approved for its contribution to knowledge and literary presentation.

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July, 1990.

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ABSTRACT

PROBLEMS OF FLOOD DISASTERS IN HADEJIA: A PHYSICAL PLANNIG PROPOSAL

Plood is perhaps the most disastrous of natural phenomenum. This was amply demonstrated through the various historical records available some of which have been highlited in this report.

Plood prevention and mitigation requires some of the most widest forms of control measures; landuse, engineering, building and the likes combined. Many scholars and researchers have shown keen interest in the area of flood studies. The United Nations through its disaster relief organisation (UNDRO) based in Geneva Switzerland, has b*een* widely involved in International efforts to cope with severe effects of flood menance.

Although engineering control measures were traditionally prefered, recent trends tend to favour a much more physical planning approach of flood plain management which sought to control the use of the flood plain rather than the forces of the floods themselves only.

The study area, Hadejia, in Kano State is located close to Hadejia river at its lower section. Three major flood disasters were documented in the town since the 1940's that is in 1942, 1963 and 1988 which were the main reference points in this study.

Floods in the study area were found to be caused by intense local rainfall, the meandering of Hadejia river as a result of the sandy clay

nature of the soil and as characteristic of river at its lower plain which also makes the river to change course suddenly. Other causes of the flood induce the almost flat nature of the topography and the constant deposition of sediments transported from the upper reaches of the river which makes its bed shallower end thus spills over the banks under high volume of water.

In an attempt to prevent the growth of Hadejia within or towards locations with higher flood risk, a zoning and growth direction proposal was made based on the analysis of past occurrences and the Topographic nature of the area among others. This was augumented with engineering measures as embankment and channel improvement. A hasin-wide long-term flood control proposals were also made to help cope with the flood problems on a regional basis. It is hoped that by the time the comprehensive physical planning proposals for flood control got implemented in reality the constant threat to lives and properties of the people in the study area would have been drastically minimised,

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CHAPTER ONE

1.00 INTRODUCTION

The disasterous impact of natural phenomenum such as Earthquake, Tornadoes, Landslide and flood is as old as civilisation. Despite the rise in the incidences of man-made disasters due to ever rising sophistication of modern technology and denser concentrations of population, majority of the most ~~dansk~~ destructive disasters are still caused by natural forces. Flood in particular is the most disastrous natural phenomenum.

It is natural for river to burst its banks from time to time and spill into its flood plain. Thus river-induced flood disasters are of special concern to the emerging field of flood plain planning. Because of the failure of man to realise that flood plain is an integral part of the system, but often only used to discharge peak flows, various disastrous consequences often result from the occupation of such lands. What is quite obvious is that all rivers are liable to flooding. A very

peculiar aspect with regards flood disasters is that the amount of losses tend to increase despite increased expenditure on control. This is as a result of increased occupation of the flood prone areas.

There are various professionals engaged in the area of flood control. Most of their attempts aimed at controlling flood disasters are mainly engineering in outlook notably by civil engineers, builders and related professionals. In physical planning the use of the flood plain is regulated rather than concentrating on flood containment alone. Physical planning measures for coping with flood disasters are therefore aimed at achieving among others, the following broad goals; directing people and economic activities away from the most hazardous places and insisting on design and construction techniques that will make buildings and other structures comparatively flood resistant.

There is a lot of inter relationship between man's works and floods. Therefore careful planning of the entire river basin is often necessary if optimum use of the flood plain is to be achieved.

The question which usually arise in physical planning is: what can be done at local level to solve flood problem? Dougal (1969), attempts an explanation; "Either we can attempt to control the flood waters or we can attempt to control use of the flood plain or we can use a combination of the two techniques. Flood plain management encompasses both, combining proper land-use planning and regulation with flood control measures" (figure 1.1). As another attempt at coping with flood disaster in physical planning, this research effort will consider the appropriate combination of the measures so as to achieve a long-term comprehensive panacea to the problem.

1.10 STATEMENT OF RESEARCH PROBLEM

The flood problem in Hadejia is quite visible from the flat nature of the terrain and the very close proximity of the town to the river. Recent rainfall trends which shows decline during the last decade, has led to the fading of memory about previous flood disasters

this situation need to be reversed. Also, the construction of Dams in the upper stream notably the Tiga Dam, seems to create a sense of security to the inhabitants and the sense of satisfaction on the part of governmental authorities. Hence, the study is important.

1.20 JUSTIFICATION OF THE RESEARCH

There is always a big price for inaction in the face of an already envisaged problem. Because of the occurrence of flood disasters in Hadejia notably in 1942, 1963 and 1988, there is great justification for measures to tackle the problem. The research is also justified because the town as a dynamic phonemum will continue to grow whether flood control measures are in place or not. The same applies to the population of Hadejia, which was 31,000 (1978) and projected to 83,000 by 1996 (Hadejia master plan). There is the absence of a

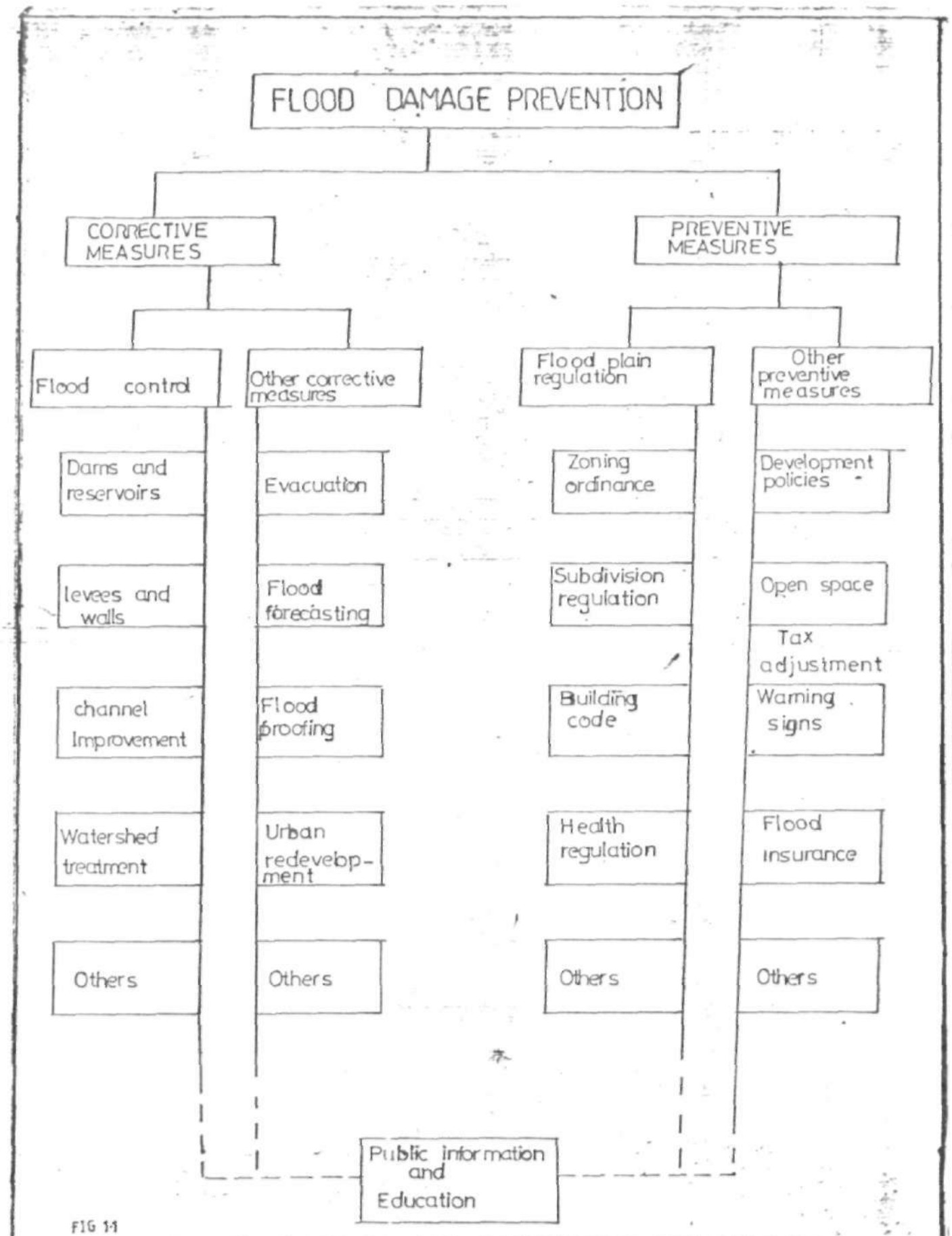


FIG 1-1

ELEMENTS OF FLOOD DAMAGE PREVENTION PROGRAMME

SOURCE: T.V.A. IN DOUGAL(1969).

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comprehensive plan to cope with flood disasters in Hadejia. The proposed measures in this research shall focus on the need for efficient land use regulations in the study area.

1.30 AIM AND OBJECTIVES

The aim of the study is to examine the factors responsible for flood disasters in Hadejia with a view to proposing physical planning solution to cope with the situation.

The following limited objectives are meant to achieve the stated aim above.

(i) To examine the geophysical nature of the study area.

(ii) To examine the nature of flood disasters

(iii) To review the impact of flooding in the area

(iv) To review the proposals provided by the consultants in Hadejia master plan.

(v) To examine the local flood control measures in the area.

(vi) To identify the appropriate physical planning proposals to cope with flood disasters in the study area.

1.40 SCOPE AND LIMITATION

The research basically focus attention on flood problems in Hadejia town, Kano State. Most of the proposals are aimed at alleviating the impact of floods within the approximate urban reach of 5km

radius covered by the Hadejia 1977 master plan. Regional references are more or less dictated by geo-political realities. Although physical planning measures are the primary concern of the research, they are complimented by appropriate engineering and related measures.

Much as the research is intended to be as thorough as possible, a number of constraints have limited the scope of the work. Most of the relevant hydrological data are either too costly to afford or were not devulged by the relevant authorities. The relative absence of skilled Hydro-meteorological and civil engineering manpower also served as limiting factor to the research in addition to financial, logistical and the lateness in the commencement of some of the field works.

1.50 RESEARCH METHODOLOGY

The research method employed in this study is the survey method to facilitate the examination of large numbers of selective characteristics of the flood problem and the environment it occurs; it thus involved extensive survey.

The type of methodological purpose is descriptive; seeking to technically establish the size and distribution of the identified flood hazard. Field surveys were carried out to establish the physical extent of the flood and observe other related environmental aspects relevant to the research.

The basic data used are geographical, historical, landuse, technical and administrative.

1.60 SOURCES OF DATA

There are various sources of data used for this research. They are broadly classified into two; primary and secondary sources.

(i) Primary sources

(a) Informal interview with local residents, local officials and related specialists.

(b) Field observations and survey.

(c) Data collected from meteorological and hydrological establishments.

(ii) Secondary Sources

(a) Use of official documents for relevant maps, statistical data and related materials.

(b) Review of related literature.

(c) Use of occassional papers, Newspapers, Journals and magazines.

(d) Use of pictures to show relevant features, events or scenes.

1.70 CONCEPTUAL FRAMEWORK

The thesis is structured in such a way as to allow for smooth flow of materials making up the thesis. It began with the general introductory aspects moving systematically into the field survey and analysis of the physical situation of the study area down to

appropriate physical planning proposals.

The conceptual framework of the research visualises the scientific flow of procedures necessary for carrying out a successful and enduring flood alleviation programme. It began from the preliminary aspects, such as the identification of the problem down to goal formulation, implementation and evaluation (Table 1.1).

Table 1.1: CONCEPTUAL FRAMEWORK

INTRODUCTION	GEOGRAPHICAL NATURE OF STUDY AREA AND THEORETICAL BACK-GROUND TO STUDY	STUDY AND ANALYSIS OF EXISTING SITUATION	PHYSICAL PLANNING PROPOSALS	IMPLEMENTATION AND MANAGEMENT
- Statement of problem - Justification of study - Aim and objectives - Scope and limitations - Research methodology - Conceptual framework	- Location - Geo-physical features - Theoretical back ground to the study	- Magnitude of flood problem in Hadejia - Impact of floods in the study area - Existing response to floods - Analysis of Findings	- Landuse planning - Flood control measures - Basin wide flood control measures - Emmergency measures	- Landuse Planning and Regulation - Engineering assistance - Emergency relief - Levels of decision making - Phasing and costing

CHAPTER TWO

2000 GEOGRAPHICAL NATURE OF THE STUDY AREA AND THEORETICAL BACKGROUND TO THE STUDY

2.10 LOCATION

Hadejia is located some 209 kms to the north-east of Kano. Hadejia lies approximately between $10^{\circ}.00'E$ and $10^{\circ}.05'E$ longitude and latitude between $12^{\circ}.25'N$ and $12^{\circ}.30'N$. The town is served by the following Federal trunck roads; to Nguru to the east, to Mallam Madori to the north, to Katagum to south and the state trunk road to Gujungu to the west. The old Hadejia town is walled although developments have now extended beyond the walls. The town is bordered on the immediate South by the Hadejia river as shown in figure 2.1.

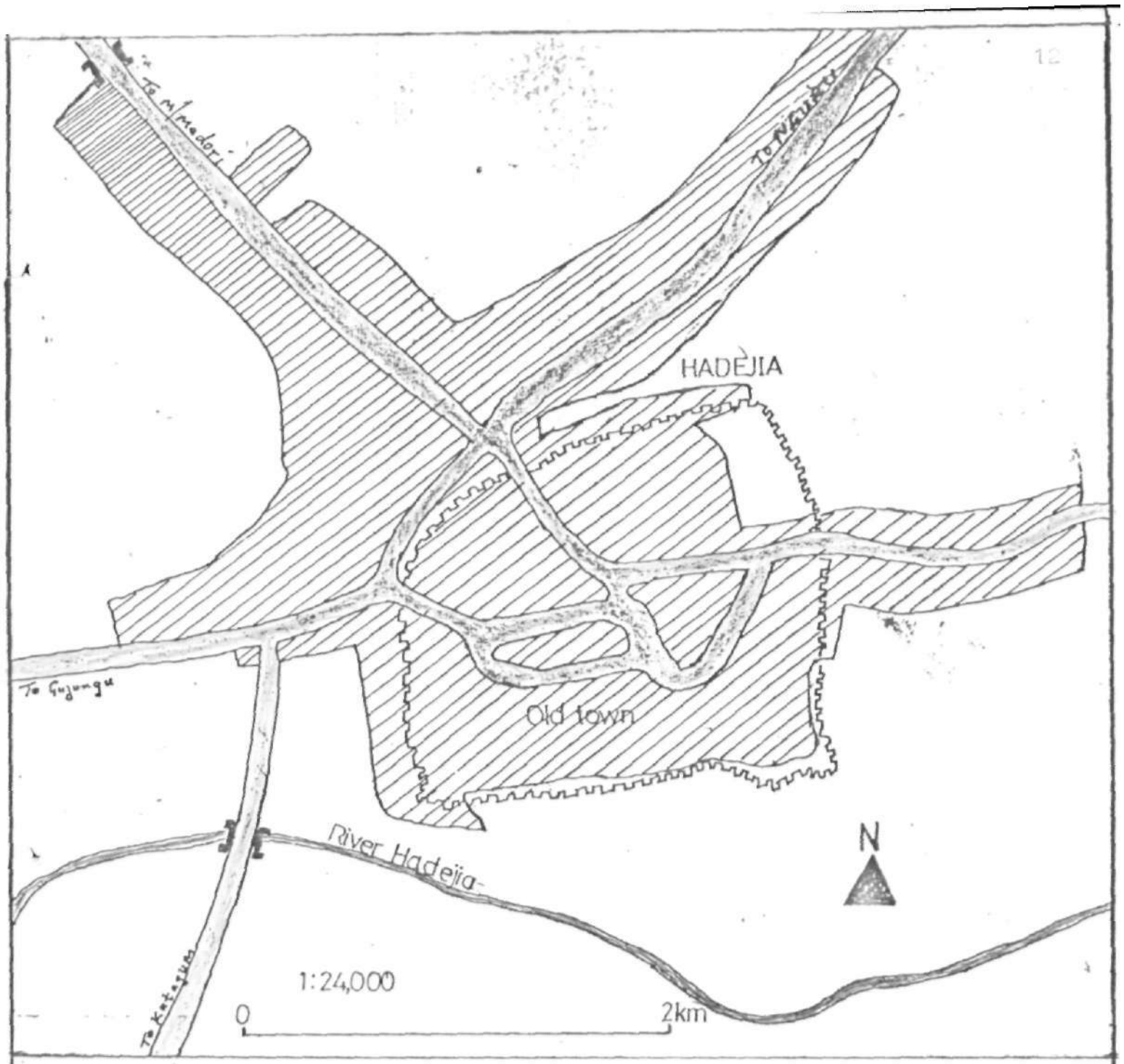
2.20 GEO-PHYSICAL FEATURES

(i) Climate

The climate of the area is that of the Sudan savanna type. The area enjoys interior location away from the sea and climate is thus hot and dry for most of the year. Maximum day temperature of about $100^{\circ}F$ are common. Minimum temperature is about $55^{\circ}F$. Temperature is adequate for plant growth throughout the year, but for the rain situation which is usually unstable.

The climate is influenced by the equatorial maritime and tropical continental Air-masses. The meeting point or boundary of these is known as the

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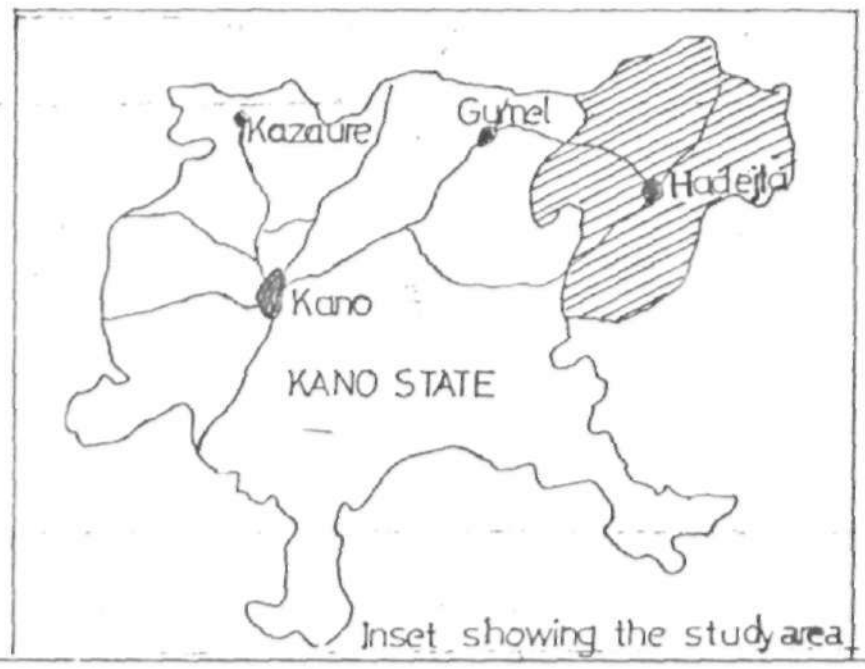


FIG 2-1

THE LOCATION OF HADEJIA -

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inter tropical convergence zone (ITCZ). The southerly winds are the main rain-bearing coming on shore from the Gulf of Guinea. The rainy season starts from May or June and ends in September. The tropical Air masses or the Harmattan, are the dusty cold-bearing blowing from the Sahara desert in winter. They are north-easterly and blows from December to February.

(ii) Hydrology and Groundwater

The amount of water available in this area is determined by the amount of rainfall for that year. Regimes of water available is closely related to the climate. Streams and rivers are seasonal. The ground level ranges from 300 - 360m. The depth of aquifers (fed by precipitation and river inflitration) is 25 - 30m for the upper ones, and 90 - 100m for the lower ones. Water is obtained beside from the river, from the upper and lower sub-artesian aquifers. Due to discharge from Tiga reservoir (Dam), the flow of Hadejia river is now perennial.

Artesian reserviors exist in the area with rises of up to 45.72m recorded in water levels in wells in the area. Level of water table is usually independent of the fluctuating in the annual rainfall, but related to extensive deforestation cultivation of vast areas. Deforestation and cultivation reduce

transpiration and evaporation and increase surface runoff. The flatness of the land in the area mean run off is not significant as to cause fall in water table. The run off water enter the river system, and this in turn enters or supply more water to the groundwater. According to water loss study of the area 65% of the water is lost through evaporation, 25% through evapotranspiration and 10% lost to the regional groundwater flow (H.J.R.B.D., 1978). Stream discharge and over land flow is seasonal and follows the input of rainfall.

(iii) Hadejia River System

The main river system of the area is made up of Hadejia river which flows from the high plateau of northern Nigeria. The Hadejia river meaders for 828kms (about 300kms within Kano State)(figure 2.2) across the old lake bed with many ox-bow lakes and numerous channels spreak over a wide area. The average annual rainfall within the Hadejia river valley region varies from 762mm along the southern edge to about 318mm in the northern corners, (F.M.E.D.1968).

In its movement within the state, the Hadejia river loses most of its water as it flows from the upper reach to the flood plains running from Tiga dam through Wudil down to Hadejia and beyond. According to WRECA Data for a dry year 1976 - 1977 and a wet year 1980 - 1981, the losses of Hadejia river at its Wudil

Suntulmaawa reach, vary from 448.5mm^3 to 2147.2mm^3 annually which is more than the maximum storage capacity of Tiga Dam (WRECA, 1985). Hadejia river is thus contributing immensely to a very vast underground acquifer, out of which very little is retrieved back to surface for utilization. Apart from those losses, others occurs in irrigation areas due to seepage in the canals and incorrect irrigation practices on the farms. The construction of Tiga Dam (1974), has changed the hydrology of Hadejia river which is now controlled during normal rainfall years. The river channel duration is now lengthened; is perennial instead of being seasonal.

There is the annual flooding of some of the areas along the Hadejia river system. The Hadejia river inland Delta formed to the east of Ringin to the east of Kano, is up to 32kms wide. The depth of the annual flooding in the flood plain areas of the river varies widely from season to season. Existing flood control works on valley wide basis by irrigation authorities includes Barrages and polders and pumping stations (Kano State Development Plan 1970 - 1974). The river collects runoff from the Jos Plateau upland area. After the Hadejia river leaves the upstream area, it is a losing stream even though two of its larger tributaries join it in its lower reaches. The average annual runoff of the

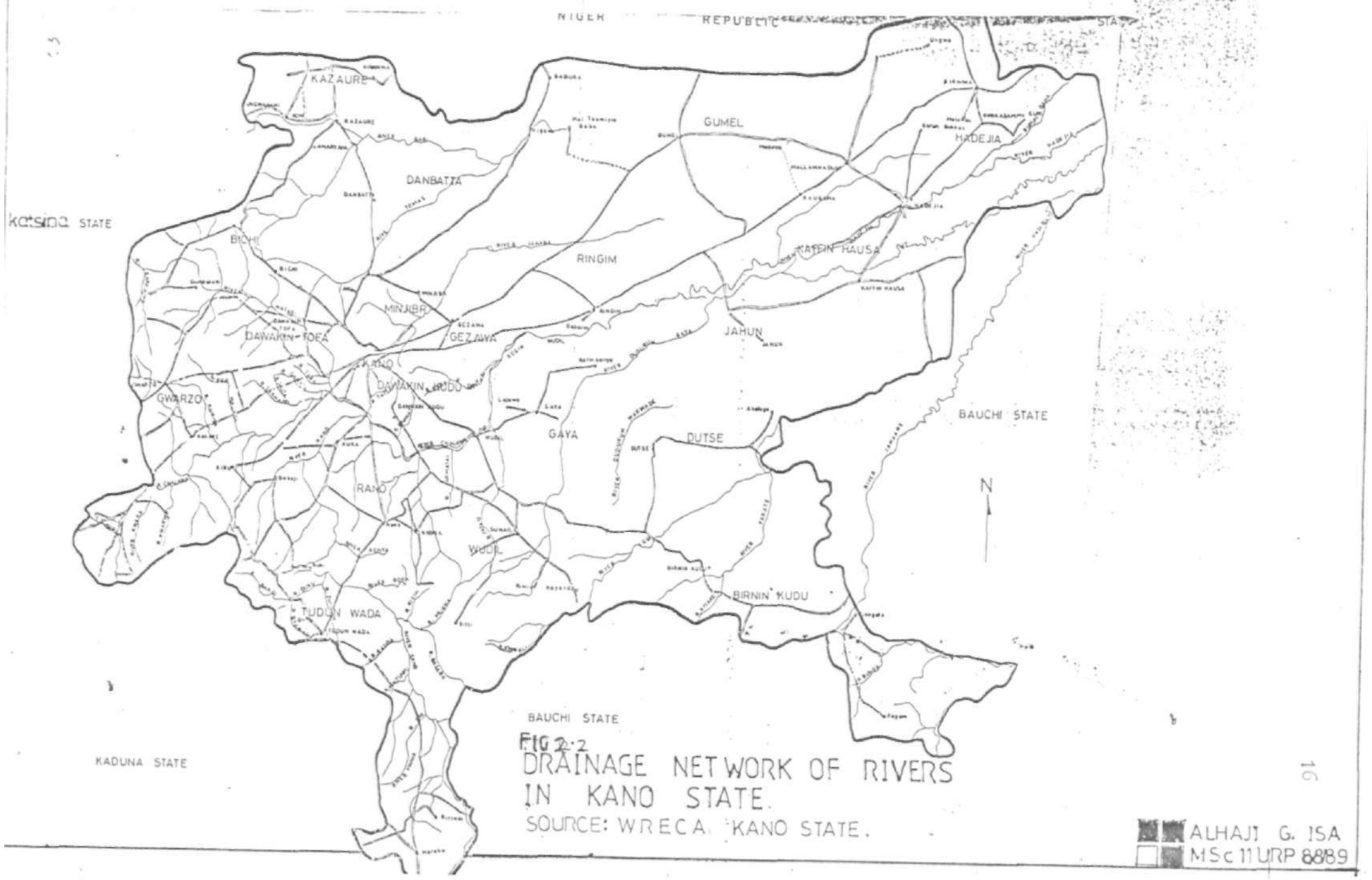


FIG 2.2
DRAINAGE NETWORK OF RIVERS IN KANO STATE.
SOURCE: WRECA KANO STATE.

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headwater tributaries is about 5,000,000 acre-feet of which probably about 360,000 acre-feet reaches the lake chad at the mouth of the river.

Because of the nature of the Chad formation soil with high inflitration rate and the openness of the semi-Arid vegetation zone, most of the limited runoff from the rainfall is captured in local depressions and Fadamas and lost to evapo-transpiration. Except for rainfall coming from the wetter southern upland areas of the region, any local runoff into the main Hadejia river drainage system does not materially affect the flooding of the areas as it is dissipated before arrival of the flood peaks from the plateau foot hill streams.

Because of the large natural storage capacity along the Hadejia river valley depressions, the flooding problem is not a function of the daily or storm peaks, but rather a function of the total monthly or even seasonal flow. A few feet of additional stage greatly increases the area flooded, but at the same time requires relatively large percentage of increase in run off to occur, (F.M.E.D., 1968). The Hadejia town lies along the lower reach of the river, where the plain is wider, with gradients lower than the plateau streams and have many more ponds and fadama areas.

The Hadejia river flow at Gashuwa (to the east of Hadejia town), with the filling of Tiga Reservoir (Dam) is estimated to be $300m^3 \times 10^6$; therefore the flow losses on Jama'are River to Gashua for 1975 were $1,700m^3 \times 10^6$ which is 68% of the inflow. For 1975, the inflow from the catchment to the Jama'are River system was two and one-half times the Hadejia River inflow. Hadejia River losses between Wudil and Hadejia (1975) was $330m^3$ 10^6. Annual losses from groundwater storage was $1,440m^3 \times 10^6$ (not through evaporation or surface water inflow), (H.J.R.B.D.A., 1976). Table 2.1 shows the longitudinal distribution of water loss along Hadejia river in March, 1975.

DATE	SITE OF MEASUREMENT OF DISCHARGE	DISCHARGE C.M/SEC	LOSS BETWEEN	CUMULATIVE LOSSES FROM TIGA/WUDIL
18/3/85	Tiga	6.96	-	From Tiga
	Chiromawa	6.75	3%	3%
	Tamburawa	4.02	40.4%	39%
19/3/85	Wudil (with Shimar) flow of 2.05	5.12	23.6%	From Wudil
20/3/85	Joda	2.85	44%	44%
20/3/85	Dabi	2.60	8.7	49%
	Suntalmawa (2 Sections 1.51x0.32)	1.83	29.6%	64%
20/3/85	Sarawuya	1.04	43.2%	80%
	Hadin	0.81	22%	84%
	Hadejia	0.21	74%	96.0%
	Marna	Impounded gauge height 0.74	-	-

Table 2.1

Longitudinal distribution of water loss along Hadejia River (March, 1985).

Source: Adapted from WRECA, Kano State.

(iv) Geology and Soil

The area is underlain by rocks of the Chad formation which are quarternary in age. Much of the ground is covered by superficial deposits of fine sand which have been swept into series of low-dunes by the wind from the Sahara desert (figure 2.3). The soils are comparatively recent in origin. The dunes are mainly composed of fine grained single sized sands derieved from the more recent sediments of the Chad formation. Heavier textured silty clay soils occupy the inter dune depressions and have poor drainge characteristics, (Soil Report, M.O.W., Kano, 1969).

The area is made up of vast open plain developed on young sedimentary rocks of the Chad formation which mainly consist of clays with some sand horizon and gravels. Clay is the dorminant soil which is very dark in most of the area as a result of accumulation of organic matter - the clays become plastic where exposed to surface and saturated with water during rainy season. The dark clay of the area dries up in dry season giving rise to hard and brittle surface with numerous cracks. In the usually flooded floors of the river valley, heavier soils with high clay content occur. This heavy soils become water logged when it rain heavily; in some places cultivation can be difficult. The soil mechanical properties are such that it mainly consist of sandy and silty soil in the

upland areas and loamy-sands to clay-loams in the depressions.

(V) Topography

The area is largely made up of strikingly uniform open land scape often flooded during the rainy season (figure 2.4) the clay plains alternate in places with patches of slighly higher grounds of Dunes of sand nature. The average elevation of the plain is 300m above sea level.

The low sand dunes are generally between 5-10m high providing about the only relief in the area. The inter-dunes areas consists of flat plains in which inter-mittent river channels can be recognised. Flooding by rain water and more rarely by the Hadejia river system occurs in the wet season (M.O.W & Survey, 1969). Hadejia river remains the most important feature of the terrain of Hadejia town - it is to the immediate southern part of the town.

2.30 RELATIONSHIP BETWEEN GEOGRAPHY AND FLOODING IN HADEJIA

As a geomorphological phenomenum flood is highly related to the geography of the study area. It is obvious from the brief outline of the geography of the area that conditions exist for the regular occurance of flooding in Hadejia. Although the climate is for most parts of the year dry, regular incidences of flood threats are likely to occur due



SOURCE: UDO R.K. 1970

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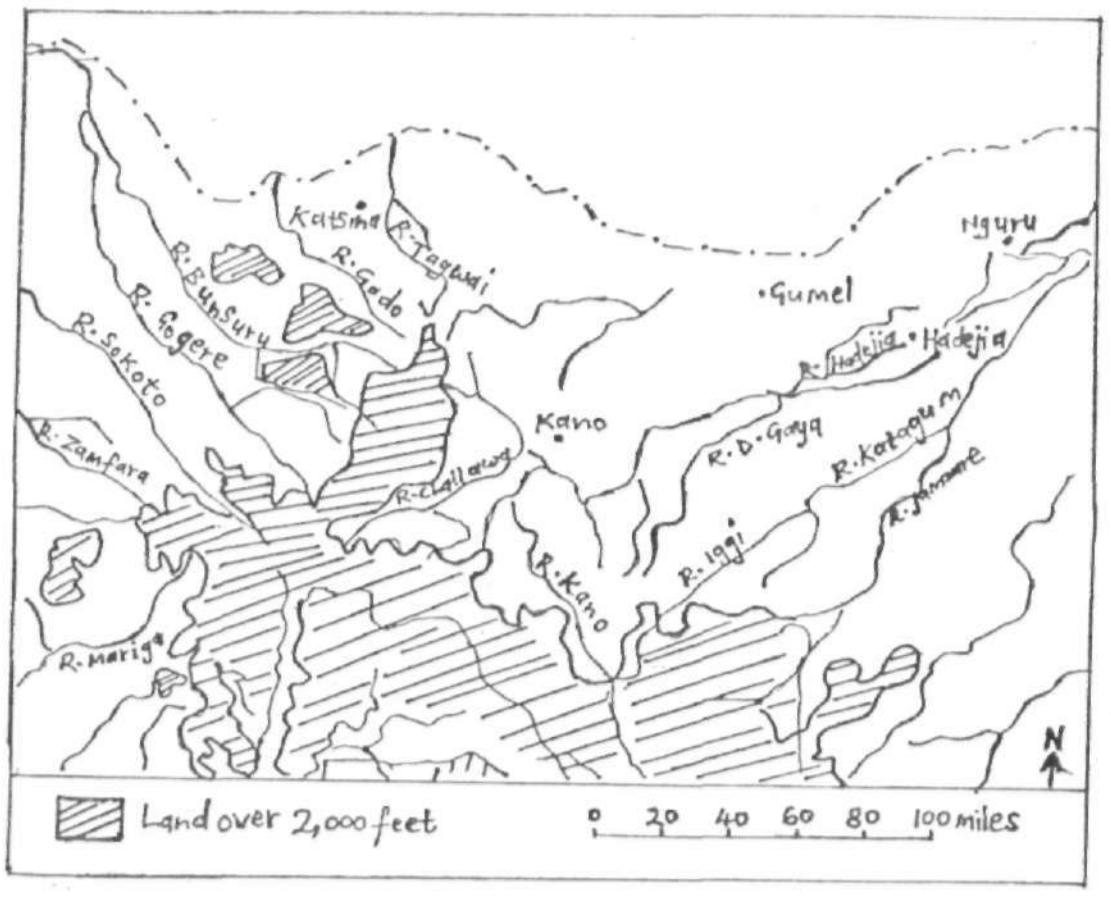
FIG 2.3
GEOLOGY AND DRAINAGE OF CHAD FORMATION

to spells of intense rainfall, the low-land characteristics of Hadejia river, scanty vegetation, the uniformly open landscape and the close proximity of Hadejia town to the river among other geographical factors.

Attempt will be made to carefully study and analyse the major geographical aspects of the area in relation to the flood problem. In addition to the geography of the area a theoretical background to the study is provided in the concluding section of this chapter to highlight the concern of various scholars to the problem of flood disasters and their heavy toils in terms of lives and property. This will enable us draw some lessons from the experience of others as we attempt measures to cope with flood disaster in Hadejia based on the understanding of the existing situation in the study area and research findings.

2.40 THEORETICAL BACKGROUND TO THE STUDY

Many scholars and international agencies notably the United Nation (UN) through its disaster relief organisation (UNDRO) have shown keen interest on the subject of flood induced disaster. The UNDRO for instance published in 1976 a series of books on the "Guidelines for disaster prevention" covering such aspects as the pre-disaster physical planning of human settlements, building measures for minimising



SOURCE: UDO R.K. 1970

FIG 2.4
RELIEF AND DRAINAGE OF KANO REGION

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the impact of disaster and management of settlements. The United Nations also organises seminars and relief efforts in case of flood and other related disasters.

Among the scholars with great interest in the issue of flood disaster was Kates (1962) who catelogued a wide range of elements needed in the future as loss-bearing, flood fighting in energency situation, structural change in land elevation, changing landuse and controlling floods. His suggestions for possible individual actions as detailed components of the choices includes stand by plan for evacuation of people, possible adandonment of high risk areas, to construction of levees.

As a result of the Ogunpa flood disaster in Ibadan in 1980, the federal government of Nigeria embarked on a channelisation programme of the Ogunpa river. The programme was meant to remove large deposits of materials which have made the river shallow as Urban residents of Ibadan continued to deposit both solid and liquid wastes into the river. This is in addition to the constant encroachment of the river's flood way which had been taken over by urban developments. The federal government is also engaged in efforts to control ecological disasters nation-wide in particular following the wide spread floods of 1988, which also affected other African countries (figure 2.5).

Among the scholars who analysed the subject of flood within the over all context of flood plain management was Dougal (1969). According to him, instead of relying on structural protections to contain flood waters, flood plain residents should rather acknowledge the "right of way" of a particular river, i.e. lands within the immediate reach of the river be reserved for the conveyance of flood waters. Where those lands must of necessity be used, they should be used for such developments with low disaster potentials as golf, plantation and other essential water front activities. Another scholar who discussed the destructive impact of flood disaster was Royward (1978). He went so far as to catalogue some devastating floods such as the Hwang Ho flood of 1887 or the 'China's sorrow' in which 900,000 people died, the 1973 flood in Mexico in which 1,500 people died and 200,000 rendered homeless.

The recurring flood disasters in Bangladesh have received substantial coverage in recent years. A common feature of flood in Bangladesh is its permanancy. The flood which hit the country in 1988 for instance, affected about 25million people and three quarter of the entire country was under water (BBC London, 1989). The flood in Bangladesh is compounded by the opening of the gates of Farrakha



FIG 2-5
SHADED ARE AFRICAN COUNTRIES AFFECTED BY FLOOD WATERS (1988).
SOURCE: THE DEMOCRAT August, 19, 1988.

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urban settlements particularly following the nation-wide flood disasters of 1988. The review of some of the existing works on the subject of flood disaster brought into focus the disastrous impact of floods in various parts of the world and hence the need for prompt action to cope with the menance. It is better to act now than watch floods wreck havoc on lives and properties with rising intensity - this is the greatest motivation for this research work "*Problems of* flood disasters in Hadejia: a physical planning proposal".

CHAPTER THREE

3.00 STUDY AND ANALYSIS OF EXISTING SITUATION

3.10 The magnitude of the flood problem in Hadejia

The location of Hadejia town on the northern bank of Hadejia River was historically informed by local economic considerations of water supply, fishing and irrigation. This fact is quite obvious from the relative dryness of the area especially during the long dry season. The topography of the town is dominated by the river which at points is some 356 - 357m above see level, which is above the altitude of most of the surrounding lands in the town with average height of 359m. The nature of the terrain and the sandy and clay soils with high infiltration rates means that underground flooding of the town is obvious as happened during previous flood disasters.

Flood disasters in Hadejia have become recurring phenomenum as shown by the major disasters which occurred in 1942, 1963 and as recently as 1988. The construction of Tiga Dam and other smaller Dams upstream of Hadejia river during the last two decades means that there now exist, potential sources for accidental discharge of flood waters to flood plain areas of Hadejia even when normal rainfall is recorded or heavy rain forced the Dams to burst their banks as did the Bagauda Dam in 1988. Hadejia

town lies on an area of gentle or imperceptible slopes, across which the Hadejia river which is heavily mud-laden wanders bounded by levees beyond which lies ox-bows and occassional discharge streams. The town is at the river's lower stage where much deposition is taking place. The river at this stage meanders and swings round its bends and impinges on the outside of it thus eroding the banks and the river by return bottom current flows towards the inside depositing sand bank. Under intense water volume, this portions of the river or its 'neck' known locally as Wuyan Ko[illegible] spills water outside the main channel to cause flooding of the area. Several such river necks exist along the urban reach of the river in Hadejia and one of such which is well known is located at Azumu village some 4kms to the west of Hadejia town. It was the main source of the flood water which caused the 1988 disaster in Hadejia.

In understanding the flood problem magnitude in Hadejia it is important to realise that many residential and commercial developments are already located within high risk locations within the close proximity of the river or along the historical flood water discharge courses. What became quite obvious in the course of the field work for the research is that because of nature of the town's terrain, the greater part of the town is always under threat of



Plate A : Collapsed Houses in Hadejia (1988)



plate B : Cows near an eroded road in Hadejia; Some of the victims.



Plate C: A stucked landrover following Hadejia flood (1988)

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Plates: FLOOD IMPACT IN HADEJIA

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FIG 3.1
EXTENT OF 1942 FLOOD IN HADEJIA
SOURCE: BASED ON FIELD WORK.

escaped after the river burst open at the shallow, meander point. The flood water had the potential to displace the whole of Hadejia but for the walls that were still in place. The flood destroyed half of the Gandun Bindigoma ward to the north of the walled town. The flood water moved far north of Hadejia and the Mallam maduri road had to be cut across for the water to move east from the west and a big culcert or Babbar Gada had to be constructed (fig.3.2). The estimated number of houses lost was about 150, about ₦270,000 agricultural produce lost, while about 500 people were rendered homeless. The duration of the flood water was about 40 days. Although as in the case of 1942 the walls helped checked water from entering the town, sub terranean flooding caused water seepage into pit latrines and wells.

The most recent of the major known flood disasters in Hadejia occurred in 1988. The flood water escaped mainly from the shallow points known as Mafucin Azumu some 4kms to the west of Hadejia on the northern bank (figure 3.3). The rainfall which fell in 1988 was about the heaviest in the town for about 50 years. Similarly the flood threat was believed to have the potential of wrecking havoc than all the previous disasters if not for the timely control measures. The massive sand-bagging through

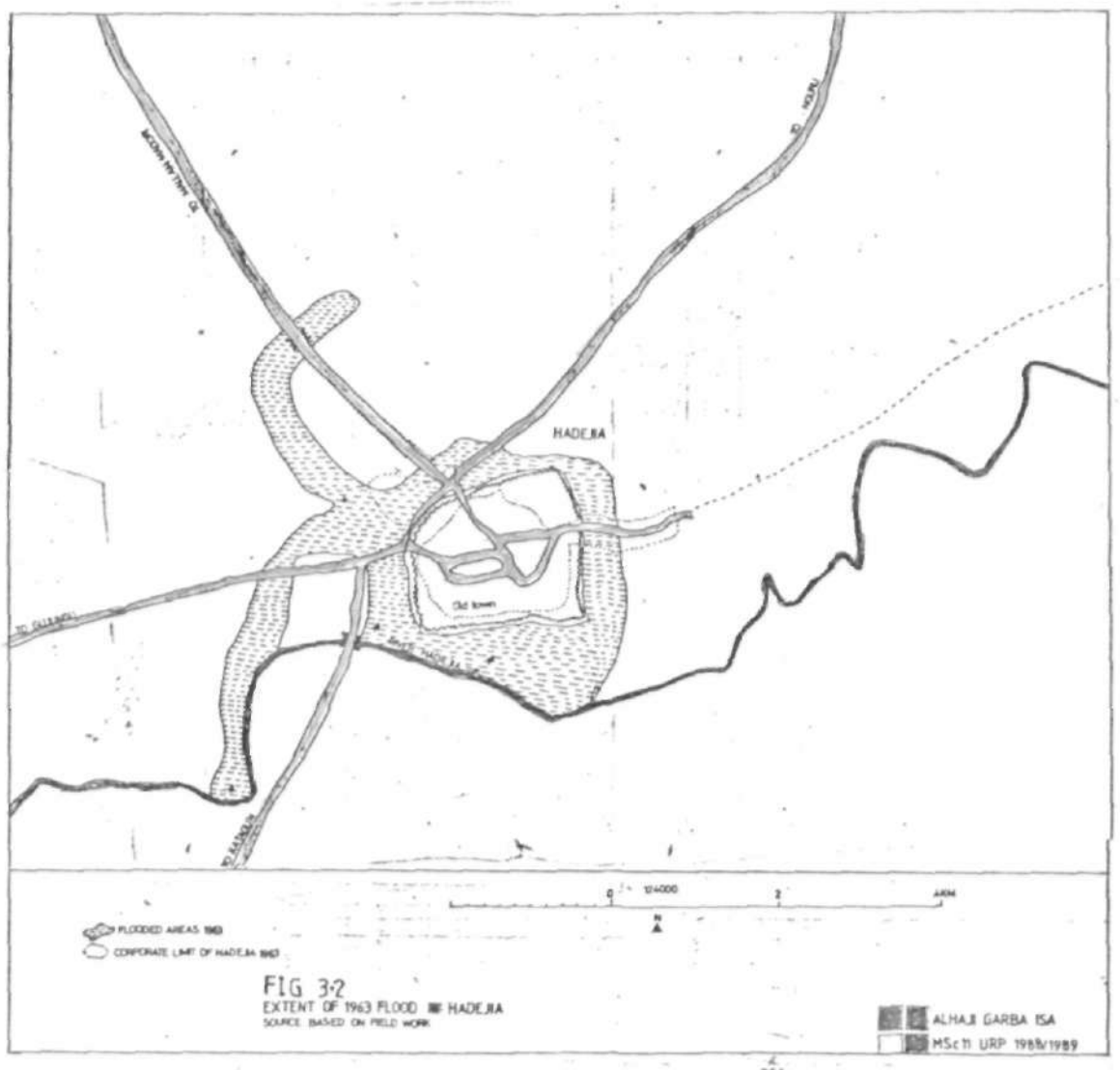


FIG. 3·2
EXTENT OF 1963 FLOOD IN HADEJIA
SOURCE BASED ON FIELD WORK

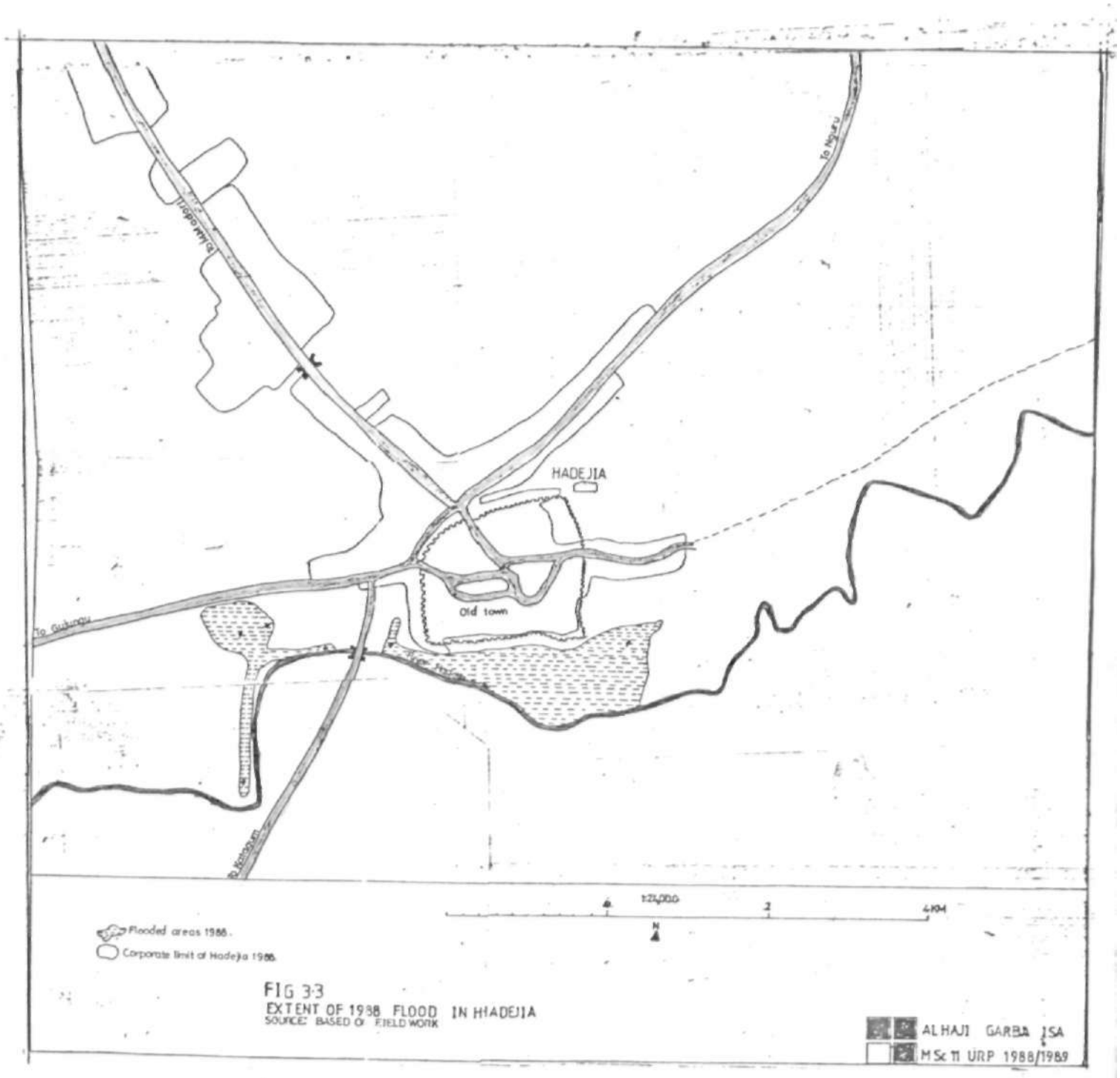


FIG 3·3
EXTENT OF 1988 FLOOD IN HADEJIA
SOURCE: BASED ON FIELD WORK

the combined efforts of the people local and state governments greatly curtailed the problem. For instance the Hadejia - Gujungu road was narrowly salvaged from been cut off by the flood water flowing north ward from the escape point near Hadin village. A number of farmlands were destroyed by the flood water, so also many developments located to the southern part of the town, they include ware houses, a primary school and the new Hadejia vetrinary clinic etc. According to the local government and the state emergency relief Agency estimates, about 1,000 houses were damaged in Hadejia, Agricultural produce worth ₦20 million lost, and about 2,000 people rendered homeless. The flood water duration was about 60 days. Figure 3.4 shows the graphic history of flood damage history for the 3 flood disasters.

3.30 EXISTING RESPONSE TO FLOODING IN THE STUDY AREA

In the course of field work for the research a number of local flood alleviation measures were found to exist in the study area. They include the flood related provisions in the master plan and other measures taken by Government, local authorities and the people themselves.

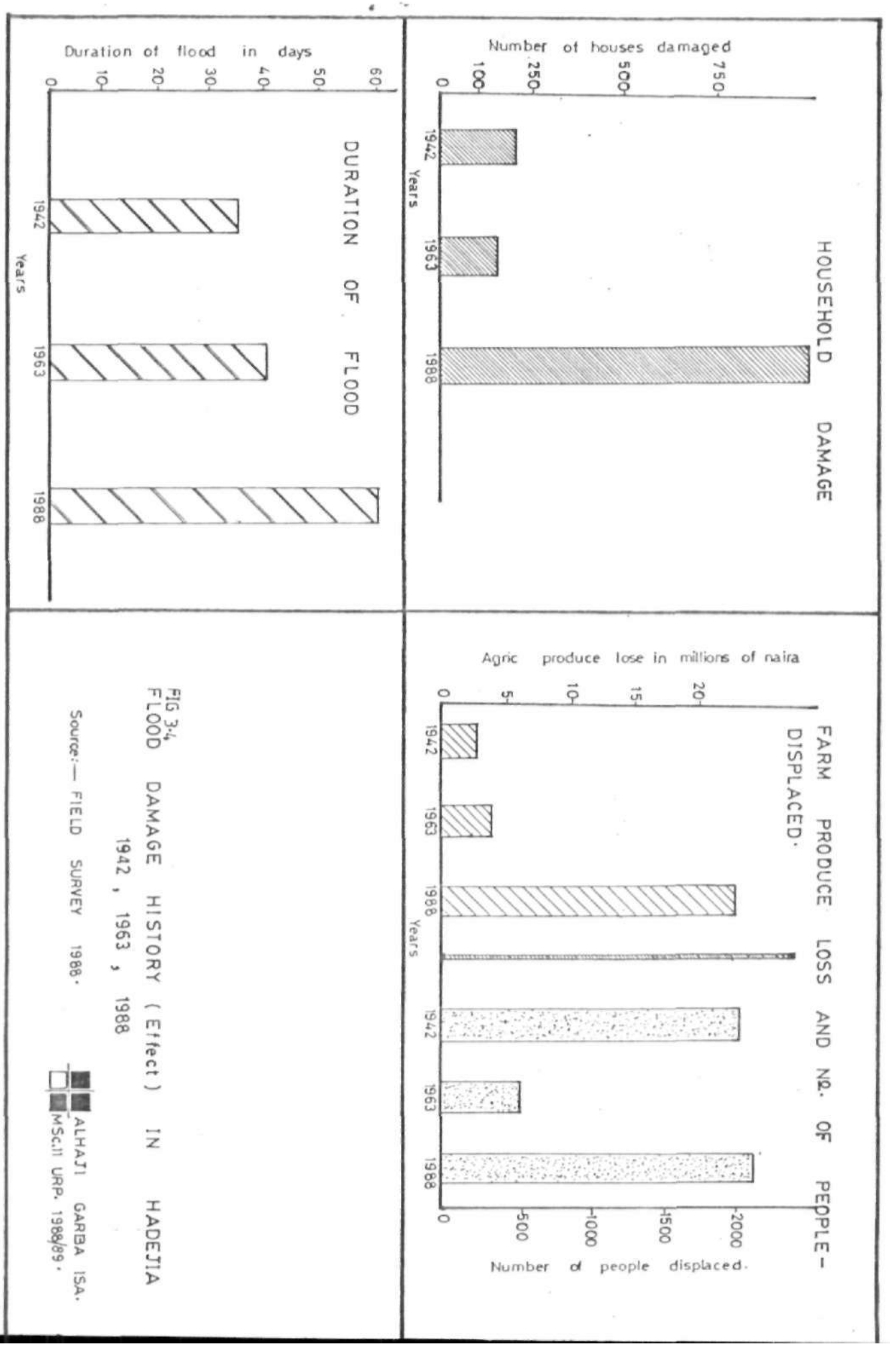


FIG 3.4
FLOOD DAMAGE HISTORY (Effect) IN HADEJIA
1942, 1963, 1988

Source:— FIELD SURVEY 1988.

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(A) THE MASTER PLAN APPROACH

(i) Landuse Proposals

The Hadejia master plan prepared by the urban development Board (UDB) in 1977, contain provisions which were clearly informed by the close proximity of the town to the river and nature of the topography. In recognising this problem, the consultants state in part; "The most important feature of the terrain is the Hadejia River bordering the southern part of the town, the expansion of the town in this direction, is determind by the proposed master plan. However, the master plan's four proposed residential districts to the north, south, east and west were apparently proposed without due regard to the flood problem in some of the districts. The ring like residential proposals are not realistic as local flood ways and topographic factors are likely to disturb the intended uniformity.

(ii) Building Measures

The master plan proposals with regards building materials is to suggest the combining of excellent performance of mud walls with the strength of concrete blocks. Although the master plan recognise the importance of stablized blocks, it says "concrete blocks will prevail as the only alternative

over the mud houses at present" (p.11). This provision failed to take note of the economic and cultural reality of the people for proposing the ultimate replacement of mud with concrete instead of suggesting what is locally obtainable and affordable with ease.

(iii) Drainage Proposals

The drainage proposals by the consultants took note of the topography and states that for the purpose of rain water collection, closed, sub-surface and open drains may be used (figure 3.6). They also support open drains because of their cheapness although they recognised their short-comings as they "must necessarily follow the surface gradiant ..."(p.29). The consultants opposed the use of temporary reserviors for rain water and sewer collection in the central areas and discourage the use of pumping stations as much as possible. They also proposed the regulation of temporary water courses witnin the area of the settlement. The drainage network plan of Hadejia (Figure 3.7) is not however part of the overall master plan and as such is not properly integrated into the plan. Investigation with the UDB shows that the drainage master plan is not being vigorously followed by the board at the moment and that only about 30% of the drainage requirement of Hadejia has actual

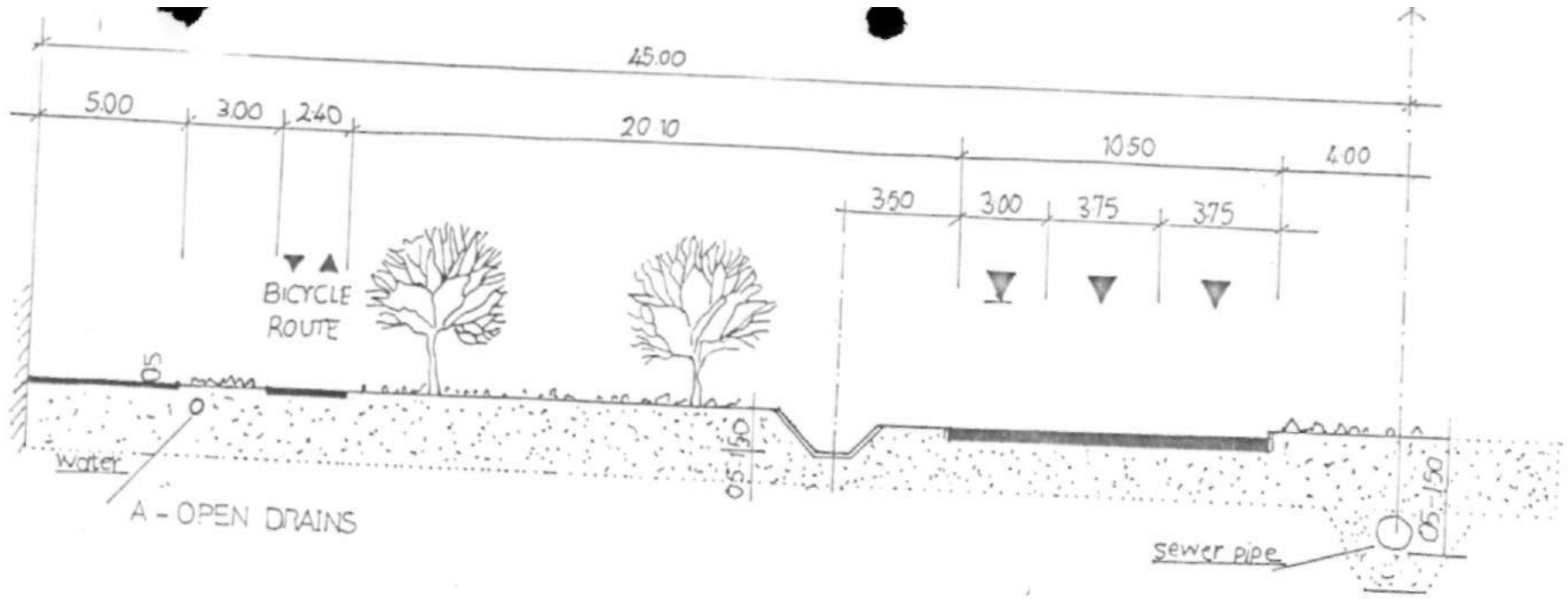


FIG 3.6

ROAD SECTIONS WITH OPEN AND CLOSED DRAINS

SOURCE: HADEJIA MASTER PLAN, (1977).

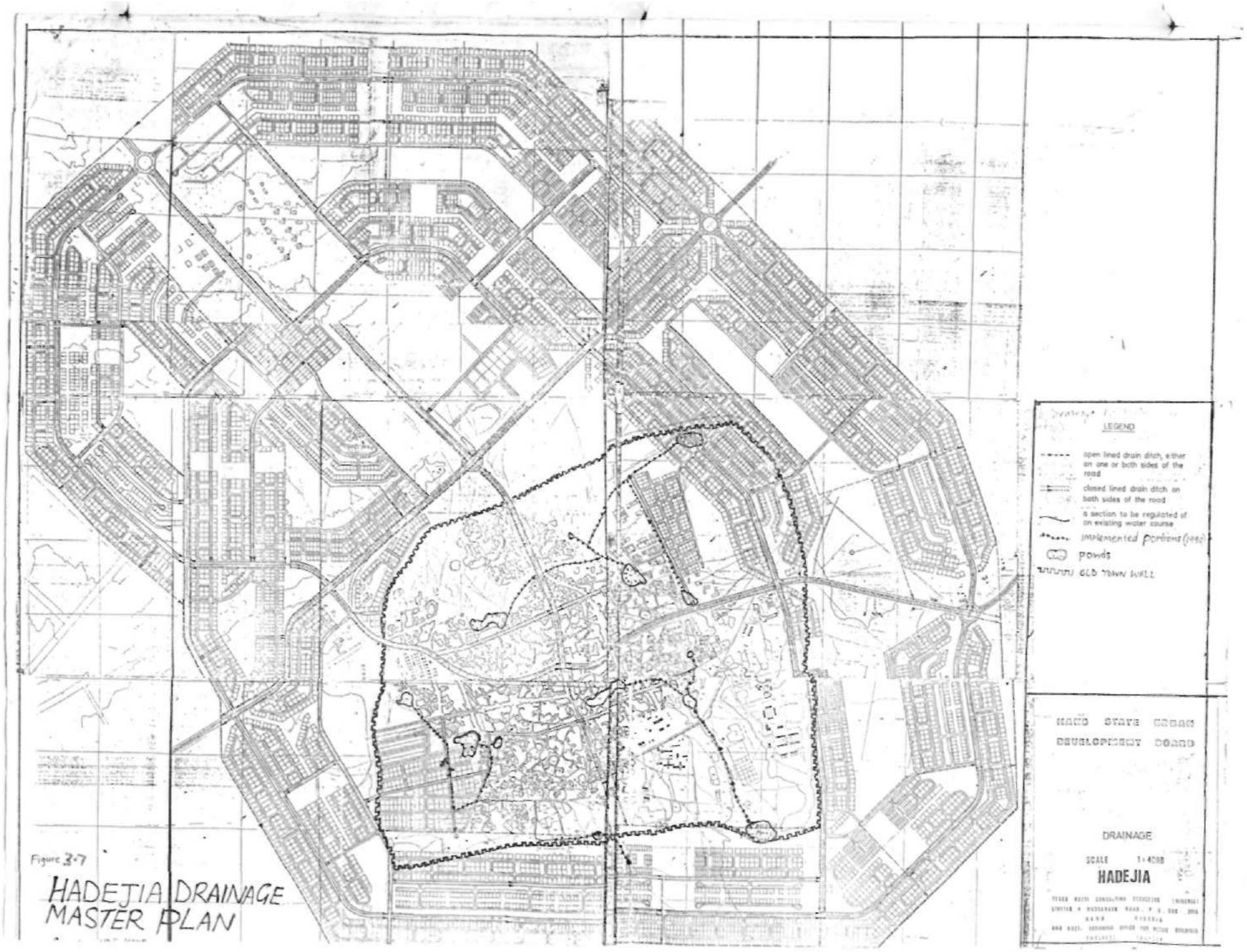


Figure 3-7

HADEJIA DRAINAGE MASTER PLAN

been implemented on the ground. As for design specifications of the drains, the master plan suggested the paving of open drains to facilitate faster flow and easy cleaning and also the use of prefabricated slabs for covering. The drains, they suggested should be on both or one side of the roads and suggested closed lined drains mainly in the centre of the town. Where there is no space to lay the closed drains beside the road pavement, the master plan suggest, they be placed or laid under the road (p.39). Because of the difficulty of discharge of rain water to the river except on one side of the town as dictated by topographic conditions, the master plan proposed the conduction of such water into "rain water reserviors" using both closed and open drains. (p.40).

(iv) <u>The issue of physical Barriers</u>

It is very interesting to note that the master plan did not propose a physical barrier to check the possible spread of flood waters in view of the nature of the topography and the proximity of the town to the river. There is no proposal for flood embankment or action to improve the river channel- this shows the failure of the consultants to carry out indepth analysis of the problem of flood disaster or that the contract terms do not seem to cover the

flood control requirements in their comprehensive physical planning sense.

(v) Other flood control measures in the Area

Beside the flood control related aspects in the master plan and the drainage plan of the town most of which are still on their design paper only, some physical response measures to flooding have been indentified in the field. They are mainly communal measures augumented with local, state and federal response.

(a) The Community Response

One of the most important contribution of the local people indentified in the course of the research is the issuance of warning to neighbourhood residents by those who noticed the flood threat in good time. For those who have planted crops, harvesting is usually hastened to minimise losses or damage. As much as possible, communities living close to the river select higher grounds to locate their settlements. When flood eventually occur, the people promptly respond in communal spirit to the call by traditional authorities to engage in community oriented blocking of flood water by building sand bags embankment or Jinga. In the Hadejia main town proper, the body guards of the emir or Dogarai were often used to keep vigil all the night during the period of flood emergency, they are complimented by other able bodied men in the town. Other community

measures applied to tame, the river flood include the use of local water chief or Sarki Ruwa and his men to perform their charms.

(b) The Local government effort

The effort of the local government (known as the native authority or N.A. during the 1942 and 1963 flood disasters) is also significant. As the local level of government authority, they provide the most immediate form of governmental presence and assistance in case of flood disasters. During the 1988 flood disaster, local information vans were used to warn residents close to the river either to evacuate their houses or be on the alert. The local government in addition foot the bills for empty sacks used for the bagging and for laterite trips among others. It was found in the course of the research that following the 1988 disaster, the estimated expenditure by the Hadejia local government was ₦155,000. The local government's public mobilisation for self help was massively reponded to in 1988 in accordance with the peoples self-help spirit demonstrated during previous disasters.

(c) State and federal governments effort

The government of Kano State usually respond to the flood threat by deploying caterpillars to raise sand embankments against the advancing flood water as was the case in 1963 and 1988. This is

usually done through the state ministry of works or the water Agency (WREXCA). Following the 1988 disaster, the government earmarked the sum of ₦1 million for partial implementation of drainage programme of Hadejia town. According to the Urban development Board, over ₦2 million was needed by 1988 estimate to provide some major drainage lines in Hadejia.

A more recent effort on the part of the State government was the establishment in 1986, of state emergency relief agency charged with the responsibility of collecting and distribution of relief materials to victims of disasters in the state. Other measures of regional nature are the government's afforestation programmes and the use of Dams for water resources development and flood control such as Tiga, Bagauda, Challawa Gorge etc.

The federal government also have some programmes of regional nature such as those of Hadejia Jamaare river basin authority's flood control efforts through water storage and regulation such as the proposed Barrage at Auyo some 37kms to the west of Hadejia. The impact of the federal government's new Federal environmental protection Agency (FEPA), National Emergency relief committee and the national committee on Ecological disasters are yet to make an impact in the area.

3.40 ANALYSIS OF MAJOR FINDINGS

Among the various data analysed include those on rainfall terrain, slope, river gauges, flood impact, history and local control measures etc.

Among the findings made is that the annual total rainfall recorded in 1988 at Kano Airport meteorological station is about 215.4mm higher than the 80 year annual average of 856mm covering the period 1905-1985 (figure 3.8). This is about 25% increase over the yearly average, and is infered to be one of the important factors for the 1988 flood disaster in the area. The flood of 1988 in Hadejia made its first appearance in July as shown by Hadejia - Jamaare river basin development authority's records and reached its peak in September. The highest river Hadejia gauge reading for 1988 rainy season was recorded in September which read 4.18m (figure 3.9). With average altitude of 355m above sea level for most lands in Hadejia (figure 3.10) it was found from the river's cross-sectional profile that if no barrier exist, any gauge reading of 4m and above could lead to the flooding of most parts of the town by the river (figure 3.11 and 3.12).

From the rainfall trends record at Kano Airport (1985-1988), rainfall in the area shows a kind of tendency to alternate between periods of dry spells

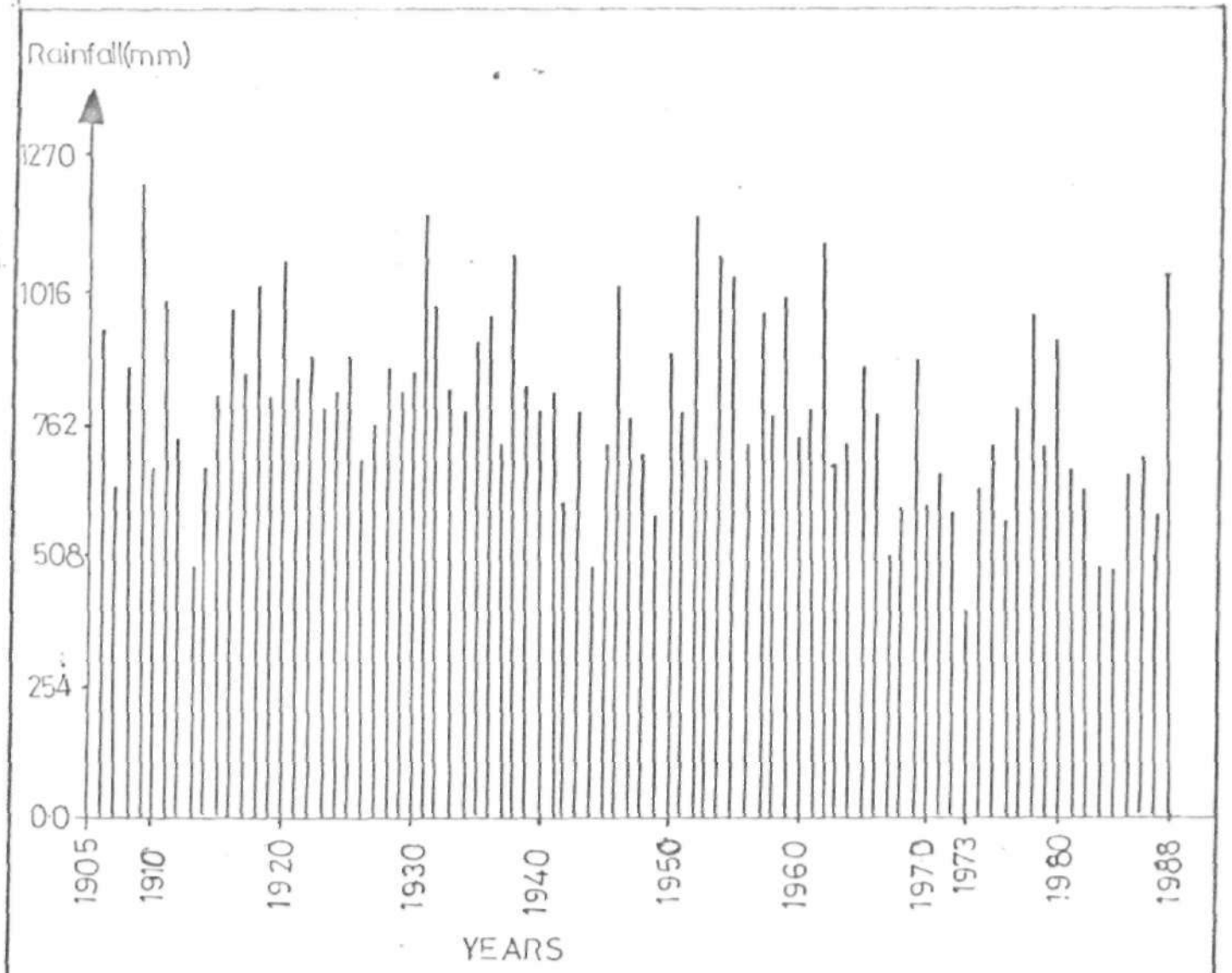


FIG 3.8

RAINFALL DATA AT KANO AIRPORT

YEARLY TOTAL RAINFALL

(1905-1988)

SOURCE: FEDERAL METEOROLOGICAL DEPARTMENT
KANO AIRPORT.

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MAXIMUM GAUGE HEIGHT OF HADEJIA RIVER AT HADEJIA FERRY STATION JANUARY DECEMBER 1988.

Months.	G.H meters
JANUARY	0.67
FEBRUARY	0.56
MARCH	0.40
APRIL	0.52
MAY	0.37
JUNE	0.92
JULY	2.77
AUGUST	3.58
SEPTEMBER	4.18
OCTOBER	3.83
NOVEMBER	2.08
DECEMBER	1.24

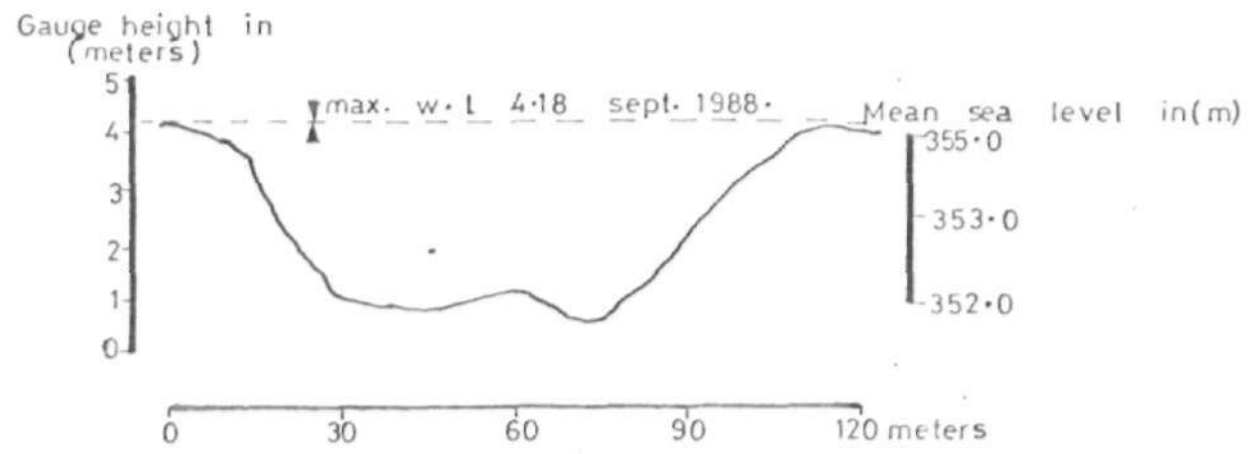


FIG 3.9
CROSS SECTION OF HADEJIA RIVER AT FERRY SITE.

Source:—FIELD SURVEY 1988.

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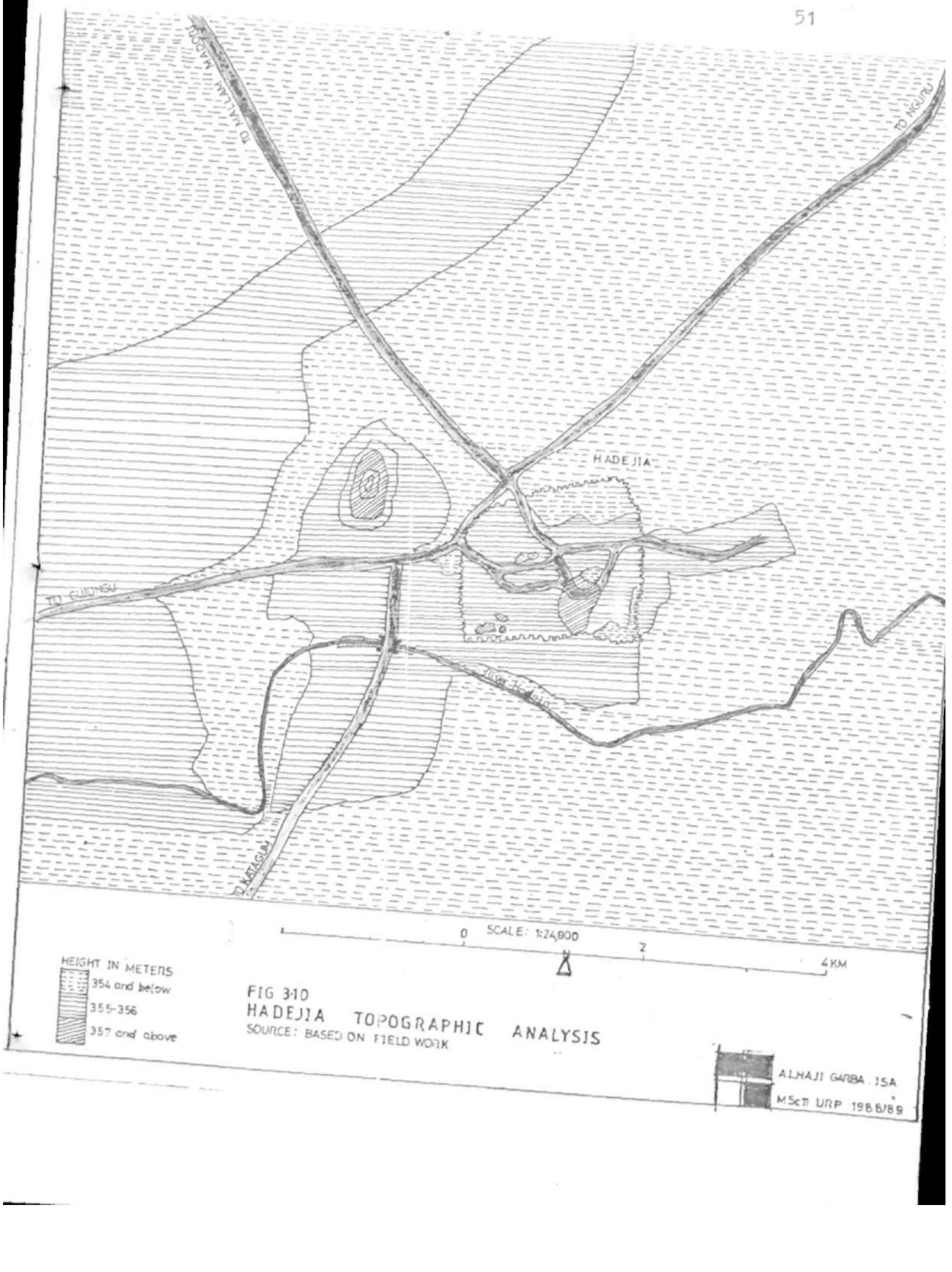


FIG 3·10
HADEJIA TOPOGRAPHIC ANALYSIS
SOURCE: BASED ON FIELD WORK

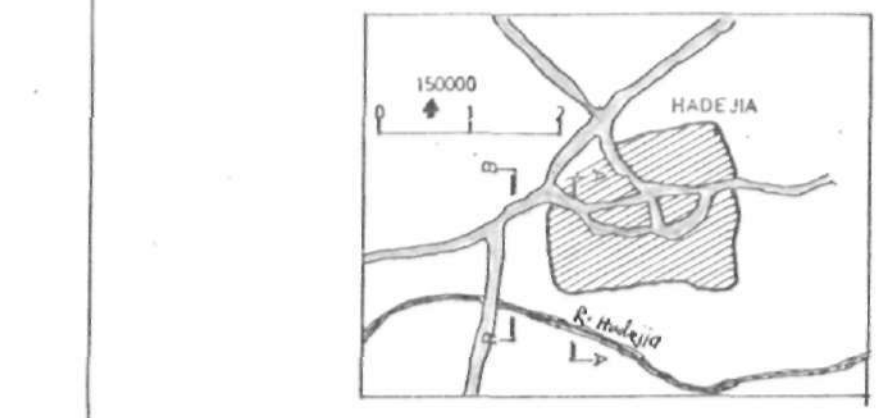
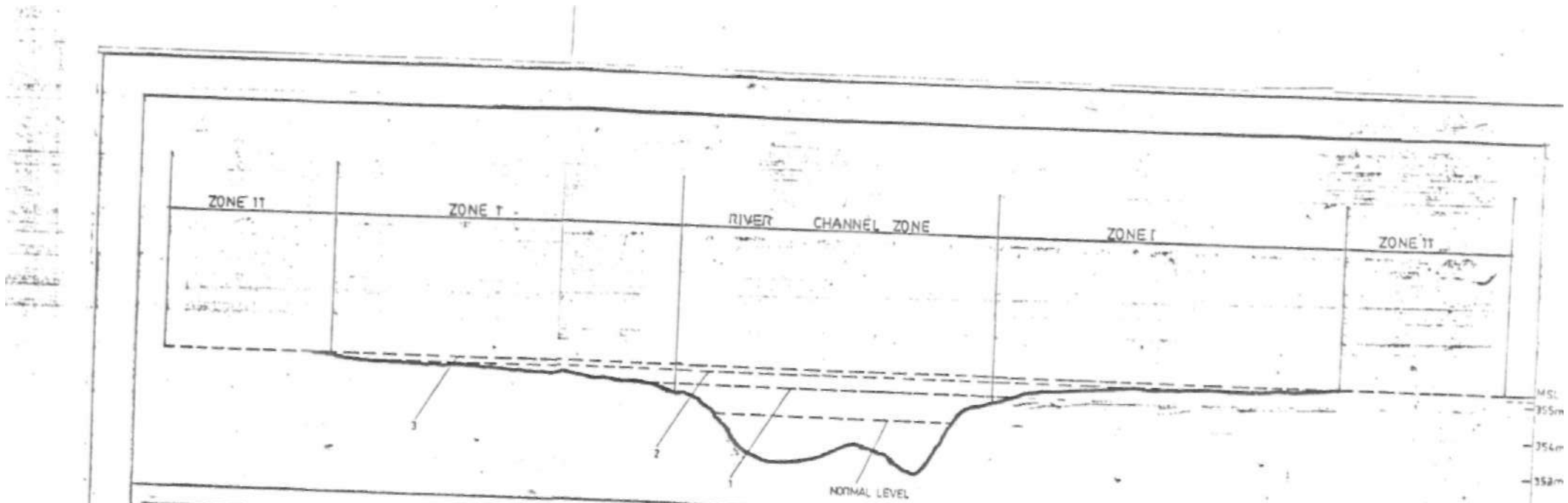


FIG 3·11

CROSS SECTIONAL PROFILES SHOWING THE FLOOD THREATS

source FIELD WORK

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	RECURRANCE INTERVAL YEARS	EXPECTED MAX WATER LV.	FLOW M³/SEC	EXPECTED REACH OF INUNDATION
1	50	4·18	87	355 and Below
2	100	4·87	114	357 and Below
3	500	4·9	116·5	Over 557

Fig 3·2
FLOOD PLAIN ZONATION IN HADEJIA
BASED ON THREE SELECTED MAXIMUM WATER LEVELS
SOURCE: - FIELD WORK, 1989

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and that of heavy rains (figure 3.13). These relatively long dry intervals or drought periods often lead to the warning of memory of previous flood disasters, as such there is the need for regular forecasting and warning programmes by the hydrological authorities and the need for vigorous urban and regional planning measures on the ground to effectively cope with possible occurances. Although floods of disastrous magnitude are not of annual occurrance in Hadejia as discovered in the course of the research, the disasters of 1942, 1963 and 1988 seems to set up a kind of regular interval of about 25 years, and this coupled with their unpredictable destruction level calls for far reaching alleviation measures. In making flood disaster preparedness in Hadejia, it is important to note that according to the rainfall regime analysed, almost all of the rainfall occurs between May and September with the peak in August (as shown in figure 3.14). From the analysis of the rainfall intensity graphs of the area based on 1938 - 1944 obtained from the meteorological station, Kano Airport, the rainfall duration for the floods of 1963 and 1988 which falls within about 25 yearly recurrence interval have durations of more than 6 hours and average rainfall intensity

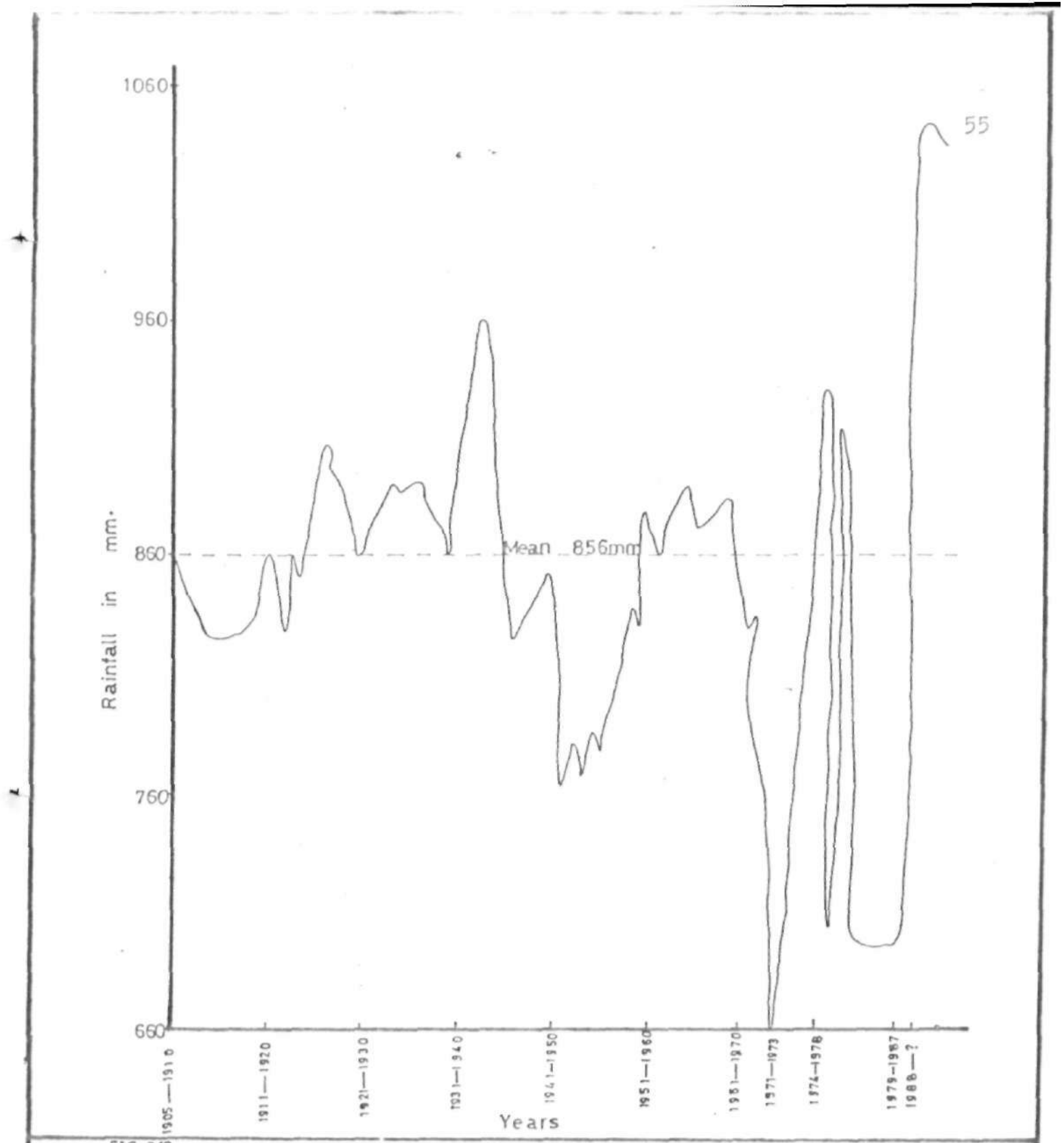


FIG 3·13

LONG—TERM RAINFALL TRENDS AT KANO AIRPORT·

(1905–1985)

Source:—— FIELD SURVEY 1988·

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REGIME OF RIVER HADEJIA AT HADEJIA TOWN

(1988)

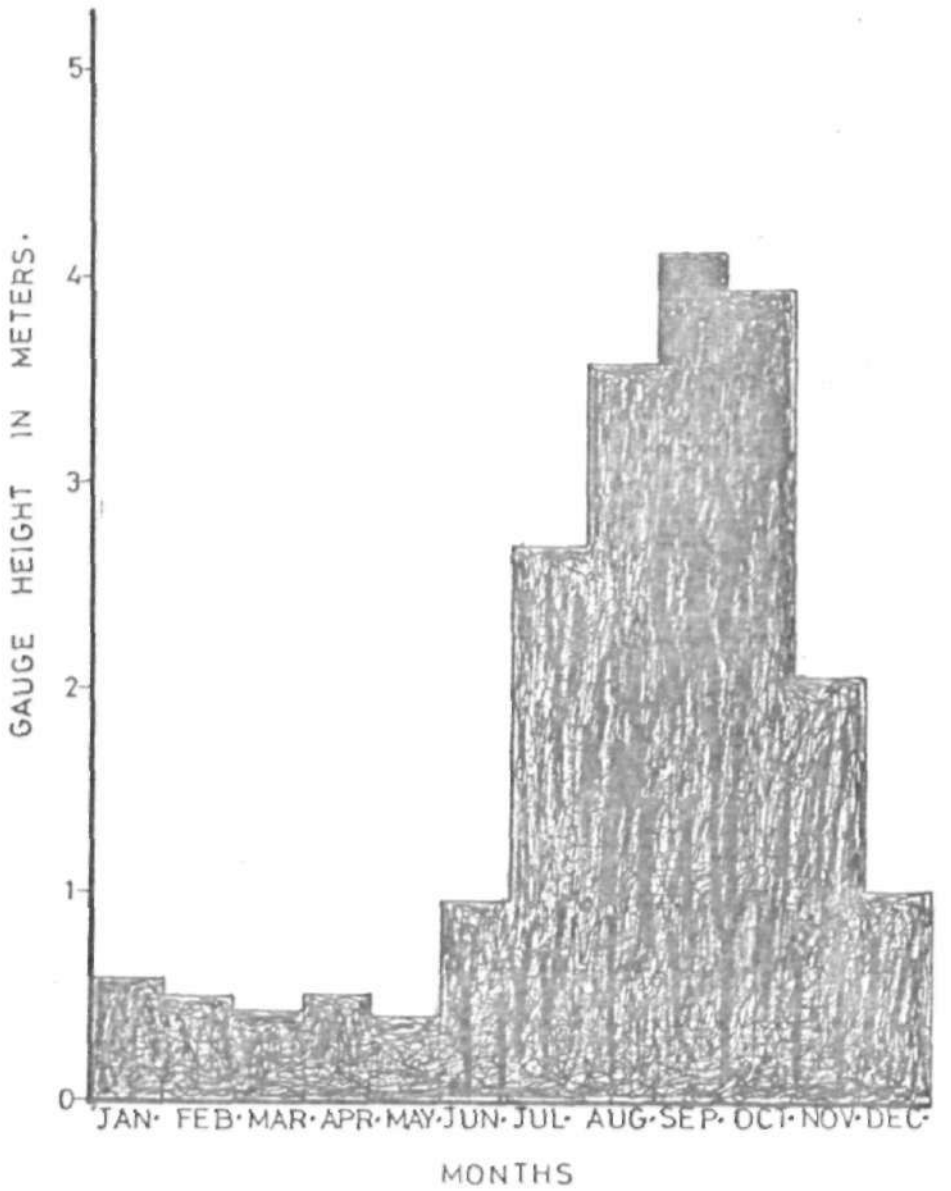
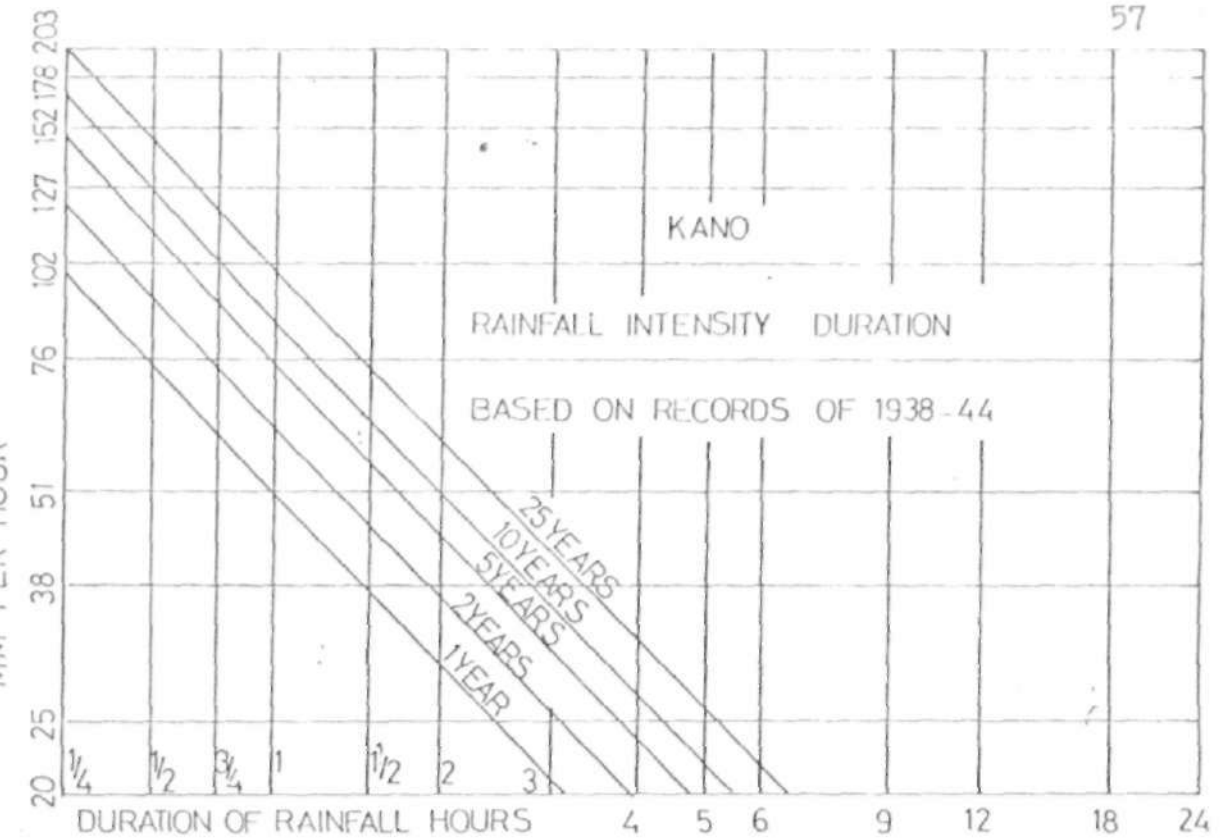


FIG 3.14

Source:—FIELD SURVEY 1988.

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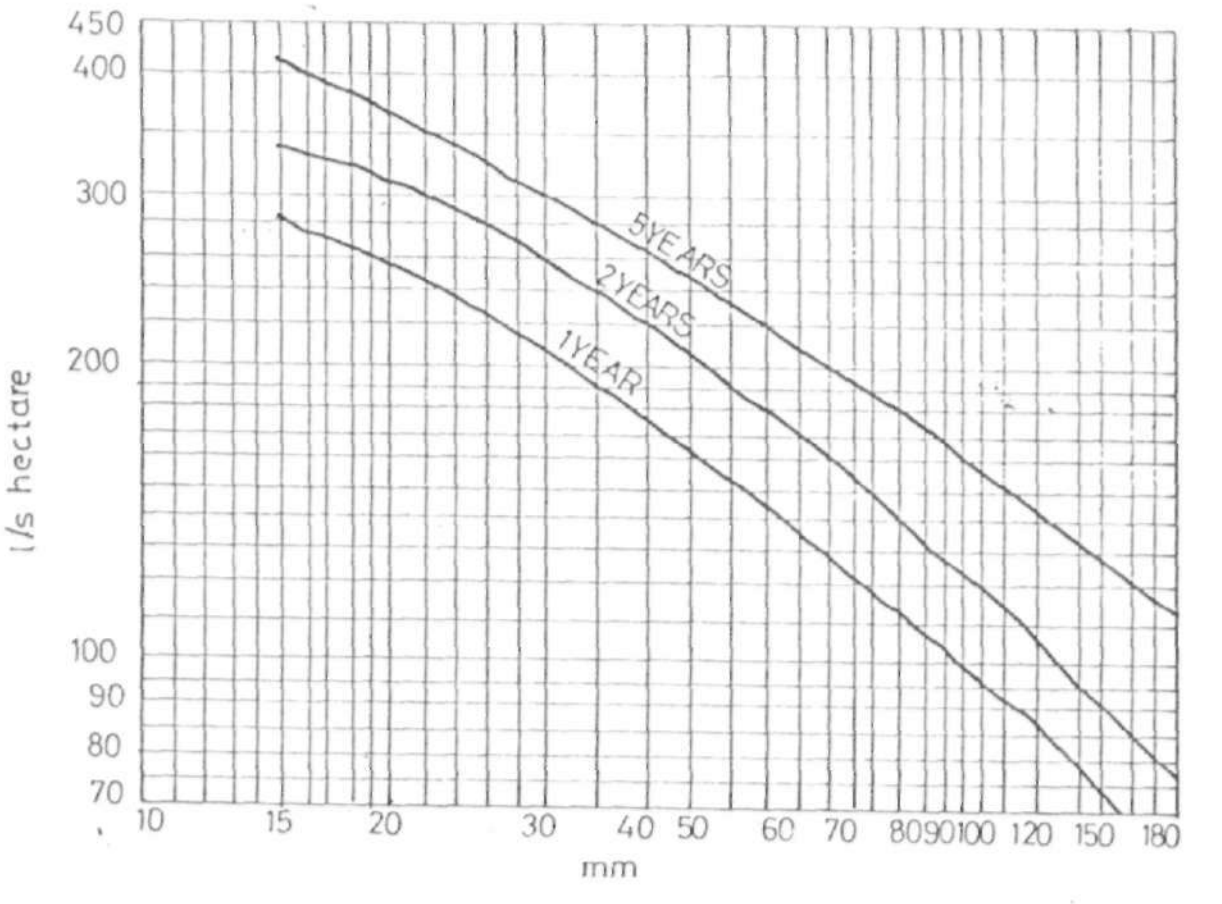


FIG 3.15
RAINFALL INTENSITY GRAPHS
SOURCE: HADEJIA MASTER PLAN (1977).

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are important aspects to understand the magnitude of the flood problem and plan proper response.

According to Hadejia river flow data obtained from WRECA Kano State, the rate of flow between Mudil and Hadejia which is down stream, reduces by between 70-75% as the gradient of the river decreases towards Hadejia (figures 3.16 and 3.17). It is infered here that in Hadejia, volume rather than rate of flow is a very important contributory factor to the floods as the river meanders and deposit sediments and water at its lower course.

The soils in Hadejia as noted in the geographical outline of the area, are mainly sandy loose type of Chad formation type with high inflitration rate of moisture. The soils of the area are found to be unfavourable to Dam construction. Major Dam or reservoir options are usually difficult under this kind of soil situation. Materials for such construction works can only be obtainable from the ~~semam~~ basement complex region around Kano city some 208kms to the west.

Another important analysis carried out in the town is that of slope. It was based on a topographic sheet of scale 1:2,000 obtained from the Kano State Survey division - the toposheet was then augument with the physical information observed on the field.

TOTAL WATER DISCHARGE OF HADEJIA RIVER AT HADEJIA AND WUDIL STATIONS FOR SELECTED —— YEARS IN MILLION $M^3/Sec.$

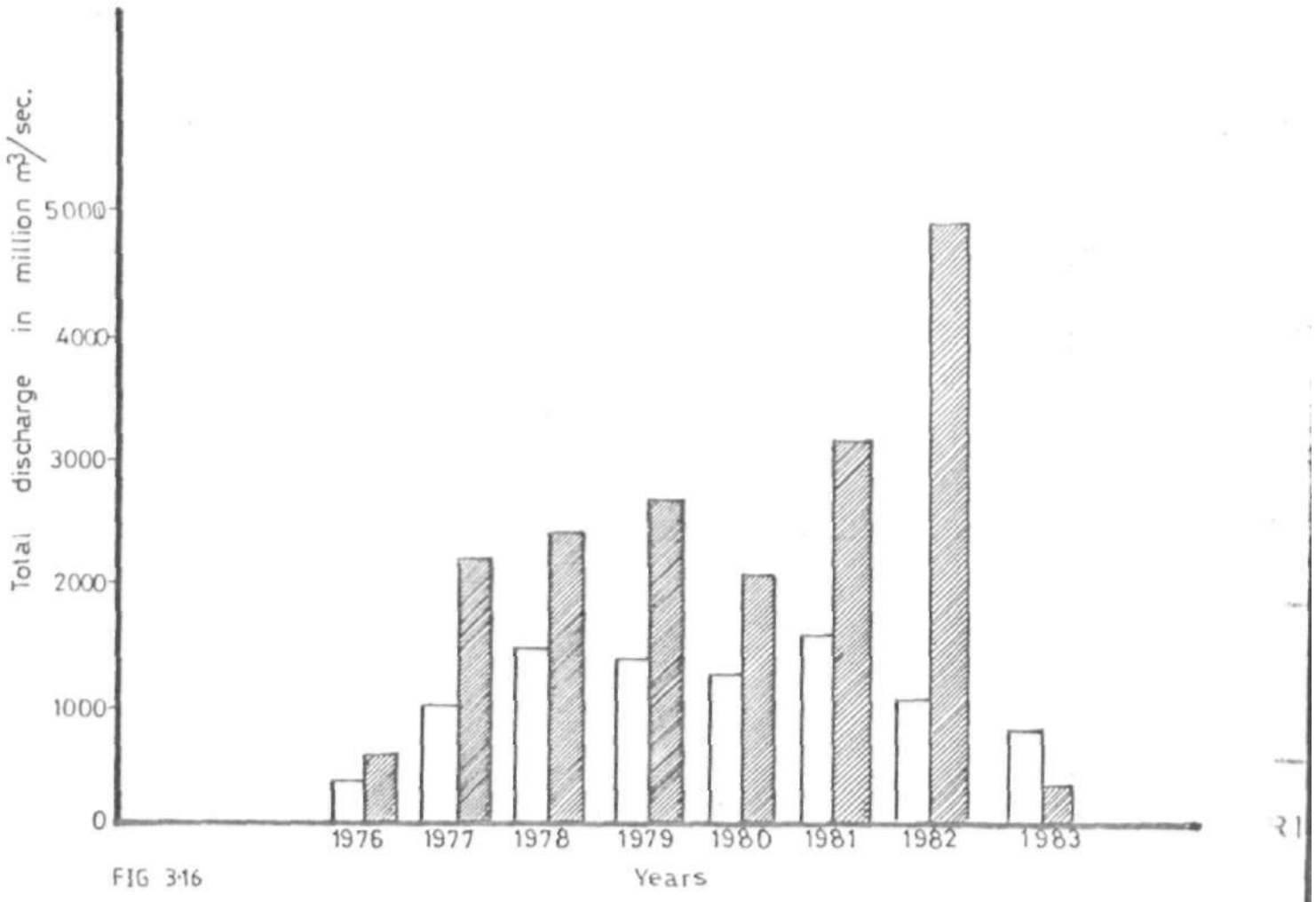


FIG 3·16

Source :—— FIELD SURVEY 1988.

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AVERAGE WATER DISCHARGE OF HADEJIA RIVER AT WUDIL AND HADEJIA GAUGE — STATIONS FOR SELECTED YEARS IN M^3/SEC.

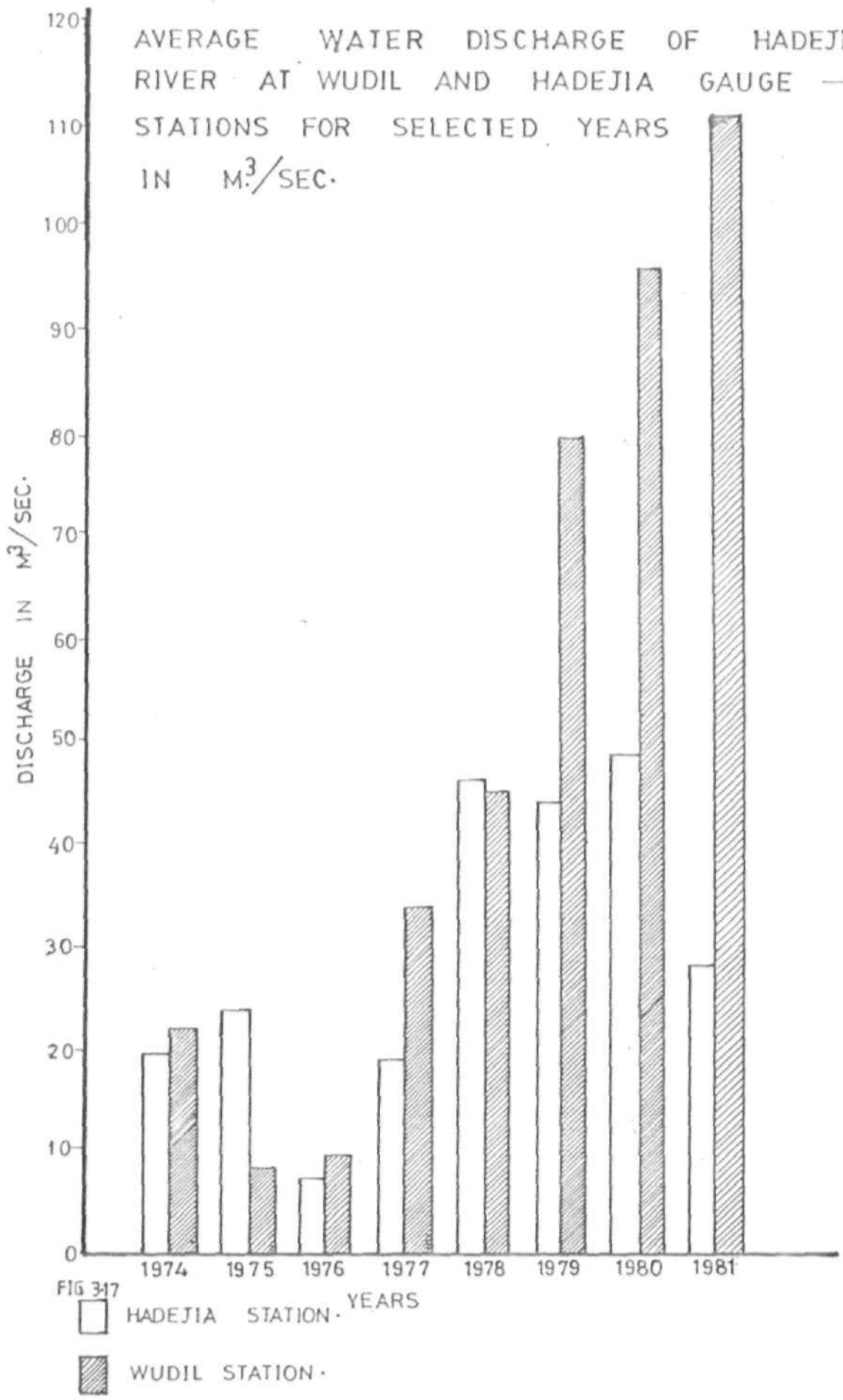


FIG 3:7

Source:—FIELD SURVEY 1989.

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The slope percentage formular used for the analysis is $\frac{V.I.}{H.E}$ x 100 = % slope. It was discovered from the analysis that most of the land in the town has slope percentage of less than 1% which form about 65 percent of the total land area under study. About 35 percent of the total land area has slope percentage age of 1 - 2% and about 2 percent of the area has slope percentage of 2-3% (figure 3.18). It is infered from this that the area has very gentle or low gradient (that is 0-1%) and is therefore too flat and thus likely to be flooded. Since the study area lies between slope percentage of 1-3%, it can on the whole only support less intensive activity and will be slow in draining. Most of the rain water and other discharges in the town either collect in series of ponds or Fagage which characterise the area, or percolate into the soil which is easily water logged especially during the raining season.

Related to the slope analysis also is the fact that since most of the slope percentage is less than 1%, drainage construction will be problematic and as such since the slope is less, it has to be taken down. There is also likely to be the problem of drainage even along the road itself. Great civil engineering feat is necessary to provide efficient drainage in the town - this is

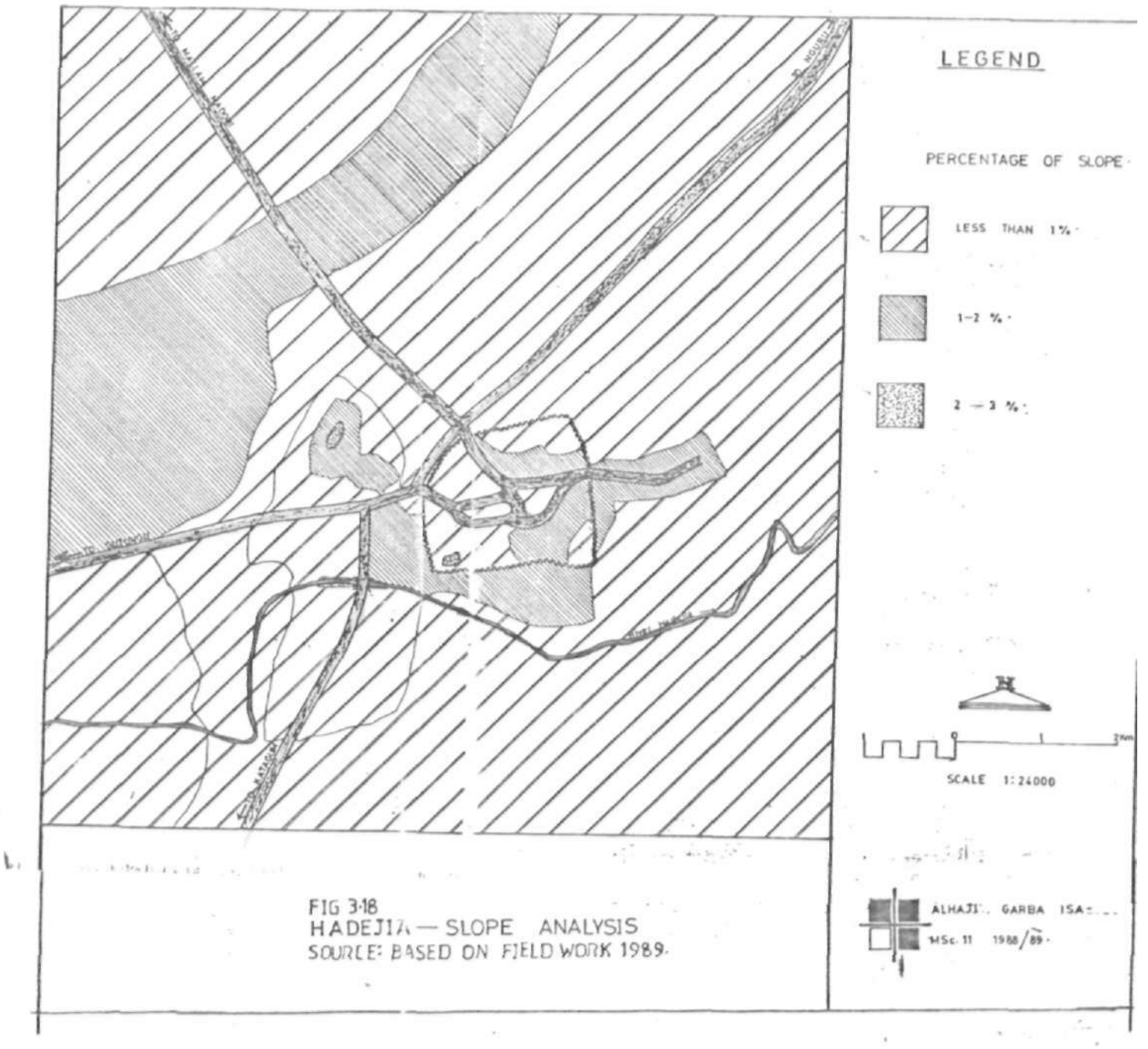


FIG 3·18
HADEJIA — SLOPE ANALYSIS
SOURCE: BASED ON FIELD WORK 1989.

considering the nature of the terrain and the soil. Plans for drainage and related civil works in Hadejia need to suit the behaviour of the land or in the case where they cannot be changed, not to be disturbed, that is, the flat nature of the terrain.

In the course of the investigations for the research, it was discovered that there are certain parts of the town with persistance of flood water inundation whenever a flood disaster occurs in the town. This areas coveres the water courses used by the river to discharge flood waters and one is located to the north-west some 4km to the west along Guyungu road near Azumu village and the other to the immediate west of Mallam Madori road to the north of Hadejia. Others are areas to the south of the existing town.

It was discovered in the course of the research that during the flood disasters of 1942 and 1963 in Hadejia, most developments were within the walled sector of the present town. But by the time the disaster of 1988 struck, many developments have spread outside the walls. Among the important commercial, administrative and political developments existing outside the walls include the new market, a rice mill, motor park, local Government secretariat,

Hadejia new G.R.A, the Stadium, Teachers College, primary schools, several petrol stations, banks, police barracks and host of other developments. The relative low level of destructions in terms of structures and monetary terms in 1942 and 1963 in comparison to 1988 is partly because of the town walls defensive role against surface flooding by the river over flow or bank burst. This calls for urgent physical planning measures to minimise future flood losses. Although the spatial spread of the flood water appears to be on the recede from the previous events, this is partly the result of increased emergency actions in terms of flood water control and the construction of a flood water by increased urban developments. But flood losses seem to be on the increase as shown from the data on flood damages, this is the direct result of increased number of costly developments in the prone sectors.

It has been established from the review of the master plan that although the consultants acknowledged the proximity of the town to the river and its determining role on the towns extension to the south the overall land use structure proposed in the plan are not tailored to the requirements of a comprehensive flood plain planning.

CHAPTER FOUR

4.00 PHYSICAL PLANNING PROPOSALS

In chapter three the issues of flood magnitude, the spatial and material impact and existing response to the flood problem in the area were highlighted. Also an analysis of the major research findings was made. This chapter is intended to put forward various physical planning proposals to cope with flooding in the study area in consonant with the comprehensive physical planning approach. The proposals are categorised into three; landuse planning, flood control and emergency measures. All the measures are complimentary, one of another.

As much as possible, the proposals are tailored to the needs of local flood control programmes in Hadejia. However, the regional nature of the river and administrative realities combine to widen the scope of the proposals or make them appear relatively more general - but the end result is to effectively cope with flood disaster specifically in the study area.

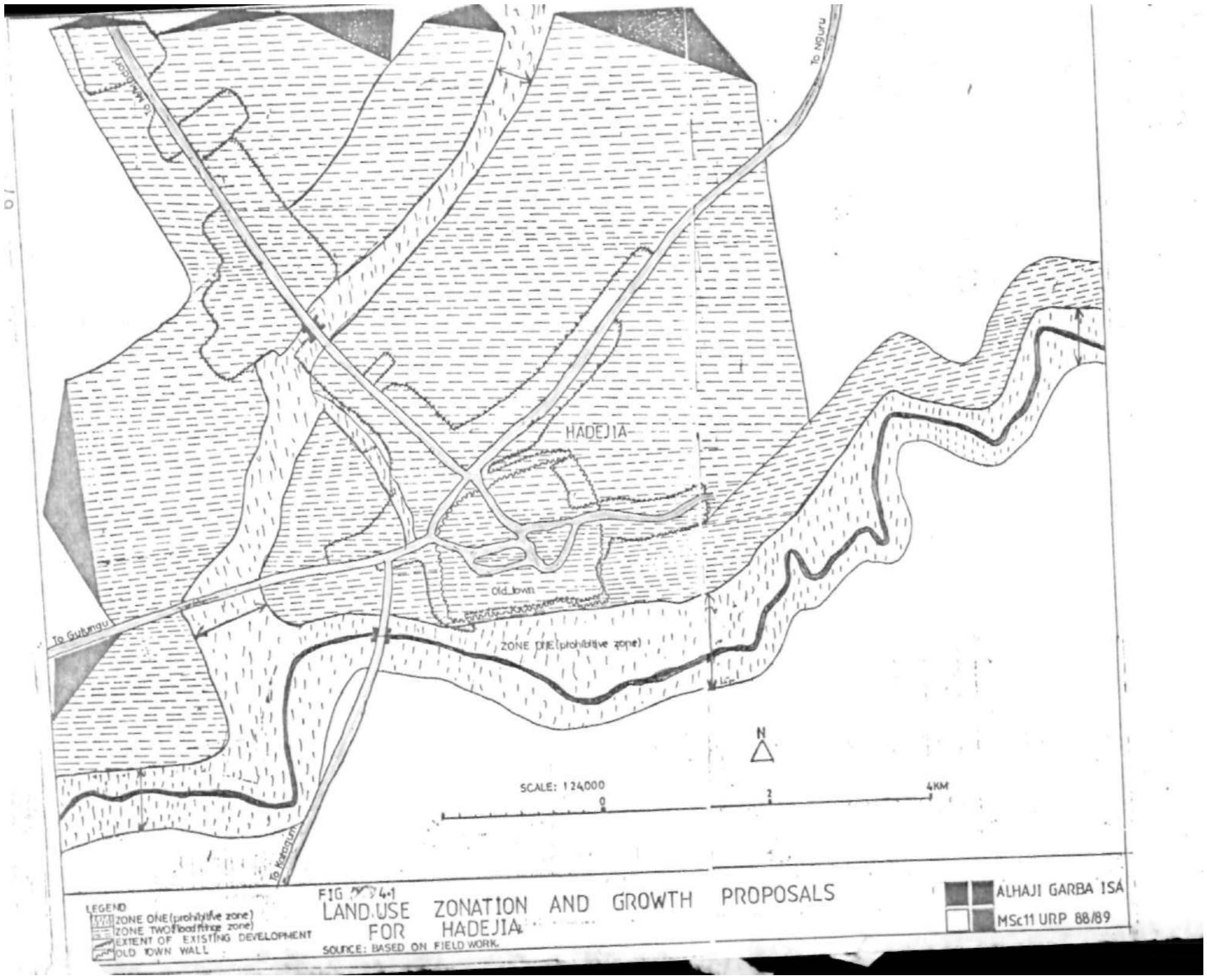
4.10 LANDUSE PLANNING

The basic landuse planning proposals are based on the results of the data analysis. The main guiding facts are those on the historical impact of the flood disasters in Hadejia, the inadequacies of

of existing control measures and the provisions of the master plan, the almost flat nature of the terrain, the slope analysis, and the proximity factor of the town in relation to the river among others.

The main feature of the landuse planning proposals in Hadejia is the zoning of the town into two broad zones (figure 4.1). They are the "prohibitive zone is the one where no structural development shall be allowed. It is the zone which runs through the immediate reach of the river on both sides. It is the floodway necessary for the conveyance of flood waters. It also runs the entire temporary water course which stretched from Azumu village some 5 kilometers to the west of existing Hadejia walled town up north-west across the Hadejia - Gujungu road and down to the north of the town across to the east passing through Hadejia - Mallam Maduri road. It was discovered in the course of the research that the proposed "prohibitive zone" served as the conveyance route of previous flood waters from the main Hadejia river channel. Another component of the zone is the temporary water course which runs parallel to Mallam Madori road on the immediate western side.

Other areas which fall under the prohibitive zone for reasons of proximity to the river rather than topography are mainly found along the southern part of the existing walled sector of the town.


To Nguru
HADEJIA
Old town
ZONE ONE (prohibitive zone)
To Gujungu
To Kano
N
SCALE: 1:24,000
0
2
4KM
LEGEND
ZONE ONE (prohibitive zone)
ZONE TWO (fadd fringe zone)
EXTENT OF EXISTING DEVELOPMENT
OLD TOWN WALL
FIG 4.1
LAND USE ZONATION AND GROWTH PROPOSALS FOR HADEJIA
SOURCE: BASED ON FIELD WORK.
ALHAJI GARBA ISA
MSc11 URP 88/89

In particular, land areas between the northern bank of the river to the walls because of being close to the river had been affected by flood waters and are more seriously threatened by flood than the more distant portions which although lying lower, are only adjoining higher grounds. As floods of varying magnitude and frequency pass through Hadejia flood plain, areas closer to the stream are more likely to suffer.

As a largely agricultural economy, the permissible uses in the prohibitive zone are those to do with both dry season and irrigation and rain fed agriculture as may be dictated by particular local realities. Essential river front activities as fishing camps and forestry development are also proposed. Where for absolute necessity such as irrigation activities, structural developments must be erected in the prohibitive zone, they should be raised above the flood level and be adequately proofed against flood destruction.

The second proposed zone for Hadejia is the "flood fringe zone". About 65% of the total land area in the town fall under the fringe zone. Under the flood fringe zone, dwellings, schools and other kinds of structures shall be permitted. But in line with the topographic and locational factors

considered in the course of the research, appropriate local details to guide local developments have to be evolved by the relevant planning authorities which in this case is the urban development board (UDB). Most of the land areas classified under the flood fringe zone do not necessarily lie within relatively higher grounds especially those to the north-east of the existing walled town, but because they are reasonably away from the river channel or were not found to have been previously flooded like the old walled sector where remnants of the walls still provide some form of protection against flood inundation. Added to the above is the fact that some of those areas ~~kike~~ lie outside the flood discharge water courses.

In addition to the zonation, a future growth direction proposals were incorporated in the overall landuse plan proposals (figure 4.1). The proposal is complimentary to the zonation plan and is aimed at directing future growth towards safer locations for the benefit of minimum flood damage and minimum expenditure on flood protection. Arrows were used to indicate the proposed growth directions on the plan. It is also proposed that existing development right within the flood discharge (temporary courses) be as much as possible be flood-proofed or relocated as the case may be.

The landuse proposals arising out of the research differ from that of the Hadejia master plan which tend to propose landuse development within some of the high risk flood locations and the fact that the master plan was not tailored to the conscious and specific need of flood control in the study area. The proposed landuse proposals for Hadejia are realistic in that they are cheap, encourage combination of measures, control use of land instead of forces of floods and encourage the growth of Hadejia towards the less hazardous directions. These not withstanding however, the landuse regulation enforcing authorities need to be strong enough to realise the objectives of the proposals.

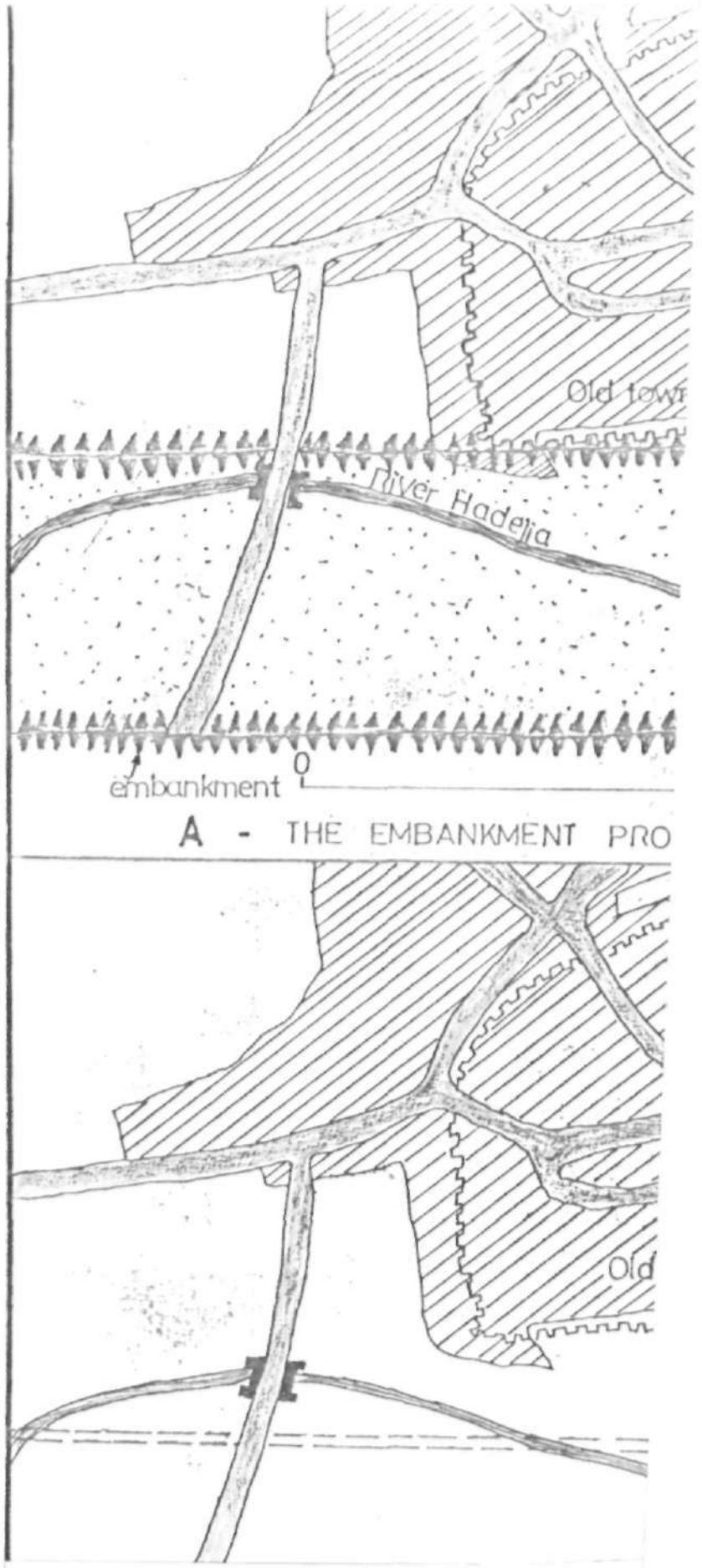
4.20 FLOOD CONTROL MEASURES

4.20.1 Flood Embankment

As components of a physical planning response to flood, embankments are proposed for Hadejia. This is because much as the landuse planning measures serve as the most realistic long-term strategy they need to be complimented with physical controls. The flat nature of the topography of Hadejia further underlines the need for physical barrier between the urban area and river channel.

The earth embankment is proposed to run the approximately 10 kms urban stretch of Hadejia on both sides of the river (figure 4.2a). The height of the embankment will differ from stretch to stretch based on height variations as lands falls between 355m in many areas and up to 357m in some portions. Depending on the height of a particular location however, a crest height of 1 meter above the highest anticipated flood water level is proposed. The main function of the embankment is to protect the land behind them from flooding.

The proposed line of the embankment is just outside the Hadejia river's meander belts on both sides. On the urban side of the river, the line runs the same axis as the southern walls of the town.



A - THE EMBANKMENT PRO

field work for the research that as the river is at its lower stage in Hadejia, much deposition and meadering characterises it. Channel improvement is thus proposed to straighten the meandering channel and clear the bed of accumulation of silt deposits.

Three basic approaches to be considered in the channel improvement are, first, clearing the banks and beds of vegetation and other obstacles, second, channel to be widened or deepened by dredging, and thirdly channel may be shortened by straightening bends and steepened in order to increase water velocity. The programme, like the embankment is proposed to run entire approximate 10km urban stretch of Hadejia eliminating major meanders and deeping the river bed and clearing it of the accumulated debris which have made it shallower over the years.

4.20.3 Building Measures

It has already been discovered in the course of the research that Hadejia is for its greater parts, liable to floods. Thus it is necessary to propose some building measures to improve the resistance of structures to the recurring flood.

Like in all building measures, two broad aspects are considered. They are the issue of height of floor and the type of building materials.

In the first place, it is necessary for all new structures especially in the high risk locations to be raised above the expected level of flood inundation at a particular location since land areas in the town as shown from the topographic analysis lies between altitudes of 355m and over 357m.

Because of the sand-clay nature of the soil in Hadejia, soils for construction need to re-inforced with materials from layers of gravel found at river's bottom. It has been discovered in the course of the research that there are now emerging studies on building materials to suit the culture, economic and geographical condition of the local environment. Research is now on between the Kano State housing Corporation and the Nigerian building and Road Research Institute (N.B.R.R.I.). Part of their findings is that laterite cement blocks are found to be of high resistance to rain water. New roofing sheet made of cement and cocoanut fibre similar to Asbestors are now being experimented. But as cocoanut fibre is not locally available in the north, local substitutes in form of shrubs called Rama and Kaba have been found. For plaster

of houses, local vegetative materials called Makuba and Dafara mixed with sand are proposed. Another option for plaster is the mixer of oil and sand or coaltar mixed with sand. These proposals are adapted for Hadejia for reasons of local sourcing and adoptability to the local climate.

4.20.4 Basin-wide Measures

Although most of the proposals are aimed at coping with the flood menance within the Hadejia Urban area, basin-wide regional measures are important components of long term strategies for coping with the menace of floods - this is more so as the Hadejia river cut across political and hydro-geological boundaries.

It has already been discovered that although various state and federal government programmes of regional irrigation, flood control and afforestation exist within the Hadejia - Jamaare river basin (figure 4.3), they are not deliberate and well co-ordinated efforts with the definite aim of flood control on basin wide basis. They are more or less geared toward irrigation or afforestation needs.



FIG 4.3
HADEJIA - JAMAARE
SOURCE: H.J.R.B.R.D.A.

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for a more regulated channel flow of Hadejia river during high waters and thereby help minimise the flood hazard in Hadejia town and other settlements. Many stream gauging sites, both proposed and existing were discovered in the course of the research, it is proposed that they be streamlined for proper forecasting and warning about hydrological events along Hadejia and other rivers within the basin. Proper monitoring of river flows or gauge level of rivers as (in figure 4.4) can serve as the basis for transfer of vital information relating to floods from upper stream stations to those down stream who will then disseminate the information to local authorities and flood plain inhabitants. Stream gauging site at Wudil up stream along Hadejia river can provide warning to the Hadejia station down stream for possible preparedness in the event of flood threat.

4.30 EMERGENCY MEASURES

4.30.1 Flood Warning and Forecasting

Among the emergency measures necessary for coping with flood disasters is the use of regular weather bulletins which should be relayed to the inhabitants as recorded by hydrological stations. Public information vans provided by the local authorities can be useful in this regard, so also

AVERAGE HEIGHT OF RIVER HADEJIA AT WUDIL AND HADEJIA GAUGE STATIONS

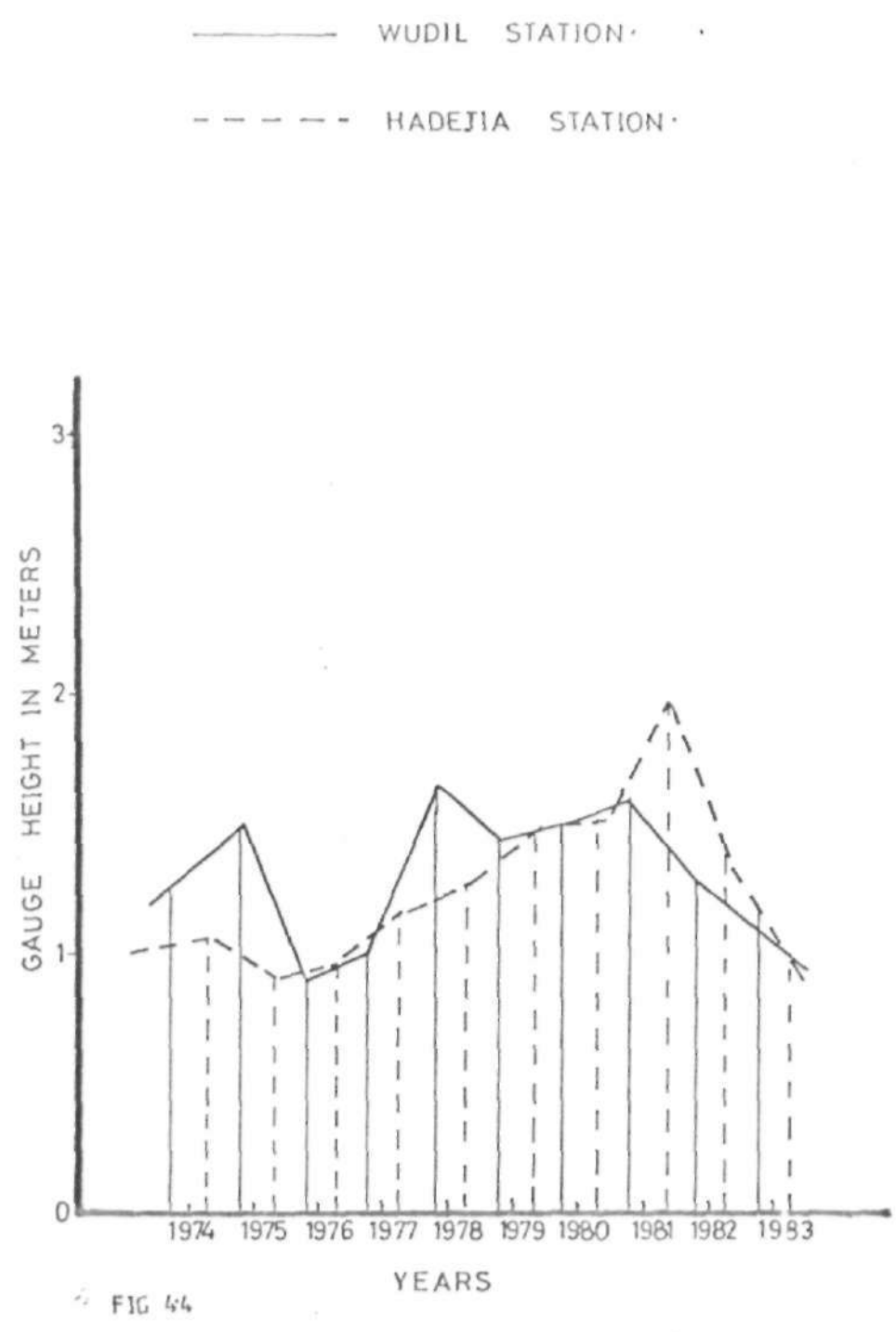


FIG 4.4

Source:—FIELD SURVEY 1989.

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MSc.II URP. '88/89.

Radio and Television. What has been observed in the course of the research is the virtual absence of such well articulated flood warning and forecasting programmes. The system of flood warning and forecasting service along the Hadejia river need to be operated in conjunction with the main meteorological Department serving the region at the Aminu Kano International Airport. Under this system, comprehensive information can be provided on the Hadejia river heights and that of other rivers within the system, Dams such as Tiga, Bagauda (as in figure 4.5) and Barrages like the proposed one at Auyo to the West of Hadejia along Hadejia river. All these information shall be given periodically over local mass media. Since the rainy season in the area begins in May, the proposed warning and forecasting should be in particular state of readiness during the period especially in the peak rain periods of July and August up to the end of the rain season in September. A typical frame work of a warning system is that of UNDRO (1979) shown in figure 4.6.

4.30.2 Evacuation and Relief

As a result of the local Geo-physical characteristics of Hadejia, flood emergency situation

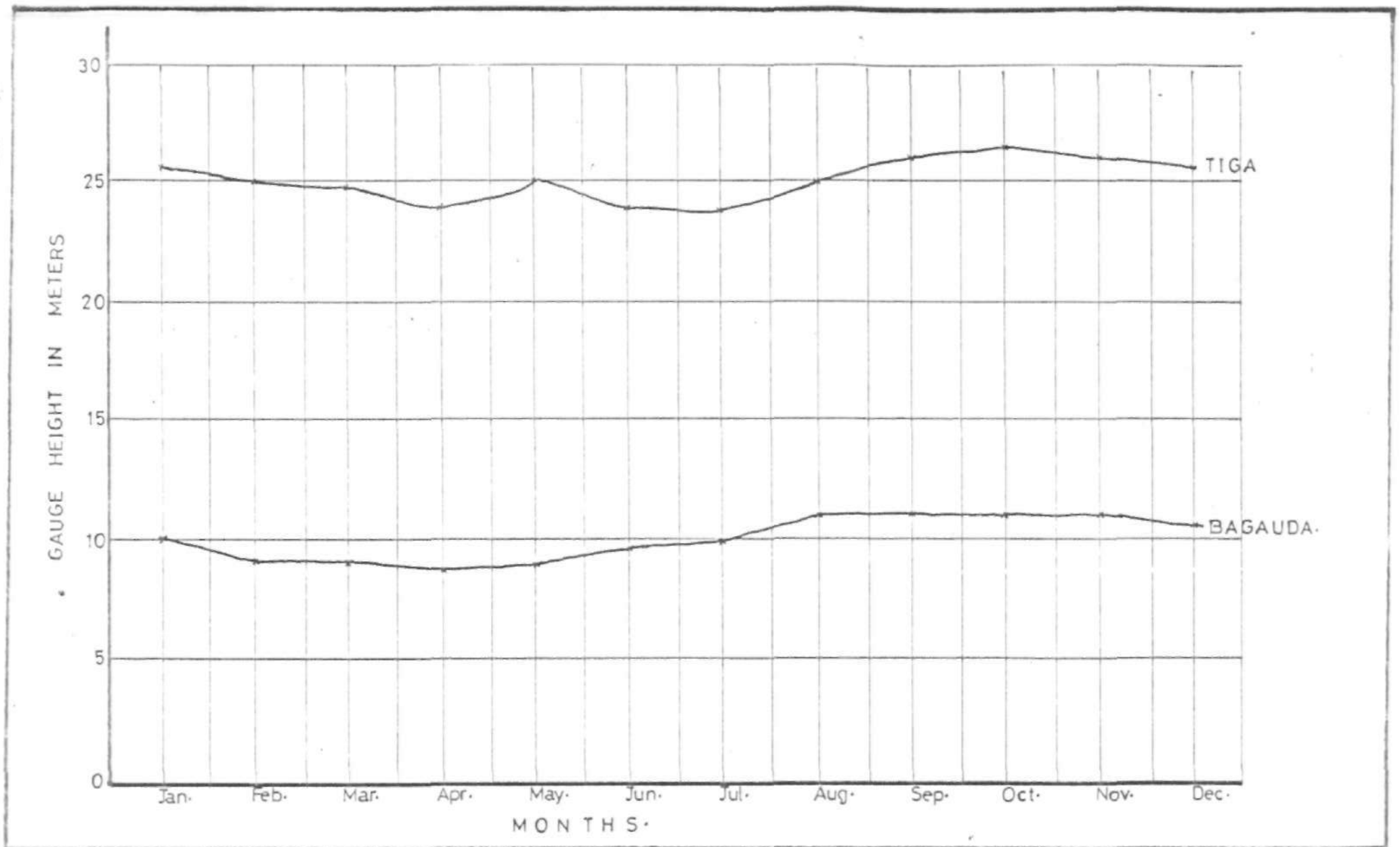


FIG 4-5 AVERAGE GAUGES OF TIGA AND BAGAUDA DAMS BY MONTHS 1983

Source:— FIELD SURVEY 1989.

ALH. ISA GARBA.
MSc 11 URP. '88/89.

cannot be ruled out despitek the viability of the measures so far enumerated. Contingency plans are therefore proposed as part of a comprehensive physical planning strategy to cope with flood disasters in the study area.

Flood fighting and evacuation of affected people and relief measures in a well co-ordinated manner is highly required. In line with the already observed trend, such efforts need to be co-ordinated between the people of Hadejia and the various tiers of governments. A specific proposal here is for the setting up of Kano State and local task forces which will go into action when floods break out. There is the need for contingency plans to make sure drainages in Hadejia are clean and take only the volume of water or discharge they were constructed to carry. Such task force as also suggested by Osenuga (1989) following the 1988 flood disaster, shall consist of experts in meteorology, Topography and engineering. It is proposed that the Kano State Fire service, self help groups and medical services also be represented on the task force. In putting forward the various proposals, consideration was given of the need to link the measures to the need to cope with flooding

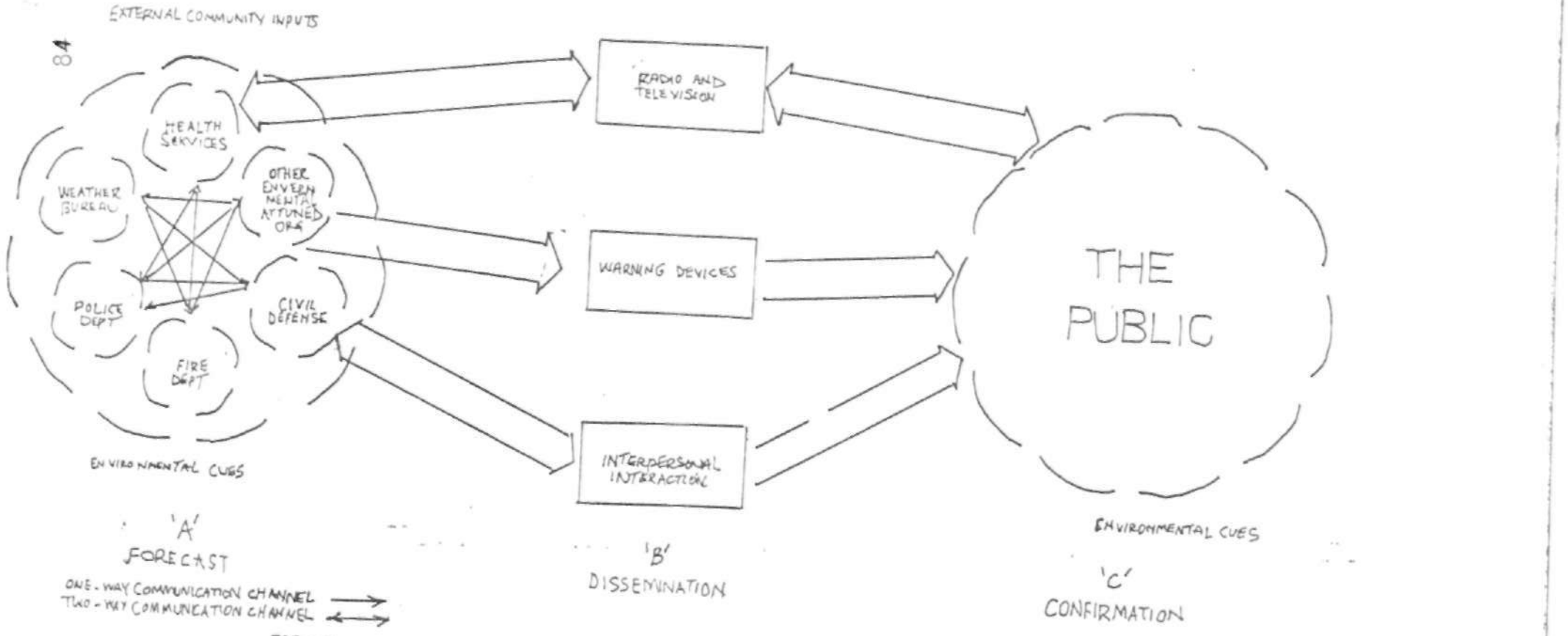


FIG 4.6

FRAMEWORK OF A WARNING SYSTEM

SOURCE: UNDRO(1979)

A. GARBA ISA
MSc II URP '89

as it relate to the study area. Specific references are made as to the institutional aspects of the proposals and related issues which shall be elaborated in the next chapter which deals with the implementation and management components.

CHAPTER FIVE

5.00 IMPLEMENTATION AND MANAGEMENT

Implementation and management is a very vital component of every comprehensive plan. It facilitates the actualisation and survival of plan proposals. The implementation and management aspects of the research report on the flood problems in Hadejia covers wide range of variables; landuse, emergency measures, engineering, the distribution of responsibilities between the people and the various tiers of government and the issue of costing and phasing for the major projects and programmes.

5.10 Landuse Regulations

Landuse planning and regulation is the central element of the research proposals whose successful implementation will have the most far reaching impact in the flood prevention effort. The study area is one of the declared urban centres in Kano State and is thus under the planning jurisdiction of the urban development Board (UDB), the board is therefore proposed to implement the landuse regulations contained in the report. Additional support for the landuse regulation measures is proposed to be provided by the Federal Environmental Protection Agency (FEPA) whose functions as contained in the

National policy on the Environment includes the prevention and mangement of natural disasters such as floods, drought and desertification. It is also in line with the Agency's programmes of landuse and soil conservation which among others seeks to establish guidelines for landuse and soil management and the necessary framework to implement them.

The landuse regulation shall cover the existing tools of planning control such as building regulations, subdivision regulations and zoning ordinances in view of the flood prone nature of the area to obtain optimal use of the land for sustained flood prevention effort. The implementation bodies of the regulations shall also marked out the physical extent of the proposed zones on the ground and provide detailed guidelines to guide development. Such details includes aspects as water surface elevation for structural protection from flood inundation etc. Legal tools of the urban development Board as the "Building Regulations of 1988" need to be strengthened and vigorously enforced. An additional impetus has however been given to the U.D.B. with the amendment of its edict

of 1976 following the flood disaster of 1988. The board is now also responsible for Environmental protection beside its traditional role of urban planning under the new name of "Kano State Urban Planning and Environmental Protection Agency" (KASUPPA). A very important recommendation here is that the building regulation for structural developments in Hadejia in particular requires building plans to be cleared by relevant building engineers before they are endorsed by planning officials.

The regulatory body shall also ensure that buildings are raised above the expected flood elevation for each zones as shown by zoning map and the flood profile of a section across Hadejia river or as may be dictated by land elevation at a particular location. It is also recommended that structural plans be checked to ensure that such aspects as grading and storm drainage proposals are adequate to accomodate storm water run off among other necessary details.

5.11 Engineering Controls

There are certain agencies of government which are engineering-oriented. They are therefore recommended to implement the engineering components of the research proposals under the relevant guidance of the planning authority. The engineering aspects covered include flood embankment, channel improvement and construction and management of flood control Dams and reservoirs as well as flood control afforestation programme.

The agencies recommended to carry out these vital aspects include the Kano State Ministry of Works, the State Water Resources Agency (WRECA), the Hadejia-Jama'are river Basin and Rural Development Authority (H.J.R.B.D.A.) and the..

Kano Agricultural and Rural Development Authority (KNARDA). Other agencies as the federal Ministry of Works, Geological Department, State Survey Division among others will be involved for their relevance to physical planning. Qualified physical planners are recommended to provide necessary co-ordination and supervision in the implementation programme.

5.12 Flood Emergency Relief

In order to effectively cope with emergency situations as a result of eventual flood occurrance in the area, the report recommends an emergency relief component. The proposed flood emergency relief system is also in line with the national policy on the environment (1989) which among others provides for the mounting of "programmes to predict natural hazards and for developing methods of their prevention" (p.9).

The emergency relief programme shall be able to provide an efficient mechanism which will facilitate evacuation and relief support for victims of flood disaster impact in the area. Necessary assistance from the federal bodies i.e.

the Federal Environmental Protection Agency and the National Emergency Relief Agency shall be channeled through the State emergency relief Agency and the proposed "State permanent committee on disaster administration". The proposed committee shall be under the political leadership of a State commissioner and the technical co-ordination of a physical planner with membership drawn from relevant environmentally attuned organisations. The Zonal planner for the study area shall provide the necessary technical co-ordination at the local level in conjunction with the local authorities. The Hadejia Zonal planner need to be equipped with necessary facilities and power to give directives to emergency workers on evacuation centres, alternative routes and services from his documented records.

The existing state emergency relief Agency shall be well-equipped and clearly organised in such a manner that it will be ever ready to meet the challenges posed by emergency situations. The agency shall provide immediate financial assistance to provide basic relief to victims of flood and related disasters. It is proposed that

all relevant bodies engaged in emergency works be technically equipped and placed in clear state of preparedness for prompt response to emergency situations.

5.20 Implementation Framework

In line with the national policy on the environment (1989), the report proposes an implementation strategy which seeks to encourage inter-sectional co-operation, involving all tiers of government. This will allow for comprehensive and well co-ordinated programmes of prevention and management of flood and other natural disasters and the integration of population and environmental factors in national development planning (p.7). There will thus be a consultative join action involving appropriate public and private institutions at federal, state and local levels.

5.20.1 The Community

The history role of the local people of Hadejia in flood control efforts has already been identified in the course of the research. It has been established that the peoples self help spirit provide the most important stimulant to their efforts in flood control works. This was clearly observed during the disasters of 1942, 1963 and even

that of 1988, the most recent. The peoples understanding of the need to respond to the flood threat need to be fully recognised and augmented by vigorous efforts to convince them that flood disasters in Hadejia are serious enough to justify the application of landuse and other control regulations and that particular regulations proposed in the research are fair and reasonable. Local government and the state administration have to effectively utilise this source of the most reliable and cheaper manpower for immediate response to the physical threat of the flood waters.

5.20.2 The Local Government

Another important element of the implementation framework for flood disasters control in Hadejia proposed in the report is the local government. The existing involvement of the Hadejia local government in flood alleviation such as purchase of latente for embankment, need to be effectively streamlined. The local government shall work collectively with the traditional institution notably the emir and his council. The local government is to serve as the basis for taking the most immediate official actions in the case of the floods.

The local government need to be in constant contact with other local bodies to co-ordinate flood alleviation measures in the periods before during and after flood impact. Most importantly, the local government is proposed to organise local flood warning and evacuation in concert with other relevant bodies. Other important functions proposed for the local government are those of organising relief centres, food and clothing distribution and possible financial dispensation on immediate basis pending the arrival of additional, more enduring support.

5.20.3 The State Government

The role of the Kano State government is to basically evolve a state-wide policy on flood disasters control. Flood disaster planning strategies to cope with the flood menace on long term basis is recommended. The state government is the third level of decision making within the proposed framework. The proposed state co-ordination task force on flood and similar disasters shall be fully prepared and equipped to face the challenges and to be able to evolve practical measures to help cope with the anticipated flood problems. The State government need to put all

necessary machinery in motion to respond to emergency requests from the local governments.

5.20.4 The Federal government

The agencies set up by the federal government to respond to urgent environmental problems need to be effectively utilized. Notable are the federal environmental protection agency (FEPA) and the National emergency relief Agency (NERA). There is also the national committee on the environment and the national committee on ecological disasters among others.

It is suggested that the federal government take necessary steps to put these measures within the framework of overall physical planning. A broad urban and regional planning package for disaster control is suggested. Mapping of flood-prone areas such as Hadejia will facilitate proper analysis of the magnitude of the problem and its locational variations.

The federal government operated Dams and reservoirs such as Tiga within the up stream of Hadejia river need to be properly maintained and their irrigation and water supply activities integrated within a conscious flood disaster control

programmes especially for downstream areas of Hadejia. The federal government owned meteorological station at Kano Airport as a component of the national weather service, need to be fully geared for positive role in flood forecasting and warning in Hadejia.

The proposed state and federal governments' intervention in flood disasters control in Hadejia, beside specific projects such as reservoirs, embankments etc. involve continous administration of the measures. Local, state and federal agencies need to order their agencies in the study area i.e. Hadejia, to evaluate flood hazards in locating their owned or financial development projects. In the general landuse regulations, which form a very crucial component of the physical planning proposals, the federal government need to take the lead.

5.30 Co-ordination

There is the need for co-ordination by local, state and federal governments in the flood control programmes for Hadejia. This is to ensure the most viable realisation of the proposed plan

and in a much more comprehensive manner. It is recommended that the federal government finance 50% of the proposed projects, Kano State government 35% and the Hadejia Local government 15%. The local people shall continue to contribute their communal labour and voluntary material and financial support.

The proposed framework for flood disasters control are quite imperative to achieve a well ordered and continous overall administration and the establishment of sense of responsibilities among the people and the various tiers of government. They are also necessary for co-ordinated action and planning. This is however without prejudice to their probable (temporal) side tracking amidst the confusion of an emergency situation.

5.40 Phasing and Costing

The programmes of phasing and costing for the proposals are in line with the 3-year rolling plan system of the government. Under the proposal therefore, any project for which there has been no expenditure in the outgoing year automatically

roll over into the coming year. The proposals themselves contain some of the basic components of a typical rolling plan such as project particulars, project cost showing estimate of each project, capital costs broken down into components as buildings and equipments etc., list of materials required for the projects and technical assistant required.

The proposed projects have their base year, 1990 and the terminating year 1999. In the spirit of new national plan each project phase is to cover a 3 year period. This means all the proposed projects would have been completed by the year 1999 all things being equal. The contract cost of the proposals were worked out using the current rates of the Kano State Ministry of works. They were worked/out as follows;

A - For embankment: Digging and loading of soil plus haulage, about ₦15.00/m^2 plus 30% addition for machine repairs.

B - For channel improvement: soft soil excavation to the depth of 3 meters, 120 metres width, plus 30% addition for machine repairs.

The phasing plan is limited to the major civil works involved in the proposals because of the huge finances involved and governments' budgetary committments in other demanding sectors. Other proposals cannot be phased because of their continous administrative nature. The estimated total cost of the projects for all the phases is about ₦37.3 million. The details for each of the 3 phases is given below.

(i) First Phase, 1990-1993:

This is the commencement phase of the proposals contained in the report. It is proposed to cover the areas to the immediate southern parts of the walled town covering a total of 3 kilometers along the river course, that is 1.5 kilometers to the east and west of the centre of the southern fringes of the walled town along the river. It involves the programmes of flood embankment and channel improvement. The approximate area coverage of the projects is shown on the map of phasing for Hadejia (figure 5.1). The estimated cost of the projects in the phase is about ₦11.2 million.

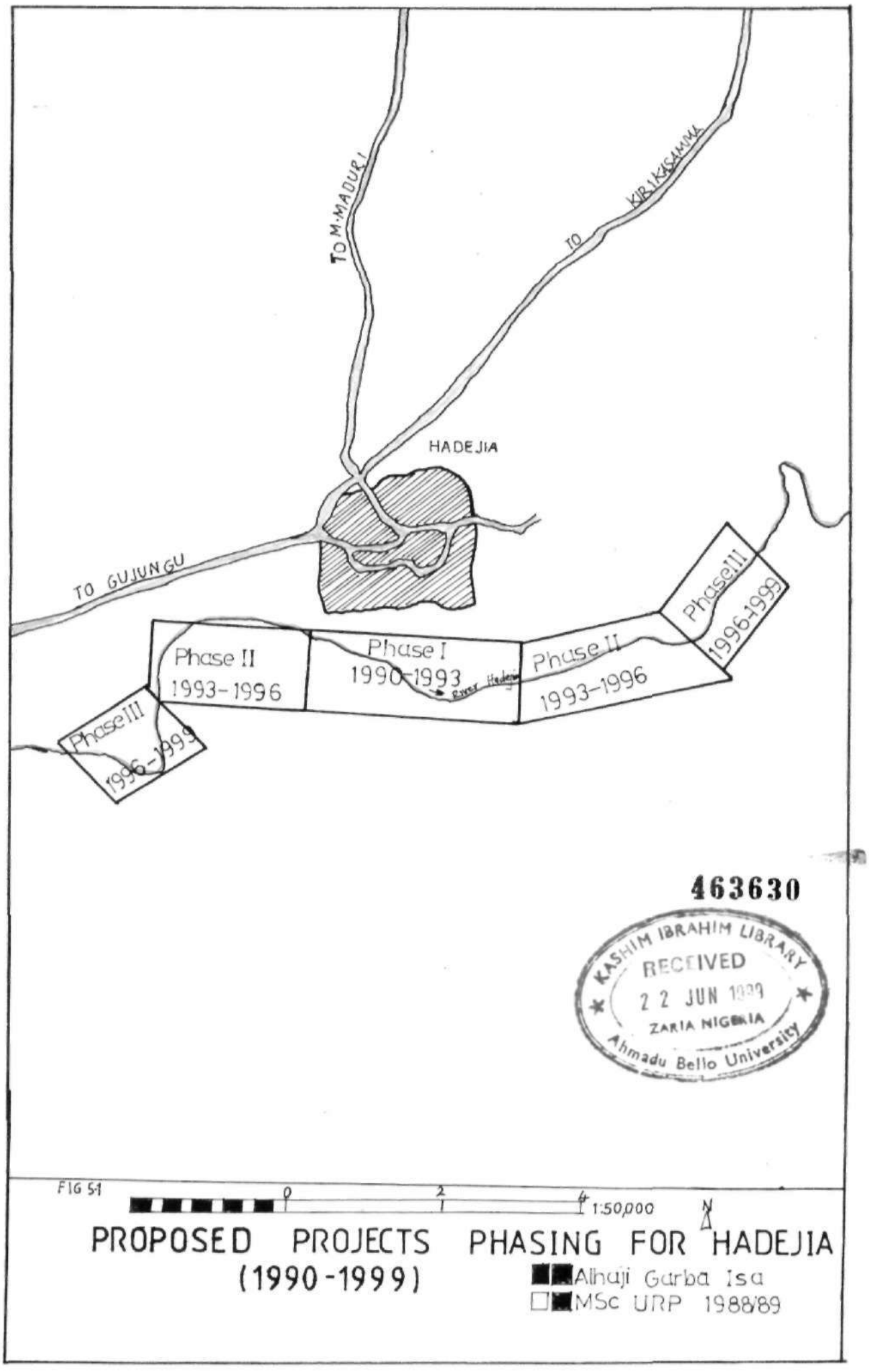
(ii) Second Phase, 1993-1996

The second phase in the projects implementation covers a total of four kilometers (2 kilometers to the immediate east and west of the phase one). It also involves flood embankment and channel improvement programmes. The extent of the area is also shown on the phasing map (figure 5.1). The estimated cost of the phase is about ₦15.9 million.

(iii) Third Phase, 1996-1999

This is the terminal phase for all the proposed major civil works along the river course in Hadejia urban area. It covers the remaining 3 kilometers of the approximate total of 10 kilometers urban reach of the town which the projects is envisaged to cover. Under this phase, a distance of 1.5 kilometers is to be covered on both sides of the previous phases. The estimated costs of the projects in the phase is about ₦11.2 million. It also involve the cost of flood embankment and channel improvement.

The relevance of costing and phasing cannot be overemphasised because of the need to implement projects in a systematic manner



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FIG 5-1

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PROPOSED PROJECTS PHASING FOR HADEJIA
(1990-1999)

Alhaji Garba Isa
MSc URP 1988/89

and because of the governments competitive financial commitments. This makes it imperative for projects with big financial involvement to be broken down into phases.

5.50 CONCLUSION

The main theme of the study has been the need to cope with the increasing menace of flood disasters. It has been observed in the course of the research that complete elimination of the flood threat particularly in riverine areas as Hadejia which is the study area, cannot for practical purpose be feasible. The main concern of the study which seek to face the issue of flood disasters from the physical planning view point is how to achieve efficient use of flood plain. This efficient use required is that accompanied with minimum flood losses or flood occurrences at minimum cost of management. A number of proposals were put forward based on the observed geographical, historical and administrative realities in the study area in the forms of

landuse and flood control measures.

A very important fact brought to sharp focus in the course of the research is the increasing need for physical planners to face up to the challenge of flood disasters. This is more so because of the flexible, wide ranging nature of the physical planning measures for flood control in flood prone areas before during and after the occurrence of the events. The flood study on Hadejia has re-enforced the need for planners to view flood as a phenomenum which need to be clearly understood, and in particular the most appropriate measures to cope with each particular incidence.

Physical planning approach to flood control rather than concentrate on 'corrective' engineering works, seeks to achieve a continous and elaborate flood plain management. That was a very vital driving force of the research effort, hence the caption "problems of flood disasters in Hadejia: a physical planning proposal".

13. Kano State Government (1988): White paper on the Report of the joint Committee on flood Disaster, December, 1989.

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