ENVIRONMENTAL IMPACT ASSESSMENT OF BOSSO AND KATEREN-GWARI DRAINAGE

BY

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DECLARATION

I hereby declare that this project tilled "Environmental Impact Assessment of Boos and Kateren-Gwari Drainage" is my own work and have not been submitted at any University or Institution. All published and unpublished works of other authors have been acknowledged.

JIBRIN IBRAHIM A.M

8/4/2002

DATE

CERTIFICATION

We certify that this research work was originally carried out by JIBRIN IBRAHIM ALH. MOH'D PGD/GEO/2000/2001/144 and approved as meeting the requirement for the award of post Graduate Diploma in ENVIRONMENTAL MANAGEMENT TECHNOLOGY in Geography Department, Federal University of Technology, Minna, Niger State, Nigeria.

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DEDICATION

This project is dedicated to God who made and control all things for his love and mercy. And to my family for their co-operation and understanding.

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Finally, I thank the Almighty God for his stead fast love in seeing me through and who has been faithful even when I am not faithful to him.

ABSTRACT

Construction of drainage play a vital role in our daily lives both directly and indirectly in terms of their importance. Therefore the need to study their environmental impact assessment need not to be given a second thought because it will go along way in assisting us. The mode of construction and techniques to combat the effects. In this study, aerial photographs and topographic study were used to acquire the basic information on the drainage basin. These photos were interpreted manually and the information acquired were observed and analysis. The effect of climate change on the area, is looked upon and environmental pollution to the drainage and its implication as well as vegetation cover to the drainage area in the down stream location are not supposed to be given a second though because this will assist in the monitoring of such river channel.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 ENVIRONMENTAL IMPACT ASSESSMENT FOR SUSTAINABLE DEVELOPMENT

It is now common knowledge that human activities tend to upset the balance, harmony and interdependence of the whole environment (UNEP, 1972). The causes of most environmental problems have their origins in the development process or in its failure and inadequacies. Technology advancement and increasing industrial production to satisfy human needs and comforts and so improve on civilization and human life styles have created unexpected adverse side effects. Man and nature have been at odds since the industrial revolution and especially in the country (Odiette W. O. 1999).

Although the impact are both favourable and unfavourable we have to weight the two and decide whether to develop or not or choose alternative sites where the adverse environmental impact are minimal.

United Nations Conference on Environment and Development (UNCED) 1992 has identified the following global adverse environmental impacts which have caused deterioration of the planet earth due largely to developmental processes: eutrophication, acid precipitation, ozone layer depletion, deforestation, Desertification, soil erosion, global warming, climate change, air, water and pollution, from toxic and hazardous industrial wastes, depletion of natural resources stock, land degradation, ill-health and death (human), loss of bio-diversity and loss in beauty and aesthetic value of the physical environment. It is therefore imperative that development be integrated with environmental considerations. World Commission on Environment and Development (WCED) drew attention of the world to the need to make development and environment

to be complementary (WCED, 1987). The commission's work culminated in the concept of "SUSTAINABLE DEVELOPMENT in a process in which the exploitation of natural resources and present means of achieving development do not reduce or limit the potential for meeting the needs of future generations."

Environmental Impact Assessment (EIA) is a process or study in which the potential physical, biological, economic and social impact of a proposed development on the immediate and more distant environment are identified, analysed and predicted it ensure that potentially significant environmental impacts are satisfactorily assessed and taken into account in the planning design, authorization and implementation of all relevant types of development projects.

Any environmental damage runs down capital, which sooner or later reduces the value of its recurrent services (Odiette W.O 1999). The level of environmental use should therefore be such as to sustain or preserve the environmental capital. Economic, fiscal, trade energy, agricultural and industrial policies should be designed to bring about development that is economically, socially and ecologically sustainable.

1.2 BACKGROUND TO THE DRAINAGE SITUATION

Man as a living thing do depend on water availability for his survival and as well as for other activities on the surface of the earth present of these water in both temporal and spatial aspect determines the location of human concentrations. Fluctuations of these water supplies have been an out standing problem to human activities and threat to life. Flood is considered as one of the greatest natural disasters on earth. Even among the advanced nations of the world, flood has remained a major problem, despite advances in atmospheric sciences. In the third world countries, the problem is worse, even though in

some regions like West Africa, the weather producing systems are of relatively less severe types.

The problem of flood in most under-developed nations is a compounded one. The lack of proper weather and climatic forecasting techniques, coupled with unplanned land use has resulted in the continued enslavement of many nations to the catastrophes of floods. (Salihu 1998).

1.3 STATEMENT OF RESEARCH PROBLEM

Drainage is cause as a result of excessive surface runoff of flood. A drainage basin is subjected to flood only when its infiltration and water holding capacity is exceeded (Wisler et. al; 1959). This means that all the factors that affect runoff in a drainage basin are basic causes of flood.

Factors that affect runoff and hence stream flow-in a drainage basin fall into two classes;

(a) Those that determine precipitation characteristic such as type, intensity, duration, including others that modify the precipitation effectiveness like evaporation, interception infiltration e.t.c.

(b) Those that determine basic characteristics, such as shape, elevation, slope, nature of underlying bed, land use etc. (Wisler and Barter 1959).

Low infiltration rate therefore, as its affect runoff in the drainage basin plays significant role during flood season in the study area. The problem have therefore is to find the excite thing that happened at the down stream of the drainage, the effect it has on the people living at the down stream area and the activities that are taking place at the drainage due to flooding.

1.4 AIMS AND OBJECTIVES

The main aim of the work, is to find out the environmental impact assessment of drainage in the down stream. People living in low-level of Bosso drainage and Kateren Gwari drainage are affected so much by these drainage, and these will be achieved through the collection of data and analyzing these data by statistical parameters, to solve the environmental impact assessment of those people.

The specific objectives of the study are;

(i) The Geomorphic aspect of data down stream of the study areas.

(ii) The water quality of the areas

(iii) Human activities at the down stream area due to drainage.

(iv) Disaster diversity in the areas.

1.5 JUSTIFICATION FOR THE STUDY

This project work aims at providing a much better information on the activities that are taking place at the down stream of drainage's and how to combat those problems that are existing, for better future planning.

The activities that are taking place now at the down stream area, is as a result of the drainage that is construct in some part of Minna without taking cognisance of the those people living at the down stream area. And when drainage is constructed one problem is solved leading to another problem created.

Before the construction of the drainage system in Minna Municipality, there use to be frequent flood occurrence every year, such floods normally leads to loss of lives and properties, the worse of those flood is that of 1984 which claim so many lives and

properties and these is what give rise to the construction of drainage system in Minna in 1987.

Since the completion of these drainage's the people at the down stream has been affected in one way of the other by these drainage(s).

(i) The normal route has been destroy by drainage

(ii) The topography of their land has been change to a different form.

(iii) Farming activities at the down stream becomes impossible too.

(iv) There drinking water are also affected

(v) The bank of down stream drainage becomes widening.

In light of these reasons, this project would attempt to provide possible solutions to these problems when strickly adre to through the information that will be gathered.

1.6 THE STUDY AREAS

For this project work, the study areas would be confirmed to Bosso and Katere Gwari both in Bosso and Chanchaga Local Government Areas respectively.

In Bosso town (upstream) passing through FUT temporary site of Bosso, down to the north south of Bosso (Down stream) the drainage is constructed from Dual carriage way that passes through Bosso from Minna to Maikun-Kele. And the constructed drainage terminate at the south west of the university wall fence. Upstream of these drainage is not constructed and took its cause from Bosso hill some metres away from the standing point of the constructed drainage and down stream of it is a road from Bosso town to area called Hanyan Gwari that linked Okada road Via Bosso locust and estate as well as type 'B' quarters.

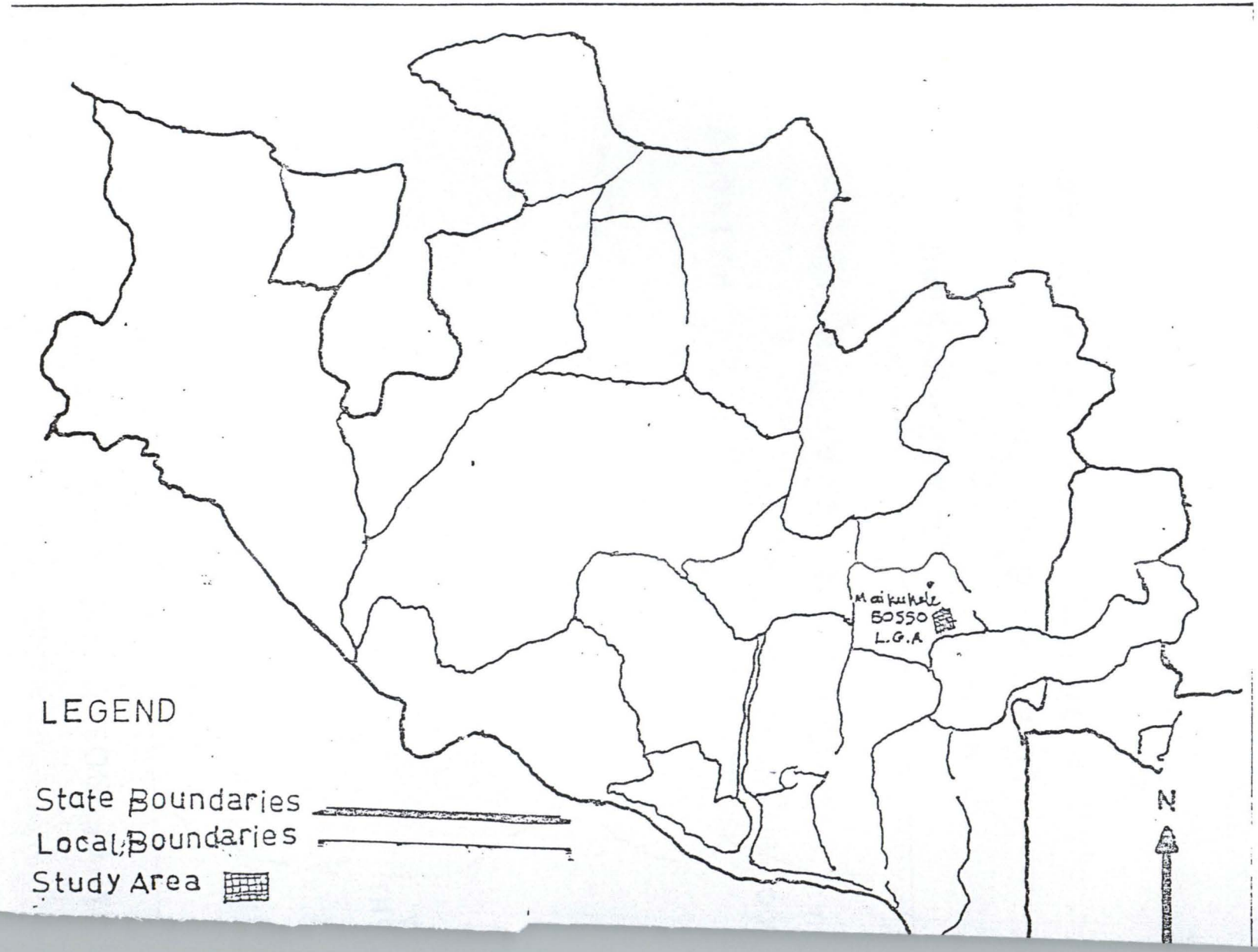
While that of Katere-Gwari took is cause in two tributaries; first one is from the Yoruba road area, at the back of Minna general hospital and the second one is from F-layout ruing via I. E. T down to Limawa area to the airport quarters were that of Yoruba road meet the one coming from F-layout area and both passing south of Ketere-Gwari down to mechanic village. The drainage terminate about 100 metres away from Minna-Bida road.

1.7 SCOPE AND LIMITATIONS

This project work is to look at what happen at the down stream of the two drainage's i.e Bosso and Katere-Gwari drainage. It limit itself to the activities that take place at the down stream and the impact it has on the environment for the people living at the down stream area.

With the limitations mentioned above however, it is hoped that the work would provide useful results in accordance with the stated objectives.

MAP OF NIGER STATE SHOWING THE STUDY AREA



CHAPTER TWO

2.0 LITERATYURE REVIEW

2.1 OVERVIEW

Over the years geomorphologists and hydrologists have devoted time and effort through various methods and techniques to the study of drainage systems and their evolution. Hydrology involves the movement of water and under the land surface, but also include a variety of geomorphic, geochemical and biologic processes that depend upon the storage and movement of water. The reasons for such studies were;

1. Obviously, the drainage system is a major feature of the physical landscape and it does much in determining the essential character of the landscape.
2. Evolutionary studies of drainage system may afford valuable information about the denudation history of the area if is useful to attempt a reconstruction of the initial form of a river system in order to have evidence of the nature and mode of origin of the land surface.

Environmental effect of the drainage system down stream location of Bosso and Kateren-Gwari which shown that the attention of the channel cascade system has triggered of a sequence of interrelated morphological and ecological changes in channel and in the low terrace, increasing the mean depth of gully mouth at the down-stream location of the two drainage system. Therefore one can said that the two drainage system down stream location has not received adequate attention on environmental effect of studies.

2.2 STUDIES INITIATION

It is difficult to know what initial surface were like, but they are usually assumed to be irregularly hollowed so that stream developed leading to the hollows, which become ponds or lakes and then over spilled into hollows lower down. The two segment of the stream so initiated would have had different origins.

The first would require enough concentration of run-off for a rill to develop.

The second is merely the overflow of a mass of water, which a stream starts from (sparks 1972). Over land flow occurs when the precipitation is so great that not all of it can infiltrate into the soil. The infiltration capacity of the soil is governed by its permeability which is a function of its depth, its distribution of particles sizes, any cracking that may be present in it, any prior saturation or wetting which still affect it as suggested by Horton (1945). In his model of over land flow it is likely vegetated area and far less capacity of vegetation. The dominance of through flow helps to understand a number of features water lakes a long time to reach streams, with the result that through flow acts as a strong regulating mechanism on peak flood discharge.

Overland flow occurring rapidly and simultaneously through small drainage system will cause high peak discharges and high erosive potential in streams. The presence of through flow mean that the rill and gully network required for the drainage of humid temperature areas is less dense than that required for the drainage of semi-arid areas in spite of their lower rainfall.

2.3 STREAM VELOCITY

Geomorphologically it is insignificant in streams being confirmed to the boundary layer at the bed and banks it is not possible for this type of flow to support suspended

load. Turbulent flow is much less regular and consists of a series of chaotic secondary addies superimposed on the main flow. The threshold flow takes place varies with the viscosity. It increases with increasing viscosity, but as temperature rises reduces viscosity, it is lowered by increasing temperature.

Two stages of turbulent flow may be recognised first is stream flow, which is the normal occurrence in stream. The second is shooting flow such as is found in rapids, it involves very high velocity and erosive potential.

As the turbulence itself is responsible for setting particles into motion, the energy required to over come function can not strictly be separated from energy used in transporting material, but in a rather artificial way it can be said that energy not transport of material. The amount is very small as it has been estimated that 96-97.5 percent is used in over coming friction.

Two quality of a stream must be carefully distinguished in this connection its competence and its capacity competence is measured by the weight of the largest fragment which the stream can transport and varies with the velocity in any given stream it is usually said to vary with the sixth power of the bed velocity. The capacity of the stream is measured by the total weight of material transported and varies with Calibre of load. It varies approximately with the third power of the velocity if a fair proportion of all grain sizes is available with a higher power if the material is source. The principle probably does not apply to the finest material as when a stream exceeds a certain specific gravity through the introduction of very fine material it is subject to totally different law of flow. A stream may be called fully loaded with respect to a given Calibre of load, when it is carrying all the material of that Calibre that it is able to move.

2.4 STREAM EROSION

Stream induce some what different problems, erosion lakes, ponds, where the stream has an excess of energy but excess of energy does not always result in erosion, just as it does not always result in transport. If the country rock is unconsolidated or weakly cemented, erosion may not differ greatly by from transport as individual particles may be lifted up by the turbulence near the bed of a stream. If the rock is susceptible is chemical erosion, the process goes on whatever the velocity of the stream but hard resistant rocks represent a difficult problem. If the stream is carrying a large bed load of coarse ground it is easily appreciated that such a load, by impact with the rock may loosen fragment. From it but many stream carrying mainly load in suspension and solution do not appear capable of eroding the underling rock except by solution. Even with a powerful stream transporting a large bed load a lot of preliminary work by other factors is probably necessary before the stream succeeds in eroding rock fragments most rocks have planes of weakness, joints, bedding cleavage or schistosity and the action of chemical weathering may well effect a general loosening of the fragments before the stream is able to dislodge them through impacts between the bed load and the rock. If they are sufficiently loosened, a stream of clear water may be able to dislodge fragment through the action of turbulence. The effect of which may be erosion upstream may be largely occupied with deposition downstream. There are probably two main reasons for this. The first is to be found in the normal decrease in gradient downstream, which loss of competence. The second is the result of the form of the valley, upstream, the channel of a river may well be bounded by comparatively steep hillside slopes, so that even a large flood discharge can be accommodated in a chemical of reasonable efficient characteristics in the lower reaches of a river however, a flood plain usually occurs, in the

middle of which is the actual river channel. The channels are usually not large enough to accommodate flood discharges and water sheds on to the adjacent flood plain.

As a wide sheet of shallow water, usually with a low velocity. It has a most inefficient form or cross-section and consequently there is considerable increase in the amount of energy transformed in over coming friction channel due from down stream is a reduction in both competence and capacity which leads to deposition.

A stream carrying capacity for suspended materials such as inorganic sediment a particular organic increase with increase velocity. Since sediment absorbs anions and cations, the concentration of many charged particles are directly related to the ability of the stream to maintain sediment in suspension.

Organism living in stream have adapted to turbulent flow most biota restrict their activities to the share and bottom zones of the stream for example, benthic algae attach themselves to the channel bottom to avoid being washed down stream. Small invertebrate animals called zooplankton live among the rocks and debris of the channel in areas where the velocity of the stream is reduced. On the other hand, any forms of free floating algae have adapted to turbulent flow areas by taking advantage of shallow, well lighted swirls for exposure to light as well spatial dispersion.

The probable importance of discharge in affecting the width of the stream to the width of the meander belt, factors other than discharge affect the width of the stream but general speaking the wider, the greater the discharge. The observation of Bates (1939) and probably the most comprehensive in this respect, the flow across the bottom from the concave bank to the convex one is supplemented by a return flow in the other direction at the surface.

a). Direction of current of greatest velocity in a meander

b). Helicuidal flow in a meander.

The motion is not absolutely at right angles to the current but must possess a down-stream component varying with the velocity of the stream. The result is a helicuidal or corkscrew motion which should tend to shift material from the concave bank to the concave bank, thus assisting in erosion on the outside and deposition on the inside of bends.

In small stream the laboratory material can be observed moving across the river from one bank to another, but whether this is due to helicuidal motion is not certain. Such flow takes place in distorted models and in channels which are very deep in relation to their width, but has not been observed in any part of the Mississippi system, which he has studies.

The energy possessed by any stream varies with the gradient of the stream surface and with the volume of the stream, but not all this energy is available for the erosion and transport of material from the bed and the bank (Sparks, 1972).

Part of the energy is transformed into heat in overcoming friction between the river and the sides and bottom of the channel or other world. Friction between stream and the wetted perimeter.

The amount of energy lost in this way will depend partly on the roughness of the bed and banks, increase. The friction with the banks and partly on the nature of the cross-sectional area of the channel. The efficiency of the cross-section form of the channel is often measured by a quality known as the hydraulic radius, which is defined as the ratio between the cross-sectioned area and the length of the wetted perimeter. The higher the ratio the more efficient the stream and the smaller the loss of energy due to friction. The

ideal form of the channel for the efficient discharge of water is one, which is semi-circular in cross-section, but very few channels have ideal shape.

CHAPTER THREE

3.0 DATA AND METHODOLOGY

3.1 DESCRIPTION OF ADTA

The data used in this study were acquired from various sources, such as aerial photographs, topographic map and other publish and unpublished literature materials and texts related to the study, as well as direct field visit.

3.2 RESEARCH METHODOLOGY

The method of data analysis in this study will mainly be aerial photographic interpretation. The aerial photographs of the study area are visually interpreted using both the pocket and mirror together with the knowledge of reconnaissance survey obtained.

3.3 RESEARCH INSTRUMENT

The instruments used in carrying out these research work are mirror and pocket camera for viewing the photographs and taking the pictures in a three dimensional perspective and images.

3.4 PHOTO INTERPRETATION

Features are observed in images in-order to detect in detail, recognised, and identify what they are. These features are classified and deductions are made which will serve as inputs in the decision making process. This studying of images is referred to as PHOTO INTERPERTATION. The observation made, are based on signal from the image and the amount and quality of the references that are stored in the interpreter's mind. The more knowledge about the study area and experience knowledge within the field of application, the more the information obtained from the image or photograph knowledge

on the study area can be acquired by actual ground truthing, which involves surveying the area. Also this can be achieved by using photographic maps of the study area.

The study of only the aerial photographs or imageries in an indirect way of collecting information about terrain, since changes are subject to occur in the area over time but all depends on the aim and purpose of the study.

When the imageries is studied, there is need to analys and judge the significance of the image characteristics that carries the information of interest, the image signal and interpretation element. The image signals are the basic image properties that assists in the process of detecting, identifying and classifying different features visible in the image. These interpretation elements can be either static or dynamic in character. The static element appear much the same in the imageries such as land forms, while the appearance of dynamic elements vary with the seasons, for example the plants or vegetation cover.

3.5 MERGING OF DATA

Aerial photographic interpretation process of an area demands much knowledge to the area in question. For this reason, aerial photographs and topographic map formed the basic of this study. These data types are then subjected to a procedure called data merging. The procedure involves placing together the two sets of data and making comparison observation to ensure a successful and accurate interpretation. The aerial photographs being at a bigger scale than the topographic map posed a problem in terms of differences in the data from the two sources. And as this affects the data merging process. The problem is solved by ignoring the small differences since they are inevitable. But maximum accuracy is maintained however possible to ensure that the aims and objective of the study are achieved.

CHAPTER FOUR

4.1.0 RESULTS ANALYSIS

This chapter is composed of the analysis and presentation of data collected from the aerial photographs and topographic study of the area. It is subdivided into so many sections: Hydrology, climate, vegetation, topography and pollution.

4.1.1 HYDROLOGY

The main courses of drainage take its source from North-south of river-Bosso orginated from Gboko hill and join river Hannum Locito which is tributary of river Tagwai. The suitable water is includes river Malendo, river Kontagora, river Eku, river Kaduna, river Chanchaga, river Gurara and Arunze system. They all drawn into river Niger at different points, many of these river systems are perennial but there are at present very scantly. The amount of water or rain water that infiltrates into the ground depends on the topography vegetation cover and human activities e.t.c each of these will tend to increase or decrease the amount of water that goes into the ground once water seeps into the ground.

4.1.2 CLIMATE

This part of the drainage is located in tropical climate which is characterised by two seasons in a year; (wet and dry season). The annual rainfall amount has been estimated to be between 1,200mm to 1,1300mm (Adefolahu, 1991).

The dry season lasts between the months of October and March. The long hours of sunshine combine with high radiative power across the study area resulting in high power

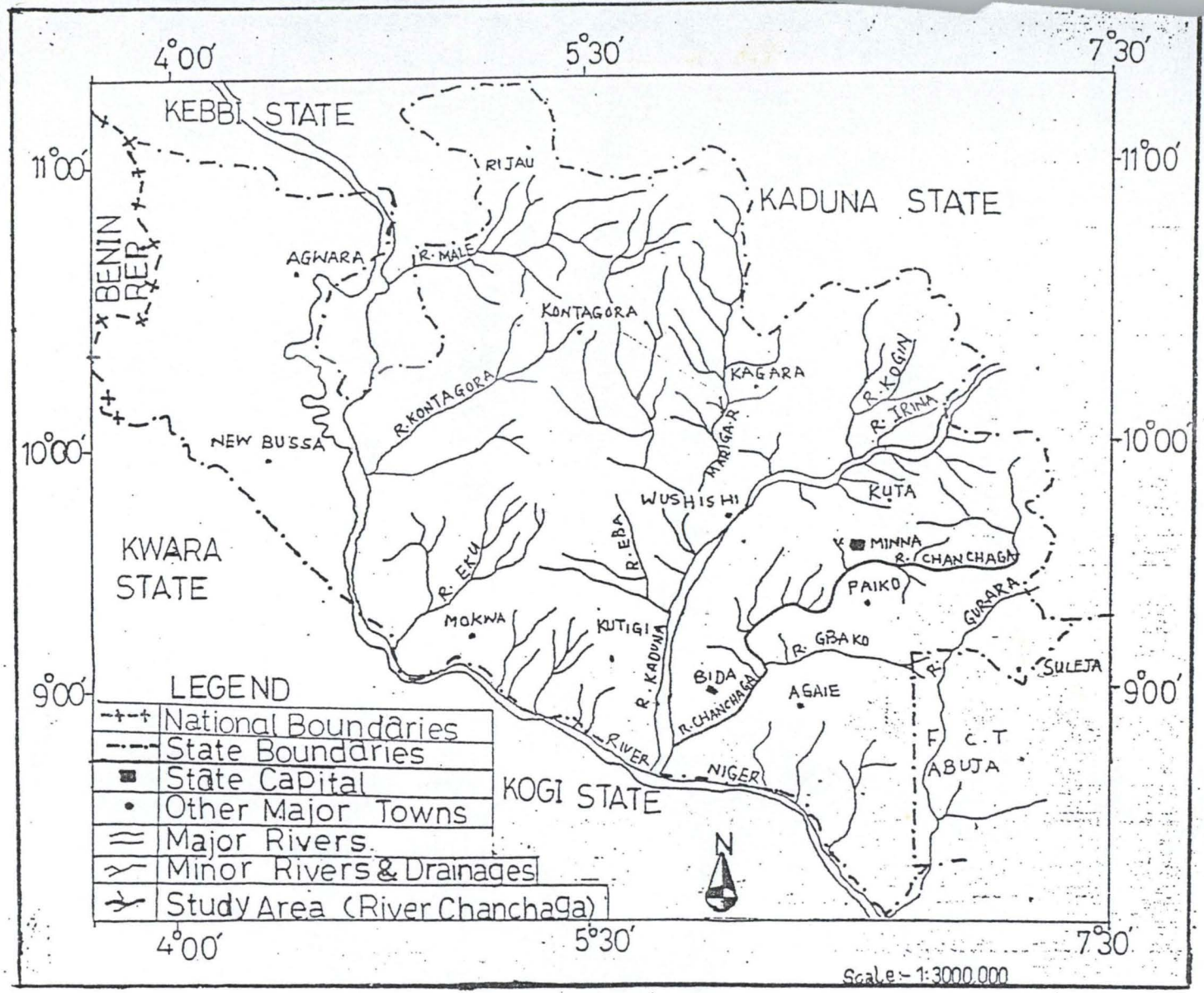


FIGURE 3·1:- HYDROLOGICAL MAP OF NIGER STATE

across the entire. The planning implications of these features related to water storage during the period when discharge exceeds recharge. The temperature varies within the region annually with the seasons. During the dry season temperature are low because the sun is in the southern hemisphere, minimum temperature below $20^{o}C$ are recorded during the hattanm period, that is late December and January in the following year.

4.1.3 SURVEY OFVEGETATION COVER

The vegetation type of the watershed is mainly the Guinea Savannah. There are marked differences, which occur at close intervals both the floristic composition and the open character of the vegetation, which is often caused by variations in soil type topography ground water situation and human interference. The vegetation is composed of mountain forest of mainly trees with The survey of vegetation cover was conducted using four cardinal point approach. The assessment procedure involves the selection of points within the study area and the subsequent division of such points into four cardinal points. Each cardinal point was surveyed serially and the contents were classified in term of the constituents were classified in terms of the constituents of the vegetal cover. The result were later tabulated for analysis.

4.1.4 DRAINAGE POLLUTION

Drainage's areas are susceptible to a greater range of environmental impact problems than any other place, because of the additional set of difficulties associated with highly developed subterranean networks and their associated fragile ecosystems.

Unfortunately all inhabitants of these areas are being particularly suited for the dumping of solid or liquid waste, because it disappears underground and out of sight is out of mind. The most important of the many impacts encountered is that arising from water pollution.

4.2.0 DISCUSSION OF RESULTS

The result acquired from the analysis of data obtained from interpretation of aerial photographs and the extraction of information from the topographic studies. The results were discussed on the basis of the significance and responsible factors of drainage effects.

4.2.1 CLIMATIC EFFECT OF DRAINAGE

Climate has both direct and indirect influence upon vegetation at the down stream sector of the two drainage's. Directly through moisture, temperature, sunlight and wind provide the climate environment of vegetation. Variation in any one of these can affect the significance of others; of the climate elements, moisture and temperature, whether by actual amount or seasonal incidence are usually of dominant influence.

Climate of these drainage's exert a dominant influence on soil formation, it occur by determining the intensity of weathering, leaching and rate of organic decomposition. Infact, specific soil forming processes are characterise by these climate influence. Organic matter and metallic cations are washed away from the soil surface and deposited in the sub-soil. The metallic cations which is washed away are entirely from soil profile

and the zones from which these materials are removed are called the alluvial zone and were they are deposited is called the illuvial zone.

Since the areas are in tropical region humid tropical chemical weathering proceeds at fast rate and the soil in these areas became deep and shallow. And all these have influence on PHYSICAL ENVIRONMENT. Relatively small climate change also cause a large water resource problems to the residence of down stream areas, especially that pollution has led to the scarcity of water to those area.

In addition to changes in water supply, water demand may also change through human efforts to conserve, and through improved growth efficiency of plants in a higher carbondioxide (Co_2) environment.

4.2.2 ENVIRONMENTAL POLLUTION

It is quite believed that air, water and land pollution have increasingly caused deterioration of our environment that it lacks the capacity to sustain some developmental process. Industrial activities relating to production of toxic waster, land clearing, stream and river dredging, petroleum exploitation and a host of other activities carried out by man aimed at solving his economic and social problems, pollute the environment.

Environmental pollution is therefore said to be the impairment of the suitability of the environment for any of its beneficial uses, actual or potential by man's activities such as land utilisation, building of industries, mineral mining, oil exploration and exploitation.

The major pollution that can be associated with these drainage's are stress to water and land pollution. Land were these drainage's are constructed are pollution by

constant disposal of solid waster (e.g. domestic refuse, and industrial waster e.t.c.) and chemical dumped on land. All these rubbish things that people don't want and disposed any how thereby polluting the land wastes from Nitrogen fertilizers use by people farming as well as mechanics and car wash people at the bank of the drainage's causes alteration in the dynamic equilibrium of the soil leading to the changes in the composition of macro and micro-organisms and soil-biochemistry. Drainage occur to the vegetation and to the water table if there is extensive percolation.

Water pollution, in its own case is the water that is not sufficiently of high quality to be suitable for the highest uses people wish to make of it at present or in future. Water in these areas are polluted by either chemicals or indiscriminate dumping of domestic and industrial waste on the ground or inside the drainage and when percolate in to the ground affect both the surface and under ground water. The polluted water has direct impact, on health in form of bacterial or viral disease, it also affect the ecosystem through which an impact on human beings may subsequently be felt. The formation of a film of oil in water bodies effectively present natural aeration, leading to the death of organism strapped below.

Under anaerobic condition, aquatic organism at the down stream of the drainage dies and aerobic microbiological processes are retarded, if at all they occur, other effects of water pollution are lack of fresh water for domestic use e.t.c and these can be stress to the BIOLOGICAL ENVIRONMENT.

4.2.3 FOUR CARDINAL POINT APPROACH TO VEGETATION COVER

This was an approach adopted in the assessment of vegetal cover of the study area. The four cardinal approach involved the selection of points within the study area and subsequent division each cardinal point was survey serially and the contents were classified in terms of the constituent of the vegetal cover and area of bare ground. The result was tabulated for analysis.

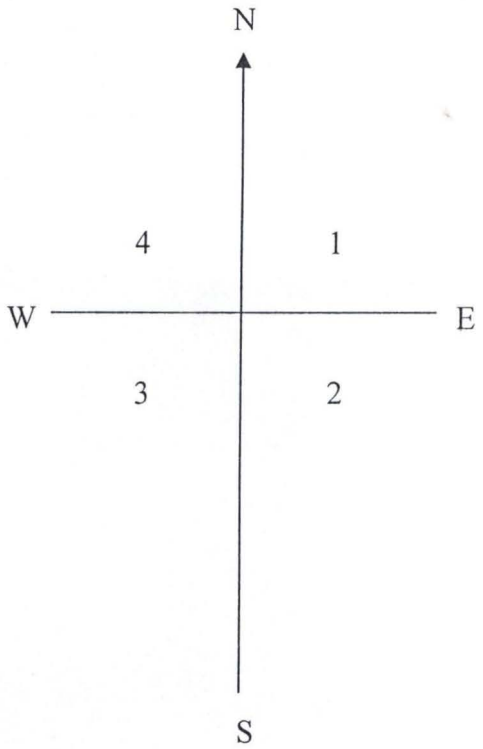
Total numbers of ten sampling surveys were carried out. Each of the 10 point was taken as sampling point view, all the environment as a complete circle it is divided into four cardinal points. Each sector was assumed to be composed of five types of vegetation namely shrubs, grassland, bare land, trees and farm land.

The result was tabulated as given below

Vegetation	Percentage
Shrubs	41.00
Grass land	3.18
Bare land	4.11
Trees	16.1
Farm land	23.99

See the analysis below.

CARDINAL POINT APPROACH DIAGRAM



Where 1,2,3 and 4
Are sectors were
Samples are taken for
Various vegetation.

The observers stand and imagine himself to be at the centre and rotate in circular form and assesses the vegetation. Below is the result obtained for various sector taken and the mean percentage recorded. And total of ten-sample point was taken and tabulated as shown.

Table 1:1

Sector	1	2	3	4	Mean
Vegetation					
Shrubs	55	52	27	30	41
Grasses	2.5	2.5	6.25	1.45	3.18
Bare land	1.45	2.5	6.25	6.25	4.11
Trees	10.25	24	10.15	20	16.1
Farm land	18.3	6.25	36.7	34.7	23.99

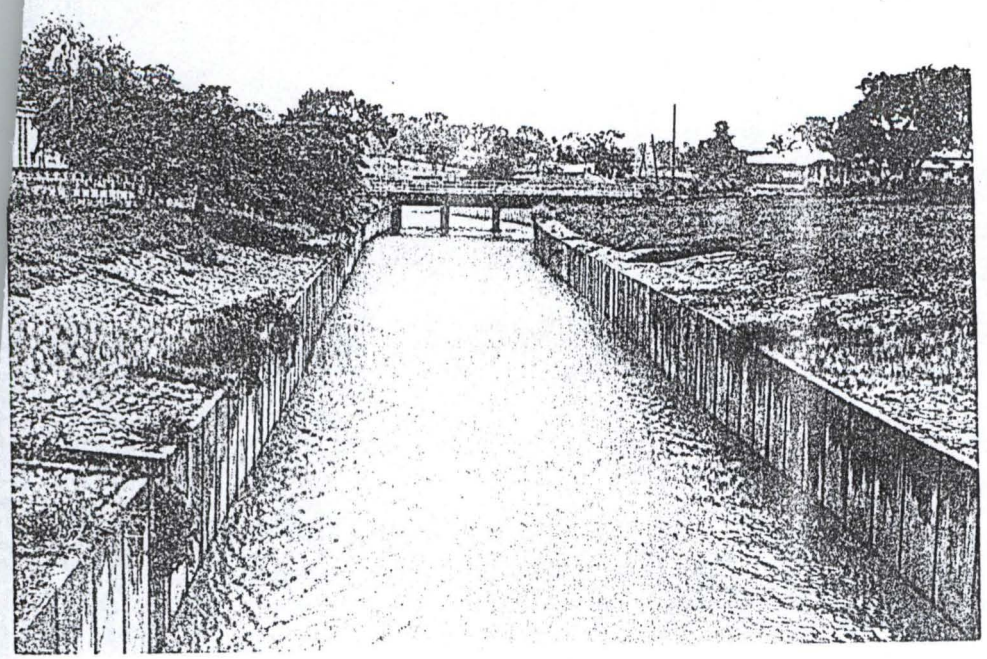


Plate 1: The Drainage Channel that cuts across the Bosso campus of FUT., Minna, concretized and also protected at the bank during it construction.

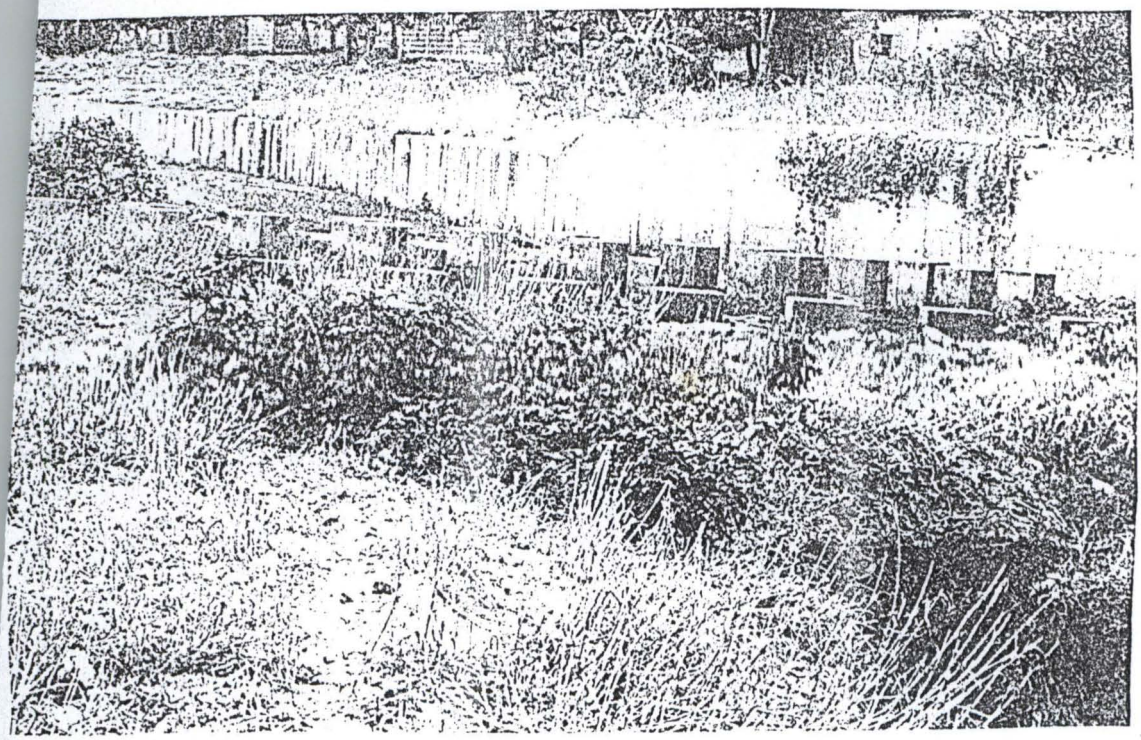


Plate 2: Terminal point of the FUT. drainage system. Note the pillars used as a means of reducing the velocity of the water.

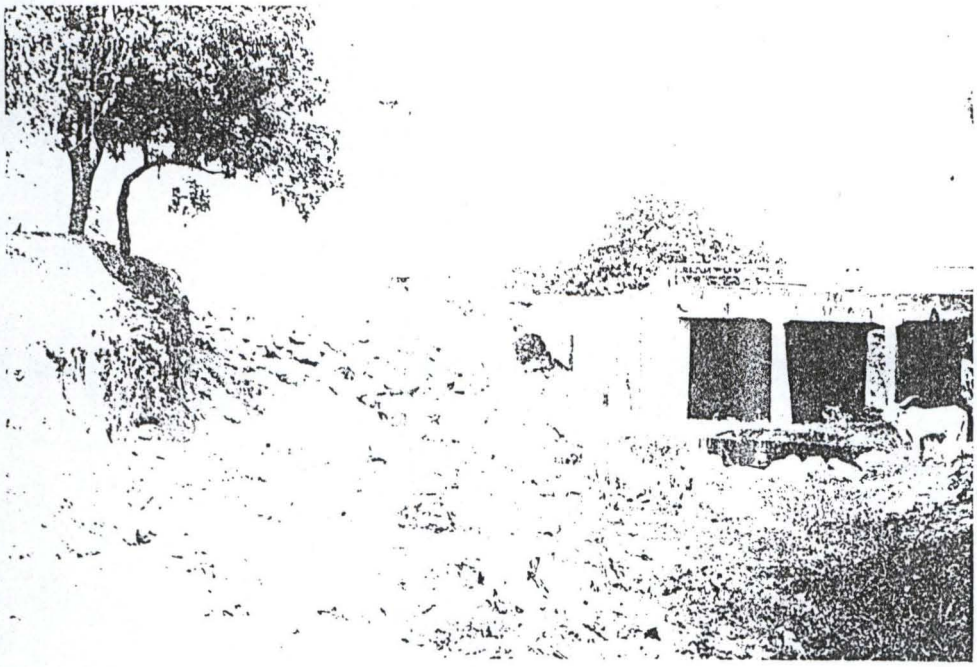


Plate 7: The downstream location showing no discharge during the dry season for a river that use to be perennial.

Plate 8: The downstream location showing meadering in the channel of the river and alluival deposit.

CHAPTER FIVE

5.0 CONLUSION AND RECOMMENDATION

5.1 CONCLUSION

This study clearly shows the extent to which air-photo interpretation was carried out providing earth's resources information especially climate change and environmental pollution. The report also show the need for the critical monitoring of vegetation cover and the hydrologic in balance of the down stream of he drainage.

It was discover that drainage construction has led to so many impact on down stream location of the drainage system. The upstream was channeled and concretised to Carter for both particles coming in and going out. It was graded to avoid deposit and erosion. These erosional and depositional activities are transferred down stream. The regulation of flow that has lead to meandering.

Climatic effect of drainage exert dominant influence on soil formation organic and metallic Ions are washed away and deposited in the sub-soil, leading to chemical weathering which acted lastly and thereby leaving the soil deep and shallow water pollution also lead to scarcity and causes alteration in the dynamic equilibrium of the soil.

Vegetation cover of the area are tempered with due to constant erosion that prevail at the down stream as a result of running water which carry derbies from the upstream. The four cardinal point approach was used to study the vegetation cover of the area. Land pressure that supposed to be shared by both residence of these drainage's and the down stream are all transferred to the down stream, thereby creating a lot of pressure on the land and creating more erosion problems.

This study will not only serve as reference to research in the shield but also provide awareness regarding the importance of studying drainage effect, as they constitute the main sources of our major problems. Therefore there is need for Nigeria like other countries to modernise our drainage construction for effective practice of the technology in the country to ensure sustainable development.

5.2 RECOMMENDATION

From this study it is evident that drainage are part from their abundant benefit such as the provision for easy movement of water, easy access of people from one part to the other, and the major benefit is control of flood disaster.

Following the result of these researches one would want to make the following recommendations;

1. That the down stream should be protected against human endangering the course of the river and ecological species.
2. There should be legislation to guide against people that will be involving themselves in one business of the other at the bank of the drainage e.g. car wash activities and mechanic people.
3. Dumping of refuse along the river (drainage) should be discourage against the occurrence of flood which would be felt much down stream than upstream
4. That the rate of deposit and erosion of the area be study, while intensive studied is carried out on the change of the river course.

5. Policy makers need to be aware on the danger of the impact of these drainage to the people at the down stream. Measure should always be taking to combat that impact.

6. Socio-economic consequence must always be considered both in supply and demand of drainage

7. There should be future consideration in design of water resources engineering which will need to take possible impacts into account when considering the life span of the structures put in place.

REFERENCES

Aya K. K., 1998, Application of Remote Sensing Techniques in the Study of Drainage Patters, Federal University of Technology Minna.

Ford D. C. et – al 1989, Karst Geomorphology and Hydrology, Unwin Hayman.

Mohammed B. Y., 2000, Some Environmental Effects of the FUT Minna Drainage System on the Location Down-Stream, Unpublished B. Tech Federal University of Technology Minna.

Horton R.E, 1945, Erosional development of the stream and the their drainage Basin, hydro physical Approach to Quantitative morphology, Bulletin of the Geological society of American.

Odiette W. O, 1999, Environmental Impact Assessment for Sustainable Development, Monthly Magazine on Environmental News, NES

Saidu Salihu, 1998, Flood Forecasting for River Kaduna Using Analysis of time series, Unpublished B. Tech Project, Federal University of Technology Minna

Sparks B. W, 1972, Geomorphology, Longman Inc.

Tator B. A, 1954, Drainage Anomalies in coastal Plain Region, Photogram metric Engineering.

William D. Thornbury, 1969, Principles of Geomorphology, Second Edition, John Wiley and Sons Inc.

Wisler C. O & Brater E. F., 1959, Hydrology, John Wiley & Sons Ltd. NY

Working Group II to IPCC, 1990, Impact Assessment of Climate Change, Commonwealth of Australia