LARGE-SCALE TOPOGRAPHIC MAPPING FOR URBAN MANAGEMENT

[A CASE STUDY OF BARNAWA, KADUNA STATE]

BY

ADEOLA JOHN ALABI

PGD/GEO/2001/2002/234

DEPARTMENT OF GEOGRAPHY

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DEPARTMENT OF GEOGRAPHY
F.U.T MINNA

SUBMITTED TO

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IN PARTIAL FULFILMENT TO THE REQUIREMENT FOR THE AWARD OF A POSTGRADUATE DIPLOMA IN ENVIRONMENTAL MANAGEMENT

OCTOBER, 2003

CERTIFICATION

I hereby certify that this work has been supervised, read and approved as meeting part of the requirements for the award of PGD in FUT MINNA, NIGER STATE.

PROJECT SUPERVISOR SIGN____________________

DR. P. S. AKINYEYE DATE 8/12/03

HEAD OF DEPARFTMENT SIGN____________________

DR. [MRS] A. E. ODAFEN DATE 8/12/03

DEAN, POST GRADUATE SCHOOL SIGN____________________

PROF. J. A. ABALAKA DATE____________________

EXTERNAL EXAMINER SIGN____________________

DATE____________________

DECLARATION

I declare that this project tilted "Large Scale Topographic Mapping for urban management- A case study of Barnawa, Kaduna State" is an authentic work done by me and has not been presented elsewhere for the award of any degree.

ADEOLA JOHN ALABI

SIGN ____________

DATE 5th JAN/2004

DEDICATION

To my family for their love.

ACKNOWLEDGEMENT

I am grateful to Dr. P. S. Akinyeye of Federal University of Technology Minna, Geography Department for his many helpful suggestions and for critically reading the thesis. I am grateful to all staff of Geography Department, Federal University of Technology Minna for their kind support, it is well appreciated. Surv. S. P. Olaleye, Mrs. Foyeke Oyeniyi, Mr. Henry Afowowe for the invaluable suggestions and for supply of materials used for this work. Finally I must thank all friends and well wishers who contributed to the successful completion and encouragement, constructive, textual criticism throughout the preparations of this thesis.

ABSTRACT

Right from colonial days through our years of independence, Nigeria has not been able to produce may to cover the entire country except for 1:500,000 an 1:1 million sizes. Maps are tools required by environmental managers and planners for regulating human developmental activities. Mappings alone during colonial time were motivated by resources exploration and exploitation and also for territories control. The earliest maps were done mainly along coastal areas where Europeans settled and possible area of high resource potential.

Subsequent attempts at producing topographic amp coverage of the whole country had failed out of 1:25,000 size started in 1972, only 3.83% was completed. At the rate Nigerian population is growing, such information are needed for development planning.

This project is an attempt to produce large scale topographic map of part of Barnawa, Kaduna State., the state is an old capital of Northern region and Barnawa as one of the fastest area of development coupled with nations map situation and complete absence of maps in this new area of the state, the effort has necessitated this project.

The aims and objectives of the study include "To produce a map of Barnawa using land surveying method at a scale of 1:2,000 and objectives are:

- To highlight the effectiveness of land alloation system within the study area.

- To identify the extend of individual allotees adherence to land allocation within study area.
- To highlight the resource potentials within the study area
- To ascertain the number of plots with certificate of occupancy
- To make recommendation for basic planning and management of basic infrastructure for well being of the people in the study area.

The map produced is that of part of Barnawa at scale of 1:2,000 using land survey method. This will make available to the state government, local government, of Kaduna as a toll for resource planning and allocation, estimated population of the area, environmental planning and monitoring.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND TO STUDY

Nature has endowed Nigeria with variety of natural resources ranging from agricultural land, forest potential, population increase to mineral resources. These have been adequate mapped and quantified to established the feasibility of their exploitation of the socio-economic well being of the generality of Nigeria people.

Over the years, Nigeria has been able to produce a few number of topographic and thematic maps for administrative use and for natural resources development, but not enough parts of the country has been mapped at relevant scales. This is making land allocation for development planning difficult and inefficient. With exception of some state capitals, most pasts of the country have not been supplied with needed controls at appropriate intervals, not to think of mapping them. The early survey and mapping in Nigeria were motivated by colonial powers for resources exploration and exploitation, also for territorial control.

Therefore, the earliest mapping activities were mainly done along the coats, areas with high relief, place where Europeans settled and park that were identified to passes high resources potential. About the close of 19th century, map in Nigeria were provided by the explores that invaded our part of Africa, the river Niger map were prepared even before the advent of British rule in Nigeria. The beginning of surveying ad mapping activities on the present Nigeria dated back of 1879, when the first survey department was established in Lagos and its colony [Ujunaw 1988]. There was an attempt by 1910 to carry out topographic mapping of southern Nigeria, which was done at production scale of 1:125,000. There were no adequate framework of survey triangulation establish for subsequent work. By 1945 further triangulation work was done for enable more accurate and rapid topographic mapping. The introduction of aerial survey in 1948 enhance the situation of topographic mapping in Nigeria. This created opportunity for Nigeria to produce maps required for development of various projects which were of interest to colonial administration.

By 1950, only 10% of the whole country had been photographed and maps plotted at scale of 1:50,000. These maps were not contoured, except where they are needed for project specifically requiring relief representation. There were other scale of topographic maps produced before the independence in 1960 for example, the following maps were produced, the Kaduna west map at scale 1:62,000 in 1950, Shendam and Zamfara at 1:100, 000 and Anambra river area at 1:25,000 both in 1958 [Ezra 1998].

During the first national development plan period between 1962-1968, the topographic map coverage of the whole country at 1:50,000 was to be provided. The programme was to ensure that the second edition of maps were produced in most parts of the north and for many part of the south. These maps were to be first set of 1:50,000 contoured maps in Nigeria, unlike the earlier edition. Earlier there have been attempts to cover the country at scale 1:1 million, 1:500,000, 1:250,000 and 1:25,000 map sizes. The only successful coverage so for was the production of 1:1 million and 1:500,000. Eight – three percent of 1:50,000 series were completed, some areas have not had a single contoured topographic map for development planning.

The 1:25,000 series started in 1972 for areas of dense population but only 3.83% completed. The Nigeria map situation is bad, and for there to be better understanding of human activities within the environment, maps are needed to guide resources planners and environmental mangers.

1.2 STATEMENT OF PROBLEM

Nigeria has undergone several structural and political subdivisions, from three regions in 1953 to four in 1963, twelve state in 1967, nineteen states in 1976, twenty-one in 1987, thirty with federal capital territory in 1991, to thirty – six in 1996. All these subdivision are without any significant effort aimed at producing comprehensive administrative maps of the country to reflect these frequent changes.

1.3 JUSTIFICATION OF PROJECT

In view of difficulty faced in planning as a result of non-availability of appropriate maps and in some cases local government headquarters made state capital. Hence, the need for maps in such place like

Kaduna State became very critical. This project aimed to attempt to produce large-scale topographic coverage of part of Barnawa Kaduna State using land survey method and physical constant method at scale 1:2,000.

1.4 AIMS AND OBJECTIVES OF THIS PROJECT

The major aim of the study is:

- To produce a map of Barnawa using land surveying method at a scale of 1:2,000.

OBJECTIVES ARE

a. To highlight the effectiveness of land allocation system within the study area.

b. Identify the extend of individual allotees adherence to land allocation within study area.

c. To highlight the resources potentials with the study area.

d. To ascertain the number of plots with certificate of occupancy.

e. To make recommendation for basic planning and management of basic infrastructure for well being of the people in the study area.

1.5.1 PROJECT LOCATION

Kaduna state with headquarters at Kaduna is one of the first state created during colony time and headquarters of northern region by then, having twenty- three local governments currently. It is located in the northern part of the country extending between latitudes $9^{0}10'$ – $11^{0}10'$ and longitudes $6^{0}10'$ – $8^{0}30'$. The state is bounded in the north by Kano State, in the east by Niger State, Kwara State, Nassarawa State in the south, while Bauchi State bounding the west respectively. It has a land mass 46054 sqkm and population of 5,415, 315 of mainly Hausa, Bajju, Yoruba, Igbo, TIV, Idoma, Igala etc ethnic groups.

1.5.2 GENERAL CLIMATE

The climate of any place has both direct and indirect influence upon its vegetation, which inturn affect the soil. Kaduna state is mixed wooded savanna vegetation zone of Nigeria. It has two season which is dog and wet season for the years. These deficiencies in dry season develop soil riches in time, but very productive not with standing the low humans content so long as water can be supplied. The soil can support agricultural produce like groundnuts, millet gingers, gunnea-corn, maize and cassavas. Plants covers are mainly grasses which are kept short by great hard of cattle grazing in the state compared to other in Nigeria. Trees such as data palm, sulk cotton and baoboo are available in southern path of the state while scattered in the northern path.

1.5.3 GEOLOGY

From the stand point of geology, Kaduna State is endowed with mineral resources such as Kaolin, potash, Tin and copper. The state include part of northern Nigeria affected little by wind and desertification, disforestation. These are major environmental problem to be tackled in this zone.

1.6 ARRANGMENT OF THESIS

To this and this thesis centered on large-scale topographic map of Barnawa, Kaduna State required for urban management. It is divided in four chapter. Following the introductory part is the chapter one reviews on methods and literature on map production. Chapter three deals with concept of land survey map computation, and finally, chapter four discusses Kaduna sheet 144 North – East as sample sheet part of Kaduna State, with conclusion high lighting the trend of mapping operation in the 21st century.

CHAPTER TWO

2.0 LITERATURE REVIEW

The use of maps over the centers primitive people of Eskimos produced maps of large areas of northern Canada without surveying instruments. These maps were remarkably well suited to their need through they compare favourably with charts, made by surveyor using modern methods. The first printed map is credited to the Chinese in the 12^{th} century, which produced maps clearly superiors to those of any contemporary civilization.

Earlier, the famous Greek cartographer ptolemy, looked to compile maps of 8,000 place in Alexandra, scholars were able to make reconstruction's of his maps. Most maps produced in European in the middles ages were highly schematic like the itinerary maps used by the pilgrims. In the early 14^{th} century Martin Behaim produced small globe of the earth, while by late 15^{th} century, the production of maps greatly increased. Central to this effort was Gerhardus Maccerator [1512-1594], who created many location on the world map, devised projection and produced a great atlas, published after his death. The frost modern atlas to appear was that of Abraham Orfelius [1570]. One of the most significant contributions to the matric mapping was the English astronomer Edmund Harely, his first important terrestrial map was published in [1686].

In France, the arrival of Giovanni Domenico Cassini in [1669] was the beginning of topographic survey of that country. France led in the production of topographic mapping, and developed methods used as standard and widely adopted world wide. The topographic mapping of France was completed in [1793] through astronomical determination.

American early maps included maps of Cape Hatteras produced in [1585] by John White, Captain John Simth's map of Cheese peak Bay [1612], Augustine Hermann's map of lord Calvert's Maryland [1670] and John foster's wood cut of New England [1670] was the first map drawn engraved printed and printed in the American colonies [Ibid].

2.1 RESOURCE MANAGEMENT

According to Popoola [1997], the built environment consist of spaces for everyday activities of man, such as residential, educational, commercial, industrial and recreational built up spaces. A healthy or same development is closely linked with arrangement of buildings and structures to meet community needs without Jeopardising their existence in whatever way either mans or in time to come. The utilities brought into the environment are in line with what the people desire, the environment is improved by the extension of modern water distribution network, electricity and street lighting, surface drainage, sewage collection and disposal, refuse collection network, gas distribution network, telephone network and road and streets. Public facilities like schools, hospital and civil halls, urbraries protection are provided, and economic infrastructures such as markets, shops, repair work shops and services industries, major shopping and commercial areas and industries. May be injected into the city set up. All the activities enumerated above are required to be located in geographical space by planners, maps are used as aid to provide knowledge about the spaces needed to make informed disease concerning the environment. The desire to generate sound environmental behaviour to ensure standard and sustainable management is possible through increased used of maps, which are either generated from geographic information system [GIS], remote sensing techniques or through land surveying may compilation.

Resources are those things capable of creating new health, they are natural potentials which need to be enhanced for generating revenue for the people. Man will like to tap all natural resources that he needs, by so doing he destroys his environment. Land is central to all natural resources ad its characteristic are issues of human conflicts. The quality and quantity of topography, availability of surface and under ground waters, nature of local climate and vegetation are issues determining the spread of man and his activities on earth surface. As awareness of environmental problems grew the 19th century, the 1987 world commission of environment and development brought the concept of sustainable management into the international agenda through sustainability began to appear on national and international agenda during the 1970s.

CHAPTER THREE

3.0 METHODLOGY FOR SURVEY COMPILATION

3.1 INTRODUCTION

Existing topographical map of the area were purchased and also collection of the coordinates and heights of control pilliars within and around the area i.e the coordinates in x,y,z called the reference point which will issue as initial starting point on the earth surface. Numbering of pillars were given by Kaduna State ministry of land and survey. ["see Appendix A"]

3.2 FIELD RECONNAISSANCE

This involves the physical inspection of the site in order to comprehend the amount of work to be involved in the project. The control points which were found and checked to ascertain whether they are in situ by observing the check angle. The boundary points [control framework] were selected such that they are intervisible from one another. The stations selected were twenty one in number and were to be coordinated by running a traverse over them, the points selected from a closed loop, stations which were selected along the stream were such that the stream could be detailed from them.

3.3 RECCONNAISSANCE DIAGRAM

"See Appendix A"

3.4 STATION CONSTRUCTION

The points selected were then beaconed using concrete pillars, and the letter [KDC 9700, 1CDC 970`----] were prefixed on them and the number of the pillar as well as an arrow to show the direction of the next station. To enable me fixed some details and obtain enough spot heights, subsidiary traverse stations were selected such that they were intervisible from adjacent station, nails were then used to mark the points. These subsidiary points were covered so as to prevent them from being disturbed by people who might run into them.

At this stage, with the recce diagram at hand I was able to plan the method to adoption order to obtain the best result.

3.5 INSTRUMENT SELECTION

In selecting the instruments that were used during the project, the following factors were considered:

i. The survey methods to be used

ii. The instruments in stock [availability at hand]

iii. The required accuracy

Considering this, the following instruments were used for the project and they are divided under the different stages of utilization as shown:

a. Traversing:

- Kern Dkm 2A Theodolite.
- Tripod
- Ranging poles [3]

(For Angular measurements)

- Eldi 1 [EDM] equipment
- 100 meter steel bond
- 30 meter linen tape
- Target

(For linear measurements)

b. Levelling

- Tilting level and tripod
- Levelling staff with spirit bubbles [2]
- Foot plates [2]

c. Tachometry

- Kern Dkm 2A theodolite with tripod
- levelling staff with spirit bubbles [2]
- Foot plates [2]

d. Miscellaneous

- Booking board and filed sheets
- Catlasses
- Arrows [3]
- Labourers.

The above instruments were tested before moving to the field in order to ensure that they are in good working conditions and to ascertain that they are in good working conditions and to ascertain that they be in good adjustment required in order to enhance a successful work.

TESTING OF INSTRUMENTS

The Dkm 2A theodolite which was used for the angular measurement was tested for the horizontal collimation and for the vertical index test.

- Horizontal collimation of the theodolite: The test was carried out by setting up the theodolite properly and levelling it, after which a ranging pole which was held about 100m away was bisected on both faces. The two reading were recorded.

FL = 38^0 15' 24"

FR = 218^0 15' 36"

The difference in the readings was 12". Considering the required accuracy for mapping, 12"/2 = 06", is okay therefore, there was no need for adjustment.

- Vertical index test of the theodolite: This test was carried out in order to ensure that the vertical angle measured on only one face was correct as it is required only for tachometry in which the vertical angle is measured on one face. In carrying out this, the theodolite was levelled properly after being set up, making sure that the attitude bubble is central, a mark is bisected on both faces, the differences between the two readings obtained gives 180^0, thereby there was no correction required.

- Eldi:1 [EDM] equipment: The Eldi 1 [EDM] Equipment used for the linear measurement which is said to measure distance to the nearest +.5mm, was tested for short distance and found to be within the measuring accuracy, after comparing it with that of a steel band.
- 100m steel band: The 100m steel band was standardized at the Kaduna State ministry of land and survey in order to ensure its reliability.

3.5.1 FIELD WORK PROCEDURE

3.5.1.1 TRAVERSING

A traverse is a sequence of connected straight lines, the directions and lengths of which are measured. The directions are measured using a theodolite and the length are measured using an electromagnetic distance measuring equipment [EDM], or a tape. The points connecting this lines are called stations.

- **Angular measurement**

Prior to the observations, the theodolite was checked to ensure that it was in good adjustment, as discussed in the previous chapter. At each station, the instrument was central using the plumbing rod [as the kern Dkm 2A theodolite used, uses a plumbing rod instead of a plumb-bob as in most theodolites]. At the first station [KDC 9700] the instrument was centered and levelled, then a man with a pole on the rear station was bisected with the vertical cross hair of the telescope on face left [FL]. The micrometer graduation lines were brought to coincidence and the horizontal and vertical circle readings were read and noted. The telescope was then turned in a clockwise direction to the forward station, with another man holding a pole there, using the vertical cross hairs, it was bisected and the horizontal and vertical circle readings were also read and noted. The telescope was then transited and face right [FR] reading were noted on the same forward station and closed back on the rear station. The angles were then deduced from this directional readings.

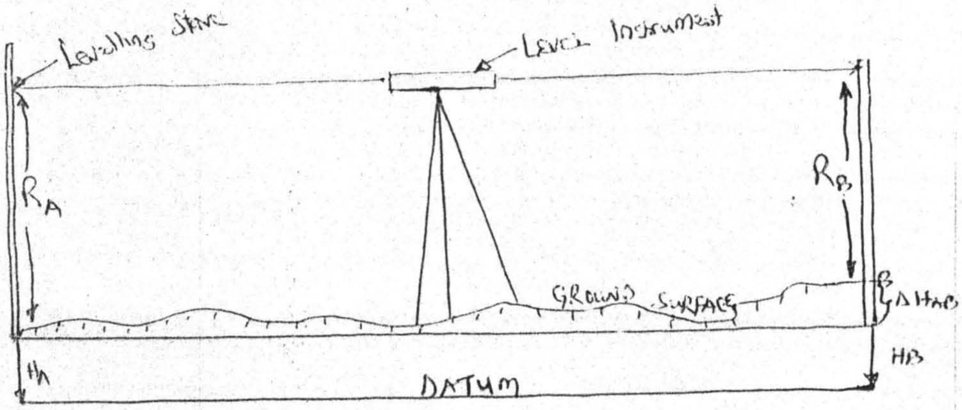
The same operation were repeated on the subsequent stations.

- Distance measurement:

Linear measurement were carried out using an electromagnetic distance measuring equipment. The type used is the zeiss Eldi 1. It uses infra-red as the carrier signal. In measuring the distance between two stations the Eld I 1, was set-up centered and levelled on a station, then the target which is made up of seven prison is set up centered and levelled on the other station. The Eldi 1, system is then switched on after the battery has been inserted into the system. With the aid of its telescope the center prison is bisected. Then by turning a knob, waves are sent from the Eldi 1, to the target [prison] which inturn reflects back this waves to the equipment within seconds. The distance will then be displaced on a screen when the distance is noted. The same procedure was repeated two or three times, the means of which gives the horizontal reading [distances].

Levelling

In the levelling operation, the method adopted is the spirit levelling. This method involves the measurement of differences in elevation between points. The levelling was carried out in three loops in order to avoid loss of accuracy. Each of the lops started and closed back on the same station of known height. To determine the difference is elevation between two stations, the level was set up mid-way between the stations, that is the station of known height and the one whose height is required. The station of known height serve as the back station, and it is then bisected and the stave is read and noted on the unknown station, the stave was then placed and the fore sight [FS] read and noted. On long traverse legs, intermediate stations had to be established. The figure below, illustrates the levelling operation.



RA = Back sight reading on station A.

RB = Forward sight reading to station B.

HA = Height of station A above datum

HB = Unknown height of station B above datum.

HAB = $\therefore H_B - H_A = R_A - R_B$

$\therefore H_B = H_A + DH_{AB}$

3.5.1.2 TACHEOMETORY

Tachometry survey involves measurements of heights and distances between two station by optical, means using a theodolites and levelling staves. It is used in picking details and establishing spot levels. In the observations, the position and height above ground level of the instrument were read and noted. The instrument was normally set-up centered and levelled over a station and for each stave position, the following observation were made:

i. Horizontal – circle reading

ii. Vertical – circle reading and

iii. The three stadia hair readings of upper, middle and lower hair readings.

The field procedure was as followed:

i. The instrument was set up on a station after it has been ascertained that it is in good adjustment as the vertical and horizontal angles are measured on only one face.

ii. The height of the instrument was measured and recorded.

iii. By rotating the slow motion screw, the horizontal reading was set zero on the orienting station.

iv. The staff man was then directed to a point, the telescope of the theodolites was then pointed at the stave.

v. The three stadia hairs were then read and recorded as well as the horizontal and vertical circle readings.

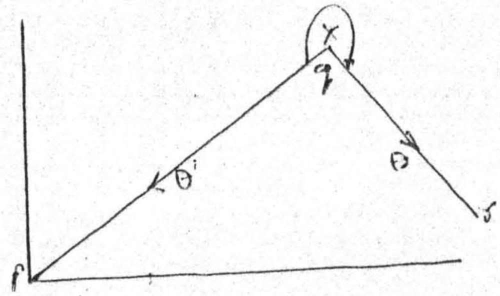
vi. The same procedure was repeated on each of the subsequent stave stations. Until on completion of the observation the telescope was directed at the orienting station to check that the horizontal circle has not been disturbed.

3.5.1.3 DETAILLING

Tachometry was employment in picking the details for this project. This was achieved by setting up and centring of the instrument on a known station and placing the levelling stave on the point of interest or by it, and nothing the three stadia readings as well as the horizontal and vertical circle readings knowing these perimeters, the distance from the point to the known station is obtained, which aids in the location of the details.

Forward bearing [O] = Back bearing [Θ'] + observed angle [X]

$\Theta = \Theta' + X$



Θ' = Back bearing qp

X = observed angle at q

Θ = forward bearing qr

The above relation was employed in the computations of the forward bearing of all the lines. In the forward bearing computations there was a difference between the computed closing bearing from the known coordinates and that reduced from the observed angles. The difference waste angular misclosure or discrepancy. This misclosure was divided by the number of stations observed this average was applied to the individual stations.

4.1.3 COMPUTATIONS OF DIFFERENCES IN NORTHING [DN] AND DIFFERENCE IN EASTING [DE]

These were computed from the following formula.

DN = L cos x

DE = L Sinx

Where

DN = Difference in northing

DE = Difference in eastings

L = Lengths of lines

X = forward bearings.

4.1.4 COMPUTATION OF COORDINATES

Using the computed differences in northings and difference in easting, the coordinates of the unknown station were computed by either adding or substracting the values of the DN and DE from the coordinates of a previously known station to obtain the uncorrected coordinates of all the stations. The difference between the uncorrected coordinates of the last station which , of course, was the closing station and the known coordinate of this same closing station gave the misclosure in northing and easting respectively.

4.1.4.1 COORDINATE ADJUSMENT

The method used in the adjustment of the coordinates was the Bowditch method. All the distances of the perimeters were summed up and the misclourese in both the northing and easting were divided by it, then the average multiply by the commulative distance to obtain the correction to the coordinates at each of the station.

i.e

correction of N = EN/Total distance [cumulative distance]

correction to E = EE/Total distance [cumulative distance]

wise EN = northing misclosure

EE = easting misclosures

Accuracy of the traverse: It is expressed as below:

Accuracy = $1/\sqrt{EN^2 + EE^2}$/ Total distance

4.1.4.2 AREA COMPUTATION

For the area computation, coordinate method was used. The convenient procedure for applying this method was carried out by using the coordinates in the following format:

EA EB EC ED EN EA

NA NB NC ND NN NA

As shown above, normally the first coordinates set is repeated at the end. The first step was to find to sum of the produce of all adjacent diagonal terms taken down to the right i.e

$E_A N_B + E_B N_C + E_C N_D + E_D N_N + E_N N_A$ = SUM I

Then, the sum of the product of all adjacent diagonal terms taken up to the right i.e.

$N_A E_B + N_B E_C + N_C E_D + N_D E_N + N_N E_A$ = SUM II

The difference between the two sums divide by two gives he area of the traverse, since the initial value got from the summation of the two sums gives twice the area.

A = ½ [sum I - sum II]

In applying the coordinate methods, should the computed areas be negative, the negative sing is ignored, since we are interested in the absolute value.

4.2 LEVELLING COMPUTATION AND ADJUSTMENT

In the reduction of the levelling operation as back sigh reading were taken to a station of know height [Bench mark]. Fore sight reading as the last before the instrument was moved. Intermediate sight readings were also obtained in between the force and back sight reading. The method adopted in the reductions, was the heights of instrument methods. This method involves summing the back sight reading which was taken on a station of known height [Bench mark] and the reduced level of the bench mark of give the height of the instrument. The height of the instrument obtained sight. That is the difference between the height of instrument and fore sight reading gives the reduced level of the for sight station. This same procedure was repeated for the intermediate sight reading and the other fore sight reading as well.

To check the correction of the reduced levels, the force sight [Fs] were surround up as well as the back sights the difference between the two sums should be equal to the difference between the last and the first reduced levels. If they are not equal then the difference gives the error in third order levelling i.e +- 24mm k

Were K = total distance levelled in kilometer. The method adopted in the adjustment of the reduced level [RL] in this project is as show below:

That is

ei = Li / L [Ec]

Where

ei	=	correction to reduced level of change point
Li	=	Distance of change point from start
L	=	Total distance levelled
Ee	=	Total misclosure.

4.3 TACHEOMATRIC REDUCTIONS

The tachometric reductions were carried out manually using an electronic scientific calculator: The formulae used in the reductions were as shown below:

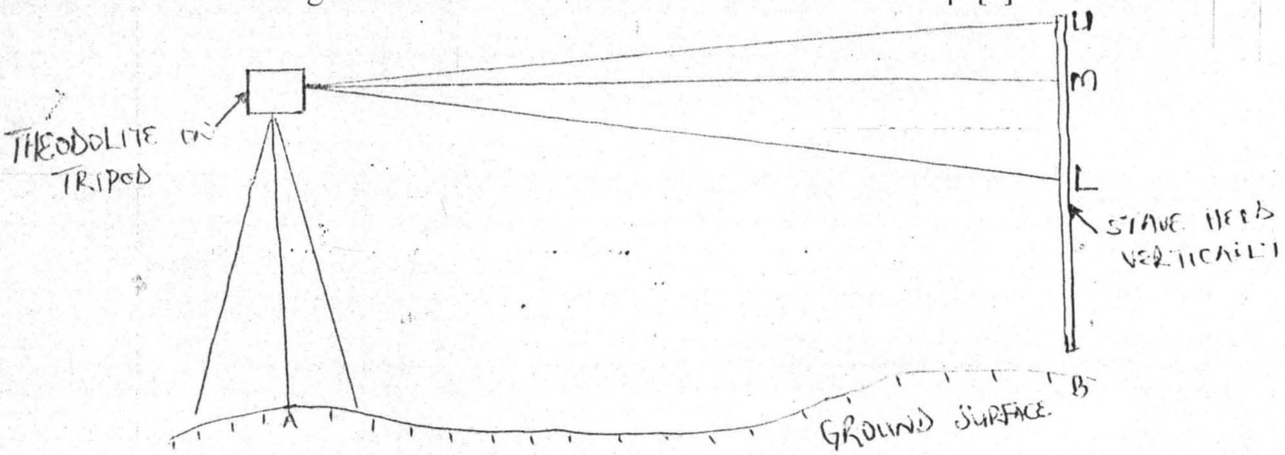
$S = U - L$

Horizontal Distance [D] $= KS\ \cos^2 \Theta$

Difference in height [Dh] $= \frac{1}{2}\ KS.\ \sin 2\Theta$

Height f stations [points] $= H_B = H_A + hi \pm Dh - m$

The diagram below illustrates how the staff intercept[s] was obtained.



S	=	Staff intercept [U-L]
U	=	upper hair reading
L	=	lower hair reading
K	=	instrument constant e.g 100

O = vertical circle reading

HA = height of instrument station

HI = height of instrument

M = middle hair reading

The above method was used to obtain the spot heights samples of the computation and adjustment sheet are attached is the Appendix "A"

4.4 PLOTTING

After the computations and adjustment, the next stage was the plotting. The plotting exercise was carried out at a scale of 1:2000. The first step involved, was mounting the drawing paper on a drawing table with the aid of masking tape. The paper was thereafter grided using a grid interval of 200m in both the northing and easting directions.

- **Instruments**

The instruments listed below were employed for the plotting exercise:

i. Drawing paper

ii. Drawing board

iii. T-square

iv. Straight edge, meter rule

v. Scale rule

vi. Pencil and eraser

vii. Circular protractor

viii. Set – square [45^0 & 60^0]

ix. Cellotape, pen & ink, tracing paper

4.5 PLOTTING THE BOUNDARY TRAVERSE

In order to determine the total grid length in both the easting and northing direction the differences between the highest and lowest easting and northing coordinates was found. Using the cellotape, the drawing paper was mounted on the drawing board. With pencil the corners of the paper were joined by two diagonals, the intersection point of diagonal was used as a point from which equal length were scaled of and marked. These four marked points were then joined together to form a square. Based on the scale of the map, which is 1:2000, the paper was grided at intervals of 200 meters using pencil scale rule and set squares, the boundary points were plotted. These plotted points were then joined to form the boundary traverse lines.

Plotting of Details

In locating the positions of the details on the map, the circular protractor and scale rule were employed. This was carried out by using the circular protractor to give the angluar direction of the details from an already plotted traverse line, that is by placing the protractor on the traverse line such that the 0^0-180^0 was oriented along this line from this line, the angular direction as measured from the field was then measured and marked with pencil. A line was then drawn to join the marked point with the orienting station along this line, using the scale rule the distance to the details was scaled out. For building the corner were scaled off in the same manner and joined together to give the shape of the buildings.

Plotting of spot height

In plotting the spot height, the method of bearing and distance was employed as was the case f plotting of details.

4.6 INTERPULATION FOR CONTOURS

After the spot height were plotted, the height of points were then compared. Then using a line, places of equal height are then joined together. This line used for joining places of equal height are known as contours. After completing the contouring, the tracing paper was then placed on the map, and inking was carried out in appropriate colours. The tracing was carried out in order to produce copies of the map.

4.7 PROSPECT OF THIS MAP

The Barnawa map will be used by administrators and land managers to ensure that human development can be sustained in the following way:

i. Provide information for public policy making in the area of agriculture, fisheries, transportation, residential education commercial, industrial and recreation.

ii. Enable town planners understand the landscape of the area, for effective dispensation of their work. The map shows drainage pattern topography area covered by vegetation and other landuse.

iii. Studies can be carried out from this map about information such as roads and streets network, residential set up etc.

iv. From general view of the area, assessment of water resources development potential can be done. Data on quantity of water needed for domestic, industrial and agricultural users can be extracted.

v. Revenue collection will be enhanced from ground rent, and will also stimulate effective land allocation scheme.

vi. Finally this map will serve as base for planning, management and development activities.

4.8 TRENDS IN MAP PRODUCTION

There has been an increase in the use of computer world wide, this has also stimulated change in the trend of mapping operations in recent time towards digital mapping system. Mapping sciences such as land survey, remote sensing, photo/image interpretation, global positioning system [GPS] and geographic information system [GIS] are emerging as promising tools for land management.

Geographic information system as management tool is used to collect data, store, analyse and present information to make decision easier for users of such information. It is time, state and federal mapping agencies all over the country engage GIS fully to manage production of maps in as effective manner to facilitate.

i. Availability of appropriate maps needed for planning.

ii. Digital mapping system will enable fast reproduction of map at any scale without difficulty.

iii. The use of computer enable map information to be kept in data bank, while updating and retrieval for various planning activities will be done, without problem.

iv. Problem of map revision is removed as information are kept in data bank, while information are kept in data bank, while new data are added for updating any times.

v. Problem associated with cartographic presentation is completely overcome with the use of complex computer graphic design.

vi. Problem of preserving map sheets is remanded with use of computer data management system.

vii. Mapping operations are now enhanced as a result of high speed at which data can be acquired and information retrieved to manage the entire environment.

Maps are therefore required as tool for bring balance between development, environmental protection and likely consequences of environmental changes. In doing this I have briefly highlighted the inescapable danger of non-availability of maps. No meaningful development planning and execution can be done for regulating human activities without use of maps.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

This project which is large scale mapping, involved the representation of natural and man made features on a sheet of paper and therefore the effectiveness of resource potential, national planning population census, population estimation, environmental management rural and urban management are basically successful with the help of large scale topographic maps, therefore Nigeria as a country should see the country at a glance through the use of the produced.

5.1 RECOMMENDATION

As maps are tools for basic planning and effectiveness Nigeria should take more modern ways of producing map of the while country every ten years interval due to natural hazards, climate changes and environmental monitoring and assessment, so prediction to avert in cumbating them can be given from the meteorologist of the country.

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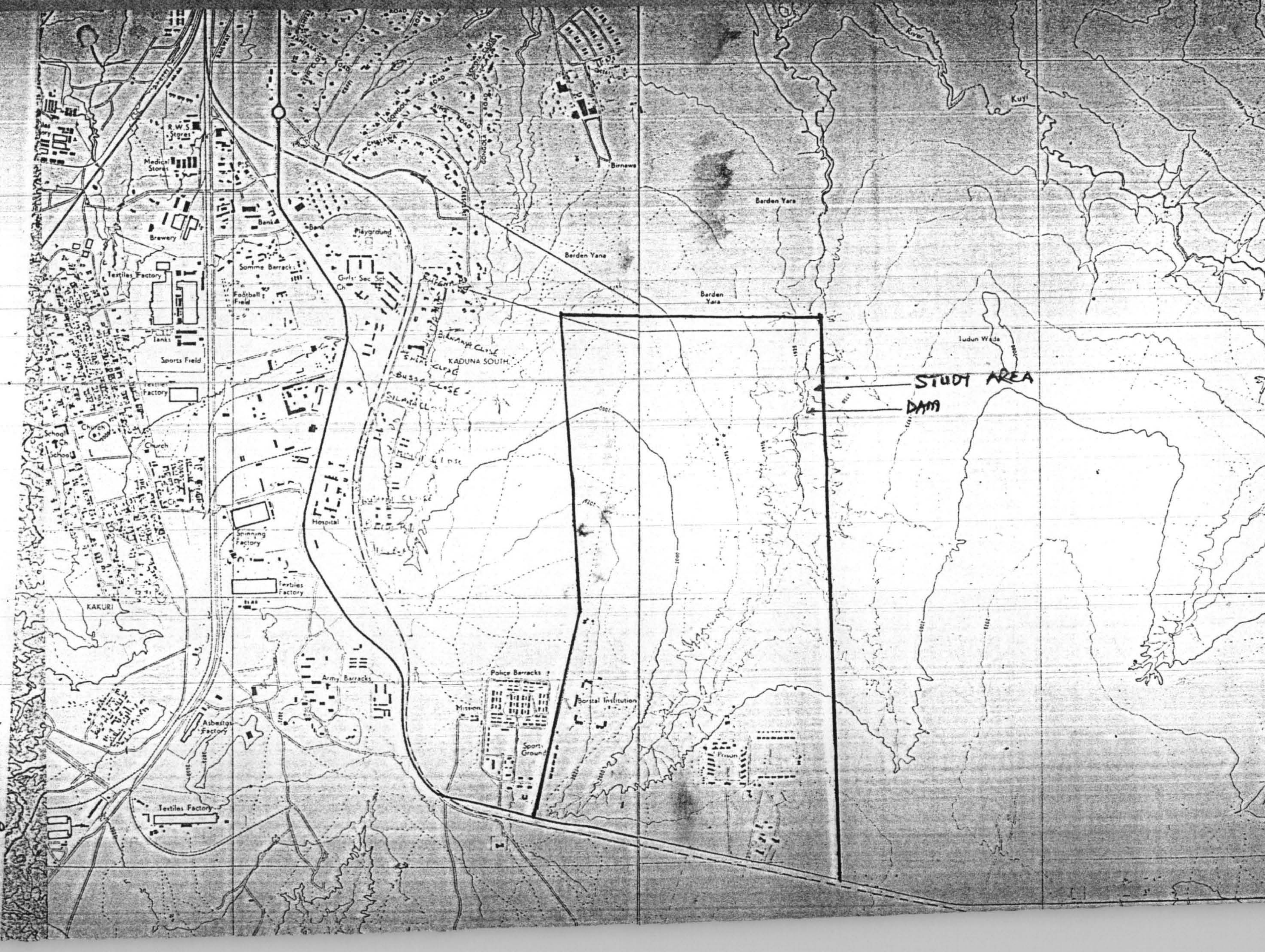
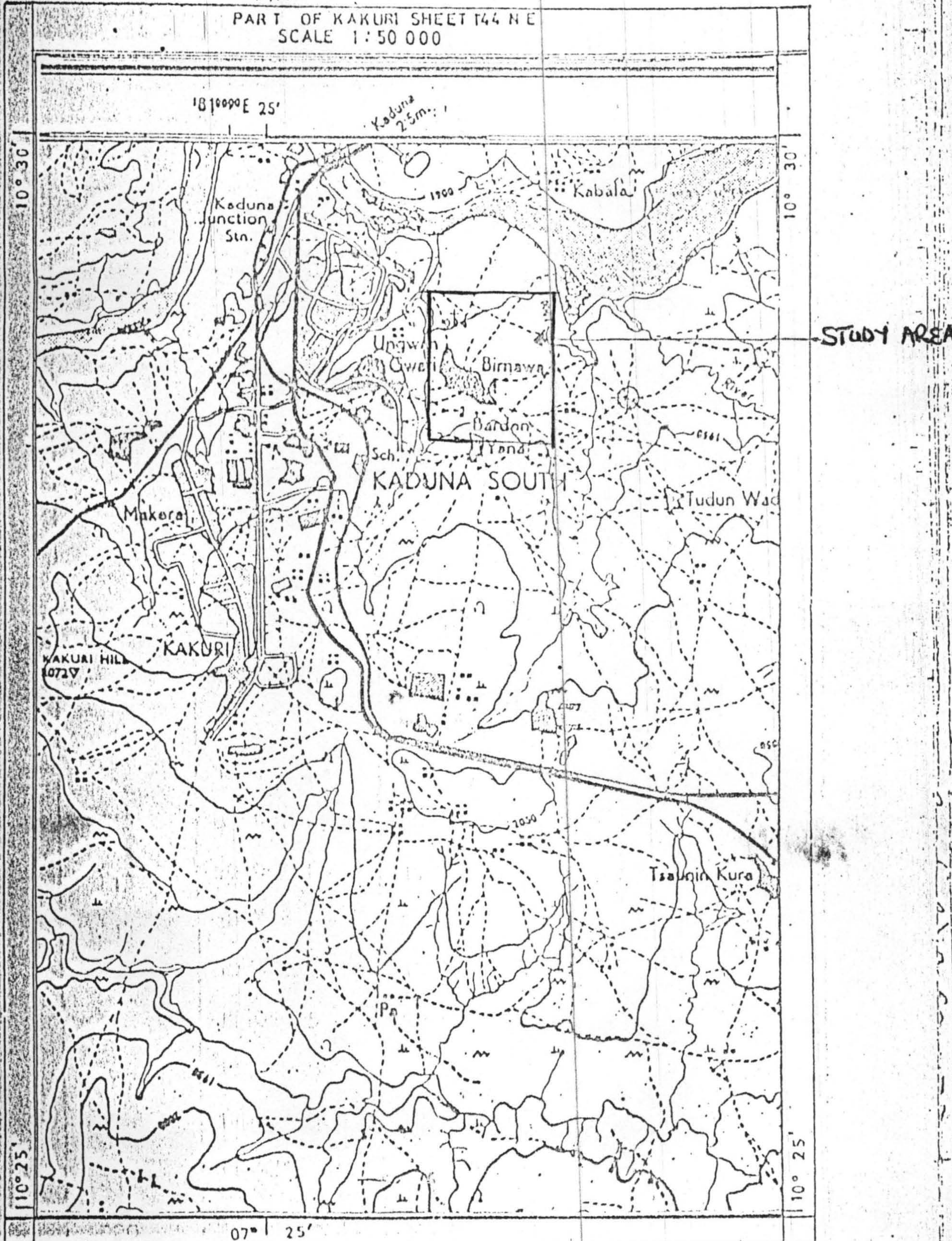
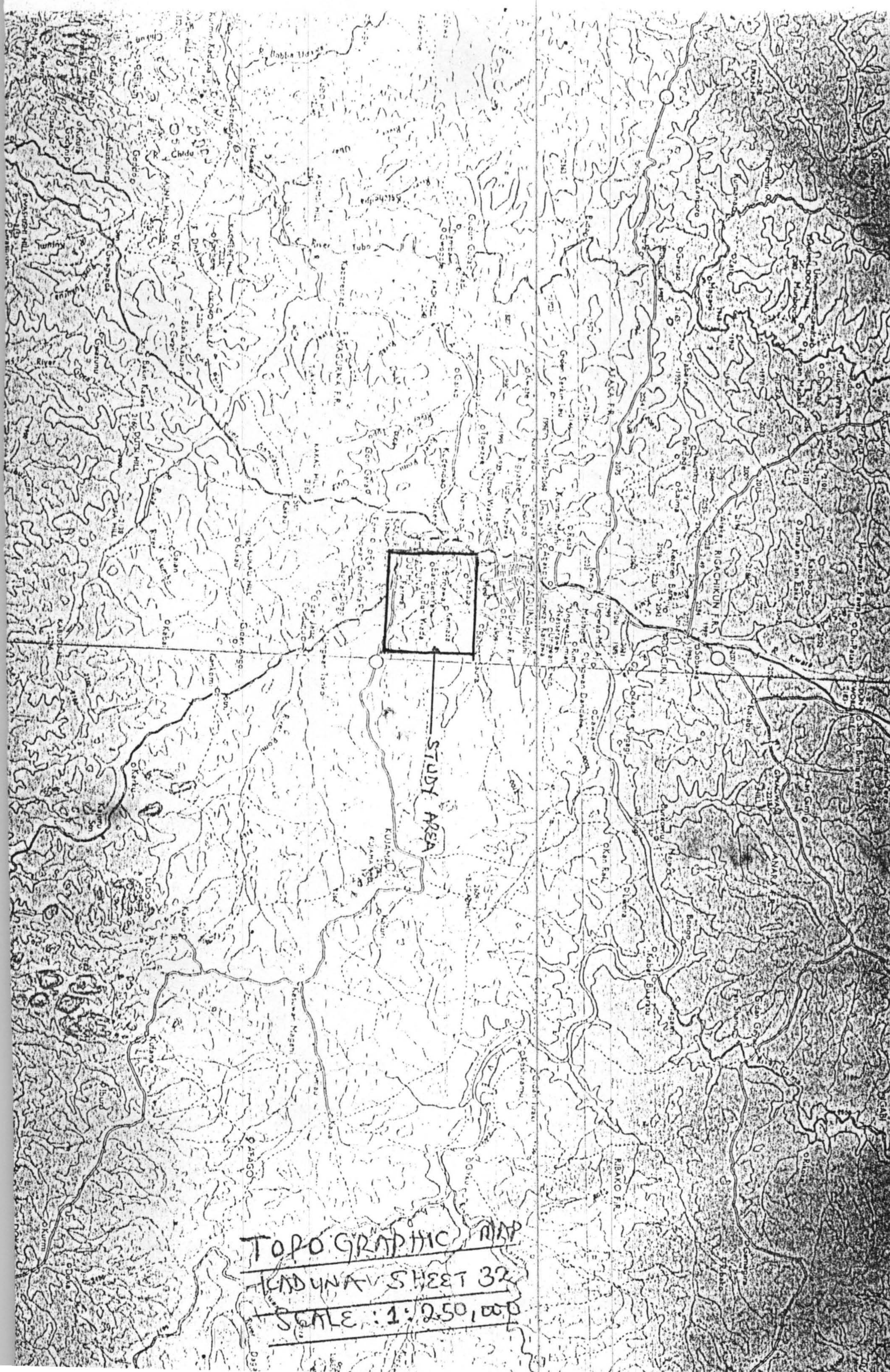
APPENDIX A



TOPOGRAPHIC MAP
KADUNA SOUTH WEST
SCALE: 1:12,500

APPENDIX 1


PART OF KAKURI SHEET 144 N E
SCALE 1 : 50 000
Kaduna Junction Stn.
Kabala
Ungwan Gwari
Birnawa
Bardon Yona
Sch.
KADUNA SOUTH
Tudun Wada
Makera
KAKURI
KAKURI HILL
1072
Tsaunin Kura
Pa
River
10° 30'
10° 25'
07° 25'
STUDY AREA



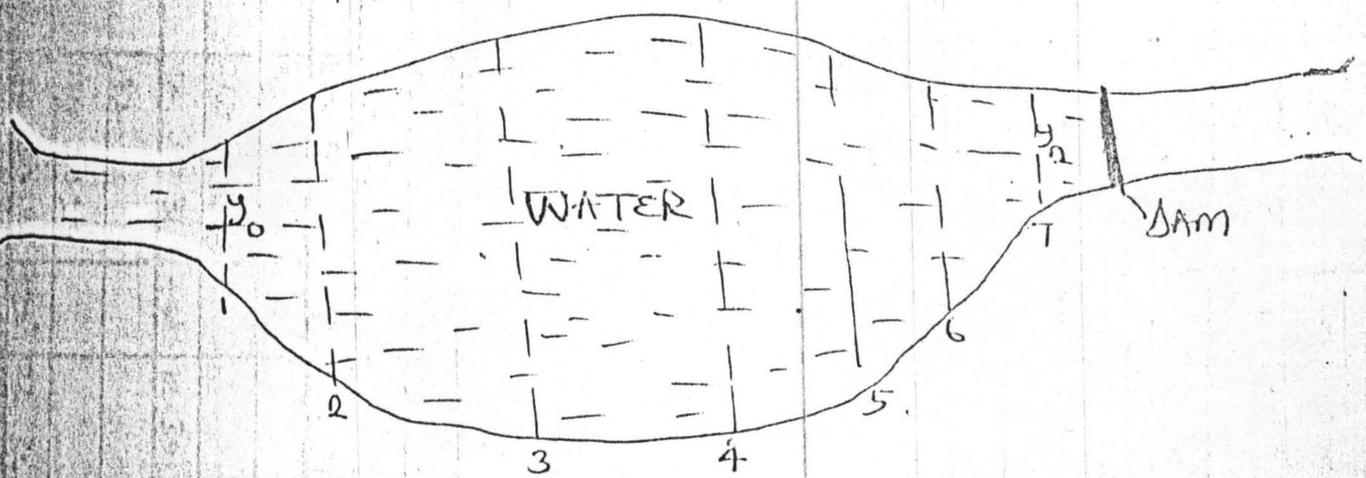
TOPOGRAPHIC MAP
KADUNA SHEET 32
SCALE : 1: 250,000

LIST OF HEIGHTS & COORDINATES

Serial	BEACONS NO'S	Northing (N) m	Easting (E) m	H (m)
1	KDC 9701	12 485 327	16 197 611	593.207
2	KDC 9702	12 487 653	16 475 113	597.917
3	KDC 9703	12 483 571	16 872 611	585.255
4	KDC 9704	12 158 719	16 861 107	587.093
5	KDC 9705	11 792 847	16 842 761	588.717
6	KDC 9706	11 492 035	16 756 901	593.966
7	KDC 9707	11 198 575	16 726 615	596.868
[illegible]	KDC 9708	10 931 024	16 554 660	602.069
[illegible]	KDC 9709	10 725 235	16 486 022	601.329
[illegible]	KDC 9710	10 540 809	16 351 982	602.563
[illegible]	KDC 9711	10 349 010	16 132 675	607.166
[illegible]	KDC 9712	10 167 786	15 981 317	612.541
[illegible]	BM3 - - -	09 927 474	16 005 332	618.359
[illegible]	KDC 9713	10 003 657	15 696 474	621.576
[illegible]	KDC 9714	10 370 590	15 780 727	620.954
[illegible]	KDC 9715	10 685 053	15 850 827	620.065
[illegible]	KDC 9716	11 155 594	15 922 573	615.981
[illegible]	KDC 9717	11 219 616	15 966 698	615.709
[illegible]	KDC 9718	11 548 966	15 979 356	614.923
[illegible]	KDC 9719	11 939 141	15 996 399	605.593
[illegible]	KDC 9720	11 936 221	16 262 466	605.181
[illegible]	KDC 9721	12 308 414	16 175 431	603.170
[illegible]	KDC 9722			

VOLUME OF WATER DAM

CALCULATION [m^3]



CALCULATION BY: SIMPSON'S RULE:

$$V = d/3 \left[y_0 + y_n + 4[\text{odd ordinates}] + 2[\text{even ordinates}] \right] m^3$$

Where
$y_0 = 1$
$y_1 = 2$
$y_2 = 3$
$y_3 = 4$
$y_4 = 5$
$y_5 = 6$
$y_n = 7$
meters

The total volume of water in the Dam as at September 2003 = 63,620 Cubic Meter in the Dam, which was Constructed by the Borstal Institution (Junior portion

COMPUTATION OF TRAVERSE CO-ORDINATES

From Station	Back Bearing / Observed Angle / Forward Bearing	Correction to Bearing	Corrected Bearing	Horizontal Distance (Metres)	± ΔN	± ΔE	Uncorrected Coordinates / Correction / Final Coordinates (Red) N (Metres)	E (Metres)	To Station
			° ′ ″				10 876·051	16 036·140	IODCS 158
IODCS 158			142 58 21·3	237·741	189·500	143·167	10 686·251	16 229·301	CS2 P531
CS2 P531			102 51 32	439·158	-97·867	478·721	10 588·384	16 655·028	CS2 P530
	102 51 32						10 540·809	16 351 973	
	36 59 44						-0·002	+0·009	
CS2 P531	139 51 18	+03″	139 51 21	190·264	-145·442	122·666	10 540·509	16 357·982	IODC 9710
	319						10 349·011	16 152·652	
	261 34 54						-0·009	+0·023	
IODC 9710	221 26 12	+06″	221 26 18	255·344	-191·798	-169·34	10 349·010	16 182·075	IODC 9711
	41						10 167·758	15 981·279	
	186 34 31						-0·002	+0·038	
9711	228 00 43	+10″	228 00 53	270·911	-181·223	-201·373	10 167·786	15 981·317	9712
	48						09 927·477	16 005·292	
	126 16 41						-0·003	+0·040	BM3
9712	174 17 24	+13″	174 17 37	241·508	-240·311	24·013	09 927·474	16 005·332	
	354						10 003·660	15 696·400	
Bm3	289 33 38						-0·004	+0·064	9713
	283 51 02	+16″	283 51 18	318·138	76·183	-308·882	10 003·657	15 696·474	
	103						10 370·594	15 780·657	
9713	268 48 29						-0·004	+0·070	9714
	12 39 31	+19″	12 39 50	384·283	374·934	84·247	10 370·590	15 780·727	
	192						10 586·206	15 866·679	
9714	189 50 29						-0·065	+0·077	PRG 1

COMPUTATION OF TRAVERSE CO-ORDINATES

From Station	Back Bearing / Observed Angle / Forward Bearing	Correction to Bearing	Corrected Bearing	Horizontal Distance (Metres)	± ΔN	± ΔE	Uncorrected Coordinates / Correction / Final Coordinates (Red) N (Metres)	E (Metres)	To Station
	262						10 655.558	15 850.149	
	148 00 00						−0.005	+0.078	
EG 1	350 30 00	+25"	350 30 25	100.225	98.852	−16.530	10 655.553	15850.227	IDC 9715
	170						10 538.513	15 985.900	
	230 59 20						−0.006	+0.059	
-9715	41 29 20	+29"	41 29 49	204.553	153.455	135.751	10 835.507	15959.959	PEG 2.
	221						11 015.600	15 922.479	
	118 47 53						−0.006	+0.094	
EG 2	340 17 13	+32"	340 17 45	188.169	177.087	−63.421	11 015.594	15922.573	IDC 9716
	160						11 219.623	15 966.601	
	211 54 22						−0.027	+0.097	
9716	12 11 35	+35"	12 12 10	208.739	204.023	44.122	11 219.616	15966.698	9717
	192						11548.974	15 979.258	
	169 59 50						−0.008	10.098	
9717	002 11 25	+35"	002 12 03	329.594	329.351	12.657	11 548.966	15 979.356	9718
	182						11 777.534	15 987.980	
	179.59 01						−0.009	+0.099	
18	002 10 26	+41"	002 11 07	228.726	228.560	8.722	11 777.525	15 988.179	PEG 3
	182						11 939.151	15 996.245	
	188 44 29						−0.010	+0.099	
3	002 54 55	+44"	002 55 39	161.828	161.617	8.265	11939.141	15 996.344	9719
	182						11936.231	16262.346	
	267 [illegible]								

COMPUTATION OF TRAVERSE CO-ORDINATES

From Station	Back Bearing / Observed Angle / Forward Bearing	Correction to Bearing	Corrected Bearing	Horizontal Distance (Metres)	± ΔN	± ΔE	Uncorrected Coordinates / Correction / Final Coordinates (Red) N (Metres)	E (Metres)	To Station
	270						12 308·425	16 175·304	
	76 12 28						−0·011	+0·127	
9720	346 49 23	+51"	346 50 14"	382·236	372·194	−87·042	12 308·414	16 175·431	9721
	166						12 485·338	16 197·483	
	200 18 28						−0·011	+0·128	
9721	007 07 51	+54"	007 08 45	178·298	176·913	22·179	12 485·327	16 197·611	9701
	187						12 487·694	16 474·963	
	262 22 01						−0·071	+0·150	
9701	89 29 52	+57"	89 30 49	277·490	2·356	227·480	12 487·683	16 475·113	9702
	269						12 483·582	16 872·431	
	181 04 42						−0·011	+0·180	
9702	90 34 34	+60"	90 35 34	397·489	−4·112	297·468	12 483·571	16 872·611	9703
	270						12 158·732	16 860·926	
	271 26 04						0·013	+0·181	
9703	182 00 38	+64"	182 01 42	325·054	−324·820	−11·505	12 158·719	16 861·107	9704
	02						11 792·861	16 842·578	
	180 50 30						−0·014	+0·183	
9704	182 51 08	+67"	182 52 15	366·331	−365·871	−18·348	11792·847	16 842·761	9705
	02						11 492·050	16 786·714	
	187 35 56						−0·015	+0·187	
9705	190 30 04	+70"	190 31 14	305·954	−300·81	−55·864	11 492·035	16 786·901	9706
	10						11198·551	16 726·[illegible]	
	[illegible]								

COMPUTATION OF TRAVERSE CO-ORDINATES

From Station	Back Bearing / Observed Angle / Forward Bearing	Correction to Bearing	Corrected Bearing	Horizontal Distance (Metres)	± ΔN	± ΔE	Uncorrected Coordinates / Correction / Final Coordinates (Red) N (Metres)	E (Metres)	To Station
	11						10 931.841	16 554.455	
	201 07 10						-0.017	+0.205	
9707	212 42 34	+16"	212 43 50	318.049	-267.558	+171.966	10 931.024	16 554.660	9708
	32						10775.252	16 485.812	
	171 02 51						-0.017	+0.210	
9708	203 45 25	+19"	203 46 44	170.241	-155.789	-68.643	10775.235	16 486.022	9709
	23						10 654.000	16 295.031	
	220 39 28						-0.018	+0.225	
9709	244 24 53	+53"	244 26 16	211.451	-91.252	-190.781	10653.982	16 295.256	PEG 4
	64						10558.402	16 657.775	
	40 19 32						-0.018	+0.253	
PEG 4	104 44 25	+86"	104 45 51	375.130	-95.598	362.744	10558.384	16658.028	CSZ P530
	284								
	358 05 38								
CSZ P530	282 53 03	+4 29"	282 57 32				10 656.257	16229.307	CSZ P531

$30\sqrt{N}$

$30\sqrt{28} = 02' 38.74''$

$$Accuracy = \frac{\sqrt{(0.018)^2 + (0.253)^2}}{7181.231}$$

$$= 1/28,312.746$$

$$= 1/28,000$$

Instrument Station : 9707 Height above datum (H_A) : 596.868 Page: 10

Reference Object : 9708 Height of Instrument (h_i) : 1.430 Date: 10/7/2003

Height of Instrument axis above datum $H_A + h_i$: 598.298

Staff Station	Horizontal Circle Reading	Vertical Circel Reading	Staff Reading			Intercept S = U – L	Horizontal Distance D Metres	Height Difference h Metres	h–M	Reduced Level Metres	Remarks/Diagrams
			U	M	L						
9707-9708	00 00 00	270 57 38	3.960	3.000	2.155	1.805	180.477	3.025	-0.035	598.263	
1	✓	270 57 34	2.000	1.285	0.578	1.422	142.182	2.381	1.096	599.394	
2	✓	270 20 44	3.888	3.358	2.822	1.066	106.600	0.643	-2.715	595.583	
3	✓	269 40 45	3.615	3.292	2.968	0.647	64.700	-0.352	-3.644	594.644	
4	✓	269 40 49	2.088	1.888	1.688	0.400	39.999	-0.223	-2.081	596.217	
5	✓	267 54 25	3.537	3.437	3.337	0.200	19.992	-0.730	-4.167	594.131	
6	60 55 46	272 38 31	1.952	1.702	1.452	0.500	49.629	2.302	0.600	598.898	edge of road
7	22 03 35	272 27 40	3.800	3.365	2.934	0.866	86.117	3.715	0.350	598.648	"
8	07 26 13	271 42 54	3.545	2.785	2.032	1.513	151.101	4.526	1.741	600.039	"
9	04 06 35	271.19 02	3.350	2.264	1.178	2.122	217.100	4.992	2.728	601.026	
10	13 21 14	271 51 27	3.674	2.606	1.536	2.138	213.412	6.926	4.320	602.615	
11	18 39 58	272 43 11	3.900	3.000	2.090	1.810	179.494	8.579	5.579	603.877	EB [A building
12	23 20 31	272 13 08	3.400	2.565	1.728	1.672	166.583	6.469	3.904	602.202	EB B
13	26 15 09	272 13 05	3.675	2.645	1.615	2.060	205.241	7.967	5.322	603.620	EB C
14	30 43 34	273 13 11	3.136	2.162	1.184	1.952	192.941	10.946	8.784	607.082	EB D
15	33 10 31	271 13 07	2.980	2.022	1.082	1.898	189.736	4.036	2.004	600.302	EB

Instrument Station :

Reference Object :

Height above datum (H_A) :

Height of Instrument (h_i) :

Height of Instrument axis above datum $H_A + h_i$:

Page: 11

Date:

Staff Station	Horizontal Circle Reading	Vertical Circel Reading	Staff Reading U	M	L	Intercept S = U - L	Horizontal Distance D Metres	Height Difference h Metres	h-M	Reduced Level Metres	Remarks/Diagrams
16	35 26 33	272 13 09	2.514	1.614	0.714	1.800	179.336	6.965	5.351	603.649	
17	41 09 26	272 13 16	2.723	1.718	0.702	2.021	201.351	7.827	6.109	604.407	edge of building
18	41 22 25	271 13 19	2.568	1.692	0.818	1.750	174.941	3.731	2.039	600.337	edge of "
19	47 32 02	272 20 23	2.0[illegible]	2.[illegible]	1.7[illegible]	1.[illegible]	1[illegible]7.323	7.500	5.208	603.506	
20	50 46 33	272 26 52	3.450	2.470	1.490	1.960	194.929	5.363	5.893	604.191	
21	50 54 44	272 26 56	2.85	2.836	2.200	1.664	165.489	7.103	4.267	602.565	
22	57 41 32	272 26 54	2.500	1.995	1.192	1.608	159.920	6.564	4.569	603.167	
23	60 49 57	272 27 17	3.524	2.550	1.580	1.944	193.326	8.318	5.768	604.066	
24	61 12 57	272 27 02	2.638	1.033	1.038	1.5600	159.122	6.835	4.997	603.295	
25	68 12 33	272 27 04	2.692	1.898	1.102	1.590	158.127	6.794	4.896	603.194	EB (u/c)
26	76 43 21	272 21 35	3.865	2.846	1.826	2.039	202.928	8.388	5.542	603.840	EB
27	74 41 35	272 24 35	2.425	1.226	1.027	1.398	139.140	5.757	4.525	602.823	
28	74 41 35	272 4 07	2.965	2.475	1.985	0.980	97.752	3.450	0.975	599.273	
29	68 45 06	272 13 41	2.984	2.374	1.764	1.220	121.342	4.739	2.365	600.663	EB foundation
30	59 30 12	273 45 02	2.602	2.988	2.368	1.234	122.326	5.915	2.922	601.225	EB
31											

Instrument Station :

Reference Object :

Height above datum (H_A) :

Height of Instrument (h_i) :

Height of Instrument axis above datum $H_A + h_i$:

Page: 11

Date:

Staff Station	Horizontal Circle Reading	Vertical Circel Reading	Staff Reading U	Staff Reading M	Staff Reading L	Intercept S = U - L	Horizontal Distance D Metres	Height Difference h Metres	h-M	Reduced Level Metres	Remarks/Diagrams
16	35 26 33	272 13 09	2.514	1.614	0.714	1.800	179.336	6.965	5.351	603.649	
17	41 09 26	272 13 16	2.723	1.713	0.702	2.021	201.351	7.827	6.109	604.407	edge of building
18	41 22 25	271 13 19	2.568	1.692	0.818	1.750	174.941	3.731	2.039	600.337	edge of "
19	47 32 02	272 39 23	3.438	2.598	1.752	1.686	167.323	7.806	5.208	603.506	
20	50 46 33	272 26 52	3.450	2.470	1.490	1.960	194.929	8.363	5.893	604.191	
21	50 54 44	272 26 56	2.85	2.836	2.206	1.604	165.489	7.103	4.267	602.565	
22	57 41 32	272 26 56	2.800	1.995	1.192	1.608	159.920	6.864	4.869	603.167	
23	60 49 57	272 27 17	3.524	2.550	1.580	1.944	193.326	8.318	5.768	604.066	
24	61 12 57	272 27 02	2.638	1.038	1.038	1.600	159.122	6.835	4.997	603.295	
25	68 12 33	272 27 04	2.692	1.898	1.102	1.590	158.127	6.794	4.896	603.194	EB (u/c)
26	76 43 21	272 21 35	3.865	2.846	1.826	2.039	202.938	8.388	5.542	603.840	EB
27	74 41 35	272 24 35	2.425	1.226	1.027	1.398	139.140	5.757	4.525	602.823	
28	74 41 35	272 4 07	2.965	2.475	1.985	0.980	97.752	3.450	0.975	599.273	
29	68 45 06	272 13 41	2.984	2.374	1.764	1.220	121.992	4.739	2.365	600.668	EB } foundation
30	59 30 12	273 45 02	2.602	2.988	2.368	1.234	122.326	5.915	2.922	601.225	EB } foundation
31	54 06 13	272 45 00	3.308	2.688	2.064	1.244	123.318	5.962	3.274	601.592	EB } foundation

Instrument Station :

Reference Object :

Height above datum (H_A) :

Height of Instrument (h_1) :

Height of Instrument axis above datum $H_A + h_1$

Date:

Staff Station	Horizontal Circle Reading	Vertical Circel Reading	Staff Reading U	M	L	Intercept S = U - L	Horizontal Distance D Metres	Height Difference h Metres	h-M	Reduced Level Metres	Remarks/Diag
48	171 45 57	268 43 26	2.982	3.098	2.24	1.658	165.716	-3.758	-6.556	591.442	
49	172 24 13	269 00 59	3.649	3.642	1.618	2.046	204.590	-3.512	7.154	591.144	
50	175 07 06	268 57 20	3.755	2.535	1.618	2.440	243.919	-4.447	7.92	591.286	ERi
51	183 33 40	268 44 40	3.960	2.610	1.24	2.699	269.770	-5.913	8.523	589.775	✓
52	185 24 01	265 59 53	3.600	2.920	1.240	1.780	117.936	-2.749	5.169	593.129	✓
53	135 24 01	267 52 41	3.525	2.888	1.853	2.073	207.300	-7.670	10.558	587.740	–
54	185 04 21	263 08 11	2.655	1.765	0.845	1.840	183.505	-5.981	7.746	590.52	–
55	192 15 36	267 45 42	3.568	3.192	2.422	1.546	154.375	-5.899	9.091	589.207	–
56	197 20 54	267 25 [illegible]	3.330	2.718	2.102	1.228	[illegible]	[illegible]	9.151	590.136	[illegible]
57	202 51 17	268 16 43	3.278	2.04	1.972	1.366	130.482	[illegible]	10.892	587.456	
58	206 20 59	263 16 8	3.004	2.228	1.453	1.551	154.887	-5.746	9.247	589.87	ERi
59	199 24 12	267 52 31	3.895	2.547	1.996	1.902	189.884	-7.945	5.229	593.069	✓
60	195 24 49	267 39 53	2.100	1.417	0.734	1.366	136.150	-7.830			
61	218 19 51	266 42 31	3.952	3.443	2.984	1.346	161.769	-1.786			
62	213 09 54	268 59 40	3.258	2.6[illegible]							
63	220 15 05	268 16 12									

Instrument Station :

Reference Object :

Height above datum (H_A) :

Height of Instrument (h_i) :

Height of Instrument axis above datum $H_A + h_i$:

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Date:

Staff Station	Horizontal Circle Reading	Vertical Circel Reading	Staff Reading U	M	L	Intercept S = U -L	Horizontal Distance D Metres	Height Difference h Metres	h-M	Reduced Level Metres	Remarks/Diagrams
64	233 31 31	267 19 43	3.308	2.684	2.060	1.248	124.529	-5.810	-8.494	589.804	OR
65	236 44 00	267 43 22	3.313	2.928	2.545	0.768	76.679	-3.049	-5.977	592.321	
66	252 56 31	267 27 49	3.985	3.520	3.053	0.932	93.017	-4.120	-7.640	590.658	
67	260 45 41	265 54 21	3.950	3.349	2.748	1.202	120.156	-2.295	-3.644	592.654	
68	246 09 44	368 48 53	3.393	2.722	2.048	1.345	134.360	-4.344	-7.066	591.232	
69	252 43 24	267 43 56	1.860	1.652	1.446	0.414	41.335	-1.637	-3.289	595.009	
70	[illegible] 24 37	266 08 34	3.361	3.209	3.022	0.339	33.747	-2.275	-5.484	592.814	
71	305 35 55	267 25 49	1.633	1.383	1.133	0.500	49.899	-2.239	-3.622	594.676	
72	280 52 14	266 32 40	2.936	2.502	2.068	0.868	86.485	-5.222	-7.724	590.574	
73	304 17 58	267 40 39	3.203	2.615	2.027	1.176	117.407	-4.761	-7.376	590.922	
74	319 55 40	265 32 11	3.700	2.904	2.106	1.594	159.296	-4.070	-6.974	591.224	
75	329 24 38	269 25 03	3.812	2.766	1.720	2.092	209.178	-2.127	-4.893	593.405	
76	342 24 57	270 15 54	3.025	2.539	1.053	1.972	197.196	0.912	-1.627	596.671	
77	342 24 57	270 00 30	2.680	2.010	1.340	1.340	134.000	0.019	-1.991	596.307	
78	342 24 51	268 26 46	2.796	2.355	2.001	0.795	70.448	-1.911	-4.266	594.082	
79											