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Water Pipeline Mapping to Resolve Water Problem from Eleyele Dam, Oyo State to the Polytechnic Ibadan Reservoir/Tanks Using GIS Application

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ABSTRACT

Water has been a serious challenge facing the students as well as the staff living within The Polytechnic Ibadan, Oyo State, Nigeria. Therefore this study explains the mapping of Water pipeline to resolve water problem from eleyele Dam to The Polytechnic Ibadan, Oyo State, Nigeria, and management using distance measure function from two sources; the utility surveys and GIS application to determine the spatial .location of the total number of reservoir/tanks within institution. The design route covers a total distance of approximately 5.213 kilometers. The existing water supply system of The Polytechnic Ibadan was analyzed with the help of GIS and geospatial water utility database created and the use of Total Station measurement to map out the pipeline route. Further analysis was carried out with the use of GIS application software (ArcMap 10.2) and CAD application software (AutoCAD Land Development 2014) and Surfer 11. From the results, the longitudinal profile and the cross section map showed clearly the vivid picture of the design route (purple color) where the water pipeline can be placed from eleyele dam to The Polytechnic Ibadan campus. Also, the map showing the spatial location of reservoirs/tanks within the institution was produced including the spatial queries for the good and the bad tanks. It can be concluded that the design route will help in proper laying of pipes from the dam to the institution which will help to combat the water supply challenges within the institution and future development along the design route will also be of benefit to the citizens living along the design route where water infrastructure is needed.

Keywords: Water Pipeline, Measurement, Management, Spatial Location, Design route, infrastructure

I. INTRODUCTION

Water is a necessary part of the majority human activities: it's needed in homes furthermore as in industries. Water is changing into a scarce resource with every passing year, due to improper water allocation, inefficient use, unmonitored wastage and lack of overall water management. [1] A water distribution network must be designed so that it can supply the desired quantity of water to the consumers at sufficient pressure. The design involves specifying the sizes of different elements of the distribution network and checking the adequacy of this network. [2] The joint problem of layout and component design of water distribution networks is addressed by Rowel and Barnes (1982). [3] All water utilities are created of assets. The physical assets of a water distribution system embrace pipelines, storage reservoirs, pump stations, hydrants, valves, meters, manholes, and any different elements that form up the system. Assets are often categorized as either horizontal or vertical. Vertical assets are those that are primarily on the top of the ground, such as pumps, reservoirs, and treatment facilities. The horizontal assets are usually the buried assets like the water mains that form the backbone of the water distribution and wastewater

collection systems. [4] Assets will contain different assets. As an example, a pump station will house necessary assets like motors and an electrical system that support the pumps. [5] Inspection, control and planned maintenance and rehabilitation programs are necessary to properly operate existing water distribution systems. [6]

The problem of daily controlling a water distribution network, including pumping devices, and storage capacities, in order to supply the consumers at the lowest cost is addressed by Joalland and Cohen (1980). [7] Chen (1988b) [8] considered a network without tanks and determined the optimal allocation of supply between the pump sources. A.M. Pindiga, M.J. Sani, Garba T, 2015 worked on Water Distribution Network of Bauchi Metropolis, Nigeria. The study recommends the employment of GIS as a decision making tool for municipal water system authorities or agencies to correct management and analysis of their installations. Digital map of water distribution network of the metropolis was made and queries were raised whereas the node valves or pipes underground were simply located using GPS coordinates by navigating from the surface. [9] For a pipeline route to be provided there must be route pipeline alignment which can be done by carrying out route alignment survey.

Route surveying is an aspect of surveying in engineering and construction projects that deals with location, designing and construction of route passages. These are carried out along a line, narrow belt, aligning the centre lines of long construction such as highways, road pipelines for water, tunnels and canals, railways, sewage, transmission line, oil and gas so as to facilitate transportation and communication. Profile leveling is a way of determining the heights of points at right angles to the direction of baseline or centre line at a chainage point. The leveling must be taken at regular intervals along the centre lines, then the same regular points will be needed for the longitudinal and cross section.

[10] Route survey is defined as the topographical and construction surveys necessary for location and construction of transportation lines or communication such as highways, railways canals, transmission lines and pipeline. It involved: planning, design and setting out of any route such as railways, highways, pipelines and canals etc. as obtained by a surveyor and it also involved the proper assessment of natural and man-made features. [11] He explained route surveying as the constructional processes and procedure that is involved in the production of design of route such as, pipeline, railways, transmission lines, road. Further still, [12] defined route survey as the survey necessary for the location and construction of lines of transportation or communication such as highways, canals, transmission lines and pipelines. He stated that the location and construction survey may consist of; Establishing the centre line by setting at intervals and running level to determine profile of the ground along the centre line, Taking cross section, Plotting such profile and fixing grades, Calculating volume of earthwork, Measurement of drainage areas, Laying out structures such as bridges and culverts. [13] He also stated that tunnels, dams, sewer lines, pipelines and transmission lines are engineering construction works having linear shapes which are classified as route.

Hence, route survey as a unique system for expressing route geometry has developed to a broad range used in executing project by all surveyors, designers and contractors. The total water requirement is on the increase and the per capita water consumption is also on the increase due to the increase in population and civilization [14]; [15]; [16]; [17]. According to [18], a water distribution system consists of three major components: distribution piping network, pumps and distribution storage. A network of pipes, pumps, valves and other appurtenances are required to move water from the source to the consumer. [19] Douglas

et al., 1995 [20] reported that a pipe, which conveys the flow of water from one point to another in a pipeline network, is the primary water distribution network component. Coordinates are geospatial information used to represent the location of natural or man -made features on the earth's surface. They are set of values that define a position within a spatial reference. [21] Geo-spatial information play an important role in the planning, design, location and maintenance management of water distribution infrastructure. Furthermore, most components of water infrastructure are referenced to the surface of the earth. [16] Therefore, this study aimed at providing pipeline route alignment survey from Eleyele water works to The Polytechnic Ibadan, Oyo State, Nigeria using GIS application which will help in proper planning and designing of pipeline along the route by corporate bodies or government agencies.

II. STUDY AREA

The study area was Eleyele Dam Oyo State Water works to The Polytechnic Ibadan reservoir/tanks. The study covers a distance of 5.213 kilometers. It lies within the geographical latitude 07^0 49' 39"mN to latitude of 07^0 48' 43"mN and longitude of 03^0 57'30"mE to longitude 03^0 58' 44"mE. It is bounded in the North by Apete village, in the West by Ijokodo area, in the East by University of Ibadan and in the south by Sango to Eleyele road. Figure 1 below shows the map of the study area

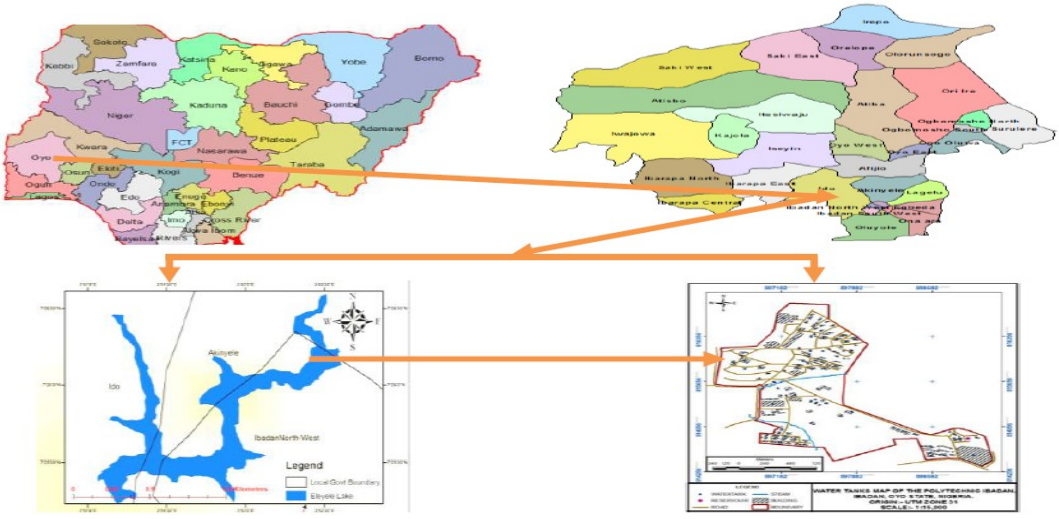

Figure 1. Map of the study area

III. MATERIALS/METHODS

Equipment Used

1. Total Station (Leica T06 Plus)
2. 2 Handheld GPS (Garmin)
3. 2 Ranging pole and 2 Prism reflector
4. 1 Red flag one
5. 1 Steel tape (50m)
6. Walkie-Talkie
7. Red paint.
8. Field book and writing materials
9. Leica USB drives (for downloading of field data).
10. Laptop computer and Hp Laserjet Printer

The software's used for the study are:

1. Microsoft Excel 2013 for editing of data
2. Notepad for the running of script.
3. AutoCAD Land development 2009 for drafting and profiling.
4. ArcGIS 10.2 for database creation, management, and spatial analysis
5. Microsoft Word 2007
6. Surfer 11 for contour and surface production

Method of Data Acquisition: For this study, data were acquired from both the Primary and Secondary source. The primary source is acquired directly from the field using handheld GPS to determine the spatial coordinates x, y, z of locations for all the reservoir/tanks within the institution while the Leica total station equipment was used to determine the geographical coordinates in three-dimensional (x, y, and z) of the centre line and cross-sectional points with 25m centre line interval and 10m interval for the cross sectioning on each side of the route. The secondary data are data retrieved from a downloaded image from online, information from social survey. Total station traverses was run through the proposed water distribution pipeline routes; The total station survey was carried out at millimetre (mm) level accuracy to capture break in slopes while support levels were run between the total station traverse routes in order to prepare ground profiles of the proposed water pipeline routes.

Data Processing: For this study, the data was downloaded from the total station into the computer with the help of leica USB flash. The final coordinates (x, y, z) were plotted in AutoCAD Land Development 2014 and Arc GIS 10.2.

Table 1. Attributes table showing location, building type and use, and tank capacity per litres

Table

WATERTANK

FID	Shape *	LOCATION	NO_TANK	BADTNK	GOODTNK	TNK_CPCITY	BUILD_TYPE	NO_FLAT	BUILD_USE	BUILD_NO
0	Point	SSQ UOKODO	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	-
1	Point	SSQ UOKODO	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	-
2	Point	SSQ UOKODO	1	0	1	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	-
3	Point	SSQ UOKODO	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	-
4	Point	SSQ UOKODO	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	-
5	Point	SSQ UOKODO	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	-
6	Point	SSQ UOKODO	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	-
7	Point	SSQ UOKODO	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	13A&B
8	Point	SSQ UOKODO	0	0	0	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	14A&B
9	Point	SSQ UOKODO	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	15A&B
10	Point	SSQ UOKODO	4	0	4	38749 LITRE	PUBLIC WATER	-	PUBLIC WATER	INFRONT OF SSQ15A
11	Point	SSQ UOKODO	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	16A&B
12	Point	SSQ UOKODO	3	2	1	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	11A&B
13	Point	SSQ UOKODO	2	1	1	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	17A&B
14	Point	SSQ UOKODO	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	18A&B
15	Point	SSQ UOKODO	2	1	1	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	12A&B
16	Point	SSQ UOKODO	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	10A&B
17	Point	SSQ UOKODO	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	9A&B
18	Point	MIDDLE BELT	4	0	4	12,200 LITRE	RELIGIOUS	-	PRAYING CENTRE	MUSLIM COMMUNITY MO
19	Point	MIDDLE BELT	2	0	2	12,200 LITRE	CLASSROOM AND OF	6	EDUCATION	POLY HIGH SCH
20	Point	MIDDLE BELT	1	0	1	12,200 LITRE	EDUCATION	4	EDUCATION	POLY NUR/PRY SCH
21	Point	MIDDLE BELT	1	0	1	12,200 LITRE	BUNGALOW	10	EDUCATION	POLY STAFF SCH
22	Point	MIDDLE BELT	1	0	1	19,706.4 LITRE	LIBRARY	3	READING ROOM AND OF	CENTRAL LIBRARY
23	Point	MIDDLE BELT	1	0	1	12,200 LITRE	BUNGALOW	1	MEDICAL TREATMENT	HEALTH CENTRE
24	Point	MIDDLE BELT	3	0	3	19706.4 LITRE	WATER TANK	-	WATER RESERVE	BESIDE HEALTH CENTRE
25	Point	MIDLE BELT	3	0	3	19,706.4 LITRE	WATER TANK	-	WATER RESERVE	INFRONT OF CENTRAL LI
26	Point	MIDDLE BELT	1	0	1	12,200 LITRE	FLAT	1	DAY CARE	CRECH
27	Point	MIDDLE BELT	1	0	1	12,200 LITRE	BUNGALOW	1	OFFICES	FACULTY OF BANKING
28	Point	MIDDLE BELT	4	0	4	19,706.4 LITRE	BUNGALOW	1	OFFICES	FIRE STATION
29	Point	MIDDLE BELT	1	0	1	12,200 LITRE	HALL	-	LECTURE ROOM	ADEMOLA HALL 2
30	Point	MIDDLE BELT	1	0	1	12,200 LITRE	HALL	-	LECTURE ROOM	ADEMOLA HALL 1
31	Point	MIDDLE BELT	2	0	2	12,200 LITRE	BUNGALOW	2	OFFICES	CEC ADMIN OFFICE
32	Point	MIDDLE BELT	1	0	1	12,200 LITRE	HALL	1	LECTURE ROOM	ROTUNDA HALL
33	Point	MIDDLE BELT	2	0	2	12,200 LITRE	TOILET	-	TOILET	PUBLIC TOILET 1
34	Point	MIDDLE BELT	2	0	2	12,200 LITRE	TOILET	-	TOILET	PUBLIC TOILET 2
35	Point	MIDDLE BELT	1	0	1	12,200 LITRE	FLAT	2	OFFICES	POLY COOPERATIVE
36	Point	NORTH	1	0	1	12,200 LITRE	HALL	-	BANKING	POLY MICROFINANCE
37	Point	MAINTAINANCE	2	0	2	12,200 LITRE	BUNGALOW	4	WORKSHOP AND OFFICE	WORKS AND SERVICE D
38	Point	NORTH	2	0	2	12,200 LITRE	BUNGALOW	2	STUDIO AND OFFICE	ARCHITECTURE DEPART
39	Point	NORTH	2	0	2	12,200 LITRE	BUNGALOW	2	STUDIO AND OFFICES	URP DEPARTMENT

40	Point	NORTH	2	0	2	12,200 LITRE	BUNGALOW	1	OFFICE	BIOLOGY DEPT
41	Point	NORTH	2	0	2	12,200 LITRE	BUNGALOW	1	OFFICE	FACULTY OF FBCS
42	Point	NORTH	1	0	1	12,200 LITRE	OFFICE	1	OFFICE	OTM 1
43	Point	NORTH	2	0	2	12,200 LITRE	OFFICE	1	OFFICE	OTM 2
44	Point	NORTH	1	0	1	12,200 LITRE	OFFICE	1	OFFICE	BURSARY
45	Point	NORTH	3	0	3	12,200 LITRE	OFFICE	1	OFFICE	BURSARY
46	Point	NORTH	4	0	4	12,200 LITRE	ADMINISTRATIVE BUIL	5	OFFICE AND CIDM	RECTORS OFFICE
47	Point	NORTH	1	0	1	12,200 LITRE	BUNGALOW	2	OFFICE	STUDENT AFFAIRS
48	Point	ALONG POLY/UI GATE NORTH	1	0	1	12,200 LITRE	FLAT	4	VOCATIONAL STUDIES	NEW VSECS BUILDING
49	Point	NORTH	28	24	4	12,200 LITRE	FLAT	29	RESIDENTIAL	UNITY HALL
50	Point	NORTH SENIOR STAFF QUARTERS	3	0	3	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 6968
51	Point	NORTH SENIOR STAFF QUARTERS	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 6463
52	Point	NORTH SENIOR STAFF QUARTERS	3	2	1	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 67&65
53	Point	NORTH SENIOR STAFF QUARTERS	1	0	1	12,200 LITRE	FLAT	1	RESIDENTIAL	SSQ 61
54	Point	NORTH SENIOR STAFF QUARTERS	4	0	4	12,200 LITRE	MOTEL	2	GUEST HOUSE	POLY GUEST HOUSE
55	Point	NORTH SENIOR STAFF QUARTERS	2	1	1	12,200 LITRE	BUNGALOW	1	RESIDENTIAL	SSQ 52
56	Point	NORTH SENIOR STAFF QUARTERS	1	1	0	12,200 LITRE	BUNGALOW	1	RESIDENTIAL	SSQ 53
57	Point	NORTH SENIOR STAFF QUARTERS	1	0	1	12,200 LITRE	BUNGALOW	1	RESIDENTIAL	SSQ 59
58	Point	NORTH SENIOR STAFF QUARTERS	4	1	3	12,200 LITRE	BUNGALOW	1	RESIDENTIAL	SSQ 62
59	Point	NORTH SENIOR STAFF QUARTERS	4	2	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 49&50
60	Point	NORTH SENIOR STAFF QUARTERS	3	3	0	12,200 LITRE	BUNGALOW	1	RESIDENTIAL	SSQ 46
61	Point	NORTH SENIOR STAFF QUARTERS	1	0	1	12,200 LITRE	BUNGALOW	1	RESIDENTIAL	SSQ 45
62	Point	NORTH SENIOR STAFF QUARTERS	4	1	3	12,200 LITRE	FLAT	6	RESIDENTIAL	SSQ 35-40
63	Point	NORTH SENIOR STAFF QUARTERS	6	1	5	12,200 LITRE	FLAT	6	RESIDENTIAL	SSQ 29-34
64	Point	NORTH SENIOR STAFF QUARTERS	2	1	1	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 14&16
65	Point	NORTH SENIOR STAFF QUARTERS	2	1	1	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 13&15
66	Point	NORTH SENIOR STAFF QUARTERS	3	0	3	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 5&7
67	Point	NORTH SENIOR STAFF QUARTERS	4	0	4	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 6&8
68	Point	NORTH SENIOR STAFF QUARTERS	5	2	3	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 1&3
69	Point	NORTH SENIOR STAFF QUARTERS	3	0	3	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 2&4
70	Point	NORTH SENIOR STAFF QUARTERS	4	1	3	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 9&11
71	Point	NORTH SENIOR STAFF QUARTERS	6	2	4	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 10&12
72	Point	NORTH SENIOR STAFF QUARTERS	8	3	5	12,200 LITRE	FLAT	6	RSIDENTIAL	SSQ 41-46
73	Point	NORTH SENIOR STAFF QUARTERS	4	1	3	12,200 LITRE	FLAT	6	RESIDENTIAL	SSQ 47-52
74	Point	NORTH SENIOR STAFF QUARTERS	5	1	4	38746.536 LITRE	PUBLIC WATER	-	-	SSQ PWATER
75	Point	NORTH	1	0	1	12,200 LITRE	BANK	1	BANKING HALL	ZENITH BANK
76	Point	NORTH SENIOR STAFF QUARTERS	4	0	4	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 43&44
77	Point	NORTH SENIOR STAFF QUARTERS	1	0	1	12,200 LITRE	BUNGALOW	1	RESIDENTIAL	SSQ 41&42
78	Point	NORTH SENIOR STAFF QUARTERS	4	0	4	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 55&56
79	Point	NORTH SENIOR STAFF QUARTERS	1	0	1	12,200 LITRE	BUNGALOW	1	RESIDENTIAL	SSQ 61
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81	Point	NORTH SENIOR STAFF QUARTERS	1	0	1	12,200 LITRE	BUNGALOW	1	RESIDENTIAL	SSQ 59
82	Point	NORTH SENIOR STAFF QUARTERS	1	0	1	12,200 LITRE	BUNGALOW	1	0FFICE	VSECS
83	Point	NORTH SENIOR STAFF QUARTERS	4	0	4	12,200 LITRE	RESIDENTIAL	2	RESIDENTIAL	SSQ
84	Point	NORTH SENIOR STAFF QUARTERS	1	1	0	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 45
85	Point	NORTH SENIOR STAFF QUARTERS	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 36&37
86	Point	NORTH SENIOR STAFF QUARTERS	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 42&43
87	Point	NORTH SENIOR STAFF QUARTERS	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 40
88	Point	NORTH	2	0	2	12,200 LITRE	FLAT	6	OFFICE, WORKSHOP, AN	PHYSICS
89	Point	NORTH	1	0	1	12,200 LITRE	BUNGALOW	1	OFFICE	MATH AND STATISTICS
90	Point	NORTH	1	0	1	12,200 LITRE	BUNGALOW	1	OFFICE	POLY CONSULT
91	Point	NORTH	1	0	1	12,200 LITRE	BUNGALOW	2	OFFICE	ADMINISTRATIVE OFFICE
92	Point	NORTH	1	0	1	12,200 LITRE	FLAT	4	OFFICE AND LECTURE R	COMPUTER DEPT
93	Point	NORTH	2	1	1	12,200 LITRE	BUNGALOW	1	OFFICE AND LABORATO	CHEMISTRY DEPT
94	Point	MIDDLE BELT	2	0	2	12,200 LITRE	FLAT	3	OFFICE	CENTRAL ADMINISTRATI
95	Point	NORTH	7	0	7	12,200 LITRE	RESIDENTIAL	8	RESIDENTIAL	RAMAT HALL
96	Point	NORTH	8	0	8	12,200 LITRE	FLAT	24	RESIDENTIAL	
97	Point	SOUTH	20	1	19	12,200 LITRE	FLAT	36	RESIDENTIAL	ORISUN HALL
98	Point	SENIOR STAFF QUARTERS SOUTH	1	0	1	12,200 LITRE	BUNGALOW	1	RESIDENTIAL	SSQ
99	Point	SENIOR STAFF QUARTERS SOUTH	2	0	2	12,200 LITRE	FLAT	2	RESIDENTIAL	SSQ
100	Point	SENIOR STAFF QUARTERS SOUTH	2	0	2	12,200 LITRE	BUNGALOW	1	RESIDENTIAL	SSQ
101	Point	SENIOR STAFF QUARTERS SOUTH	1	0	1	12,200 LITRE	BUNGALOW	1	RESIDENTIAL	SSQ
102	Point	SENIOR STAFF QUARTERS SOUTH	2	0	2	12,200 LITRE	FLAT	3	RESIDENTIAL	SSQ
103	Point	SENIOR STAFF QUARTERS SOUTH	2	0	2	12,200 LITRE	FLAT	2	RESIDENTIAL	SSQ
104	Point	SENIOR STAFF QUARTERS SOUTH	2	0	2	12,200 LITRE	FLAT	2	RESIDENTIAL	SSQ
105	Point	SOUTH	2	0	2	12,200 LITRE	FLAT	2	OFFICE	QUANTITY SURVEY DEP
106	Point	SOUTH	4	0	4	12,200 LITRE	FLAT	3	OFFICE	FACULTY OF ENGINEERI
107	Point	SOUTH	2	0	2	12,200 LITRE	BUNGALOW	1	LECTURE ROOM	NAEES HALL
108	Point	SOUTH	2	0	2	12,200 LITRE	FLAT	2	OFFICE	DEPUTY RECTOR OFFICE
109	Point	SOUTH	2	0	2	12,200 LITRE	FLAT	40	LECTURE ROOM AND LA	MECHATRONICS ARENA
110	Point	SOUTH	2	0	2	12,200 LITRE	BUNGALOW	1	OFFICE	PENSIONER BUILDING
111	Point	SOUTH	1	0	1	12,200 LITRE	BUNGALOW	1	OFFICE	ALUMNI BUILDING
112	Point	SOUTH	1	0	1	12,200 LITRE	BUNGALOW	1	BANKING HALL	WEMA BANK
113	Point	SOUTH	2	0	2	12,200 LITRE	BUNGALOW	1	CONFRENCE HALL	CONFRENCE CENTRE
114	Point	SOUTH	2	0	2	12,200 LITRE	BUNGALOW	1	-	CONFRENCE CENTRE
115	Point	SOUTH	2	0	2	12,200 LITRE	BUNGALOW	4	BIOMETRIC AND POST U	ICT CENTRE
116	Point	SEWAGE	1	0	1	12,200 LITRE	BUNGALOW	1	OFFICE	CADET BASE
117	Point	SEWAGE	2	0	2	12,200 LITRE	TOILET	1	TOILET	SEWAGE TOILET
118	Point	NORTH	1	0	1	12,200 LITRE	BUNGALOW	2	OFFICE	ITF CENTRE
119	Point	NORTH	2	0	2	12,200 LITRE	FLAT	6	RESIDENTIAL	RAMAT ANNEX
120	Point	NORTH	3	0	3	12,200 LITRE	FLAT	4	RESIDENTIAL	RECTORS LODGE
121	Point	NORTH	1	0	1	12,200 LITRE	BUNGALOW	1	OFFICE	PRELIM OFFICE
122	Point	NORTH	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ
123	Point	NORTH	2	0	2	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 9
124	Point	NORTH	1	0	1	12,200 LITRE	BUNGALOW	2	RESIDENTIAL	SSQ 10
125	Point	NORTH	2	0	2	12,200 LITRE	BUNGALOW	1	RELAXATION CENTRE	SENIOR STAFF CLUB

IV. RESULTS

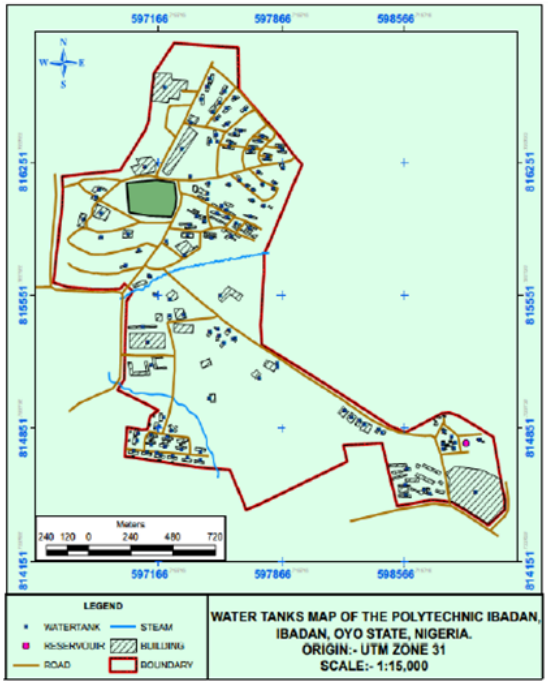

Figure 1. Composite Map of The Polytechnic Ibadan

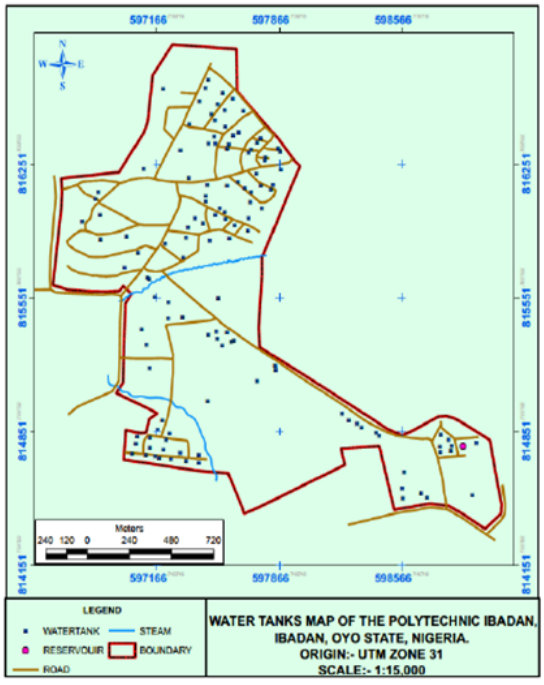

Figure 2. Map Showing Water Tanks and Reservoir

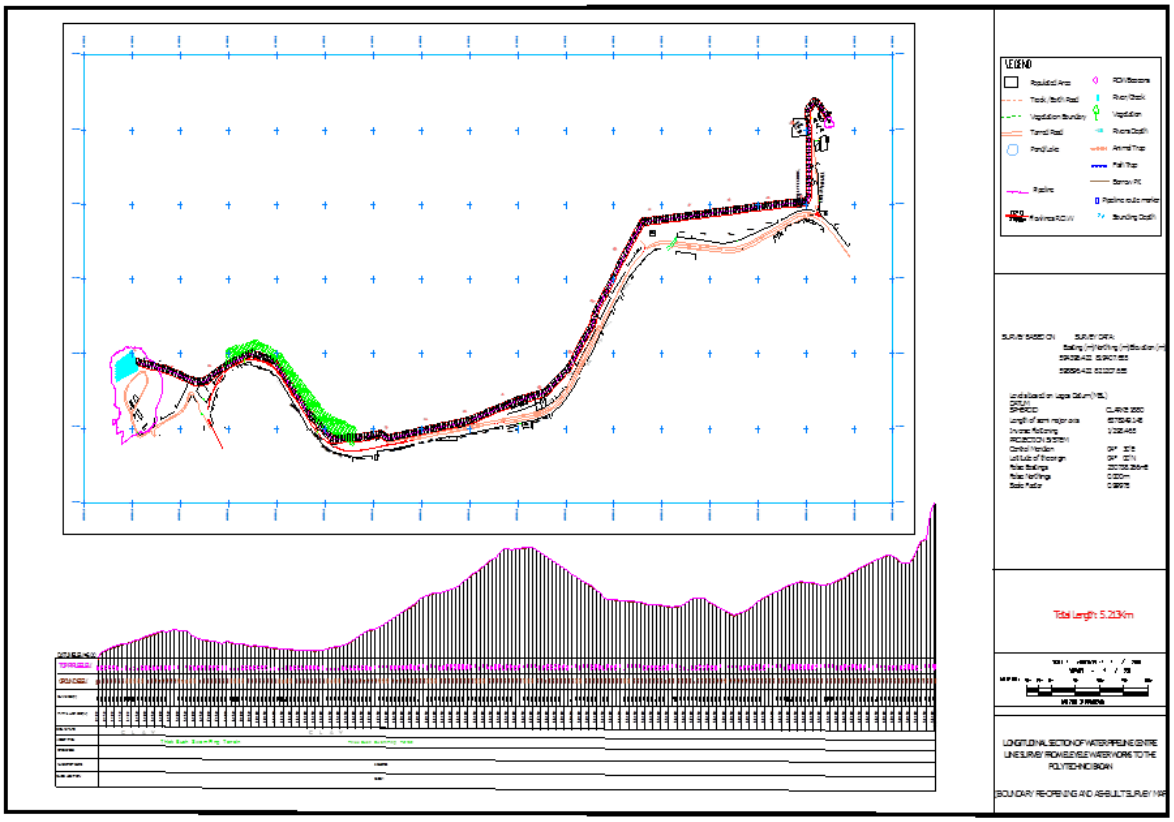

Figure 3. Composite plan and profile of water pipeline Route

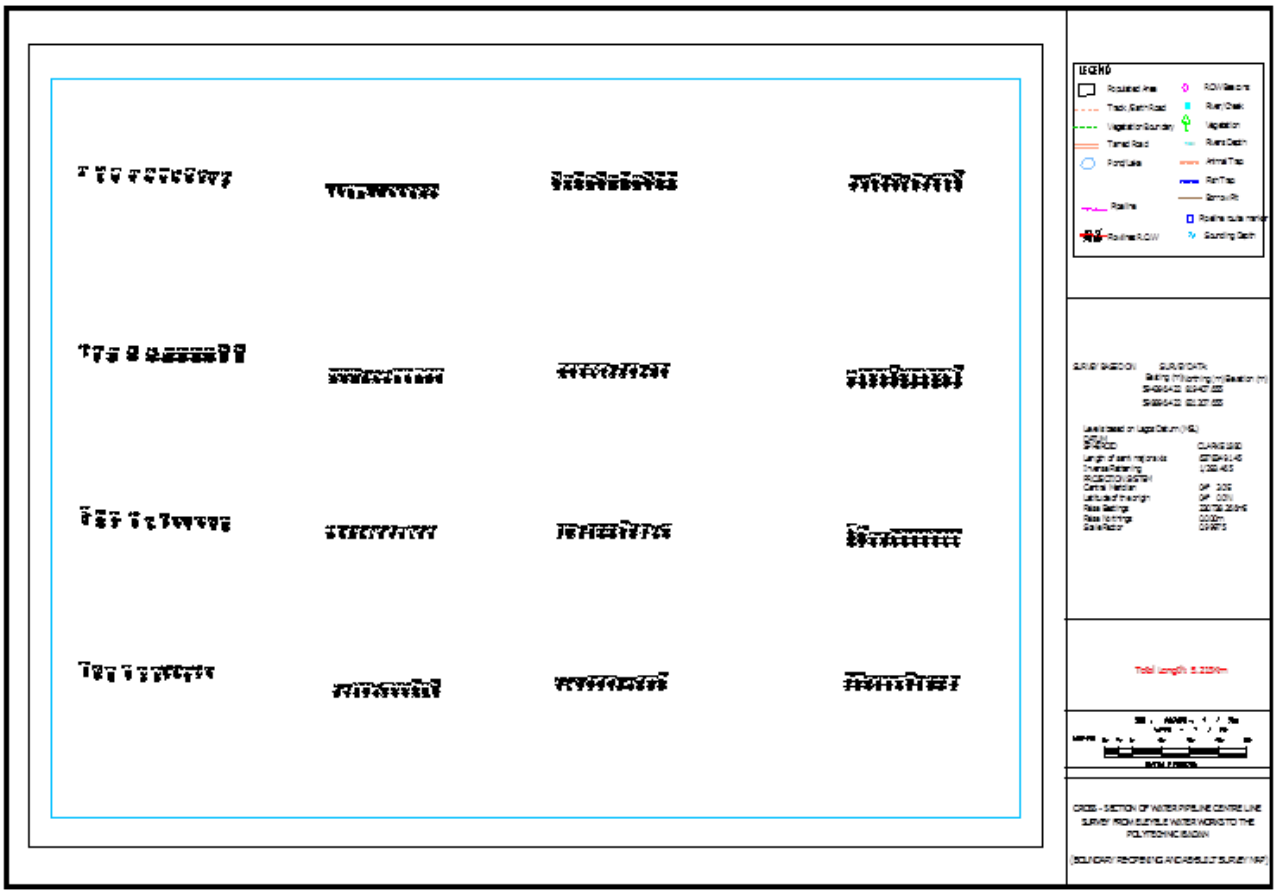

Figure 4. Cross Section map for the study

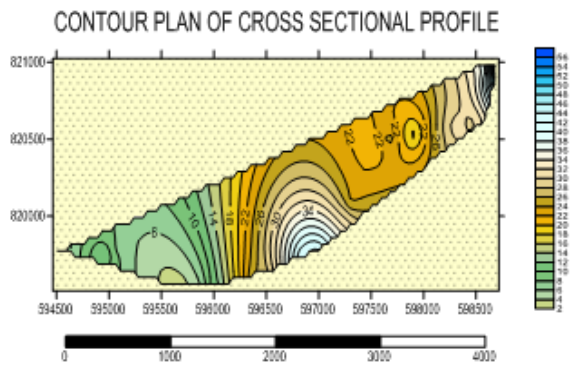

Figure 5a: Contour Plan of the cross section profile

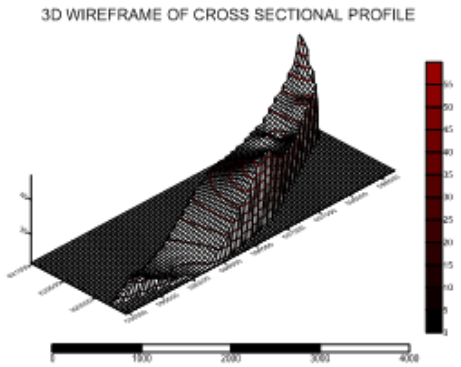

Figure 5b: 3D Wireframe of cross section

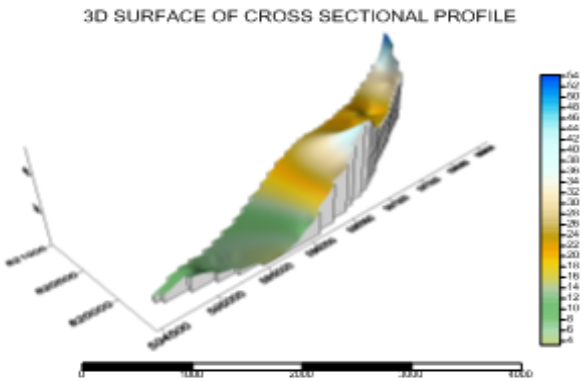

Figure 6a: 3D Cross Section Surface Map

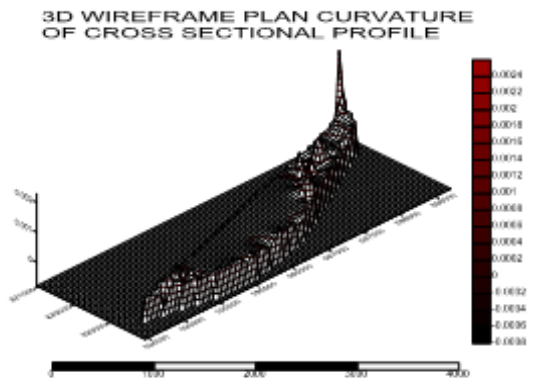

Figure 6b:3D wireframe Wireframe Curvature

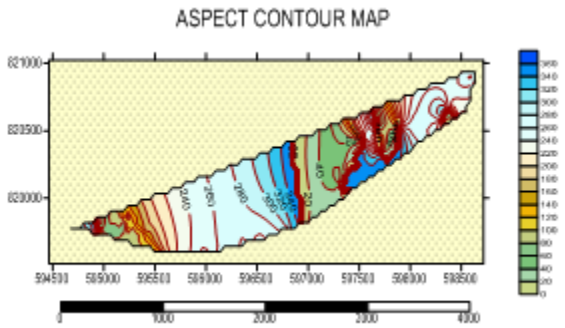

Figure 7a: 3D Aspect Contour Map

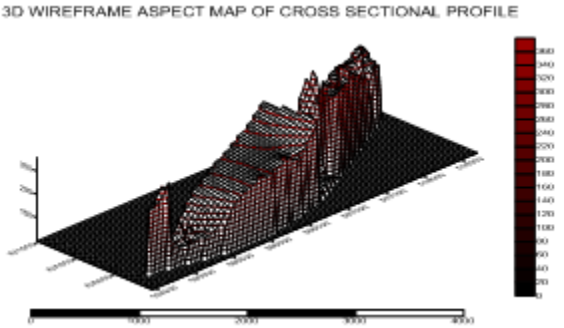

Figure 7b: 3D wireframe Aspect Map

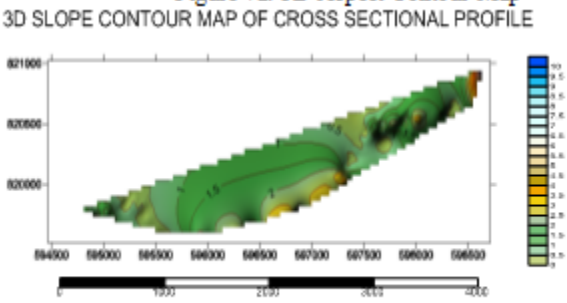

Figure 8a: 3D Slope Contour map

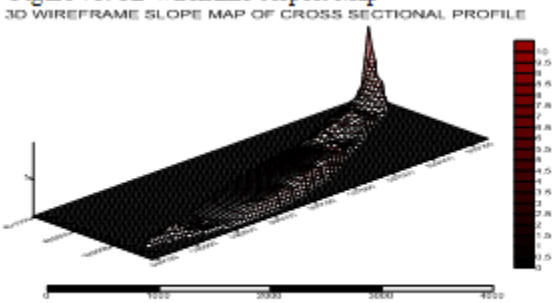

Figure 8b: 3D wireframe slope map

V. DISCUSSION OF RESULTS

The result in (figure 2) showed that three hundred and twenty six (326) tanks (aluminium and plastics) in which three hundred and twenty two (322) tanks contain twelve thousand two hundred (12,200) litres of water per tank while the remaining four (4) tanks at (Central Library, Water reserve beside health centre, water reserve opposite central Library and fire station) all at the middle belt of the institution contains 19,706.4 litres per tank which indicates that the litres in those four area were bigger than the remaining tanks and only one reservoir that was at Orisun Hall, South Campus of The Polytechnic Ibadan. Here, it was observed that two hundred and seventy one(271) reservoir (83%) are in good condition while fifty five (55) tanks (17%) of the water tanks were in bad condition which implies that more water tanks are needed to solve water problem within the institution. The symbol with purple color (figure 3) showed the main pipeline design route for the study. From the legend, each feature was represented with different color as it is represented on the map/plan (figure 3). Figure 4 depicts the cross section profile. The contour map (figure 5a), aspect and slope contour (7a & 8a) depicts the cross sectional profile showing the topography of the study area. Figure 6a showed the 3D cross sectional surface. Figure 5b & 6b depicts 3D wireframe and 3D wireframe plan curvature. Figure 7b & 8b depicts 3D wireframe of aspect and slope map. The Longitudinal Profile and the cross section clearly showed vivid picture of the terrain and the route in which the pipeline can be placed from eleyele dam to The Polytechnic Ibadan. The size of the proposed pipe for the pipeline route for the study was 12 inches (0.305m). According to [17], most engineering infrastructure such as waterlines, railways, highways, buildings, dams and powerlines located on, beneath or above the surface of the earth are spatial objects. The most convenient and most used method of describing their positions is by their rectangular coordinates. [22]

Application of Products

1. It can be used for sustainable water production and consumption in the study Area
2. It can be used for Decision making on physical planning of the Area

3. It can be used for land Evaluation
4. It can be used for utility distribution planning operations
5. It will aid infrastructure facility distribution in the Study Area

VI. CONCLUSION AND RECOMMENDATION

This study examined the use of Geographical Information System and Geomatics techniques in solving water problem within The Polytechnic Ibadan and its environment by determining the route alignment for pipes through route alignment survey from Eleyele Dam Oyo State. The results showed exactly the total number of reservoir that are in place be it good or bad. Also, the Longitudinal and cross sectional route design produced will go a long way in planning for where water pipe should be placed. More tanks should be provided by the institution management to curb the menace of water problem within the institution. At last, in spite of all odds the production of proper alignment of water pipeline, which can be used to run pipe from Eleyele Dam to the Polytechnic, Ibadan for consumption of water by its student and staff due to the present poor state of water in the institution, has been achieved. The importance of water pipeline to resolve the water problem at the Polytechnic Ibadan in the planning, location, design and development of water distribution infrastructure has been highlighted. Moreover, in a dynamic world with increasing population, urbanization and industrialization, the geo-spatial information (the water distribution systems maps) should be regularly updated using Geomatics technology and equipment including Electronic Total Station (ETS), GNSS receivers, or satellite remote sensors

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