DEDICATION

I dedicate this write up to God Almighty who gave me the enablement to write and to my husband who served as a great help to me during the writing of this project.

WATER QUALITY ANALYSIS FOR IRRIGATION PURPOSE:

CASE STUDY OF STREAM LANZUN BIDA, NIGER STATE

By

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SUBMITTED IN PARTIALFULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGEE OF POST-GRADUATE DIPLOMÁ IN AGRICULTURAL ENGINEERING OF FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA.

JUNE, 2002

CERTIFICATION

A project submitted to the Department of Agricultrial Engineering Federal University of Technology, Minna in partial fulfillment of the requirement for the award of post-graduate Diploma in Agricultural Engineering. The project was certified by:

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ACKNOWLEDGMENT

I give glory to God Almighty who made it possible for me to carry out this project. I acknowledge the fact that except He builds a house, the labourers are only labouring in vain. I thank Him for the possibility.

I appreciate the efforts of my project supervisor Dr. J. K Adewumi who took the pains to take me through the rudiments of the project. Engr. Muhammed Nakorgi of irrigation department Bida is one person I am indebted to so greatly for his concern, efforts and advise towards the success of this work. To Engr. Bashir Muhammed I say thank you.

The Head of department Agric. Engineering Department Dr. D. Adgidzi and members of staff of Agric. Engineering Department I say thank you.

I appreciate the co-operation and efforts of my husband Engr. Solomon O. Oladoja during the course of this programme. You are wonderful God bless you. To all friends too numerous to mention but who contributed in one way or the other towards the success of this work. You shall be richly rewarded in Jesus name (Amen).

ABSTRACT

The evaluation of water quality for Irrigation purpose in river lanzun with the intention of finding solution to the problem and recommending ways of bringing the stream to supply good quality water to Bida environment can not be over emphasised.

The effectiveness of water quality and supply measures are related to their effect on the users; if the supply of good quality water is made available, the lives of the users will be saved and surplus food will be made available.

Therefore for these to be achieved certain tests were carried out to evaluate the water quality.

It was found in the analysis of water samples taken, that the coli form count of the stream is high, Ecoli is positive, MPN is 16.0, other organisms is positive other coli is positive.

Therefore from the result of the analysis the water in the locality is good for the purpose of the evaluation and possible comparison should be made to provide cheap chemical and extension farmers to realize the goals.

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CHEMICALS AND SYMBOL

1.	Pb	-	Lead
2.	F	-	Fluoride
3.	As	-	Arsenic
4.	Sc	-	Selenium -
5.	Cr ⁶⁺	-	Hexavalent Chromium
6.	Ba	-	Barium
7.	Cu	-	Copper
8.	Fe	-	Iron
9.	Mn	-	Manganese
10.	Mg	-	Magnesuim
11.	Zn	1	Zinc
12.	C1	-	Chlorine
13.	SO-4	-	Sulphate
14.	рН	-	Pondehy dromuim ion
15.	CO ²⁻ 3	-	Carbonate
16.	CaCo ₃	-	Calcium Carbonate

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CHAPTER ONE

1.0 INTRODUCTION

1.1 GENERAL

Water quality analysis deals with the supply of quality water for public and Irrigation purpose. It is the supply of water in its purest form for public use to stop the spread of diseases to both human and livestock and also the supply of water to agricultural land in the form that at will not affect the growing plants negatively. (H.L. Goeterman 1978).

The origin of this stream is a spring located near Egbazhi village which is near the Islamic School and it is directly opposite former Vespa Company at the western side of Bida. In conjunction with natural rain water . (Irrigation Department Bida).

The natural rain water as it falls and flows on the surface of the land dissolves some chemical element and bacteriological toxic that will affects its quality to both the public and agricultural land. (H.L. Goeterman 1978).

Water can thus be considered as the most important raw material of cirllization, since without it, man and plant can not survive. The concept of water as a natural resources is essential, as growing population with corresponding food demand ever increasing supplies of quality water.

The importance of water can not be over emphasized because man's prime need in his environment is for quality water both for public and agricultural use. It is therefore essential that such a supply

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must be of very high quality. Liquid and solid wastes from such an environment if not dispelled off in a satisfactory manner can render the water in that area unpleasant and unhealthy.

Man requires water for his numerous activities, be it domestic, agricultural or industrial; for water to be safe and reliable for their activities, it must satisfy the standard qualitative requirement recommended by the world health organisation in 1970, 1971. (Michael 1950).

These requirements are broadly classified into three different areas, which are physical, chemical and bacteriological parameters.

Due to the importance of water, man has employed ways of storage both for domestic, agricultural and industrial use by means of storage reservoirs in forms of Dams, surface reservoirs and elevated reservoirs to enhance its availability. (Taiwo, 1979).

1.2 STATEMENT OF PROBLEMS

The Increasing Population

The increasing population worldwide calls for exploration of water for domestic and commercial purposes, this is so because the importance of water to man, plant, and animals is too much to mention, hence, ways and method of exploring, conserving and recycling water has to be identified so as to experience its scarcity which will have consequence effect to man and its environment.

The need for increase production for the low and subsistence farming. Water plays very important parts in the life of a farmer. Hence for both low and subsistence farmer water has to be sourced

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especially for Irrigation. In growing this water, its quality and quantity has to be considered to determined whether the water meet W.H.O standard for Irrigation.

One of the avenues for increased production is through the mechanized farms with large expanse of land coupled with adequate (competent) Manpower and machinery production round demands adequate and quality water for man, animals and Irrigation.

1.3 JUSTIFICATION

Since water is a universal material and common in origin, man has to employ ways of its utilization not only for drinking unit, for other public and agricultural uses.

To achieve this, its quality has to be examined for various uses such as

- i. To protect the health of the consumers by eliminating water borne infections.
- To protect the plants against dissolved chemical that will affect their growth.
- iii. Also for authentic reasons, the removal of qualities which not being harmful are authentically unpleasant. For example, the removal of taste, colour, odour and turgidity.
- iv. For economic reasons, for example in softening water and removing Iron to reduce laundry costs, and save the laundered materials.
- v. For industrial purposes, for example, in the preparation of water suitable for use in boilers. For example by removal of

salts of calcium and magnesium which would form scales in boilers and increase heating costs and time.

- vi. For other miscellaneous reasons, for example to reduce corrosiveness in pipes and to add desirable elements, for example iodine and fluorides to combat quite and tooth respectively.
- vii. Also to ascertain whether existing Irrigation waters would have any detrimental effects on the soil or crops or it will not have effect on it.

1.4 SCOPE OF STUDY

The scope of the study is to:

- a. Analyse water of Landzun stream to ascertain its quality for man, animals and Irrigation purposes.
- b. Make recommendation for quality and distribution.

1.5 AIMS AND OBJECTIVES

The research project work is aimed at studying the quality of water in Landzun stream around Bida area for Irrigation purpose. The study should be able to determine.

- 1. The chemical quality of water for Irrigation purpose and public use.
- To compare or correlate the chemical analysis of data with W.H.O standard.
- To proffer corrective measures and management practice for Irrigation and portability where such acceptable limits are exceeded.

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CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 SOURCE OF LANDZUN STREAM

Landzun Stream which has its origin from a spring, is located near a village called Egbazhi and directly opposite the former vespa company at the western side of Bida in Niger State.

Landzun stream flows from this location through the side of the prison yard, following the back of the school of midwifery and all through the house of Usman Zaki and polytechnic junction which later join the river share at a point along Agaie gate which later join a samply location. (Fig. 1)

2.2 QUALITY OF WATER

2.2.1 COMPOSITION OF WATER

The quality of natural water depends upon its content of impurities. Water itself is an associated liquid consisting of hydrol H_2O , dihydrol $(H_2 O)_2$ tri-hydrol $(H_2 O)_3$, and hydrogen and hydroxyl ions H⁺ and OH⁻. The impurities in water occur in three progressively finer states of subdivision, suspended, colloidal, and dissolved which are of significance in that they influence the methods required for the removal of the impurities. The total amount of solid impurities in water is obtained by the total solid test, in which a sample of unfiltered water is evaporated and the residue weighed. The result is expressed in parts per million (ppm) by weight, and it includes suspended, colloidal and dissolved solid. A suspension is a dispersion of solid particle that are large enough to be removed by filtration on settling. Such particle are macroscopic and contribute turbidity to the water. The concentration of suspended neither in water is measured by its turbidity or by the suspended solids analysis. The turbidity of a water is its capacity of absorbing or scattering light and is measured by the concentration of fine silica in (ppm) part per million, which produces an equivalent effect. The suspended solids content of water is the conc. in (ppm) part per million by weight of solid matter removed from the water by filtration through a filter paper. There is no definite relation between suspended solids and turbidity in as much as the size and character of suspended particles as well as their concentration influence, the latter by weight. The ratio of the suspended solids to the turbidity called the coefficient of fineness is a measure of the size of particles causing turbidity, the particle size increasing with the coefficient of fineness.

The suspended - solid determination widely used for concentrated suspensions such as sewage but is difficult to apply to relatively clear water and therefore is not commonly used in routine water analysis.

A colloid or solution, is a finely divided dispersion of one material called the dispersed phase in another called the dispersion medium. An aqueous suspension colloid is a water solution of solid particle that are too small to be removed effectively by ordinary filters and which were so small that they exhibit Brownian Motion (i.e they diffuse) and that the electric charges on their surfaces are large enough in comparison with their mass to cause the particles to repel one another when they move within the sphere of action of each other charges. The electric charge is due to the presence of adsorbed ions on the surface of the solid and the material of the particle and PH value of the liquid determines the sign of the charge neutral or acid materials such as silica glass, and most organic particles tend to acquire negative charges in neutral water, where as basic materials such as the metallic oxides Al_2O_3 and Fe_2O_3 tend to be positively charged.

Many colloidal particle also adsorb water, and when the amount of adsorbed water is large as compared with the solid matter in the particle the colloid is called an emulsion. Most of the properties of colloidal particles varies widely with the character of the particle but is approximately 1 $\mu(1\mu = 1 \text{ Micro} = 0.00)$.

Colloidal particles cannot be seen with the naked eye except with the aid of a Tyndall cone of light. In ordinary light a suspension appears clear but is usually coloured. Most of the colour of water is due to the presence of colloidal particles, but some colloids such as silica are colourless.

There is no convenient means in routine laboratory technique for measuring the amount of colloidal matter in water but the colour test is an indication of the concentration of certain types of colloidal matter.

The colour of water is the amount of platinum in platinum cobalt colour standard expressed in (ppm) parts per million required to match the strength colloidal of the water. In order to remove colloidal particle from water, they must first be combined into large particles by coagulation, after which settling and filtration are effective. Some colour may also be remove by adsorbent.

A solution is a molecular or ionic dispersion. Solids, liquids, and gases are dissolved in natural water. Some substances, particularly organic compounds remain in solution largely as molecular dispersions. Other substances the strong electrolytes, ionize completely when they are dissolved in natural water. Practically all inorganic rocks or salts are found in true solution in nature are fully ionized in the concentrations in which they normally occur. The concentration of total dissolved solids, usually expressed in (ppm) parts per million, is obtained by weighing the residue after evaporation of the water from the filtered sample. The determination will include colloidal matter if present. Substance in the solution may be removed from water in a variety of ways. Some dissolved solids may be removed by adding a chemical that reacts with the soluble substance to form a precipitate, the precipitate being subsequently regulated and removed by sedimentation and filtration. Some dissolved substances may be removed by an exhaust process with zeolites and some by adsorption on activated carbon or other adsorbants. Still another method is aeration for the liberation of gases, volatile and odoriferous substances and for the precipitation of Iron.

Most of the substances that occur in natural water are shown in table 1. All these substances do not occur in single waters, and

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their concentration varies widely for different waters. Some substances of sanitary significance occurring in water because of artificial contamination, such as phenols and cyanides, are not specifically included in the table. Other substances, such as the secretions of certain micro-organism which cause odour but which in such minute amounts that they can not be detected by chemical analysis, are not shown.

The presence and concentration is indicated by odour measurements. Several other substances of some sanitary significance such as lead, copper, zinc, and chlorine Cl_2 which enter water because of treatment or from the pipe of the distribution system, are not shown since they do not usually occur in natural waters.

For methods of identification and measurement of concentration of the various impurities in water see standard methods for the examination of water and sewage living micro-organisms are identified and counted in accordance with the microscopic and bacteriological examinations. Chemical substance are determined from the sanitary chemical and mineral examinations. A mineral analysis is preferably stated in terms of the concentration of the ions.

2.2.2 QUALITY OF IRRIGATION WATER

Whatever may be the source of Irrigation water, viz, river, stream, canal, tank, open well or tube well, some soluble salt are always dissolve in it. However, the nature and quality of dissolved salt depend upon the source of water and its course before use. The main soluble constituents in water are calcium, magnesium, sodium and sometimes potassium as cation and chloride, sulphate, bicarbonate and sometime carbonate as anions. However, ion, of some other elements such as lithium, silicon, bromine e.t.c and organic matter, are present in minor quantities. These elements usually do not affect the quality of Irrigation water as far as the total salt concentration is concerned, but some ions as selenium, molybdenum and fluorine, if absorbed by plants in excessive amount may prove harmful to the animal life when taken by them through drinking water, feed or forage. Among the soluble constituents, calcium, magnesium, sodium, chloride, sulphate and carbonate, and baron are prime importance in determining the quality of water Irrigation purposes. However, other factors as feature structure of the soil, its drainage characteristics, nature of the crop grown and climatological conditions is/are equally important in determing the suitability of Irrigation water in Agriculture.

The amount and kind of salt present will determine the suitability of water for Irrigation, with poor water quality various soil and cropping problem can be expected to develop. Special management practices may then be require to maintain full productivity. Problems that result from using poor quality Irrigation water.

- i. **Salinity:** The accumulation of salt in the crop root zone to the extent that the yield are affected. It reduces water intakes by crop.
- ii. **Permeability:** It's when rate of water infiltration into and through the soil is reduced by the effect of specific salt or

lack of salt in the water to such an extent that the crop is not adequately supplied with water and yield is reduced.

- iii. **Toxicity:** This occurs when certain constituents in the water are taken up by the crop and accumulated in amount that result in reduced yield. Constituent such as boron, chloride and sodium.
- iv. **Miscellaneous:** Various other problems related to Irrigation water quality occur with sufficient frequency and should be specially noted.

2.2.3.1 ALKALINITY

Alkalinity of water represents its content of OH^{-} or of other ions that combine with H^{+} upon the addition of acid. The most important of these other ions is \underline{HCO}_{3} , which is usually present in considerable quantity.

In alkaline waters, normal carbonate, $(Co_3)^{2^-}$, is a source of alkalinity since it forms $(HCO_3)^{2^-}$ upon the addition of acid. Borate, silicates, and phosphates also cause alkalinity, but they are usually not present in natural waters in appreciable quantities. Alkalinity is measured by titration with acid.

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	SUBSTANCE	SUSPENDED	COLLOIDAL		DISSOLVED	
	•			Positive ions	Not ionised	Negative ions
	of mineral origin	Clary, sand Other Inorganic soils	Clay silica S ₁ O ₂ Iron oxide Fe ₂ O ₃ Alumina Al ₂ O ₃ Manganese Oxide Mno ₂	Calcium Ca ²⁺ (40) Magnesium Mg ²⁺ (24.3) Sodium Na ⁺ (23) Potassium K ⁺ (39.1), Iron Fe ²⁺ (55.8) Manganese Mn ²⁺ (54.9) Hydrogen H ⁺ (1)		Bicarbonate Hco ₃ (61) Sulphate so ₄ , (96) Chloride cl (35.5) Nitrate No ₃ (62) Carbonate Co ₃ (60) Hydroxyl OH (17) Silicate HsiO ₄ (77.1) H ₂ Bo ₃ (60.8) Phosphate HpO ₄ ² (97) Iodide I (126.9) Fluoride F (19)
	of organic origin	Organic soil (top soil) Decomposing organic wastes	Vegetable colouring Matter organic wastes	Ammonium NH ₄ [•] Hydrogen H •	Vegetable Colouring Matter Organic Wave Ammonia, NH ₄ OH, carbonic acid H ₂ Co ₃ other organic acids.	Nitrate No [•] ₃ Nitrite No• ₂ Hydroxyl (OH•) B icarbonate Hco ₃ [•] Other organic acids.
iving organism	Gases Fish life Algae diatoms minute Animals	Bacteria Vruses, Algae diatoms minute Animals			Free carbon dioxide Co ₂ oxygen O ₂ Nitriate N ₂ Hydrogen, H ₂ Sulphid H ₂ S Methane CH ₄ Sulphurdioxide So ₂ Armonia NH ₃ Odour rivectors	

TABLE 2.1 SUBSTANCES OCCURRING IN NATURAL WATERS

The amount of acid required to bring water to PH_4 expressed in (ppm) parts per million of equivalent $CaCo_3$ is called thotal, or methyl orange alkalinity. If the water is alkaline, the amount of acid required to bring the PH down to 8 expressed in (ppm) parts per million of equivalent $CaCo_3$ is called phenolphthalein are indicator that have significant colour changes at about PH_4 and PH_8 respectively.

2.2.2b. HARDNESS

The hardness of water represents its content of metals which form precipitates under the normal condition of use of the water. These include all the metal of table 1 except Na⁺ and K⁺ where salts are all soluble. Most of the hardness of water is due to the presence of Ca2+ and Mg2+ for these element occur in substantial amounts, Hardness, like alkalinity, is expressed in (ppm) parts per million as CaCo₃. It is objectionable principally because of soap waste and boiler scale. In hardness, metals form insoluble precipitates with soap and a leather cannot be obtained until all the hardness has been so precipitated. The precipitated hard soap moreover may form stains upon fabrics being laundered, particularly if Fe and Mn are present. Boiler scale is obtained by the precipitation of the metal as salts (principally carbonates, sulphates, chloride and nitrates) Owing to their increased concentration upon the evaporation of the water. If the hardness is less than 100ppm the water is generally considered soft, but for efficient boiler use and for certain industrial processing purposes waters of zero hardness are desirable.

The hardness of many waters of the middle west in the united states exceed 500ppm whereas the hardness of many waters on the Eastern scabbard is less than 50ppm. It has been demonstrated that the savies in soap for home use alone 46 complished by the softening of water with a hardness exceeding about 150ppm is sufficient to pay for the cost of softening. In summary, hard water is water that has a high soap consuming power (i.e water which will not produce lather unless a large amount of soap is used).

Hardness in water is due primarily to the presence of Ca and Mg Con in water. The presence of the following may also cause slight increase in hardness. Fe, Mn, Cu, Ba, and Zn, water is soften by two methods:

- a. The hire soda process in which Ca and Mg lons are precipitated and removed by sedimentation and filtration and
- b. Ion exchange method, using zeolite, Ca and Mg cons are exchange for Na when water is softened with hire it may be necessary sometimes to introduce Co_2 which results with any excess hire to form Ca Co_3 which is precipitated before filtration.

2.2.3 SANITARY SIGNIFICANCE OF IMPURITIES

The impurities of greatest sanitary significance in water to be use for drinking purposes are the pathogenic bacteria and other pathogenic micro-organism the most serious water-borne diseases are cholera in the third world countries and typhoid in America, but other important human decease, such as dysentery and diarhea, are known to be water borne and still other may be yet undiscovered. The solution of the causative organism of these diseases from water is impractical in routine water examination. Because these disease are of intestinal origin and the source of the germs in water is human excrete the presence of the colour bacillus (B-coli or e-coli) whose usual habitat is the alimentary canal of man and other mammals in the best avoidance of savage pollution.

The 1046 U.S Public Health Service Drinking Water Standard for water user for drinking and culinary purposes or interstate carriers which standards have been adopted by many public health authorities and are widely used require a most probable number (M.P.N) of coli from bacteria not exceeding I per 100ml of water for all samples collected in one month other requirements of the U.S.P.H.S standards are as follows:

2.2.4 STANDARDS GUIDE CHEMICAL ASPECTS

2.2.4.1 PHYSICAL CHARACTERISTICS

- 1. Turbidity shall not exceed 10ppm (silica scale)
- 2. Colour shall not exceed 20ppm (standard cobalt scale)
- 3. There should be no objectionable taste or colour.

2.2.4.2 CHEMICAL CHARACTERISTICS

- 1. Lead pb, shall not exceed 0-1ppm.
- 2. Fluoride f, shall not exceed 1.5ppm.
- 3. Assenic As, shall not exceed 0.05ppm.
- 4. Selenium 55c, shall not exceed 0.05ppm.
- 5. Hexavalent chromin Cr^{bt} shall not exceed 0.05ppm.
- 6. Salt of Barium Ba hexavalent chromin Cr^{bt}, heavy metal,

glucosides, or other substances with deletaries physiological effects shall not be added for water treatment purposes.

- 7. Copper Cu, should not exceed 3.0ppm.
- 8. Iron fe, and magenese Mn, together not exceed 0.3ppm.
- 9. Magnesium Mg, should not exceed 125ppm.
- 10. Zinc Zn, should not exceed 15ppm.
- 11. Chloride Cl, should not exceed 250ppm.
- 12. Sulphate SO_4 , should not exceed 250ppm.
- 13. Phenotic compounds should not exceed 0.001ppm in terms of phenol.
- 14. Total solid should not exceed 500ppm. But may be permitted up to 1000ppm.
- 15. For chemically treated waters the PH should not be greater than 10.6, the normal carbonate (Co_3^{-2}) alkalinity should not exceed 120ppm as Ca CO_3 and the total alkalinity should not exceed the hardness by more the 35ppm as CaCo₃.

Many of the requirement of the U.S.P.H.S. standards have no health significance although they are of aesthetic importance. The presence of too much pb may result in lead poisoning. Lead is not present in natural waters but may enter the water by solution from lead services and plumbing system lead is corrosive to lead. Arsenic, selenium, and hexavalent chromium are all toxic and their concentration must be limited.

The toxicity of copper to man has been the subject of much discussion, but it now appears that Cu is not injurious up to concentration of about 20ppm. The taste of water become disagreeable when Cu content reaches about 5ppm. Zinc appears to be safe in drinking water up to concentrations of about 40pmm, but out of that concentration it will impart a milky appearance and a stringent to the water. Too much $Mg80_4$ (Espson salt) and $N0_2$ So₁ (Glanber's salt) in water produce laxative effects. Mach and NGWo₃ tend to produce thirst, and carbonate and hydroxide tent to neutralize the acid of the stomach. Iron is unofficial to the health, it is objectionable because of red water and stains. Manganese is more objectionable than fe because of strains and because of its interference with the orthotolidine test for residual chlorine. It's concentration should be limited to less than 0.1ppm.

The presence of fluorine in concentration exceeding 0.5ppm many result in wild endemic dental fluorides (mottled enamel) in children, although about 1.5 or more ppm of f is require for severe cases it has recently been found that fluoride in the drinking water is accompanied by new incidence of dental caries (tooth decay) in children and many health officials are now advocating the addition of fluorides to drinking water up to about 1.0ppm in region where caries is prevalent. Because simple epeites has been shown to be due to a deficiency of iodine in the thyroid gland, many attempts have been made to supply the deficiency regions where this condition is endemic by adding NaI (Sodium Iodide) to the water supplies. Studies of the relationship of the incidence of goiter to the I (10 dine) content of drinking waters have given a conflicting results, however, and it is probable that I (iodine) in organic combination of foods where it is also more concentrated is more readily assimilated than I(10dine) in water.

Disaffection by means of tonic and colloidal silver is growing for swimming. Pool waters but this method should not be used for drinking water until more is known about the effect upon the human body of those infected.

2.2.5 BACTERIOLOGICAL STANDARDS

Coliform organisms should ideally be absent from any water entering a system whether treated or untreated. Both the WHO and Epn recognise that the presence of coliforms become significant over a period of time. The most up to date standard at the writing of this thesis, the EPA standard, which recognizes the use of membranes filters. The WHO standard; are quoted only for completeness as one aspects the to be updated in the not too distant future.

2.2.6 <u>THE WHO (1971) RECOMMENDATION FOR THE WORLD ARE</u> AS FOLLOWS:

no robbotto.

Treated Waters:

In 90% of the samples examined throughout the year the MPN index of coliform micro-organisms should be less than 10. None of the samples should show and MPN index area less than 20.

For Europe, WHO (1980) recommends that of the 100ml samples taken throughout the year should not show the presence of any coliforms.

The U.S. standards deal separately with membrane filters and multiple - tube methods of coliforms assessment in water. For membranes filtration the maximum number of coliform should be:

- a. One per 100ml in more than one sample when 20 or more are examine per month.
- b. One per 100ml as the Arithmetic means of all samples examined per month or.
- c. Four per 100mls in more than 5% of the sample when 20 or more are examine per month.

For the multiple-tube fermentation method the sample may either be 10ml or 100ml. Details of the combinations are in standard methods. When coal samples are used, coliform bacteria should not be present in:

- a. More than 10% of the portion in any month.
- b. Three of more portions in more than one sample when less than 20% samples are examine per month.
- c. Three or more portions in more than 5% of the sample when20 or more samples are examined per month.

When local samples are used coliform bacteria should not be present in:

- a. More than 60% of the portions in any month.
- b. Five portions in more than one samples when less than five sample are examine per month.
- c. Five portions in more than 20% of the samples when five or more sample are examined per month.

It will become clear from the differences in the regularity or samples that the rational is that the bigger the sample the more likely it is that coliforms will be picked up.

2.2.6.1 W.H.O AND EPA STANDARDS

The sampling regularity required for chemical determination by the WHO and EPA vary from 3 months to 2 years. But it would be more

frequent when waste discharge into the water are expected. Some of the chemicals for which analysis is done are toxic beyond a contain level. Other may affect the aesthetic and other aspect of the water without necessarily affecting health. The chemical for which analysis required or recommended are given in table which also indicates the land beyond which they become toxic or given rise to various difficulties, which are themselves listed:

SUBSTANCE	CONSEQUENCE OF EXCESS AMOUNT IN-ORGANIC CHEMICALS		LIMIT ALLOW WATER (MG)	(ABLE IN LITIES)
Arsenic	Toxic	0.05	0.2	0.05
Baruim				1.0
Cadmium	Toxic	0.01		0.01
Chromium	Toxic	0.05	0.5	0.05
Aynanide	Toxic	0.05	0.01	
Fluoride	Fluorosis	0.7 . 1.7	10.15	14.24
Lead	Toxic			0.05
Mercury	Toxic		0.01	0.00
Selenium	Toxic	0.01		0.002
Sitter	Toxic		0.05	0.05
literate	Danger of		0.00	0.00
	infertility			
	Methare -			
	oglobinaemic	50 - 100		10.00
Pherolies	Taste			
	Especially in			
	Chlorinate			
	H ⁰	0.001		
Conner	Astingent taste	0.001		
Coppor	discolourate	05.30		
	and corrosion	0.0 0.0		
	of nines			
Iron	Tasta discolouration	01		
non	denosite and	0.1		
	arowth of Iron			
Mangangen	Bactoria	0.05		
Wanyanese	Turbidity	0.05		
7ine	-do-	50		
Magnesium	rotingent taste	20.250		
Sulvdrate	Onalescence	20 200		
ouryurate	and sand-lite	350		
Hydrogen	Denosites			
Sulnhide	Hardness tastes			
oulpinde	ausoro-Intestrial			

2.3.0 TABLE 2.2 CHEMICALS FOR WHICH ANALYSIS IS REQUIRED OR RECOMMENDED IN WATER (WHO, 1970) (EPAYT 1976)

ORGANIC	CHEMICAL	(PESTICIDE	S)	
Endrni	Toxic	-		0.002
Hindance	-do-	-		0.004
Meltoxychler	-do-	-		0.1
Toxanhene	-do-			0.005
2 4 D	-do-			0.1
2.4.5 TP	-do-		•	0.01

Source: WHO (1970)

2.3.1 TURBIDITY

The EPA regulations requires that drinking water be sampled for turbidity at least once a day by the Nephelometric method set out in standard methods. The method consists of comparing the turbidity along with that determined in a series of tubes containing suspended particles of formazin polymer. The maximum level of turbidity allowed is a monthly average of one turbidity unit (TU). Not more than five may be allowed if it can be show that this level of turbidity does not interfere with disaffection or with the counting of micro-organisms.

2.3.2 RADIOACTIVITY

The level of radioactivity in drinking water is important in economically advanced countries. A number of economically developing countries have required or are arranging to acquire nuclear capability. The EPA standards which are quoted have should be the aim of their latter to have a lead in the technical expertise of assessing these materials. The regularity of assessment is from one to two years, using method given standards methods or indicated in the EPA (1976) publication. The maximum radioactivity in drinking water includes the following. The maximum contaminant level for radium 226, radium 228 and gross alpha particle radioactivity is given thus.

a. Combined radium 226 and radium 228 - 5pli/litre

b. Gross alpha particle activity - 15pli/litre.

The maximum contaminant level for both particle and photon radioactivity from man-made radio-nuclides in water should not produce on animal dose equivalent to the total body or any internal organ greater than 4 mitre per year.

TABLE 2.3 The two tables below shows the World Health Organisation recommended acceptable inorganic constituents for drinking water quality (WHO 1993) and acceptable levels of chemicals in drinking water.

CHARACTERISTIC	HEALTH BASED GUIDELINE
Antimony (mg/I)	0.005
Arsenic (mg/I)	0.01
Barium (mg/I)	0.7
Boron (mg/I)	0.3
Cadmium (mg/I)	0.003
Chromium (mg/I)	0.05
Copper (mg/I)	2
Cyanide (mg/I)	0.07
Fluoride (mg/I)	1.6
Lead (mg/I)	0.01
Manganese (mg/I)	0.5
Mercury (mg/I)	0.001
Molybdenum (mg/I)	0.07
Nickel (mg/I)	0.02
Nitrate (mg/I)	50
Nitrite (mg/I)	3
Selenium (mg/I)	0.01
Uranium (mg/I)	140

Consumer Acceptability level

Aluminum (mg/I)	0.2 .
Chloride (mg/I)	250
Hardness as $Ca CO_3 (mg/I)$	500
Hydrogen Sulphide (mg/I)	0.05
Iron (mg/I)	0.3
Manganese (mg/I)	0.1
pH	6.5.9.5
Sodium (mg/I)	200
Sulphate (mg/I)	250
Total dissolved soilds (mg/I)	1200
Zinc (mg/I)	4

Source: WHO (1993)

2.4 TABLE 2.4 ACCEPTABLE LEVELS OF CHEMICALS IN DRINKING WATER

Indication	Acceptable level	Effect above level
Acidity	Above pH 7.0	Alkaline
Acidity	Below pH 7.0	Acidic
Aluminium	0.15 ppm	Deposits
Ammonia	0.02 ppm	Pollution
Calcium	200 ppm	Hardness*
Carbon dioxide	10 ppm	Corrosion
Chlorides	250 ppm	Salt taste
Chlorine	0.2 ppm	Taste
Colour	20 Hazen units	Visual
Detergent	1 ppm	Pollution
Fluoride	1 ppm	Mottled teeth
Iron	0.2 ppm	Taste
Lead	0.1 ppm	Poison
Magnesium	125 ppm	Hardness*
Manganese	0.2 ppm	Deposits
Nitrites	0 ppm	· Pollution
Nitrates	10 ppm	Toxic
Oxygen	1.0 ppm	Pollution
Phenol	0	Taste
Phosphates	1.0 ppm	Pollution
Silica	20 ppm	Scale
Sulphite	250 ppm	Taste, diarrhoea
Total dissolved solids (tds)	500 ppm	
Turbidity (tss)	5 Hazen units	Visual
Zinc	15 ppm	

*Hardness: 0.50 ppm, soft

50-100 ppm, moderately soft

100-150 ppm, slightly hard

150-250 ppm, moderately hard

over 250 ppm, hard

High nitrate figures over 2 ppm indicate decomposition of organic pollution.

PARAMETERS FOR DRINKING WATER						
PARAMETERS	HIGHEST DISPERSAL	MAXIMUM				
	LEVEL (MG/L)	PERMISSIBLE LEVEL (MG/L)				
APPEARANCE	CLEAR AND ATTRACTIVE	CLEAR				
TASTE AND ODOUR	UNOBJECTABLE	UNOBJECTABLE				
COLOUR (ºH)	5	50				
TURBIDITY	< 5	25				

Table 2.5 W.H.O STANDARD FOR PHYSICAL AND BACTERIOLOGICAL

2.4.0 BACTERIOLOGICAL STANDARDS

The standard for the bacteriological characteristics is stated below.

- 1. Throughout the year 95% of samples should contain any coliform organisms in 100ml.
- 2. No sample should contain E.coli in 100ml of sample analyzed.
- 3. No sample should contain more than 10 coliform organisms get 50ml.
- 4. Coliform organisms should not be detectable in 100ml of any consecutive sample.

Source - W.H.O. Guidelines for drinking water (1984) and

agricultural water.

TABLE 2.5 THE TABLE BELOW IS THE PROPOSED STREAM STANDARDS FOR IRRIGATION $(F A \cdot O \ TABLe)$

SUGGESTED LEVEL OF STREAM STANDARD
Not more than $400 \text{ mg}/1$ where there are
poor drainage, saline soil and inadequate
water supply. (EC less than 75 millisiemens
per m at 25° C).
Not more than 175 millisiemens per m at
25° C)
Not more than 200 mg/1 where there are
salt-resistant crops, good drainage, proper
water management and low sodium
adsorption ratio (SAR) of water. (EC less

	than 225 millisemens per m at 25°C)
Sodium adsorption	Not more than 10 where there is poor
	drainage.
(SAR)	Not more than 18 where is good drainage.
Boron	Not more than 1.25 mg where there are
	sensitive crops.
	Not more than $4 \text{ mg}/1$ where there are
	tolerant crops.
Dissolved oxygen	Greater than $2 \text{ mg}/1$. A level of $2 \text{ mg}/1$
	should not occur for more than 8 hours out
	of any 24-hour period.
Faecal coliform	Not more than 100/100 ml if the water is to
	be used for unrestricted irrigation. This
	standard may be relaxed when the crop is
	not intended for human consumption.

TABLE 2.5 PROPOSED STREAM STANDARDS FOR FISHING

QUALITY PARAM	IETER SUGGESTED LEVEL OF STREAM STANDARD
CO2	<12mg/1
pH	6.5-8.5
NH ₃	< 1 mg/1
Heavy metals	< 1 mg/1
Copper	< 0.02 mg/1
Arsenic	< 1 mg/1
Lead	< 0.1 mg/1
Selenium	< 0.1 mg/1
Cyanides	< 0.12 mg/1
Phenols '	< 0.02 mg/1
Dissolved solids	< 1000 mg/1
Detergents	< 0.2 mg/1
Dissolved oxyge	> 2 mg/1
Pesticides	
DDT	< 0.002 mg/1
Endrin	< 0.004 mg/1
BHC	< 0.21 mg/1
Methyl parath	nion < 0.10 mg/1
Malathion	< 0.16 mg/1

BACTERIOLOGICAL QUALITY FOR IRRIGATION

If the effluent is to be used for 'restricted' irrigation (i.e. for industrial or fodder crops) the FC density should be < 5000/100 ml (which is the general minmum standard - section 3.4). American¹⁰ and south African¹¹ practice requires FC < 1000/100 ml. However, if the effluent is to be used unrestricted irrigation, a much higher standard is necessary: FC < 100/100 ml.¹²

2.4.1 PURIFICATION OF WATER

2.4.1.1 WATER TREATMENT:-

Water treatment involves physical chemical and biological changes which transform raw water into portable waters. The treatment to be employed have to be worked out from a knowledge of the quality of the raw water and also the purpose for which the water is needed. Thus because drinking water and that of livestock of Bida locality is obtained from tap and River Landzun for - Irrigation with no bacteria on treatment as you can see from the results of the biological test on the then other hand, the Landzun river having source from a spring, has flowed on the surface and so there is need for extensive purification including chlorinating which is applied for its treatment if it is to use for drinking. It is therefore essential that natural water in eventually obtained are not so polluted that self purification and water treatment processes, cannot produce water of reliable portability in an economical manner.

2.4.1.2 CLASSIFICATIONS OF RAW - WATERS

Group I: Water requiring not treatment:

Limited to underground water not subject to any possibility of continuation and meeting the standards of drinking water in everywhere.

Group II: Waters require simple chlorinate includes underground and low contamination surface water containing 50 coliform bacteria per 100ml per month.

<u>Group III:</u> Waters requiring complete rapid sand filtration continuous post Chlorination. This group includes water requiring

filtration treatment for turbidity and colour removal; waters requiring high amount of chlorination, waters polluted by sewage to such an extent that they contain an average coliform number of 50-5000 per 100ml per month and beyond this number in not more 20% of the sample examined in any one month.

Auxiliary treatment includes per-sedimentation with coagulation pre-chlorination or mere storage for extensive period (30 ll more days).

2.4.1.3 TREATMENT (OR PURIFICATION) OF DRINKING WATER

All or some allowing treatment are given to raw water to make them suitable/safe for drinking.

- 1. Pre-filtration.
- 2. Storage and sedimentation without coagulation.
- 3. Aeration.
- 4. Filtration.
 - a. Slow sand
 - b. Rapid sand (with pre-coagulation and sedimentation)
- 5. Chlorination
- 6. Iron and Manganese Removal.
- 7. Softening of water (sand taste and stabilization) or demineralization.

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8. Fluoridation

9. Algea Control (Sand taste and odour control).

A flow diagram of water treatment is given below:

Prechlorination (Sometime).



Fig. 2.1. Water Treatment Processes

The quality of water remains serious concern especially for human and livestock consumption hence the need for water treatment. The treatment of water improved it's sanitary condition.

2.5.0 WATER SUPPLY

Classification

Water supplies are classified as surface and ground water supplies. Surface supplies may be divided into two groups:

- a. Those from large rivers lank as which must be pumped into the distribution system and
- b. Those from smaller apland streams which require storage reservoirs and aqueduct or pipe lines for delivery usually by gravity to the distribution systems.

2.5.1 RELIABILITY OF SOURCE OF SUPPLY

An important consideration in the selection of source of water supply is its reliability. A supply should be capable of furnishing an adequate quantity of water continuously with a maximum damage of interception due to breakdown or other causes.

The relative order of reliability (A gravity source of supply that is

inadequate at times and therefore require storage reservoirs/from the stand point of quantity of water is substantially as follows:-

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- 1. A surface or ground-water supply from a practically inexhaustible source distributed to and throughout the city by gravity.
- 2. A gravity source of supply that is inadequate at times and therefore require storage reservoirs.
- 3. A never failing source that requires pumping.
- 4. A source of supply that requires both storage resources and pumping.

2.5.2 EFFECTS OF SOURCE OF SUPPLY UPON WATER QUALITY

The quality of water is determined by its contents of hung organism and by its content of mineral and organic matter. Living organisms may be present in suspension and in colloidal dispersion. Mineral and organic matter may be in solution in colloidal dispersion, and in suspension practically, all the foreign matter in water is collected as the water over the surface of the ground or through the soil of the atmosphere, but it contains few other impurities except in areas where the atmosphere is charged with smoke, Indiorerial fumes, or dust.

2.5.0 IRRIGATIONS

Irrigation generally is defined as the application of water into soil for the purpose of supplying the moisture essential for plant growth. However, an more inclusive definition is that irrigation is the application of water to the soil for any number of the following purposes.

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- 1. To add water to soil to supply moisture essential for plant growth.
- 2. To provide crop insurance against short duration droughts.
- 3. To cool the soil and atmosphere, thereby making more favourable environment for plant growth.
- 4. To reduce the hazard of frost.
- 5. To wash out or dilute salts in the soil.
- 6. To reduce the hazard of soil piping.
- 7. To soften tillage pens and clods.
- 8. To delay bad formation by evaporation cooling.

Irrigation may be accomplished in following ways.

- 1. By flooding
- 2. By mean of famous, large or small.
- 3. By applying water underneath the land surface through sub-Irrigation thus causing the water table to rise.
- 4. By sprinkling
- 5. By trickle systems.

The sources for water to bring about plant growth may come from

1. Precipitation

- 2. Atmospheric water other their precipitation.
- 3. Flood water
- 4. Ground water
- 5. Irrigation

The above five mentioned factors are responsible for the design of Irrigation system of an irrigation system.

CHAPTER THREE

METHODOLOGY

3.0 METHOD AND MATERIALS USE

3.1 PREAMBLE

The general water use considered in this project includes Agricultural and Public water.

Water sample selected for various uses according to certain quality standards it must meet in order to be deemed fit suitable for the purpose intended. These standard are very important, and should be established only after careful consideration. The standards are measured according to criteria depending on the ultimate water use.

3.2 COLLECTION OF WATER SAMPLE

Collection of water sample for examination was made in four (4) clean sterile ragolis water container and another bottle for bacteriological test. Water sample was taken at (2) two different location upstream and down stream and at two different time. Two weeks interval.

The four (4) bottles were labelled A1 & A2 B1 and B2 C1, C2 D1, D2. The one labelled E was for Bacteriological test and the one labelled A,B,C,D, was for chemical test.

The samples collected was in the middle of the stream so as to avoid toxic i.e dissolved of the stream.

Since it was not possible to start processing the samples immediately, the four (4) plus Extra bottles sample collected were well covered placed in the refridgerator and was taken to the lab on reaching Abuja to be processed and the rest placed in the refridgerator to avoid contamination.

3.3 SAMPLING POINTS

This refers to the points at internal where the water sample was collected. The stream is located at the western side or part of Bida which is very close to the prison and near the asylum at the Doroha Gate which continues its flow through distributaries to every other part of Bida towards the nursing school dormitory which continues the flows through the Federal Polytechnic Junction, Gbangbara e.t.c. It went ahead to join river share at the southern part of Bida which proceeds through toward Agaie gate.

3.4 PROBLEM ENCOUNTERED

In the cause of carrying out the analysis on the sample collected some of the test could not be immediately conducted because of the unavailability of the material sand equipment until we got to Abuja.

The scarcity and cost of chemicals used for analysis was a big problem, which constituted another major hindrance in the course of the research. Also, some of the equipment are old they many render results faulty.

3.5 PHYSICAL EXAMINATION

This deals with the determination of colours turbidity and odour and other physical factors capable of defecating the water such as total solid content of water, physical properties are not to be completely over looked in relation to chemical composition of water. This parameters indicates acceptability or other wise, of water to the consumer as they are widely used to establish its quality.

3.5.1 APPEARANCE

The appearance of water refers to the way affected by the level of impurities which the water contained e.g. Vegetable, humus, peat, Iron manganese and industrial waste such as dye.

All the listed contaminants are capable of impacting colour to the water which will in turn makes it not authentic to consumers. The appearance of water was determine by visual means. The sample was then assigned its appropriate term either clear or not dear for the purpose of this project work, the sample collected conforms with the general and accepted standard required to an appreciable extent.

3.5.2 TASTE AND ODOUR

Odour and taste depend on actual contact of the stimulating substance with the appropriate human recepter cell. The sense of odour is closely related to that of taste. In fact its normally correct or suggest that most taste in water are really a sensation of smell.

There are four (4) sensation of taste, i.e sour, sweet, salty and bitter taste, all other sensations are of odour, although not necessarily notice until the water is in the month, some taste in water are however unreated to odour and this include the blackishness associated with the relative amount of dissolved salt (sodium chloride or magnesium sulphate). Odour and taste are recognised as quality factors which affect water in several ways either acceptability of drinking water aesthetics of recreational waters e.t.c. Determination of taste and odour is still based on subjective judgement given by a panel of tasters.

It is also limited in application as a contaminated water sample may be too dangerous for taste testing. That is why the samples collected were not tasted, though, no odour was perceived in most samples at least in the slightest for which the human smelling organ can attempt.

3.5.3 P.H MEASUREMENT

This is the intensity of acidity or alkalinity of a sample measured by P.H. which actually measures the concentration of hydrogenous present. The P.H of water is fit for drinking or domestic use or good for Irrigating crops. The P.H can be measured on a PH scale, which ranges from PH 1 to 14.

PH 1 to PH 6.5 is considered acidic. PH 7 is referred to a neutral, and PH 9 to PH 14 is referred to as alkaline. The PH of water at 25C is 7.0. The PH of neutral water is usually governed by some salts dissolved in it. e.g carbodioxide, Hydrogen, cabonate and carbonates in equilibrium.

P.H measurement in the laboratory, involved the use of two buffer solutions with PH 4.0 and that with PH 9.0 these two solutions are formed with the aid of two standard PH salt which are dissolved in water of particular quality. The PH meter is the equipment used in the measurement of Degree of acidity or alkalinity of the various water samples collected, first to use PH meter it has to be calibrated. To calibrate the PH meter, first the electrode which is connected to the PH meter through a wire cord inserted to container with PH 4.00 after the PH 4.00.

Then the electrode is removed from the container of PH 4.00 and rinsed with distilled water and immediately put into the container with PH 9.00. After the figures have become stable reading of PH 9.00 then the electrode is removed again and rinsed with distilled water and wiped with clean cloth, then the electrode is placed into the container with water sample whose PH is to be determined.

After the figure have stabiles on the dial, the PH of the water was read after which the electrode is rinsed again and then packed.

3.6.0 CHEMICAL EXAMINATION

Chemical characteristics tend to be more specific in nature than some of the physical parameters and are thus more useful in assessing the quality of water. Physical parameters are easy to be determined and some may be readily observable by a lay man e.g Temperature, taste, and odour, colour, turbidity, solids and possibly the electrical conductivity. These physical parameters are not enough for the quality 'of water to be properly analysed. This is why the chemical analysis of water needs to be carried out and this is usually done in the laboratory. The chemical characteristics of water helps to know more about the water quality especially the kind of dissolved element it contains. This will help to know whether the water is toxic or non toxic. This aspect of water analysis helps in knowing the level of pollution and contamination in the area.

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3.6.1 TITRIMETRIC METHOD USED FOR DETERMINATION OF Cl., Ca2+, Mg2+

To determine chlorine ion, calcuim ion and magnesium ion, we use the titrimetric analysis which depends on the measurement of volumes of liquid reagent of known strength. The requirement of titrimetric analysis is the use of pipette for measuring sample accurately. A standard solution of known concentration, an indicator which is used to show the stoichiometric end-point.

A graduated burette for measuring accurate measurement of the volume of standard solutions necessary to reach end point. To simplify the titrimetric analysis, standard solutions of such concentration that are equivalent to one another are usually employed. This involved the knowledge of equivalent weights of the reading solvents. Normal solution are usually too strong for accuracy in titration and dilute solutions are used. It is often convenient to adjust the concentration to give a direct reading of the solvent determinant from the volume of titration. For the Initial standardization of the solutions used in titrimetric analysis a standard material of known purity is required. These primary standards are usually salts or acids salts of high purity, which can be accurately weighed.

Reagent required for the determination of Cl⁻, Ca²⁺ and mg²⁺.

0.0 M AgNo₃ solution

Potassium Dichromate

Distilled water procedure

25cm³ of water sample were measured into 25cm³ conical flask each 5 drops of potassium Dichromate indicator added to the sample in the conical flask.

The samples in the conical flask were then titrated with 0.01m Ag No, to the end point.

Volume of 0.01m AgNo_3 used to the end point were all recorded. (H.L Goeterman (1978)).

3.6.2 CALORIMETRIC METHOD USED FOR DETERMINATION OF FE²⁺, CU²⁺ AND SO₄⁻²⁻.

The used of atomic absorption spector-photometer to determine Fe^{2+} , Cu^{2+} and SO_4^{2-} are very important in this practical analysis. It involves the use of elector magnetic radiation in invisible and ultraviolet region of the spectrum to change electronic structures of atoms.

METHOD

Source omitting radiation characteristics of elements of interest (hollow cathode lamp with the element to be detected for as its filament). This is observed by passing radiation characteristics of particular element through atomic vapour of the sample. Sample vaporised by aspiration of solution into a flame or evaporation are from electrically headed surface. The absorbency is proportional to the concentration of the element in the vapour and hence in the original sample and the reading taken each time. This procedure was carried out on all the water samples.

Reagent required for the determination of SO²⁻, Cu²⁺ and Fe²⁺.

- a. $0.02MH_2SO_4$
- b. Nacl and Hcl solutions
- c. Na SO₄ solution (3 in $100 \text{ cm}^3 \text{ H}_2 \text{ O}$)

- d. Conditioning reagent
 - i. 50cm³ Glycerol
 - ii. 30cm³ concentrated Bacl₂
 - iii. 75gm Nacl
- e. Bacl, crystals
- a. Prepare serial standards or working standings from $Na_2 SO_4$ solution.
- b. Working standard should range from 5, 10, 15 and 20mg/ liter of SO²⁻.
- c. Add 10cm^3 of the conditioning reagent 1gm of Bacl_2 anyslals plus 2m^2 of 0.02m H₂ SO₄.
- d. Shake well and make up to the mark with distilled water.
- e. Take the observance of the standards at 420mm against each concentration.
- f. Pass the samples immediately after the addition of the reagents and when it has filled to the mark with the samples through the spectro-photometer.
- g. Plot the graph of absorbency against the concentration of the standard.
- h. Obtain the concentration of the sample by interpolation of the value obtained.

3.6.3 <u>ULTRAVIOLET SPECTRO PHOTOMETER USED FOR THE</u> <u>DETERMINATION OF NO₃².</u>

This is an accurate instrument for laboratory determination of the concentration of some ion e.g $NO_3^{2-}SO_3^{2-}$ e.t.c. The basic principle is similar to an absorption meter but in place of filters, a prism is

used to provide monochromatic light of the desired wavelength. In the Instrument, a null meter is used for adjustment and percent transmission or optical density appear on a long scale with both types of instrument a blank of the sample without the lost colour forming reagent is needed to set the zero optical density (100° transmission), position and is then replaced by the sample. After re-balancing, the optical density of the sample may be read off.

The procedure for calorimetric analysis on a spectrophotometer. First to determine the optimum wavelength for the sample colour i.e the wavelength which gives greatest absorption of light, then using the optimum wavelength a series of standard samples of known concentration are used to prepare a calibration chart. The reading of concentration of NO_3^{2} in the sample was then read off the calibrating chart. It was ensured that full colour development has taken place before the sample was removed and that the turbidity in the samply has been removed.

Reagents required for determination of NO_3^{2-} .

- a. 1m Hcl
- b. KNO₃ standard stock solution
- c. Distilled water

PROCEDURE

- a. Take 50cm³ of each of the sample into 250cm³ conical flask.
- b. Add. 1ml of 1M Hcl, mixed thoroughly.
- c. Prepare working standard of KNO₃ stock i.e dilution of 2,4,6,8,&10.
- d. Measure the observance 1st at 220mm and 2nd at275mm

substract observance at 275mm from observance at 220mm and treat the samples the same.

e. Plot calibration curve with this observance obtained, then distilled water as blank twenty minutes.

The sample in the form of solution is indicated into the instrument, where it is drawn into, and the system to set it at zero reading, standard solution were prepared and then diluted at various working range of 5mg/litre, 10mg/litre 15mg/litre and 25mg/litre. Following thermal exitation, the radiation omitted is exited, atom relax is viewed by a photocel. The current generated in the detector circuit may be read directly or converted to a meter or digital read out. Various intensities are recorded against the various concentration of the standard solution, which was used to plot the graph of concentration against intensities to give the standard curve, this was done for K⁺ to finally get the concentration of the ion of these element in the water sample.

3.7.0 BACTERIOLOGICAL EXAMINATION

While a chemical analysis is necessary for the purpose of detecting poisonous or corrosive substances in the water, for determining hardness and for giving indications for the degree of organic pollutant or pollution chemical test can not show the presence or absence of pathogenic bacteria in water. Chemical and physical analysis should therefore be accomplished by bacteriological examination. This test is usually done to look for organisms which are called coliform, and most sensitive is Eschericha Coli, which is found in water. Their presence indicates contamination by faces.

METHOD

The most probable number (MPN) test was adopted for the test for the presence of E.coli in the water sample collected. This method is divided into three different stages, which are the presumptive test, the confirmed test and the completed test.

3.7.1 PRESUMPTIVE TEST

Serial dilution of decimal multiples and sub-multiples of 1ml of water sample from all the sample was prepared in fermentation tube containing one inverted vial each are inoculated with lactose broth. The samples are incubated at 35°c. After 24hours the samples were examined for gas formation were shaken gently and they were closely observed for gas formation. Those sample formation ions indicate positive result while those without gas formation indicate negative results. The gram staining process follows. The gram stain is the most important and frequently used in bacteriological analysis. It helps to differentiate bacteria into two main groups possibly showing major evolutionary relationships among those organisms. The two groups are gram positive (blue or purple, reactions to stain) and gram negative (pink to red reactions to stain) the difference in reaction cell wall.

3.7.2 PROCEDURE FOR GRAM STAIN

A drop of sterile water was placed in the middle of a clean slide. A loop was sterilised by flaming and waved in the air to cool. A colony was touched using the inoculating loop, rubbed in the bacteria cells in the drop of water on the slide and spread into a thin smear along the slide. It was allowed to air dried and then the reverse side was drawn quickly, three times over a flame in order to fix the bacteria, care was taken to avoid a prolong exposure to flame, the slide was allowed to cool and smear is now ready to be stain. The inoculating loop was flamed before repeating the procedure above for other bacteria colories.

GRAM STAINING PROCESS

- a. The smear was flooded with crystal violet stain and allowed to act for 60secs.
- b. The dye was drain quickly and washed with gram's iodine.
- c. The 10 dine was left on for 60seconds.
- d. It was drained and washed with water under the tap.
- e. The slide was washed using 95% Ethanol until the slide appears free from violet stain. This process of differentiation takes about 15 seconds.
- f. It was rinsed in tap water again.
- g. The slide was then flooded with safranin for 30 seconds.
- h. The stain was drained washed and blot dried.

OBSERVATIONS

The slide were examined under immersion objective lens colours, shapes and sizes of the bacteria were noted.

3.7.3 CONFIRMED TEST

After initial bacteriological count they were further inoculated onto selective and differential medium, the plates were all examined for the presence or absence of E.colli therefore the result was recorded in a chart. Based on the results the portability of the water was determined. The presence of E.colli a positive confirmed test and suggests that the water may not be portable.

3.7.4 COMPLETED TEST

Gram staining of the cultures were made as already outlined earlier. The slides were examined microscopically for the presence of gram negative-short bacilli, which are indicative of ecolli and thus not, portable. The results was obtain by counting the ecolli using start scientific colony counter the result was recorded as to Gram-stain reaction and the number of ecolli found in each sample analysed.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

Table 4.1 shows the result of laboratory analysis of water collected from four (4) locations within the project area.

Sources of water	River	landzun			•	River la	ndzun	1	
	Week	1				Week 2		•	
Location	A1	A2	B1	B2	C1	C2	D1	D2	
Date of sampling	9	•	3		20	02	0	4.	
PH at 27°C		6.	0		PHa⁺	29°C	6.	4	
Phoshate	< 0.1mgl	< 0.03	< 0.1	< 0.2	< 0.09	0.08	< 0.2	< 0.1	
Chloride ion	22.82mg/l	67.45	25.46	08.0	23.80	30.02	22.60	25.44	
Sulphate	< 40ml\g/l	62	36	50	34	39	25	35	
Total Hardness	16mg/l	46	18mg/l	28.2	18mg/l	200	17.3	23	
Iron -	0.5mg/l	0.4	0.1	0.06	0.4	0.8	0.2	0.1	
Sodium	0.7	0.97	0.8	0.95	1.20	1.38	0.92	0.98	
Manganese	0.2	0.2	0.14	0.15	0.2	0.08	0.04	0.15	
Calcium —	5.79	6.0	7.0	8.2	9.10	10.5	8.89	9.0	
Nitrate	2.10	2.40	2.5	3.5	2.6	4.0	3.4	3.9	
Total Disolved solids	38	23	22	35	25	18	22	16	
Elect. Conductivity	58.4	35	20	18	20.5	30	40.9	45	
Temp at	27ºc		26		29.5		28.5		
PH at	6.0		6.9		6.4		6.2		
Turbidity	29.53 ftu	30.48	28	26	29.4	29.82	30.25	30.1	
Total Alkalinity	12.0	16	14.5	14	14.0	14.50	16.04	16.2	
Total Silica	< 0.06	0.08	0.04	0.06	0.07	0.12	0.06	0.08	

Та	bl	e	4.	1	
Ia		C	т.		

The total hardness in most sample is equal to calcium hardness plus magnesium hardness i.e $Ca^{2+} \times Mg^{2+}$ gives total hards in water

SAMPLE E BACTERIOLOGICAL TEST RESULT TABLE 4.2

Water Sample	10.0ml	MPN	EMB	BGBB	E.Colli	Other Organisms	Other Coli
	4ml	16.0	+ve	+ ve	+ve	+ ve	+ve

4.1.0 DISCUSSION OF RESULTS

These section will deal with the analysis of the results obtained from the laboratory test the four samples of water obtained from from two local the stream landzun.

The objective of this chapter is to analyses the laboratory results of the sample and compared with health organisation. Standard recommended for public and Agricultural use.

4.1.1 RESULTS OF PHYSICAL ANALYSIS OF WATER SAMPLES

This deals with the determination of colour, turbidity, taste and odour and other physical factors capable of defecasing water such as total solids content of water physical properties of water are highly necessary in water usage especially for public use. The clarity of water to the layman always render it potable. This parameters indicate acceptability or otherwise of waste to the consumer as they are widely used to establish it's quality. (Goeterman 1978).

4.1.2 COLOUR

Colour in water may originate from metallic impurities such as vegetables, humus, peal, Iron, manganese and industrial waste such as dye. They are capable of impacting colour to water supply. The colour of water might not affect the quality of water for agricultural use but right seriously affects the quality of water for public or public water.

The colour of water can be determined by visual comparison with properly calibrated glass colour disc, standard colour solution with known concentration and visual means. Goeterman (1978). The

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that all the samples observed were clear and not objectionable in fact, in general, the sample satisfy the recommended level by health organisation.

4.1.3 TASTE AND ODOUR

Taste and odour depend on actual contact of the stimulating substance with the appropriate human receptor cell. The sense of colour is closely related to that of taste. In fact its normally correct to suggest that most taste in water are really a sensation of smell. There are four (4) sensation of taste i.e sour, sweet, sort and bitter although not necessarily noticed until the water is tested in the mouth. Some taste in water are however unrelated to odour and this include the brackishliners associated with the related amount of dissolved salts (sodium chloride or manganess sulphate). Odour and taste are recognised as quality factors which affect water in several ways, either acceptability of drinking water, aesthestics of recreational water e.t.c H. L. Goeterman (1978).

The determination of taste and odour was done orally on four samples collected and it was observed that all the samples were not objectionable.

4.1.4 APPEARANCE

The appearance of water is closely related to colour of water, the colour of a potable water is colourless and the appearance of a potable water has to be clear and attractive according to the world health organisation standard for drinking water. This was done by close observation of the samples collected at different sampling points.

The sample obtained and observed were all clear and attractive but a bit colloured due to plants remain of the stream bank.

4.1.2 RESULTS OF CHEMICAL ANALYSIS OF WATER SAMPLES

Chemical characteristics tend to be more specific in nature than some of the physical parameters which depends on climate. They are thus more immediately useful in assessing the properties of a sample. Chemical composition of ground water depends on the characteristic of the geology of the area where the samples where taken. Ground water acquires the characteristics of the rock through which it flows. Chemical materials that may be discharged into a receiving water may be classified into organic and inorganic pollutant.

Organic materials can be defined as compounds containing a carbon atoms. undesirable results from the discharge or inorganic materials including charges in the pH of water caused by salts and toxity caused by heavy metals (Furman 1962). Few of the elements were analysed using atomic absolution spector, flame photometry analyses, and ultraviolent spectrometer analyser. The elements analysed are chlorine, calsium, magnesium, Iron, Copper, Sulphate, Nitrate, and Ph.

The PH values of the water and shown in Table 4.1. This is the degree of acidity or alkanity contained in the sample. The pH vale of the four samples ranges between 6.5 and 7.0 showing that there is an increase in PH during the 2nd visits to stream the PH of the four samples are above 6.3, the recommended value for quality of water but below the maximum permissible value of PH 9.2. In

general the values got coniforms with the range recommended by WHO standard which infers that they are in a safe range for drinking.

CONCENTRATION OF IONS DETERMINED IN MG/LT CALCIUM ION CONCENTRATION Ca++

Calcium is very common environmental pollutants and essential for normal growth of root tips. The highest concentration of calcium was recorded in the downstream of the first sample of the second week and the lowest that there is change in the calcium deposit in the stream due to either rainfall or washing that usually take place at the downstream before where the sample was taken. The World Health Organisation standards permissible limit of calcium concentration is 75.00 to 200 mg per intre from this standard we can see that Cal- Cuim concentration falls within the range which means the water is good for drinking and irrigation.

IRON IONS CONCENTRATION

The presence of iron is water is a major factor that determines its portability. They arise in water when the decomposition of cans and scraps or irons one which are potential source dissolves in water. Iron is essential for most plants but is particularly necessary for chlorophyll production. It is usually required by plant in small quantity. From the result collected from the four samples in four different locations, which has its highest value to be 0.5mg/lit and 0.08mg/lit lowest it shows clearly that the results falls within the range specified world health organisation standard which has maximum permission limit of 1.0mg/lit. Which means that the water is good for Agricultural irrigation and drinking.

PHOSPHATE

Phosphate are used extensively as fertilizer and are present in natural waters from surface runoff. They are also used in water treatment and as builder compound in some synthetic detergents. The limits for phosphates is 0.2mg/lit in domestic raw water supplies to minimize coagulating difficulties. And our result has its highest values as <0.2 and the lowest as 0.09 which is still within limit. And it means the water is good for drinking and irrigation.

SODIUM

The result from the table has highest reading to be 1.38mg/lt the lowest reading is 0.7mg/lt which falls within the permissible limits which means that it will not affect the supply of water both for public and agraltural use.

CHLORIDE ION

Chlorides in water supply up to about 250 mg/lt, it has no adverse effect physic logical effects, but a sudden increase in chloride above its background level may indicate pollution. From our result the highest value of chloride got is 67.45 mg/lt and the lowest value is 22.60mg/lt which shows that the water chloride content is within range and so can be use for drinking and irrigation.

SULPHATE

Sulphate occur in natural water as a result of leaching from gypsuim and other minerals. It may even be from oxidized state or organic matter in the sulfurcycle.

For domestic supplies, it is usually recommended that sin thulphate do not exceed 250 mg/lt. But from our result we have the highest value of sulphate to be 62mg/lt and the lowest value to be 25.mg/ lt which means the water is good for drinking / domestic use and for irrigation.

TOTAL DISSOLVED SOLID (TDS)

The acceptable total dissolved solids which is general recommended is to be less than 500 mg/lt with an acceptable upper limit of 1000 mg/lt. And total dissolved solids refer only to the solids in solution or the solids remaining in the filtrate after all the suspended solids have been removed on the filtert. From the result of the analysis the highest value is 38.0mg/lt and the lowest value is 16.0mg/lt which means the result is within range with the recommended standard and the water can be use for public and irrigatio.

NITRATE

Nitrate is oxidized nitrate but in drinking water standards they are grouped together under one heading and should be less than the maximum permissible limits of 10mg/lt expressed in nitrogen or 45 mg/lt expressed as nitrate (NO₃).

in surface water nitrate are not normally a problem because they ranely exceed 5 mg/lt and are usually less than 1mg/lt. Our result of the analysis shows the highest value of nitrate to be 4.0mg/lt and the lowest value is 2.10 mg/lt which shows that it is still within recommended value and so the water can be used for domestic and irrigation purpose.

MANGANESE

The concentration of manganese in the water has its highest value to be 0.2mg/lt and the lowest value to be 0.04 mg/lt which is within the recommended range and so the water can be use for drinking and irrigation without problem.

4.2.2 BACTERIOLOGICAL ANALYSIS RESULT

While a chemical examination is necessary for the purpose of detecting poisonous or corrosive substance in the water and for determining the effects it will have both on public effects it will have both on public and Agricultural use because of their hardness and effect on plants. Chemical test can not show the presence or absence of pathogenic bacteria in the water so bacteriological examination is done.

For the bateriological results the water was found to be comfotable. Microscopically the organism is positive, E.coli is positive other organism is positive, other coli is positive and from the MPN table, the reading indicate 16.0 micro organisms per 100ml of water with a probability of 99% of no organisms in the water.

The water is good for drinking and irrigation.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

Technically, it has been absent that most of our surface water supplies are of satisfactory quality for irrigation purposes. This is based on the result of the result of the analyses conducted on two samples taken at the Lanzun River whose result of analysis does not prevent the use of the water on the field as they are within permissible limits in terms of chemical composition and the water is good for fishing.

The *p*.*H* of the water samples are generally okay but regular check of this parameter in our Irrigation waters is very important to prevent the possible problem of acidity or alkalinity.

5.2 RECOMMENDATION

Finally, since water has been described as life and since it plays a very important role in the human activities and endeavours especially in Agriculture. I recommend that Irrigation activities be boosted in Bida town for more availability of farm produce i.e increasing the production out put of farm since landzun stream is all round the year.

I recommend that quality control management of the water be made, erosion processes which affect water quality should be controlled. Water must be transported, preserved and treated by boiling public . use and Agricultural use since from the result of the analysis it shows that the water is good for drinking i.e domestic and agricultural (Irrigation) purpose it should therefor be used.

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