# GROUNDWATER POLLUTION WITH QUALITY IN GIS APPLICATION

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**ABSTRACT**

*Today's groundwater calamity of the predictable area is highlighted. Normally water shows vital role in the improvement of agricultural facilities in all over the world. Groundwater condition of an area is mainly depending on geology, hydrology, hydrologic parameter, soil properties, recharge and discharge, hydraulic characteristics of aquifer. An important component of the water balance equation is ground water recharge. This paper focuses mainly on about the groundwater, groundwater fluctuation and also to determine the analysis of groundwater. As well as the Water samples are also collected at the stipulated Locations where the Survey is carried out. The Collected Water samples are subjected for testing to assess whether the Water Samples are Potable or not according to the Standards Prescribed by the BIS 10500:2012. This is subjected to different kinds of Parameters like physical, chemical, and micro biological parameters. Water samples were analysed by physic – chemical and biological parameters. A Toposheet of the Surveyed is collected and the collected Toposheet area is subjected to Geo referencing and the collected GPS Readings are projected on the Toposheet. The Physiography at the Surveyed area is also mapped on the toposheet. As the water reserves, the yield of the water, the points are differentiated by their reserves, yield, and compositions. Finally, The water reserves of each and every point are assessed, yield at that point also. If the values are meeting the desirable limit and not exceeding the permissible limits. Then the water can be assessed as POTABLE.*

**Keyword:-** *Groundwater, Physical parameters, Chemical parameters, Biological parameters, Geographical Information System*

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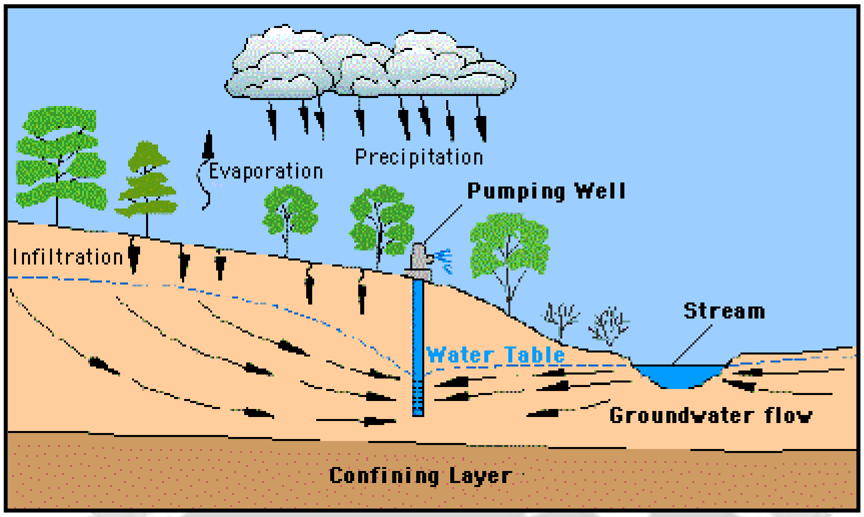
## 1. INTRODUCTION

### 1.1 Ground Water

Groundwater is water that occurs under the ground surface of Soil pore spaces and in the fractures of rock formations also called (Lithologic formation) and usable quantity of water is yielded from a unit of rock called Aquifer. It gets completely saturated with voids of rock at the depth of soil pores spaces or fractures and forms water table[7]. Groundwater recharge or deep drainage is a hydrologic process where water moves downward from surface water to groundwater. Natural discharge occurs in spring and can form an isolated area of vegetation in the desert called Oases. Water is one of the nature's five elements and used in our day to day life, such as agriculture, municipal and industrial use by constructing and operating extraction wells the area of geology that deals with the distribution and movement of groundwater in soil and rocks of the earth's crust is called Hydrogeology[3]. Groundwater is renewable, naturally by rain, snow and to a smaller extent by surface water (rivers and lakes). Typically, groundwater is thought of as liquid flowing through shallow aquifers and frozen Soil as shown in the figure1




Groundwater is about twenty percent of the world's fresh water supply, which is about 0.61% of entire world's water, including the oceans and permanent ice. Global groundwater storage is roughly equal to the total amount of freshwater stored in the snow and ice pack, including the north and south poles. This makes it an important resource which can act as a natural storage that can buffer against shortages of surface water, as in during times of drought. Groundwater is naturally replenished by surface water from precipitation, streams, and rivers when this recharge reaches the water table[8].

Groundwater can be a long-term 'reservoir' of the natural water cycle (with residence times from days to millennia), as opposed to short-term water reservoirs like the atmosphere and fresh surface water (which have residence times from minutes to years). The figure shows how deep groundwater (which is quite isolated from the surface recharge) can take a very long time to complete its natural cycle.

### 1.2 Aquifer

An aquifer is a layer of relatively porous substrate that contains and transmits groundwater. When water can flow directly between the surface and saturated zone of an aquifer, then the aquifer is unconfined[4]. The deeper parts of unconfined aquifers are generally more saturated since gravity causes the water to flow downwards. The upper level of this saturated layer is an unconfined aquifer is known as the water table or phreatic surface. Below the water table, where generally all the pore spaces are saturated with water is called the phreatic zone .Substrate with relatively low porosity that permits limited transmission of groundwater is called an aquitard. An aquiclude is a substrate with porosity which is so low it is virtually impermeable to the groundwater. A confined aquifer is that aquifer, which is overlain by a relatively impermeable layer of a rock or a substrate such as an aquiclude or aquitard. If a confined aquifer is following a downward grade from its recharge zone, then the groundwater can become pressurized as it flows. This usually creates artesian wells which flow freely without the need of any pump and rise to a higher level than the static water table at the above unconfined aquifer. The properties of aquifers vary with the geology and the structure of the substrate and the topography in which they occur. Usually, the most productive aquifers are found in the sedimentary geologic formations. Relatively, the weathered and the fractured crystalline rocks yield smaller amount of groundwater in most of the environments. Unconsolidated poor cemented alluvial materials that have aggregated as valley-filling sediments in the major river valleys and the geologically subsiding structural basins are included among the most productive sources of groundwater .Also, the high specific heat capacity of water and the insulating effect of soil and rock can lessen the effects of climate and maintain groundwater at a relatively constant temperature. In some places where the ground water temperatures are maintained by this phenomenon at about 50°F/10°C, groundwater can be used for controlling temperature inside the structures at the surface[6]. For example, during hot weather relatively cool groundwater can be pumped through the radiators in a home and then returned to the ground in some other well. During the cold seasons, because it is warmer, the water can be used in the same way as a source of heat .Pumps that are much more efficient than using air. The relatively constant temperature of the groundwater can also be used for heat pumps. The Figure 2 shows the case of Aquifer in the Groundwater Table.

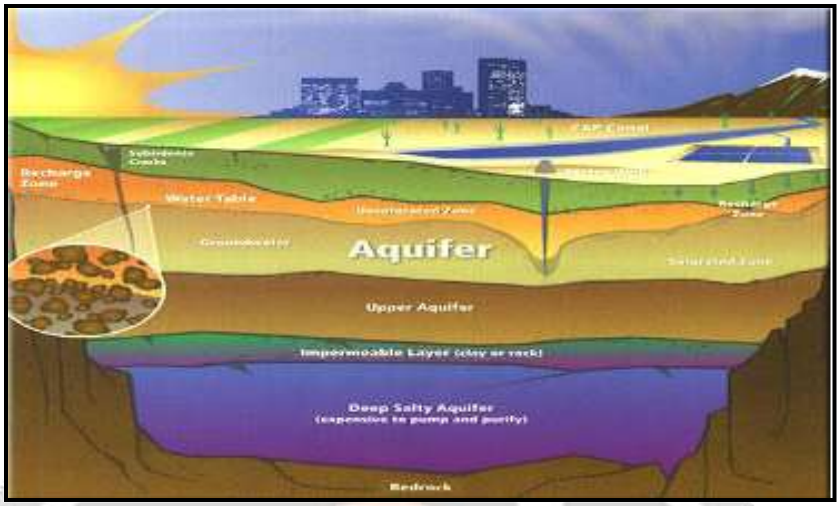



**Fig -2** Aquifer in Ground Water Tabl

## 2. WATER TESTING

The groundwater in natural system is generally consists less than 1000mg/l dissolved solids. Consequently, soil zone and aquifer gases and most of the soluble minerals and salts in an aquifer generally determine the chemical composition of ground water aquifer. Most of the groundwater is recharged through the soil zone containing partial pressure of carbon dioxide gas that are higher than the atmosphere. Recently charged groundwater, therefore generally contains high inorganic and carbon concentrations. Minor and trace element compositions of natural groundwater depend on the availability of minor and trace elements is easily soluble phase or on absorption sites and the redox state of water in the aquifer.

The knowledge of natural groundwater quality, can provide important insights into the nature of resources. Evaluation of the natural chemicals and isotopic compositions of groundwater can provide inference of the reactions that produce the natural water chemistry and recharge, movement, mixing, and discharge of groundwater.

## 3. NATURAL GROUND WATER QUALITY

### 3.1 Measures of Water Quality

The chemical characteristics of groundwater are determined by the chemical and biological reaction in the zones through which the water moves. In specifying the quality characteristics of groundwater chemical, physical, and microbiological analyses are normally required, the characteristics of water that affect water quality depends both on substances dissolved in water and on certain properties[9]. The natural inorganic constituents commonly dissolved in the water that are most likely to affect water use include bicarbonate, carbonate calcium, magnesium chloride, fluoride, iron, manganese, sodium, and sulphate. A complete chemical analysis of groundwater sample includes to determine the concentration of inorganic constituents present. Dissolved salts in groundwater normal salinity occur as dissociated ions. The analysis also includes measurement of $P^H$ and specific electrical conductance Depending on purpose of water quality investigation, partial analysis of particular constituents will sometimes sufficient.

### 3.2 Sampling

The guidelines provided here take into account experience in surveillance programs in remote, typically rural, areas and in per urban communities. More general advice on sampling is given in IS 10500:2012 Safe Drinking water.

### 3.3 Sampling Frequency

The most important tests used in water-quality surveillance or quality control in small communities are those for microbiological quality (by the measurement of indicator bacteria) and turbidity, and for free chlorine residual and pH where chlorination is used. These tests should be carried out whenever a sample is taken, regardless of how many other physical or chemical variables are to be measured. The recommended minimum frequencies for these critical measurements in un-piped water supplies are summarized in and minimum sample numbers for piped drinking-water in the distribution system.

### 3.4 Storage of Samples for Microbiological Analysis

Although recommendations vary, the time between sample collection and analysis should, in general, not exceed 6 hours, and 24 hours is considered the absolute maximum. It is assumed that the samples are immediately placed in a light proof insulated box containing melting ice or ice-packs with water to ensure rapid Cooling[10].
If ice is not available, the transportation time must not exceed 2 hours .It is imperative that samples are kept in the dark and that cooling is rapid. If these conditions are not met, the samples should be discarded. When water that contains or may contain even traces of chlorine is sampled, the chlorine must be inactivated. If it is not, microbes may be killed during transit and an erroneous result will be obtained. The bottles in which the samples are placed should therefore contain sodium thio-sulphate to neutralize any chlorine present, as per IS 10500:2012

### 3.5 Sampling Methods for Physicochemical Analysis

Results of physico-chemical analysis are of no value if the samples tested are not properly collected and stored. This has important consequences for sampling regimes, sampling procedures, and methods of sample preservation and storage. In general, the time between sampling and analysis should be kept to a minimum.
Storage in glass or polyethylene bottles at a low temperature in the dark is recommended. Sample bottles must be clean but need not be sterile. Special preservatives may be required for some analysis. Residual chlorine, pH, and turbidity should be tested immediately after sampling as they will change during storage and transport.

### 3.6 Microbacterial Analysis

The principal risk associated with water in small-community supplies is that of infectious disease related to fecal contamination. Hence, as described in the microbiological examination of drinking-water emphasizes assessment of the hygienic quality of the supply. This requires the isolation and enumeration of organisms that indicate the presence of fecal contamination. In certain circumstances, the same indicator organisms may also be used to assess the efficiency of drinking-water treatment plants, which is an important element of quality control. Other microbiological indicators, not necessarily associated with fecal pollution, may also be used for this purpose. The isolation of specific pathogens in water should be undertaken only by reference laboratories for purposes of investigating and controlling outbreaks of disease. Routine isolation in other circumstances is not practical.

## 4. GPS

The Global Positioning System (GPS) is a space-based Satellite Navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellite. The system provides critical capabilities to military, civil and commercial users around the world. It is maintained by the United States government and is freely accessible to anyone with a GPS Receiver. The GPS project was developed in 1973 to overcome the limitations of previous navigation systems, integrating ideas from several predecessors, including a number of classified engineering design studies from the 1960s.GPS was created and realized by the U.S Department of Defense(DOD) and was originally run with 24 satellites. It became fully operational in 1995. Brad Fort Parkinson, Roger L Easton, and Ivan A Getting are credited with inventing it.
Advance in technology and new demands on the existing system have now led to efforts to modernize the GPS system and implement the next generation of GPS III satellite and Next Generation Operational Control System (OCX). In 2000, the U.S Congress authorized OCX). In 2000, the U.S Congress authorized the modernization efforts, GPS III. In addition to GPS, other systems are in the use or under development. The Russian Global Navigation Satellite System (GILONASS) was developed contemporaneously with GPS, but suffered from incomplete coverage of the globe until the mid-2000s.There are also the planned European Union Galileo

positioning System, India's Indian Regional Navigation System, and the Chinese Beidov Navigation Satellite System.

### 4.1 Georeferencing

Geo referencing means to associate something with locations in physical space. The term is commonly used in the geographic information systems field to describe the process of associating a physical map or raster image of a map with spatial locations. Geo-referencing may be applied to any kind of object or structure that can be related to a geographical location, such as points of interest, roads, places, bridges, or buildings. Geographic locations are most commonly represented using a coordinate reference system, which in turn can be related to a geodetic reference system such as WGS-84.Examples include establishing the correct position of an aerial photograph within a map or finding the geographical coordinates of a place name or street address (Geo-coding). To geo-reference an image, one first needs to establish control points, input the known geographic coordinates of these control points, choose the coordinate system and other projection parameters and the minimize residuals. Residuals are the difference between the actual coordinates of the control points and the coordinates predicted by the geographic model created using the control points. They provide a method of determining the level of accuracy of the geo-referencing process.

In situations where data has been collected and assigned to postal or area codes, it is usually necessary to convert the geographic coordinates by use of a definitive directory or gazetteer file. Such gazetteers are often produced by census agencies, national mapping organizations or postal service providers. At their simplest, these may simplest, these may simply comprise a list of area codes or place names and another list of corresponding codes, names or coordinate locations. The range and purpose of the codes available is country-specific.

### 4.2 Digitising

The process of converting the geographic features of an analog map into digital format using a digitizing tablet, or a digitizer, by connecting it to a computer is called digitising. Features on a paper map are traced with a digitizer puck, a device similar to a mouse, and the x, y coordinates of these features are automatically recorded and stored as spatial data.

### 4.3 Attribute Table

A database or tabular file containing information about a set of geographic features usually arranged so that each row represents a feature and each column represents one feature attribute. In raster datasets, each row of an attribute table corresponds to a certain zone of cells having the same value. In a GIS, attribute tables are often joined or related to spatial data layers, and the attribute values they contain can be used to find query and symbolize features or raster cells.

### 4.4 Basic Operation

This section explains of the more common operations you can perform with your ETREX, including creating and using waypoints, using the Find Menu, how to create and use tracks and use tracks and routes.

### 4.5 Creating and using Waypoints

Waypoints are locations or Landmarks that will record and store in GPS. We can add waypoints to routes and even create a GO TO Location directly in the GPS Selected waypoint. We can create waypoints using three methods. Press ENTER while at a Location, Create a Waypoint on the Map page, or Enter coordinates for a Waypoint manually.

### 4.6 Marking Current Location

Press in and Hold the ROCKER to quickly mark your current location, creating a new Waypoint. You must have a valid position fix to mark our location.Press and hold the Rocker (MARK) until the mark waypoint page appears. A default three digit name and symbol are assigned to the new waypoint. To accept the waypoint with the waypoint with the default information, highlight OK.

To Change any Information, Select the appropriate field, and press ENTER to open the on-screen keypad. After entering and Confirming your changes, select OK.

### 4.7 Creating waypoints using the map

On the Map page, Use the ROCKER to move the Pointer to the Map item you to Mark. Press in and Quick release the ROCKER to capture the Pointer location and open the information page for the map item.Click on save. If there is no information for that point, a no map information for that point. Do you want to Create a User Waypoint here. Prompt appears. Select YES.

## 5 GEOGRAPHIC INFORMATION SYSTEMS

A geographic information system (GIS) is a computer-based tool for mapping and analyzing spatial data. GIS technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps[2]. These abilities distinguish GIS from other information systems and make it valuable to a wide range of public and private enterprises for explaining events, predicting outcomes, and planning strategies. GIS is considered to be one of the most important new technologies, with the potential to revolutionize many aspects of society through increased ability to make decisions and solve problems.
The major challenges that we face in the world today -- overpopulation, pollution, deforestation, natural disasters – all have a critical geographic dimension. Local problems also have a geographic component that can be visualized using GIS technology, whether finding the best soil for growing crops, determining the home range of an endangered species, or discovering the best way to dispose of hazardous waste. Careful analysis of spatial data using GIS can give insight into these problems and suggest ways in which they can be addressed. The figure 3 shows some GIS edited image.

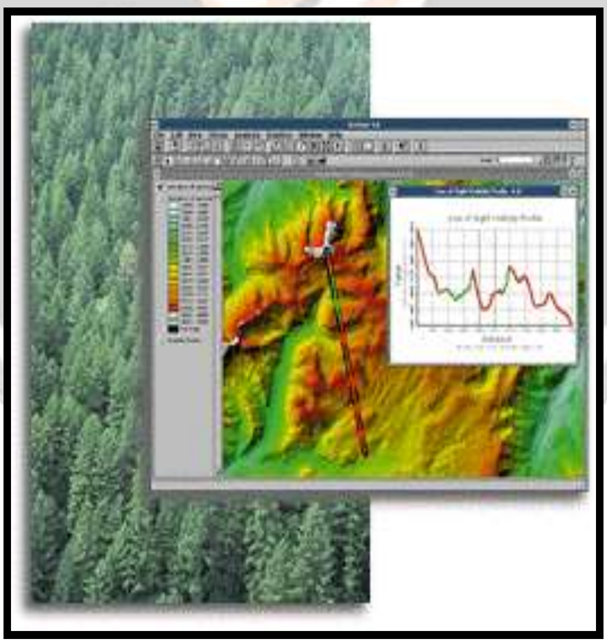


Fig: 3 showing GIS edited image

Map making and geographic analysis are not new, but a GIS performs these tasks better and faster than do the old manual methods. And, before GIS technology, only a few people had the skills necessary to use geographic information to help with decision making and problem solving. Today, GIS is a multi-billion-dollar industry employing hundreds of thousands of people worldwide. GIS is taught in high schools, colleges, and universities throughout the world. Professionals in every field are increasingly aware of the advantages of thinking and working geographically.

### 5.1 Geographic References

Geographic information contains either an explicit geographic reference such as altitude and longitude or national grid coordinate, or an implicit reference such as an address, postal code, census tract name, forest stand identifier, or road name[2]. An automated process called geo-coding is used to create explicit geographic references (multiple locations) from implicit references (descriptions such as addresses). These geographic references can then be used to locate features, such as a business or forests and, and events, such as an earthquake, on the Earth's surface for analysis.

### 5.2 Geographic Information System

The ability of GIS to search databases and perform geographic queries has revolutionized many areas of science and business. It can be invaluable during a decision-making process. The information can be presented succinctly and clearly in the form of a map and accompanying report, allowing decision makers to focus on the real issues rather than trying to understand the data. Because GIS products can be produced quickly, multiple scenarios can be evaluated efficiently and effectively. For this reason, in today's world, the ability to use GIS is increasingly important.

### 5.3 Procedure

The Toposheet of the survey area is collected. The GIS process is carried out by using the ARCMAP 10.1 Software .The Toposheet is introduced into it. Five folders are created and named as Arc Catalog, GCS, PCS, Source and Result. The Toposheet is subjected TO GEOREFERENCING and converted into TIFF format and copied into Source file. The TIFF image is made to Project Raster and copied into PCS. The KML Image is introduced through the add data and the points are located on the Toposheet. Make assurance that encrypted KML points are fixed in the surveyed area. Feature classes like Roadways, undefined canals, water tanks, rivers etc., are created in the Arc Catalog. These Features are introduced into the file using Add data and these features are mapped in the Toposheet.

## 6. WATER SAMPLE TESTING

### 6.1 Physical Properties

The water samples were analysed by physical properties such as colour, odour and turbidity.

#### 6.1.1 Turbidity

Turbidity is a measure of the cloudiness of water. It can come from fairly benign sources, such as suspended sediment in the water, or from high levels of disease-causing organisms. All are generated as water moves through soil and into your ground water supply. Turbidity caused by high levels of organic matter can protect microorganisms from the effects of drinking water disinfection. It can even stimulate bacterial growth. Therefore, it is critical to successful water treatment and disinfection to keep turbidity levels low[6].

Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites and some bacteria. These organisms can cause nausea, cramps, diarrhea and associated headaches.

#### 6.1.2 Colour

Drinking water should ideally have no visible colour. Colour in drinking water is usually due to presence of coloured organic matter associated with the humus fraction of soil. Colour is also strongly influenced by the Iron and other metals. It may also result in the contamination of the water source with the industrial effluents.

Most people can detect colour above 15 true colour units in a glass of water. Levels of colour below 15 TCU are often acceptable to consumers high colour from natural organic carbon could also indicate a high propensity to produce by-products from dis-infection processes.

#### 6.1.3. Odour

The odour causing compounds are more prominent during extended warm temperatures. When temperature reach $19^0$ C and above, naturally occurring compounds which can create a musty odour or taste are formed. Two compounds Geosmin and 2-methylisobornoel are responsible for a musty or earthy odour that is detectable by some persons in concentrations as low as a few parts per Trillion.

**6.2 Chemical Properties**

**6.2.1 pH**

The $p^H$ of a solution is the negative common logarithm of the hydrogen ion activity: $P^H$ = -log (H+)
In dilute solutions, the hydrogen ion activity is approximately equal to the hydrogen ion concentration.
The pH of water is a measure of the acid–base equilibrium and, in most natural waters, is controlled by the carbon dioxide–bicarbonate–carbonate equilibrium system. An increased carbon dioxide concentration will therefore lower pH, whereas a decrease will cause it to rise[1]. Temperature will also affect the equilibrium and the $P^H$. In water with a buffering capacity imparted by bicarbonate, carbonate, and hydroxyl ions, this temperature effect is modified. The pH of most raw water lies within the range 6.5–8.5.
Although pH usually has no direct impact on water consumers, it is one of the most important. Operational water-quality parameters. Careful attention to pH control is necessary at all stages of water treatment to ensure satisfactory water clarification and disinfection. For effective disinfection with chlorine, the pH should preferably be less than 8. The pH of the water entering the distribution system must be controlled to minimize the corrosion of water mains and pipes in household water systems. Failure to do so can result in the contamination of drinking-water and in adverse effects on its taste, odour, and appearance.

**6.2.2 Total Dissolved Solids**

Total Dissolved Solids (TDS) is the term used to describe the inorganic salts and small amounts of organic matter present in solution in water. The principal constituents are usually calcium, magnesium, sodium, and potassium cations and carbonate, hydrogen carbonate, chloride, sulphate and nitrate anions. The palatability of drinking water has been rated by panels of tasters in relation to its TDS level as follows: excellent, less than 300 mg/liter; good, between 300 and 600 mg/litre; fair, between 600 and 900 mg/liter; poor, between 900 and 1200 mg/litre; and unacceptable, greater than 1200 mg/liter. Water with extremely low concentrations of TDS may also be unacceptable because of its flat, insipid taste. The method of determining TDS in water supplies most commonly used is the measurement of specific conductivity with a conductivity probe that detects the presence of ions in water. Conductivity measurements are converted into TDS values by means of a factor that varies with the type of water. The practical quantitative limit for TDS in water by this method is 10 mg/liter. High TDS concentrations can also be measured gravimetrically, although volatile organic compounds are lost by this method. The constituents of TDS can also be measured individually.

**6.2.3 Alkalinity**

Alkalinity is a chemical measurement of water's ability to neutralize acids. Alkalinity is also a measure of water's buffering capacity or its ability to resist changes in pH upon the addition of acids or bases. Alkalinity of natural waters is due primarily to the presence of weak acid salts although strong bases may also contribute i.e., ($OH^-$) in extreme environments. Bicarbonates represent the major form of alkalinity in natural waters; its source being the partitioning of $CO_2$ from the atmosphere and the weathering of carbonate minerals in rocks and soil. Other salts of weak acids, such as borate, silicates, ammonia, phosphates, and organic bases from natural organic matter, may be present in small amounts[6]. Alkalinity, by convention, is reported as mg/L CaCO3 since most alkalinity is derived from the weathering of carbonate minerals.

**6.2.4 Total Hardness**

Hardness in water is caused by dissolved calcium and, to a lesser extent, magnesium. It is usually expressed as the equivalent quantity of calcium carbonate. Depending on pH and alkalinity, hardness above about 200 mg/litre can result in scale deposition, particularly for heating. Soft waters with a hardness of less than about 100 mg/litre have a low buffering capacity and may be more corrosive to water pipes. A number of ecological and analytical epidemiological studies have shown a statistically significant inverse relationship between hardness of drinking-water and cardiovascular disease. There is some indication that very soft waters may have an adverse effect on mineral balance, but detailed studies were not available for evaluation. No health-based guideline value is proposed for hardness. However, the degree of hardness in water may affect its acceptability to the consumer in terms of taste and scale deposition.

**6.2.5 Chloride**

Chloride in drinking-water originates from natural sources, sewage and industrial effluents, urban runoff containing de-icing salt and saline intrusion. The main source of human exposure to chloride is the addition of salt to food, and the intake from this source is usually greatly in excess of that from drinking-water. Excessive chloride concentrations increase rates of corrosion of metals in the distribution system, depending on the alkalinity of the water. This can lead to increased concentrations of metals in the supply. No health-based guideline value is proposed for chloride in drinking-water. However, chloride concentrations in excess of about 250 mg/litre can give rise to detectable taste in water.

**6.2.6 Fluoride**

Fluoride accounts for about 0.3 g/kg of the Earth's crust and exists in the form of fluorides in a number of minerals. The most important source of fluoride in drinking water is naturally occurring. Inorganic fluoride-containing minerals are used widely in industry for a wide range of purposes, including aluminum production. Fluorides can be released to the environment from the phosphate-containing rock used to produce phosphate fertilizers; these phosphate deposits contain about 4% fluorine. Fluoro-silicic acid, sodium hexa fluorosilicate and sodium fluoride are used in municipal water fluoridation schemes. Daily exposure to fluoride depends mainly on the geographical area. In most circumstances, food seems to be the primary source of fluoride intake, with lesser contributions from drinking-water and from toothpaste.

**6.2.7 Iron**

Iron is one of the most abundant metals in the Earth's crust. It is found in natural fresh waters at levels ranging from 0.5 to 50 mg/litre. Iron may also be present in drinking-water as a result of the use of iron coagulants or the corrosion of steel and cast iron pipes during water distribution. Iron is an essential element in human nutrition. Estimates of the minimum daily requirement for iron depend on age, sex, physiological status and iron bio availability and range from about 10 to 50mg/day. As a precaution against the storage of excessive iron intake in body, taken during pregnancy and lactation or for specific clinical requirements. An allocation of 10% of this PMTDI (Provisional Maximum Tolerable daily intake) to drinking-water gives a value of about 2 mg/litre, which does not present a hazard to health. The taste and appearance of drinking-water will usually be affected below this level. No guideline value for iron in drinking-water is proposed.

**6.2.8 Nitrate**

Nitrate is naturally occurring ions that are part of the nitrogen cycle. Nitrate is used mainly in inorganic fertilizers, and sodium nitrite is used as a food preservative, especially in cured meats. Anaerobic conditions may result in the formation and persistence of nitrite. Chlorination may give rise to the formation of nitrite within the distribution system if the formation of chloramines is not sufficiently controlled. The formation of nitrate is as a consequence of microbial activity and may be intermittent. Nitrification in distribution systems can increase nitrate levels, usually by 0.2–1.5 mg/liter.

**6.2.9 Sulphate**

Sulphate occurs naturally in numerous minerals and are used commercially, principally in the chemical industry. They are discharged into water in industrial wastes and through atmospheric deposition; however, the highest levels usually occur in ground water and are from natural sources. In general, the average daily intake of sulphate from drinking-water, air and food is approximately 500mg, food being the major source. However, in areas with drinking-water supplies containing high levels of sulphate, drinking-water may constitute the principal source of intake. The data from a liquid diet piglet study and from tap water studies with human volunteers indicate a laxative effect at concentrations of 1000–1200 mg/litre but no increase in diarrhea, dehydration or weight loss. No health-based guideline is proposed for sulphate. However, because of the gastrointestinal effects resulting from ingestion of drinking water containing high sulphate levels, it is recommended that health authorities be notified of sources of drinking water that contain sulphate concentrations in excess of 500 mg/litre.

**6.3 Microbiology**

**6.3.1 Coliforms**

Coliform bacteria are present in the environment and feces of all warm-blooded animals and humans. Coliform bacteria are unlikely to cause illness. However, their presence in drinking water indicates that disease-causing organisms (pathogens) could be in the water system. Most pathogens that can contaminate water supplies come from the feces of humans or animals. Drinking water Testing for all possible pathogens is complex, time-consuming, and expensive. It is easy and inexpensive to test for coliform bacteria. If testing detects coliform bacteria in a water sample, water systems search for the source of contamination and restore safe drinking water. Fecal coliform bacteria are a subgroup of total coliform bacteria. They exist in the intestines and feces of people and animals.

## 7. CONCLUSION

Water quality is dependent on the type of the pollutant added and the nature of mineral found in a particular zone of bore well. Monitoring of the water quality of ground water is done by collecting representative water samples and analysis of physicochemical characteristics of water samples at different locations. The study area results revealed that a survey assessed for the Groundwater Reserves, Yield of the water. The survey also describes the Requirement of water, the type of the Drainage to be provided according to the Physiography. The survey also determines the depth of the water, Recommended Yield from where the water can be obtained. The Survey and the collection of the water samples also examines different parameters of Physical, Chemical, Microbiological like Turbidity, TDS, $P^H$, Total Hardness, Chlorides, Alkalinity, Calcium, Sulphate, Nitrates, Iron, Fecal Coliforms. The study finally Creates Maps in GIS according to the Reserves, Yield of the water according to the Details assessed from the Ground Water Exploration. The Maps that are established according to the Data obtained from the Water Testing. The Survey also that the Ground Water Cycle in that area is fine.

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