MANAGEMENT SPONSORED

STUDENT PROJECT

On

Ground Water Exploration

by

III BSc (GPC) Students

Department of Geology

Guided by

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Submitted to

The Research Committee

HINDU COLLEGE, GUNTUR

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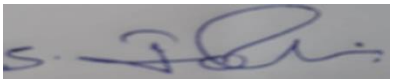
DECLARATION

We hereby declare that the **Management , Hindu College, Guntur** sponsored Minor Research Project report titled **Ground water exploration** comprises of our own and original work. It has not been submitted fully or partially to any other institution or organization and is not published.



(Sk.Johnsaheb)

CERTIFICATE

Certified that this is a genuine and bonafide work done by **Third year BSc(GPC) Students ,** department of Geology with the Minor Research Project titled **Ground Water exploration ,**sanctioned by **Hindu college,Guntur**.

The Principal

Hindu College, Guntur

ACKMOWLEDGEMENTS

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CONTENTS

HYDROLOGICAL CYCLE

- Precipitation-Runoff+Infilteration+Evaporation+Transpiration

PRECIPITATION

- It is the atmospheric discharge of water in the solid (hail,snow) or liquid (rain)form on the earths surface .some of the precipitation is intercepted by the vegetal canopy (interception) and the rest reaches the surface (through fall) .

EVAPORATION:

- Evaporation is the spontaneous process by which the water is transformed into vaporous state from the surface water bodies ,such as sea, lakes,rivers,tanks,glaciers etc.the rate of evaporation depends on several factors it increases with the decrease barometric pressure, increases in air and water temparatures,sunshine ,wind velocity,dryness of air and purity of water.

TRANSPIRATION:

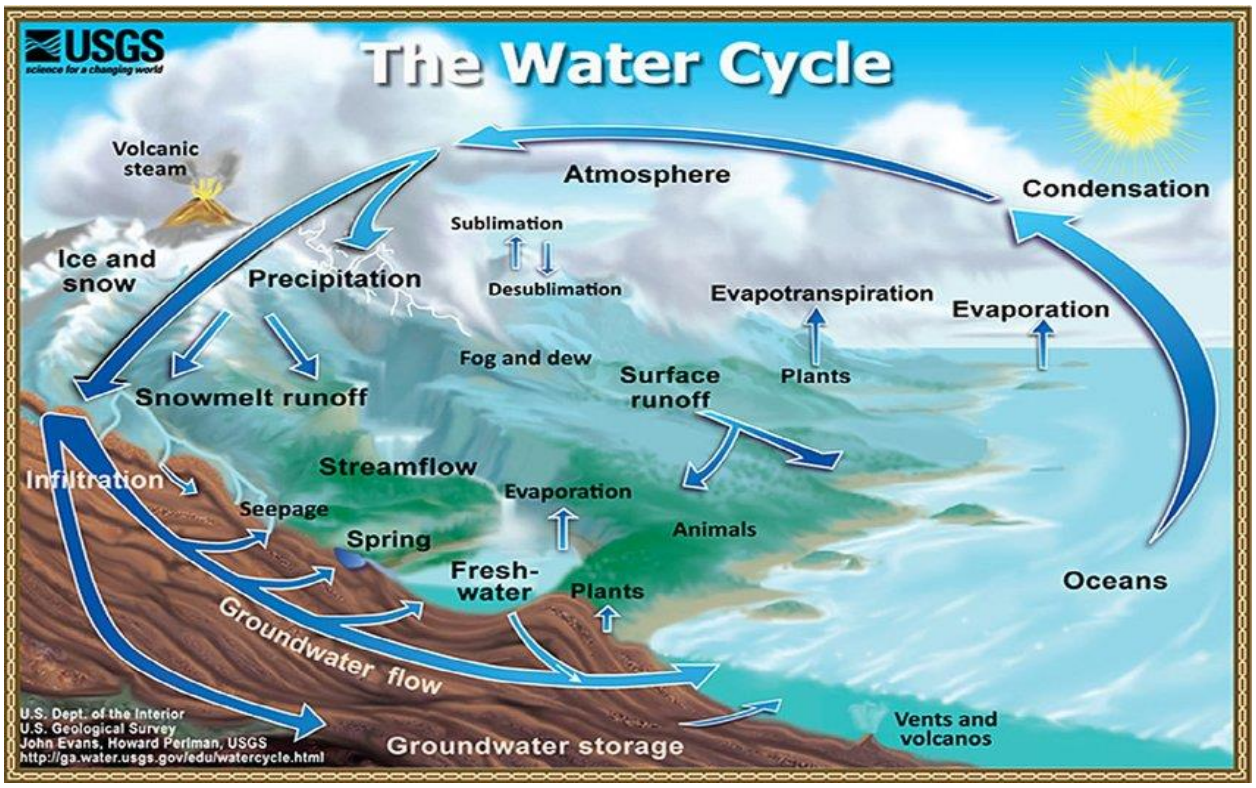
- Part of precipitated water intercepted by plants is directly returned to the atmosphere by evaporation and part of the water reaching the ground and making up the soil moisture is evaporated through the leaves by transpiration . Transpiration rates may be extremely low in xerophytic plants in deserts but very height in hydrophyte plants of particular interest are the transpiration losses of potential ground water supplies through phreatophytes the habitually deplete water from the zone of saturation either directly[or] through the capillary fringe.

INFILTRATION :

- The infiltration characteristic of the soil determine the rate at which water received as rainfall [or water applied on the surface]can move into the surface. The term percolation is used to denote the transit of infiltrated water through the unsaturated zone. Percolating water flows the path of least resistance ,travelling fast under gravity through the larger inter connected voids.

RUNOFF :

- runoff may be defined as the water that falls on the ground flowing from a higher gradient to a lower one . If relatively impervious horizons above the water table out crop at the land surface , water may flow over them to reach streams as interflow . Runoff depends on a number factors namely
- 1. Dimensions and configurations of drainage basins.
- 2. The climatic conditions including intensity ,duration and areal distribution of precipitation.
- 3. moisture content of soil
- 4. topography and land surface slopes.
- 5. infiltration and permeability of soils and subsurface formations.
- 6.type and density of vegetation
- 7.aquifer – streams relationships and
- 8. Human activities relating to land use urbanisation diversion of water



ORIGIN, OCCURRENCE, VERTICAL DISTRIBUTION AND FORMS OF GROUND WATER Origin

- Ground water is derived from several sources such as meteoric, connate , marine , juvenile etc..
- **MARINE WATER**: Sea water [or] ocean which has invaded rocks and unconsolidated sediments which are in contact with the ocean
- **Meteoric water :** Ground water which originates from precipitation is called meteoric water. This water which is initially supplied by the rains [or] snow as a part of the hydrological cycle is known as meteoric water
- **Connate water** : The water that is entrapped in the rocks during their formations due to sedimentation in an aqueous environment is called connate water.
- **Juvenile water** : it is also called magmatic water which is of only theoretical importance . It is the water formed in the cracks.

Metamorphic water : water that has been associated with metamorphic rocks during the course of metamorphism is called metamorphic water

OCCURRENCE OF GROUND WATER:

- ground water occurs in the earth crust in different forms depending upon the lithology, stratigraphy and structures
- Lithology is the physical makeup of mineral composition, grain size and grain packing of the sediments or rocks that make up the geological system. stratigraphy describes the geometrical and age relations between various groups, beds and formations in geological system of sedimentary origin .
- Structural features such as fractures, cleavages, folds, joints and faults are the geometrical properties of the geological system produced by deformation after deposition or crystallisation.
- The major geological units in terms of ground water occurrence and potentiality are as described below
- Unconsolidated

  Fluvial deposits : fluvial deposits are the materials laid down by physical process in river channels [or] on food plains

Aeolian deposits : sediments that are transported and deposited by wind are known as Aeolian deposits .

Glacial deposits : they include glacial till , glacio – fluvial sediments , glacio lacustrine sediments.

SEDIMENTARY ROCKS

Sand stones : sand stone forms the best repositories of ground water. Sandstone beds owe their origin to various depositional environments.

- **Carbonate rocks** : carbonate rocks mostly consist of limestone , dolomites and dolomitic limestone . Geologically young carbonate rocks commonly have porosities that range from 20 to 50 percentage

- **Shales** : shales are the poorest aquifers . Although they are porous they are impermeable.

CRYSTALLINE ROCKS

- **Igneous and metamorphic**: igneous and metamorphic rocks are relatively impermeable hence they serve as poor aquifers . Where such rocks occurs near the surface under weathered conditions.

- **Volcanic rocks** : volcanic rocks can form highly permeable aquifers.

VERTIFICAL DISTRIBUTION OF GROUND WATER

The subsurface occurrence of ground water is divide into the following zones.
Zone of aeration

Soil water zone : water in the soil water zone exists at the zone of saturation except temporarily when excessive water reaches the ground surface as from rainfall or irrigation
Intermediate zone : in intermediate vadose zone lies in between soil water zone and capillary zone .

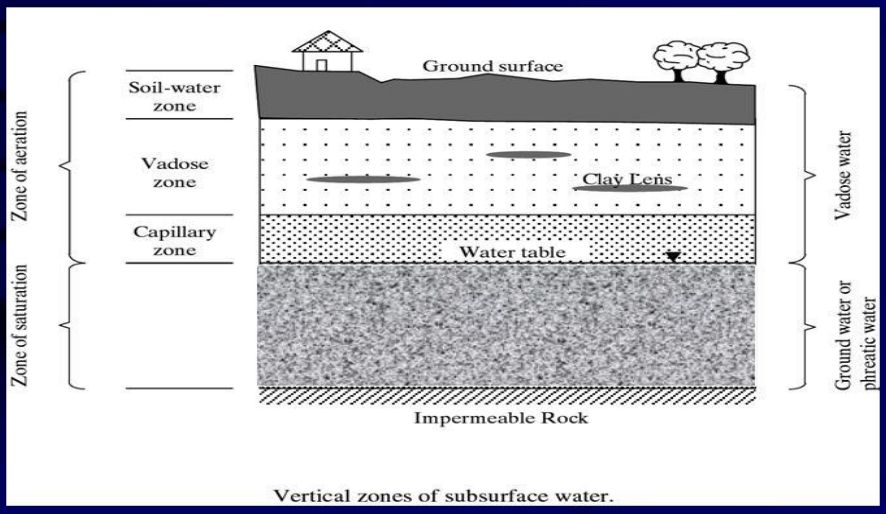
Capillary zone : this zone s also known as capillary fringe . It extends from water table upto the limit of capillary rise of water

ZONE OF STURATION

In the of saturation ground water fills all of the interstices. Hence the porosity provides a direct measure of the water contained for unit volume.

Water table : the surface below which rocks a permanently ssturated with water is known a water table . The actual position of the water table show seasonal variations. During the rainy season more water is added than is lost . So water table rises and it wil be nearer to the surface

Vertical Distribution of Ground Water



Vertical zones of subsurface water.

FORMS OF GROUND WATER

Wells :a hole dug into the ground to a considerable depth which reaches the water table is called a well.

Artesian wells : the aquifer is permeable bed and is overlain underlain by permeable beds.

- **Geysers** : a geyser is a special type of thermal spring tat intermittently erupts a column of steam an hot water.
- Areas can be delineated into recharge and discharge areas depending upon whether water in these areas is added to or abstracted from the zone of saturation.

AQUIFERS

Aquifers : a geological formation that yields significant quantities of water is defined as Aquifer. ex :unconsolidated sands and gravels

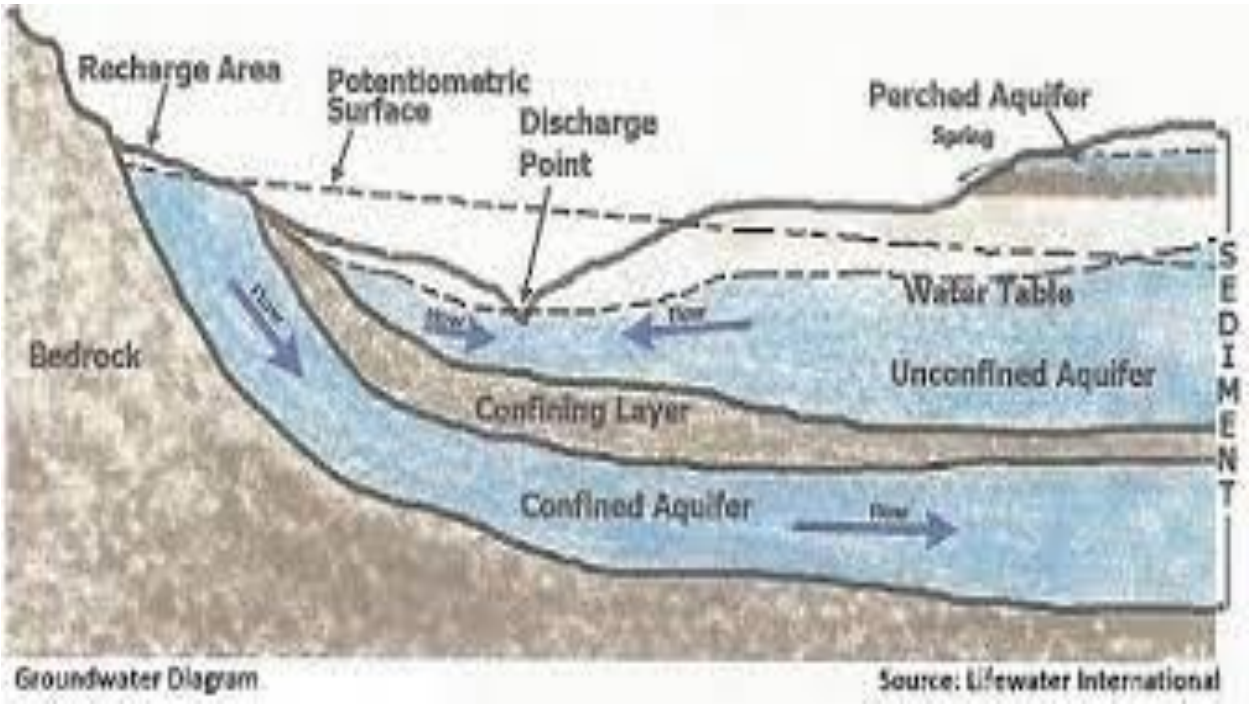
Aquiclude : a saturated but relatively permeable material that doesn't yield appreciable quantities of water to wells. Ex :clay

Aquifuge : a relatively impermeable formation neither containing nor transmitting water. Ex : solid granite , basalt etc..

Aquitard : a saturated but poorly permeable stratum that stops ground water movement and doesn't yield water freely to wells but it may transmit appreciable water to or from adjacent aquifers.

TYPES OF AQUIFERS

- **Unconfined aquifer** : an unconfined aquifer is one in which water table varies in undulating form and in slope depending on areas of recharge and discharge pump age from wells and permeability.



Perched Aquifer : A special case of an unconfined aquifer involves perched water body as shown in figure . This occurs whenever a ground water body is separated from the main ground water by a relatively impermeable stratum of small areal extent and body of ground water. ex ;clay
these sources yield only temporary or small quantities of water.

- **Confined aquifer** : confined aquifer is also known as artesian aquifers or pressure aquifers.
- **Leaky aquifer** : aquifers that are completely confined or unconfined occur less frequently than leaky aquifers.
- **Idealized aquifer** : for mathematical calculations of the storage and flow of ground water , aquifers assumed to be homogeneous and isotropic.

POLLUTION OF GROUND WATER

Definition : pollution is a modification of a chemical , physical and biological properties of water , preventing its normal use in various applications

CAUSES AND SOURCES OF POLLUTION

- Domestic and urban pollution
- **Sewer leakage** : sanitary sewers are intended to be watertight . But inn reality leakage of sewage into the ground commonly occurs.
- **Liquid waste** : waste water in urban areas originate from domestic source and industries such water with out giving treatment is discharged into the surface water finally finds way into the ground water causing pollution.
- **Solid water** : land disposal of solid waste creates an important source of ground water pollution.

Septic tanks and cess pools : in urban and highly populated domestic areas leakage from septic tanks and cess pools cause ground water pollution on large scale.

Roadways deicing salts : chloride ions from runoff from road deicing salts cause high chlorinity in ground water.

AGRICULTURAL POLLUTION

- **Irrigation return flows** : approximately 1\2-2\3 water applied for irrigation of crops is consumed by evapo- transpiration.
- **Animal waste** : where animals are confined within a limited area of beef or milch production , large amount of animal wastes are deposited on the ground.
- **Fertilizers and soil amendments** : when fertilizers are applied to the agricultural land , a portion usually reaches through the soil and to the water table.

Pesticides and herbicides : insecticides , pesticides and herbicides are cumulative poisons in agricultural areas and cause ground water pollution.

Industrial pollution

Liquid waste : the major use of water in industrial plants is for cooling , sanitation , manufacturing of different products and processing .

- **Tank and pipe line leakage** : petroleum tanks and pipe lines of chemicals when subjected to structural failure , cause ground water pollution due to leakage.
- **Mining activities** :mines can produce a variety of ground water pollution problems.
- **Oil field brines** : the production of oil and gas is usually accompanied by the discharge of waste water n the form of brine .
- **Trace metal pollution** : in industrial areas heavy metals such as arsenic , cobalt , cadmium , chromium , copper , lead , iron , manganese and mercury enter into the waste water as traces and finally reaches the ground water table to cause pollution.

Spills and surface discharges : liquids discharge on the ground water surface in an uncontrolled manner can migrate downward to degrade ground water quality

- **Stock piles** : solid materials are frequently stock piled near industrial plants construction sites and large agricultural operations.

Other causes

- 1. pollution from salt water intrusion
- 2. pollution from surface water contamination
- 3.pollution from wells
- 4. pollution from atmospheric dissolved gases
- 5.pollution from radioactive substances
- 6.high concentrations of fluorine etc ..