GROUNDWATER MANAGEMENT
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- # What is groundwater management?
- The management of a groundwater basin implies a program of development and utilization of subsurface water for some stated purpose, usually of a social or economic nature.
- ## *Need for groundwater management*
- Increase of groundwater usage in agriculture, industry and domestic purposes is causing continuous depletion of water level, drying up wells and quality problems.
- Development the maximum possible groundwater to satisfy the requirements of all user within the basin.
- The continuous increase in population and the recent increase in water demands necessitated proper planning and sound management of groundwater management of groundwater resources.
- Increase in urban wastes and expansion of industry and agriculture lead to a deterioration in quality of groundwater.
- In coastal aquifer, increase in water demand have resulted in inland progress of saltwater intrusion.

- What is IWRM?
- Integrated Water Resources Management is an approach that promotes the coordinated development and management of water, land, and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.
- Integrated management means that all the different uses of water resources are considered together.
- Functions of groundwater management
- 1.regulating of water consumption:-water consumption can be regulated either directly by allocation or indirectly by a fee or tax on consumption.
- 2. augmentation of water supply:-several method are used to increase the water supply, such as artificial recharge, relocation of wells or importing water.
- 3. aquifer conservation:-certain protective measures should be taken to restore the aquifer against pollution and excessive withdraws.

- SubSurface reservoirs

- Advantage

- 1. many large capacity sites available
- 2.sligt to no evaporation loss
- 3.Require little land area
- 4. slight to no danger of catastrophic structural failure
- 5. uniform water temperature
- 6. high biological purity
- 7.safe from immediate radioactive fallout
- 8.serve as conveyance system –canals or pipeline across lands of others unnecessary.

Disadvantages

- 1.water must be pumped
- 2.storage and conveyance use only
- 3.water may be mineralized
- 4.minor flood control value
- 5.limited flow at any point
- 6.power head usually not available
- 7.difficult and costly to investigate, evaluate, and manage
- 8.reacharge opportunity usually dependent on surplus surface flows
- 9.Recharge water may require expensive treatment
- 10.cotinuous expensive maintenance of recharge area or wells.

- ## Equation of hydrologic equilibrium:
- (Surface inflow + subsurface inflow +precipitation + imported water +decrease in surface storage+ decrease in groundwater storage)=(surface outflow+ subsurface outflow+ consumptive use+ exported water+ increase in surface storage+ increase in groundwater storage)

- ## Groundwater basin investigations
- Groundwater management studies are usually undertaken by local government agencies. Four levels of study are generally recognized , although not all are required. In brief these include:
- 1.preliminary examination- based largely on judgment by experienced personnel.
- 2.reconnaissance- this study considers possible alternatives in formulation of a water management plan to meet a defined need for an area , including estimate of benefits and costs.
- 3.feasibility- this study requires detailed engneering, hydrogeologic that economic analysis together with cost and benefit estimated to ensure that the selected project is an optimum development.
- 4.definite project- this investigation involves planning studies necessary for features of the selected project.

- Data collection and fieldwork
- 1. topographic data:-contour maps, aerial photograph are directly applicable for locating and identifying wells, measuring in groundwater levels,.
- 2.geological data:-surface and subsurface geologic mapping provides the framework for the occurrence and movement of groundwater.
- 3.Hydroogical data:- the principle purpose of hydrologic data collection is to evaluate the equilibrium.

- Alternative basin yields
- In managing a groundwater basin ,one of the main goal is to evaluate the maximum annual groundwater yield of the basin that can be withdrawn and used without producing undesirable effects.

- Safe yield or sustained yield:
- safe yield first defined by lee(1915)as the limit of the quality of water which can be with drawn without depletion of storage reserve.

- It is two type:
- 1.mining yield: If groundwater is withdrawn at a rate exceeding the recharge, a mining yield exists. this process lowers water table and piezometric surface to irreversible positions if the withdrawn is continues. the water table under these conditions is known as the mining yield.
- It is two type:-
- (a) maximum mining yield: - this is the total volume of water in storage that can be feasibly extracted and utilized but cannot be replenished.
- (b)permissble mining yield:-maximum volume of water in storage that can be economically extracted without producing an undesirable effect.

- 2.Perennial yield:-the perennial yield of a groundwater basin define the rate at which water can be withdrawn perennially under specified operating conditions without producing an undesired result.

- An undesired result in an adverse situation such as
- 1. progressive reduction of the water resource
- 2.development of uneconomic pumping conditions
- 3.degradation of groundwater quality
- 4.land subsidence caused by lowered groundwater levels.
- 5.Any draft in excess of perennial yield is referred as overdraft.

- The perennial yield is further subdivided to two types:-
- 1. deferred perennial yield
- 2. maximum perennial yield
- 3.Variability of perennial yield

- Sequence of activities preceding start of a groundwater management investigation(after Amer. Soc. civil Engrs.)
- 1. identification of problem
- 2. formulate alternative management objective and selective
- 3.define elements of management plan
- 4.obtain authorization and financing of water resource management investigation
- 5.develop goals for investigation
- 6.Select scope of investigation
- 7.develop work program for investigation
- 8.create planning organization
- 9.commence investigation
- 10.projecting future water demands
- 11.surface and subsurface exploration
- 12.assessment of water resources
- 13.capability of extraction and recharge facility

- 14.Aquifer boundary conditions
- 15.legal and organizational considerations
- 16.alternative plans for water resources management
- 17.report on the investigation

- ## Basin management by conjunctive use
- In basins approaching full development of water resources, optimal beneficial use can be obtained by conjunctive use, which involves the coordinated and planned operation of both surface water and groundwater resources.

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