

Impact of Urbanization on Ground Water Dynamics

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Introduction

Urbanization is a process that leads to the growth of cities due to industrialization and economic development. The rate of growing population is about 17 million annually which means 31 births per minutes. If the current trend continues, by the year 2050, India would have 1620 million populations. Over 50 % of the Earth's population now lives in cities and it is estimated that by 2025 this will increase to over 70 %. Due to uncontrolled urbanization in India, environmental degradation has been occurring very rapidly and causing many problems like shortages of housing, worsening water quality, excessive air pollution, noise, dust and heat and the problems of disposal of solid wastes and hazardous wastes. The conversion of natural, agricultural and other low-population density lands to cities or urban areas changes to the hydrology of the area.

Impact of urbanization on groundwater systems and recharge

Altered topography

Urbanization tends to level off the landscape for ease of construction and for roadway design. Over time, low-lying areas are filled in and elevated areas lowered.

Altered vegetation

Changes in the rates and distribution of evapo-transpiration can alter recharge and groundwater flow directions.

Groundwater temperatures

The urban heat island effect is well documented. Urban areas are hotter than adjoining rural areas.

Changing water table elevations

Water tables can either fall or rise with urbanization. Ground water extraction in urban area can either increase or decrease with time. so there is chance to change in water table elevation.

Construction and pumping effects

Various construction activities and designs affect the groundwater. If the water-table is close to the surface or if deep tunnels or subways are being built, dewatering or depressurization may be required that can lower water tables for considerable periods of time.

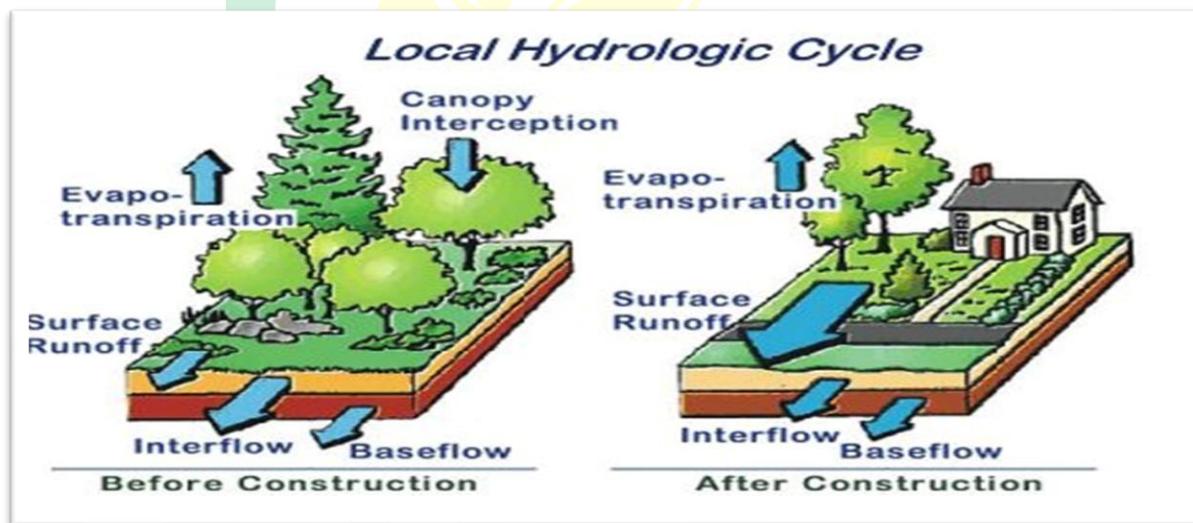
Altered permeability field

Although urban soils tend to become less permeable because of compaction fill near buildings and over utility trenches is more permeable. In the latter case, permeability commonly increases by several orders of magnitude.

Groundwater recharge

Leakage from water mains estimated to range from lows approaching 5 % to over 60 % of water pumped from the surface reservoirs or groundwater. The lowest rates are for special low pressure, newly constructed water delivery systems, but rates under 10 % can be achieved with good continual maintenance.

Impacts on groundwater quantity



Local Hydrologic cycle

This figure shows how development and its corresponding increase in impervious cover disrupt the natural water balance. In the post-development setting, the amount of water running off the site is drastically increased.

**Runoff in parking lot in urbanized area****Discharge from urban area during heavy rainfall**

Increased storm water runoff

Increased storm water runoff: Impervious cover, such as this parking lot, is impervious to rainfall, creating large amounts of runoff. 50 % of the land area becomes impermeable, direct recharge will be reduced by a comparable amount.

More frequent flooding

The large amount of runoff entering an urban stream can frequently result in flooding, such as this moderate overbank flooding.

Effects of urbanization on groundwater quality

- Leaks from underground storage tanks containing solvents, brines, gasoline and heating fuels
- Municipal waste disposal (land filling).
- Industrial discharges, leaks and spills.
- Industrial wastes.
- Spillages during road and rail transport of chemicals.

Distributed and line sources include

- Effluent from latrines and cesspits.
- Leaking sewers and septic tanks.
- Oil and chemical pipelines.
- Lawn, garden and parkland fertilizers and pesticides.
- Oil and grease from motorized vehicles.
- Wet and dry deposition from smoke stacks

Overall conclusion of this chapter

- Urbanization process has altered the natural hydrological cycle and urban recharge component plays a vital role in urban balance.
- The urban recharge component includes a large portion of water from water supply network and sewage network.
- The sewage network and water supply system need to be maintained and improved to stop the further alteration and pollution of groundwater.
- It also means that the ground sealing or impermeabilization has largely affected the natural recharge process.
- Rapid urban population growth is the main cause of groundwater level decline in the city.
- Change of land use practice resulting from urbanization, namely increase of urbanized area and decrease of agricultural and natural land only causes a slight decrease of groundwater recharge.
- Lack of accounting for groundwater withdrawal and proper analysis of water resources.
- Improper disposal of domestic waste is percolate down and contaminated the groundwater.
- Sewer leakage contaminates ground water.