

Groundwater recharge in urban areas

[Environment](#), [Water](#)



Groundwater recharge (GWR) is a hydrological process by which surface water infiltrate into the soil stored in the aquifer. Owing to absence of rainwater harvesting (RWH) and/or groundwater recharge (GWR) urban areas are experiencing groundwater depletion, water scarcity, water logging and climate change etc. Quick urbanization along with unplanned cities affecting climate changes, the 'urban storm water-logging' was already identified as a common issue around the world, for instance USA, Canada, Europe, Australia, Philippines, Sri Lanka, Japan, China, Nepal, Bangladesh and India. Recently urban storm water logging becomes crucial issue during rainy season for the city dwellers in Chittagong city like other parts of Bangladesh. Besides around the world GWR is very crucial issue for Sao Paul, Bengaluru, Beijing, Cairo, Jakarta, Moscow, Istanbul, Mexico city, London, Tokyo, Cape Town cities now a days. Transportation system is affected greatly by water logging and causes sufferings to the people with disrupted road networks and city facilities.

Besides increasing amount of paved surface around the urban environment is affecting the natural groundwater recharge (GWR) system. Hence, a notable amount of groundwater is retracted to meet the increasing demand which leads to increase the groundwater depletion rate rapidly creating water scarcity around the world. As a result decreasing of the water level of in wells, streams and lakes decay of water quality, land subsidence and increasing pumping price. Besides around the world groundwater depletion is very crucial issue for Sao Paul, Bengaluru, Beijing, Cairo, Jakarta, Sa'dah, Darab, Jahrom, Estahban, Moscow, Istanbul, Mexico city, London, Tokyo, Cape Town, Punjab, Haryana, Delhi, Rajasthan cities now a days. To get rid of

water scarcity evaluation of artificial potential groundwater recharge zone could aid in proper advancement and implementation of groundwater and surface water resources. Moreover, the main advantages of the RWA include adequate utilization of available natural resources, increasing current supply acceptability, reducing contaminated loads of water body, reducing load of sewage network, avoiding soil erosion, reducing risk of flood and drought, and environmental protection.

RWH linked with the artificial recharge provided sustainable water resource management to improve the environmental condition and increase water management techniques and supply to overcome the issue of water scarcity. Thus, RWH would contribute no excessive runoff, flood control in the downstream catchment, improved soil moisture availability and soil conservation. Slope is the one of the most unavoidable part in both reducing urban storm water logging and increasing ground recharge. The slope gradient directly impacts the infiltration of surface water. Low levels of recharging can be observed on steep slopes as water flows rapidly downwards providing insufficient time to infiltrate. On the other hand, flat lands facilitate groundwater recharging due to extensive retention of rain water, providing moderate evaporation conditions. Drainage density map is an puissant factor to determine the high permeable and porosity terrain due to identification of suitable recharge sites. Most of the geological discontinuities are attributed to faults or fracture systems, those acts as conduits for groundwater movement and storage. Therefore, lineament density can be used to deduce high secondary porosity in a particular area. In general, a buffer zone of 300 m around each lineament is considered a

favorable zone for groundwater recharge. For determining the best sites for recharge structures soil properties and coefficient of permeability could be one of the major factors.

Generally, permeability is directly proportional to the particle size, structure of soil mass, shape of particles, void ratio, properties of water, degree of saturation, adsorbed water, impurities in water. Land use/land cover influences the rate of surface runoff, infiltration and groundwater utilization. Therefore, land use/land cover need to be considered as an indicator in the selection of sites for artificial recharge of groundwater. Geology provides descriptive information on underlying soil/rock layers and their properties. Geomorphological features combined with structures and lithology controls the occurrence, movement and quality of groundwater. Evaluation of landforms is useful to understand the occurrence of porous and permeable zones. Thus, geomorphology of the study area is an essential component to be considered for groundwater recharging. However, locating the potential sites for artificial recharge is very difficult and depends on many interdependent factors including rainfall, drainage density, lineament density, slope, soil permeability, land use/land cover, geology and geomorphology. To maintain sustainable development and management of natural groundwater resources emerging geospatial technologies i. e. Remote Sensing (RS) and Geographic Information System (GIS) could be effective tools to evaluate the artificial groundwater recharge zones and potential RWH sites for RWH structure based on modern science principle and techniques to provide better water management and sustainable planning of water resources. To identify potential groundwater recharge

zones RS and GIS techniques are being used entirely around the world. In these studies Most of were based on analysis through integration of different parameters, viz. land cover/land use, geology, geomorphology, lineament density, drainage density, slope, soil permeability, water logging, ground water table depth, etc. To prepare these thematic layers RS, GIS and Geospatial and image processing techniques were linked. In present studies to obtain these thematic layers Multi-Criteria Decision Analysis (MCDA) and Analytic Hierarchy Approach was preferred by the researchers.

Analytic Hierarchy Approach (AHP) was proposed by Saaty (1980), MCDA or AHP method provides specific value in order to deal with multi factors gives context-specific multi-criteria evaluation for each factors when general criteria failed to provide that. Thus, AHP In cooperation with RS and GIS could be a useful mean to evaluate RWH based groundwater recharge potential zones. Due to increasing population and decreasing amount of barren land in order to cope with the water demand it's necessary to implement GWR method immediately to prevent the water loggings and water scarcity problem in Chittagong. There was no past research carried out in order to solve these problem in Bangladesh but recently around the world researcher are being conscious to solve this problem. To resolve the water logging, groundwater depletion and meet the current water demand in Chittagong city it is essential to adopt GWR for future development and water management.