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RAPID URBANIZATION: AN ADVERSE IMPACT ON THE GROUND WATER RESOURCES INGURUGRAM

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ABSTRACT

Though, the development of tube well irrigation has contributed significantly to the increase in food production and reduction in poverty, sustainable development and management of this resource has posed many challenges in recent years. Major problems associated with the ground water development and management are over exploitation of ground water in several parts of the country, water logging and salinitydue to rising water table in major irrigation commands, correct assessment of ground water potential and ground water pollution. Water is prime natural resource, a basic human need and precious natural asset. Water is also a vital part of socio-ecological system. This is evident from the fact that the ancient civilizations existed along the water courses and near water bodies.

INTRODUCTION

Water has remained the backbone of all early civilizations and gave rise to the world. Importance of water and its development for various needs and environmental functions can be found in ancient texts, inscriptions, local traditions and archaeological remains. The average annual water availability in the country remains more or less fixed according to the natural hydrologic cycle but the per capita water availability is coming down due to increase in population and highly uneven distribution of water resources. Now–a-days, the natural water resources like rivers, lakes, estuaries and coastal waters which would have been public good can all be appropriated into the ownership of public or private bodies. Thus, water is not merely a natural resource but also an economic resource. Urbanisation and rapid growth in urban population can dramatically increase per capita use of fresh water. In fact, from being necessity water has now become a luxury in the cities whereas despite adequate natural endowment, water resources appear to be shrinking. Under this back drop, this chapter examines the time and space characteristics of water resource availability in the study area.

MATERIALS AND METHODS

The recharge from rainfall can be estimated based on water table rise inshallow aquifers and in this approach increment of water levels in the block ismultiplied by its area and average specific yield. The recharge thus obtained is compared with the recharge estimated to monsoon rainfall evaluated from norms considering monsoon rainfall and infiltration factor. Before comparing the evaluation by water table approach with evaluation based on norms, additional input to ground water reservoir during monsoon period through canal irrigation and canal seepage have been subtracted from the estimated figure of recharge by the water table fluctuation approach and actual utilized ground water during the season which has notbeen reflected by water table rise have been added.

It has been normalized with respect to long term normal rainfall. And in caseof these two figures of monsoon rainfall recharge are comparable within 20% accuracy, the figure evaluated based on water table fluctuation approach have been utilized for ultimate ground water potential evaluation, in the case where estimate by fluctuation approach exceeds 20% the estimate based on norms are used. The rainfall contribution to ground water for monsoon period have been worked out considering non monsoon rainfall, area of the block and infiltration factor because contribution of non monsoon rainfall is not so substantial which could affect the water levels of phreatic aquifers in the study area.

The annual recharge has been worked out as the total of rainfall recharge with additional inputs from surface water bodies and flood plains. The inflow of groundwater in the study area has been considered to be equal to the outflow. The static reserves of ground water up to the depth of 5m below ground level with respect to water table depth in pre monsoon period have been added to annual recharge to get ultimate ground water potential. Out of this 15% potential have been kept for domestic and industrial use and the remaining 85% has been considered as available ground water for irrigation. The ground water studies has been worked out by considering number of various structures and their annual unit and 30% of total groundwater has been considered to be returned to ground water reservoir through seepage. Hence 70% of annual groundwater has been considered as actual loss of utilization of ground water.

The balance ground water resource is the difference between available resource for irrigation and 70% of the annual ground water resource.

Resource Availability

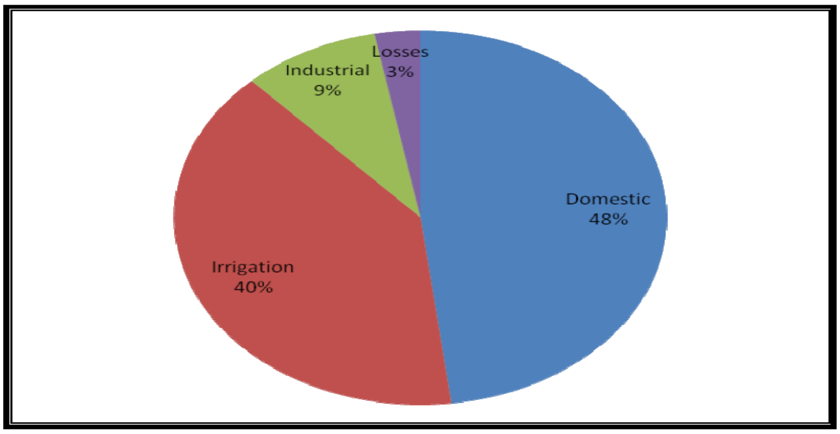
Gurugram receives 99 mm3 of average annual rainfall, 80 per cent of which falls between the end of June and September and partly contributes to the Yamuna river flow. Yet, the river does not always have enough water to meet the requirements of the region; hence to meet the annual water requirement, Gurugram heavily depends on neighboring states for its basic water supply. Gurugram‟s sources of water consist of surface and groundwater.

Groundwater

Groundwater is one of the major sources of water supply in many parts of the country. In Gurugram too, groundwater contributes a substantial quantity of water supply. Especially in newly developed areas, groundwater is largely being used as drinking water resources. Central Ground Water Board (CGWB) assessed the total groundwater potential to be 292 million cubic meter (MCM) in 2008 as compared to

428.07 MCM in 1983, showing an overdraft and reduction of around 130 MCM over the past 25 years2. Groundwater exploration is carried out at a depth ranging from 50 to 150 meters. The Quaternary deposits constitute the major repository of groundwater. The annual extraction of groundwater is estimated around 47945.18 hectare meters1. Salinity and overexploitation has contributed to depletion of the resource and drastically affected the availability of water in different parts of the city.

Gurugram: Groundwater Usage



The complexities of situation of groundwater occurrence in rock formations, presence of saline groundwater at varying depth and growing urbanisation has influenced the groundwater availability in different parts of Gurugram. According to CGWB (2018), 48 per cent of groundwater is used for domestic purposes, 40 per cent for irrigation and 9 per cent for industrial use, 3 per cent groundwater losses during different uses.

The rapid urbanisation has had an adverse impact on the water resources of the district. The water table has declined in most parts by 2 meters to 8 meters during the past decades. The groundwater does not constitute a homogeneous system in its lateral extent and there are variations in groundwater level in pre monsoon and post monsoon seasons. The pre monsoon water level is measured in the month of May.

Around 44 per cent of the groundwater is recharged by the rainfall during monsoons, 31 per cent from other sources during non-monsoon, 19 per cent from other sources in monsoon and 6 per cent from rainfall during non-monsoon. The groundwater in Gurugram does not constitute a homogenous system in its lateral extent. Due to urbanisation shrinking of the exposed land surface for direct infiltration of rainfall has led to very limited recharge. Groundwater recharge from rainfall showsa wide range (0.2 per cent - 66.0 per cent) of spatial and temporal variations, withmost parts receiving less than 5 per cent recharge. Because annual recharge is very small compared to the local groundwater withdrawal, there is a wide spread decline ingroundwater level.

Surface water

Till 1955, there was no major outer source of water in Gurugram and by and large, Yamuna was fulfilling the requirements. With the settlement of large number of refugees from Pakistan, the water shortage was felt for the first time in the fifties. Around the same time the Bhakhra-Nangal dam was completed and became an important source in providing water to Gurugram and it continues to be so even today. Over 86 per cent of Gurugram‟s water supply comes from surface water through the Yamuna River, whose flows are largely diverted upstream in Punjab and Haryana for canal irrigation. Gurugram receives 310 MGD water from river Yamuna. Other sources are Himalayan Rivers, under various inter-state agreements, and sub-surface sources like ranney wells and tube wells, as shown in Table .

Delhi: Quantity of Surface Water from Different Sources

Sources	Total Quantity (MGD)
Yamuna	**310**
Bhakhra Storage	**140**
Ganga	**240**
Surface water Sub total	**690**
Ranney well/tube wells	**115**
Total Raw water	**805**

Source: Economic Survey of Gurugram, 2020-21.

Water for Gurugram is released via Delhi from Bhakhra-Nangal dam to Tajewala barrage (near Ambala) and then it reaches to Munakh (Panipat) 70 kilometers further down. Munakh is the receiving point for the Delhi Jal Board (DJB). From Munakh, it is the responsibility of DJB to take this water to Delhi. Delhi Jal Board sends this water to its two water treatment plants – Haidarpur (130 kilometers from Munakh) and Wazirabad (150 kilometers from Munakh). This transportation is facilitated through the old Yamuna and Indira Gandhi canals. This water is eventually suppliedto all other water treatment plants . The Bhagirathi water treatment plant, since 1990, receives its 270 cusec water from the upper Ganges through the Muradnagar canal covering a distance of 28 kilometers.

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