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Impact of Landuse Change on Hydrology: A Case Study of Gurgaon City

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Abstract

Gurgaon City is a satellite town of NCT Delhi and is an important center of trade and commerce in Haryana State. The town has a number of mnc's and mechanical, electrical, textile, electroplating, chemical industries. The rapid urbanization and population growth has resulted in the expansion of city boundaries. To meet with the requirements of the residents over exploitation of resources is done. In this study we deal with the change in hydrological profile. Ground water decline and salinity is the major problem in the district. Ground water is declining at a rate with the range of 0.77m/yr to (Bilaspur) to 1.2 m/yr (Haily Mandi). Perusal of the Estimates reveals overall stage of ground water development in the block is of the order of 209% which has exceeded the available recharge and thus the whole district has been categorized as over exploited. Net annual ground water availability of the district is 20215.12 ham and existing gross ground water draft for all users is 33055.33 ham. It means that the ground water is under stress and the ground water level is declining. There is no scope for further ground water development. Only measures should be taken to reduce on the dependence on ground water and to enhance the ground water resources.

1. Introduction

The ground water levels are declining much faster in the urban settlements. Some areas where poor quality of ground water is reported, needs special attention. Any withdrawal of ground water from aquifers creates empty space, which is refilled during wet season in natural ecological setup. Excessive exploitation of ground water leaves larger spaces, part of which remains unfilled and lead to irreversible decline of ground

water levels. Such spaces can be utilised to fill up through artificial recharge system to replenish ground water resources. The Present study aims to Study the nature and impact of Land use change on the Surface as well as Sub Surface Water Resources in Gurgaon.

In the present study, the methodology adopted was taken up in two major parts. The first part dealt with the collection of basic information and Data of the study area by integration of Bore Hole Data from Central Ground Water Board and Ground Water Directorate, Collection of Sub Surface Information using Resistivity Meter, Detailed Pre-Monsoon and Post-Monsoon analysis of Water Bodies, Secondly the comparative study of old topographic maps and recent remote sensing images provide noteworthy variations in characteristic of the fluvial landforms. Analysis of data was done and maps were developed with the help Of Remote Sensing and GIS technique.

2. Landuse Profile of Gurgaon

The rapid and hazardous growth of urban area and increasing population pressure is resulting into the deterioration of infrastructure facilities, loss of productive agricultural land and green areas, potential, loss of surface water bodies, besides causing air pollution, contamination of water, health hazards and micro-climate changes. By the study of the above area, we can say that the Major agricultural land is converted into industrial, residential and the other land uses Wasteland, hill, and forest area are also affected from city expansion. The Major land use- Residential is converted to commercial in the core city.

A rapid urban expansion in Gurgaon region has taken place at the cost of wasteland and agricultural land. The impact of mega city Delhi and the development of physical infrastructure specially the transport system has triggered the land use changes. The open areas, greenery of surrounding area as well as its vicinity to Delhi are some factors, which attract the people towards this satellite city. It has been observed that agriculture land located in the surrounding region of the city have shown a declining trend due to population growth and growth of economic activities. The city has grown towards Delhi and Faridabad along the main roads. Hence we can conclude that the expansion of city with rapid urbanization has largely effected the land use. The landuse pattern of Gurgaon has changed, resulting in a concrete jungle. This landuse change has affected the hydrology of the area.

3. Ground Water Status

The water supply to the Gurgaon district is mainly based on groundwater through tubewells .100 % of the urban population is covered under drinking water supply scheme. The water supply to the villages is meet out with the installation of hand pumps by the villager as spot and convenient source of water . The shallow tubewells for irrigation purpose in the district range from 45 to 70m. deep, tapping the aquifer from 31m to 50 m. with a discharge of 400 to 1000 lpm. Most of the shallow tube wells are either run by diesel engines or electric motors.The major part of the district is

being irrigated through ground water. . A recent estimate, calculated by the Centre for Science and Environment, holds that Gurgaon's watertable is declining at an average rate of 1.12 metre every year. And officials of The Hydrologist say that unless every drop of rainwater is harvested and efficiently utilized, there can be no way to reverse this damage.

4. Ground Water Quality

Ground water is considered as the preferred source of water for meeting domestic, industrial and agricultural requirements, due to its longer residence time in the ground, low level of contamination, wide distribution and availability within the reach of the consumer. Hence, development of ground water gets first priority both at individual as well as governmental level, for different uses. However the occurrence and distribution of ground water is not uniform throughout the country and is subject to wide spatio-temporal variations depending on the underlying rock formation, their structural fabric and geometry, surface expression etc.(Pg V RGNDWM Project Manual)

The shallow ground water of the district is alkaline in nature (pH 7.25 to 8.13) and is moderately to highly saline (EC 805 to 3410µS/cm). Among cations, sodium is the dominant cation in 63% samples and in the remaining mixed cationic character is observed whereas among anions, mostly mixed anionic character dominates. However, bicarbonate is found to be the dominant anion in 25% samples. On comparing the concentration values of major ions with the recommended desirable and permissible concentration limits for drinking waters (Bureau of Indian Standards) it is found that ground waters is mostly unsuitable for drinking purposes in 88% of wells mainly due to high nitrate and fluoride contents that exceed the maximum permissible limits of these parameters which are 45 mg/l and 1.5mg/l respectively.

Salinity (EC), Sodium Adsorption Ratio (SAR) and Residual Sodium Carbonate (RSC) are generally the parameters for ascertaining the suitability of ground water for irrigational uses. These parameters range from 805 to 3410 µS/cm at 250C, 1.57 to 15.27 and –17.15 to 5.30 milli-equivalents respectively. Plot of USSL diagram used for the classification of irrigation waters indicated that ground water samples mostly fall under class C3S1 & C3S2 (56%). Such waters are likely to cause medium to high salinity hazards but they may not cause sodium hazards because of low SAR. The remaining 44% of water samples fall under C3S3, C3S4, C4S1, C4S2 C4S3 and C4S4 classes of irrigation water. Waters having C4, C3 and S3 and S4 may lead to both salinity and sodium hazards when used for irrigation under normal practices. Such waters, nevertheless, can be used for semi-salt tolerant to salt tolerant crops along with appropriate amount of gypsum on well drained soils.

The Gurgaon city has a number of mechanical, electrical, textile, electroplating and chemical industries. The waste generated by these units is dumped untreated either on land (nearby depression) or into the city sewage drains. The city sewage, which also contains toxic industrial effluents, is made to flow in unlined channels for ultimate discharge into watercourses. Disposal of waste effluents in this way can cause pollution of ground water through seepage and industrial effluents .The shallow

ground water in most part of the city has been found polluted due to sewage contamination as the well waters showed high concentration of nitrate and chloride. The ground water at deeper depths have much low concentration of these constituents, which indicates that the pollution of ground water is restricted to shallow depths only.

5. Conclusion

Gurgaon has evolved in the last two decades from a stretch of agricultural land in the neighbouring state of Haryana to a flourishing suburb of Delhi, catering to the ever growing requirements of the National Capital Region (NCR) of Delhi. Only some parts of the north and north–west regions remain agricultural while most of the other sectors, in their entirety, have evolved as residential sectors interspersed with commercial areas and industrial areas along the main transportation line of NH-8 (National Highway-8) that connects Delhi to Mumbai. The entrepreneur of Delhi discovered Gurgaon as a separate nucleus offering a combination of various inputs of land, material, labor, skill and transport. The stage of ground water development for the district is 209% and all the four blocks fall in over-exploited categories. That means that the ground water is under stress and the ground water level is declining. There is no scope for further ground water development. Only measures should be taken to reduce on the dependence on ground water and to enhance the ground water resources.

Thus in the end we can conclude that groundwater harvesting is essential for the region. Rain water Harvesting should be made mandatory for new constructions. The old house owner ready to go for harvesting measures shall be given incentives in the form of conferring public honor and sustainable concession in municipal taxes. The surface run off on the roads and open grounds during the monsoon period be diverted to pits (Recharge shafts) judiciously constructed in the colony, parks or play grounds. Awareness in students and public should be made regarding conservation of water. Habit of Saving Water like Money, should be adopted since childhood.

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