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Report and Opinion

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Parameters Related to Hydrological Information of district Sonipat, Haryana (India)

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Abstract: The district of Sonipat is bounded by 28048'15" to 29017'10" North latitude and 76028'40" to 77012'45" East longitude. It falls in the survey of India topo sheets no.53C,53D, 53G & 53H covering an area of 2260.53 sq.km. Sonipat is one of the smallest district in Haryana State and covers 5.11 % area of the state. The district is surrounded by Panipat district in the north, Jind district in the west, Rohtak district in the S.W direction and Delhi in the South. The district headquarter, Sonipat is connected by metalled roads with important cities of the state and to Delhi. It is also connected by broad gouge railway line with Delhi and Chandigarh. Gohana, Ganaur, Rai & Kundli are the other important towns in the district. Sonipat district is one of the densely populated districts of the state. The total population of the district as per 2001 census is 12,79,175. The population density is 471 persons per sq.km against the state average of 372 persons per sq.km.
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1. Introduction:

Water is one of our most important natural resources. Without it, there would be no life on earth. The supply of water available for our use is limited by nature. Although there is plenty of water on earth, it is not always in the right place, at the right time and of the right quality. Adding to the problem is the increasing evidence that chemical wastes improperly discarded yesterday are showing up in our water supplies today. Hydrology has evolved as a science in response to the need to understand the complex water systems of the Earth and help solve water problems. Hydrologists play a vital role in finding solutions to water problems, and interesting and challenging careers are available to those who choose to study hydrology.

Hydrology is the science that encompasses the occurrence, distribution, movement and properties of the waters of the earth and their relationship with the environment within each phase of the hydrologic cycle. The water cycle, or hydrologic cycle, is a continuous process by which water is purified by evaporation and transported from the earth's surface (including the oceans) to the atmosphere and back to the land and oceans. All of the physical, chemical and biological processes involving water as it travels its various paths in the atmosphere, over and beneath the earth's surface and through growing plants, are of interest to those who study the hydrologic cycle.

There are many pathways the water may take in its continuous cycle of falling as rainfall or snowfall and returning to the atmosphere. It may be captured for millions of years in polar ice caps. It may flow to rivers and finally to the sea. It may soak into the soil to be evaporated directly from the soil surface as it dries or be transpired by growing plants. It may **percolate through the soil** to ground water reservoirs (aquifers) to be stored or it may flow to wells or springs or back to streams by seepage. The cycle for water may be short, or it may take millions of years.

People tap the water cycle for their own uses. Water is diverted temporarily from one part of the cycle by pumping it from the ground or drawing it from a river or lake. It is used for a variety of activities such as households, businesses and industries; for irrigation of farms and parklands; and for production of electric power. After use, water is returned to another part of the cycle: perhaps discharged downstream or allowed to soak into the ground. Used water normally is lower in quality,

even after **treatment**, which often poses a problem for downstream users.

The hydrologist studies the fundamental transport processes to be able to describe the quantity and quality of water as it moves through the cycle (evaporation, precipitation, streamflow, infiltration, groundwater flow, and other components). The engineering hydrologist, or water resources engineer, is involved in the planning, analysis, design, construction and operation of projects for the control, utilization, and management of water resources. Water resources problems are also the concern of meteorologists, oceanographers, geologists, chemists, physicists, biologists, economists, political scientists, specialists in applied mathematics and computer science, and engineers in several fields.

2. Drainage

The River Yamuna, which borders the district in the East, is the main river in the district. The district is drained by drain no.8, which was constructed to take out excess monsoon runoff from uplands to River Yamuna. The areas east of upland plains are more prone to flooding because of its low-lying nature.

3. Irrigation

Irrigation in the district is done by surface and ground water as well .Around 42% of the area is irrigated by tubewells and rest of the area is irrigated by canals. About 96% area has been irrigated with respect to net sown area in the district. The district has a high irrigation intensity of 159%. About 91% area of the district is gross area irrigated with respect to total cropped area. The area, which is irrigated by surface water lies towards west where ground water is mostly saline while ground water irrigation is maximum in the eastern parts adjoining the Yamuna river. In this part of the district, ground water is fresh. The canal irrigation is mainly done by West Yamuna Canal system.

4. HYDROMETEOROLOGY

The climate of the district is characterized by the dryness of the air with an intensely hot summer and a cold winter. The cold season starts by late November and extends to about the middle of March. It is followed by hot season, which continues to about the end of June when the southwest monsoon arrives over the district. The period from July to September is the southwest monsoon season.

Rainfall:

The normal annual rainfall of the district, based on the record for the period 1901-1980 is 567 mm recorded in 30 rainy days in a year. There is no meteorological observatory in the district, so the climatological data of the nearby observatory at Delhi has been taken as representative of the climatological conditions of the district. About 76% of the annual rainfall is recorded during the southwest monsoon from June-September. July is the wettest month of the year with 7.5 rainy days and 169 mm rainfall. During the period 1901-80, deficient to scanty rainfall was recorded in 18 years. The probability of occurrence of rainfall in the range 400-700 mm is 0.65.

January is the coldest month with mean daily maximum temperature 21.3^{o}C and mean daily minimum temp 7.3^{o}C. May is the hottest month with mean daily maximum temp 26.6oC. In May and June, the maximum temperature sometimes reaches about 47oC.

Physiography

The area forms a part of the Indo-Gangetic plains and exhibits flat terrain with general slope from North to South. The area is devoid of any prominent topographic features. However, a natural depression exists in North & Northwest of Gohana (29008’22”N & 76042’55”E). The maximum elevation of the plain is 230m above msl. Topographically the district can be divided into the following units.

1. Active flood plains along the present day course of the river Yamuna in eastern part of the district

2. Abandoned flood plains of recent past. These are generally bordering the active flood plains and are wider, low lying flat tracts.

5. Upland plains representing the relatively older river deposits. The western Yamuna canal has been roughly aligned along the ridge formed by upland plains.

Soils Types

- **Psammaquents and Haplaquepts-** These soils are found in Yamuna Plains
- **Haplaquept-** These soils are non saline, alkalinity hazards are classified as typic ustochrepts but water logged soils with loam to clay loam texture showing the effect of glazing, are classified as aeric/ typic Haplaquepts. Areas as aeridic

soil moisture have soils classified as camborthics and torropsamments.

5. Hydrogeology

Ground water occurs in alluvial sand, silt, kankar and gravel, which form potential aquifer zones. Depth to water level during pre-monsoon varies from 1.57 -24.84 m while during post-

monsoon it varies from 0.64- 22.46 m. The depth to water level lies within 5 – 20 m below the land surface in most parts of the district. It rests between 2 to 25m deep in the eastern side and 2 to 10m in the north western parts of the district. Only in small patches in the Rai block, water table is deeper having range of 20m to 40m. Water table elevations range from 230 to 220m amsl and the general ground water flow is from northwest to southeast. In general, the water table has declined all over the district over the past decade.

During past oen decade the district has recorded a fall of less than 1m to 7m .The decline was 2 to 4m in most parts of the district. Long term water level fluctuations indicate rise of water level over a period of last one decade in Mundlana, Kathura, K harkhoda and Rari blocks. The trend of rise of water level is in the range of 0.05 to 0.32m/year. The trend of decline of water level is 0.05 to 0.95m/year.

Central Ground Water Board has drilled 15 wells under ground water exploration programme; 8 are exploratory wells, 5 are piezometers and 2 are slim holes. Out of 8 boreholes drilled for ground water exploration, 7 were abandoned due to poor quality of ground water or due to inadequate thickness of permeable granular zones. Granular zones exist down to 460m depth i.e. to depth explored. However, the chemical quality of ground water is not fresh in deeper horizons in most parts of the district and in shallow horizons; in some parts. In general, the quality of ground water in shallow dugwell zones is fresh in the eastern and north, northwest parts and gradually gets deteriorated in the western and southwestern parts. Also the deep zones below 150m depth contain brackish / saline ground water. A number of shallow tubewells exist in all the blocks - more in number in Sonipat, Rai and Ganaur block and these tap water bearing zones in the shallow unconfined aquifer group. These tubewells yielded 300 to 600 lpm for moderate drawdowns. Detailed test drilling has established occurrence of three distinct aquifer groups, down to 450m depth in Upper Yamuna Basin which includes Sonipat district.

Aquifer group-I which was in unconfined state extends from water table down to 70m depth. A tubewell located at Khera in the eastern part of the district and tapping this aquifer group-I, yielded 4540 lpm for about 7.5m of drawdown. Aquifer characteristics at Khera site were - Transmissivity : 2340m2/day ; Lateral Hydraulic conductivity - 36m/day and specific yield - 2.15 x 10-1 (21.4-I contains fresh water in eastern parts of the district. Aquifer group-II which is under semi-confined / confined state occurs in the depth range of 90 to 200m and has not been tested for its yield and aquifer characteristics since the formation water is saline. Aquifer group-III which too is under confined state occurs in the depth range of 250 to 400m and contains brackish saline ground water.

Ground Water Resources

The block wise ground water resource potential in the district has been assessed as per GEC-97 as on March 2009. The stage of ground water development ranges between 78% (block-Kathura) to 196% (block-Rai). The total replenish able ground water resource in the district is 774.26 mcm, of which the total existing ground water draft by all means is 945.35 mcm. The net utilizable ground water resources for future irrigation development are - 173.64 MCM.

Table 1.1 GROUND WATER RESOURCES OF SONIPAT DISTRICT, HARYANA STATE.

Block	Net annual ground water availability (ham)	Existing gross ground water draft for irrigation (ham)	Existing gross ground water draft for all uses (ham)	Provision for domestic & industrial requirement supply to 2025 (ham)	Net annual ground water availability for future irrigation development (ham)	Stage of ground water development (%)	catagory
Ganaur	19778	22384	23711	1327	-3933	120	OVER EXPLOITED
Gohana	7609	10183	10282	99	-2673	135	CRITICAL
Kathura	5344	4187	4193	261	896	78	SAFE
Kharkhoda	8067	11420	11541	121	-3474	143	CRITICAL
Mundlana	15751	12566	12575	9	3176	80	SAFE
Rai	7902	14472	15526	1054	-7624	196	OVER EXPLOITED
Sonepat	12975	15410	16707	1297	-3732	129	OVER EXPLOITED
Total	**77426**	**90622**	**94535**	**4168**	**-17364**	**122**	

Discharge of the tubewells increases from west to east towards river Yamuna. Good aquifer exist in the flood plain of Yamuna river. The discharge of tubewells constructed in Mundlana, Gohana, Kathura, Kharkoda blocks is generally upto 10 lps(86.4_m3/day). However, in the eastern parts of Ganaur, Sonipat and Rai blocks high discharge wells upto 20 lps have been reported.

6 Ground water quality

The shallow ground water of the district is generally alkaline in nature and is moderate to highly mineralized with EC ranging from 597 to 6710µS/cm. at 250C . Ground water occurring in the southern and N-W parts of the district is more saline as compared to ground water occurring in the rest of the district. Among anions, either bicarbonate predominates or none of the anion dominates. Similarly, among cations, sodium predominates in 50% of the samples and in the remaining calcium + magnesium combined dominates.

On comparing the ionic concentration of major ions with the recommended limits prescribed by Bureau of Indian standards for drinking waters, it is found that more than half (68%) the ground waters are not suitable for drinking purposes mainly due to salinity and fluoride contents that exceed the maximum permissible limits of these chemical parameters, which are 3000µS/cm. and 1.5mg/l respectively.

Plot of USSL diagram used for the determination of irrigation rating of ground waters indicates that ground waters at several places fall under C2S1, C3S1, C3S2, C4S2 classes of irrigation rating. These waters are, therefore, suitable for customary irrigation for salt tolerant crops like wheat, rice, maize, gram etc without any fear of salinity hazards to the crops. Waters falling under C4S3 and C4S4 classes are likely to cause salinity as well as sodium hazards. It would be better if such waters are used for irrigating salt tolerant crops along with appropriate amount of gypsum on well drained soils.

7. Status of Ground Water Development

Irrigation from ground water is being done in large parts of the district. Maximum number of minor irrigation units have been installed in Sonipat and Ganaur blocks. Density of MI units is also highest in these blocks, while it is lowest in Kathura block. A large number of pump sets have been installed at shallow depth in range of 5 -10m in Mundlana, Kathura, Gohana, Kharkhoda blocks. Deep tubewells are installed in Sonipat, Ganaur and Rai blocks. Ground water is relatively fresh in these blocks at

deeper levels as compared to other areas. Generally the H.P. of Pump varies from 3 to 7.5 in large parts of the district. However, higher capacity pump having H.P. upto 20 are being used for lifting ground water from deep tubewells in Sonipat and Rai blocks. These areas are more or less parallel to the Yamuna River in the eastern part of the district.

8. Geophysical Studies

The results of the surface geophysical studies in entire Sonepat district indicates that ground water is saline at all levels in some part of the Sonepat district. About 28% area is adversely affected with shallow ground water salinity. Such areas include few localities in Mundlana, Gohana, Kathurah and Kharkhauda blocks. Ground water is saline within 20m depth over half of the Sonepat district particularly in the areas lying in west, northwest, and south of the district. However, the impact of ground water salinity is less in the vicinity of river and canals. Part of the study area over northern eastern, northeastern, central and southeastern direction has fresh quality of ground water within a depth of 40 to 80 m b.g.l. Such areas include blocks of Sonepat, Rai, & Ganaur. Major area has saline quality of ground water in the depth range of 40 to 80m depth b.g.l. The prominent localities where considerable

thickness of aquifer bearing fresh ground water has been inferred are Kheora, Ganaur, Chirasmi, Quamaspur, Kheri-gujar, Rajpura, Ghasauli, Murthal, Majri-mawai and Ahulana. Part of the area over southeast and small pockets in extreme north and northeast of Sonepat district has been identified bearing fresh ground water within a depth of 100 to 150m b.g.l. The prominent localities where fresh water available within 100 to 150m depth are around Simbalgarh and Jagdishpur lying in extreme northeast and southeast of the district adjacent to Yamuna river. Part of the district over northwest, west and south is water logged which is also one of the reason.

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References:

[1]. Chen JQ. 1994. Water resources in China. In Water Resources Development in China, Qian ZY (ed.). China Water and Power Press: Beijing; 1–42.
[2]. Chen JQ, Xia J. 1999. Facing the challenge: barriers to sustainable water resources development in China. Hydrological Sciences Journal 44(4): 507–516.
[3]. Chen XD, Li XM, Lu GQ. 1999. Drying up courses of lower Huanghe River and variable characteristic of water resources. In Research and Practice on Sustainable Management of Water Resources. Wuhan Mapping University of Science and Technology Press: Wuhan: 23–28 (in Chinese).
[4]. Chen ZK. 1985. China's water resources and its utilization. GeoJournal 10(2): 167–171.
[5]. Falkenmark M. 1997. Society's interaction with the water cycle: a conceptual framework for a more holistic approach. Hydrological Sciences Journal 42(4): 451–466.
[6]. Huang GH, Xia J. 2001. Barriers to sustainable water quality management. Journal of Environmental Management 61(1): 1–23.
[7]. Kundzewicz ZW. 1997. Water resources for sustainable development. Hydrological Sciences Journal 42(4): 467–480.
[8]. Liu CM, Chen ZK. 2001. Assessment of Water Resources Status and Trend of Water Demand and Supply in China. China Water Power Press: Beijing (in Chinese).
[9]. Liu CM, Cheng L. 2000. Analysis on runoff series with special reference to drying up courses of lower Huanghe River. Acta Geographica Sinica 55(3): 257– 265.