SIRSA DISTRICT HARYANA

CENTRAL GROUND WATER BOARD
Ministry of Water Resources
Government of India
North Western Region
CHANDIGARH
2013

GROUND WATER INFORMATION BOOKLET
SIRSA DISTRICT, HARYANA.

C O N T E N T S

DISTRICT AT A GLANCE

1.0 INTRODUCTION

2.0 RAINFALL &CLIMATE

3.0 GEOMORPHOLOGY & SOIL

4.0 GROUND WATER SCENARIO

4.1 HYDROGEOLOGY

4.2 GROUND WATER RESOURCES

4.3 GROUND WATER QUALITY

4.4 STATUS OF GROUND WATER DEVELOPMENT

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 GROUND WATER DEVELOPMENT

5.2 WATER CONSERVATION & ARTIFICIAL RECHARGE

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

7.0 RECOMMENDATIONS

SIRSA AT A GLANCE

S.NO.	ITEMS	STATISTICS
1	**GENERAL INFORMATION**	
	I Geographical Area (Sq Km)	4277 Sq km
	Ii Administrative Divisions	
	Number of Blocks	7
	Number of Villages	321
	Iii Population (as per 2011 census)	1295114
	Iv Average Annual Rainfall (mm)	318
2	**GEOMORPHOLOGY**	
	Major Physiographic Units	Alluvial Plain
	Major Drainage	Ghaggar River
3	**LAND USE (sq km)**	
	a Forest area	10
	b Net Sown area	3940
	c Cultivable area	4050
4	**MAJOR SOIL TYPES**	Sandy, Kaller or Rehi and Sierozem soils
5	**AREA UNDER PRINCIPAL CROPS**	Paddy 480 Sq Km Wheat 2430 Sq Km
6	**IRRIGATION BY DIFFERENT SOURCES** (areas and number of structures)	
	Dugwells	Nil
	Tubewell / borewell	41374 /930 sq km
	Tanks / Ponds	6.77 sq km /487 nos.
	Canals	2640 sq km
	Other sources	-
	Net Irrigated Area	3220 sq km
	Gross Irrigated Area	6210 sq km
7	**NUMBER OF GROUNDWATER MONITORING WELLS OF CGWB**	
	DUGWELLS	27
	PIEZOMETERS	18
8	**PREDOMINANT GEOLOGICAL FORMATIONS**	QUARTERNARY ALLUVIUM
9	**HYDROGEOLOGY**	
	Major waterbearing formations	Sand layers
	Pre-monsoon depth to water level	2.27mbglto 35.6mbgl
	Post-monsoon depth to water level	4.38 mbgl to 36.9mbgl
	fluctuation	-0.04 to -1.23 fall 0.02 to 1.09 rise
10	**GROUNDWATER EXPLORATION BY CGWB (as on 31.3.2012)**	

	Number of wells drilled EW OW PZ SH	 14 1 - -
	Depth range (m)	151-306
	Discharge (liters per minute)	2160-4320
	Storativity	$1.9*10^{-2}$ to $6.38*10^{-ч}$
	Transmissivity (m^2/day)	1500 - 3000
11	**GROUNDWATER QUALITY**	
	Presence of Chemical constituents more than the permissible limit EC, in micromhos at 25ºC F, in mg/l As, in mg/l Fe, in mg/l	 340 - 15400 1.85mg/l to 4.82 mg/l 0.0117 mg/l to 0.044 mg/l 1.09 mg/l to 8.04 mg/l
	Type of Water	Alkaline
12	**DYNAMIC GROUND WATER RESOURCES (2009) IN MCM**	
	Annual Replenishable Groundwater Resources	754.52
	Net Ground water Draft	1164.10
	Projected Demand for domestic and industrial uses upto 2025	7.89
	Stage of Groundwater Development	154%
13	**AWARENESS AND TRAINING ACTIVITY**	
14	**EFFORTS OF ARTIFICIAL RECHARGE AND RAIN WATER HARVESTING**	
15	**GROUNDWATER REGULATION**	
	NUMBER OF OE BLOCKS	4
	NUMBER OF CRITICAL BLOCKS	1
	NUMBER OF SEMI CRITICAL BLOCKS	1
16	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	Declining groundwater levels Water quality

GROUND WATER INFORMATION BOOKLET

SIRSA DISTRICT, HARYANA

1.0 INTRODUCTION

Sirsa, the north western most district of Haryana State with a total geographical area of 4270 sq. km is located between $29^{o}13'$: $29^{o}59'$ north latitudes and $74^{o}30'$:75^{o} 7' east longitudes. It is surrounded by Muktsar, Bathinda& Mansa districts of Punjab in the north, Ganga Nagar &Hanumangarh districts of Rajasthan in West and South, Fatehabad and Hisar districts of Haryana in north east and south east respectively.

The district is under control of Hisar division and administratively divided into seven development blocks namely Sirsa, Dabwali, Odhan, Baragudha, NathusariChoupta, Rania&Ellenabad. The Sirsacity, occupies an area of 19.73 sq. km within the municipal limit and is situated on the N.H. No. 10. The city falls in Sirsa block of the district.

As per 2011 census the total population of the district is 1295114. Out oftotal population 683242 are males and 611872 are females. In Sirsa district rural population is settled in 321 villages and the rest of population is concentrated in fivetowns.Thereisno scheduled tribe population in the district, as no part of the district is under tribal area.

The Ghaggar, an important seasonal river in the district is a major drainage of the area. It enters the district near village Ranga (Block- Baragudha) and flows through the central part of the district (covering Sirsa, Rania, Ellenabad and part of Baragudha blocks) in south westerly direction but about 1.5 km down stream of OttuWeir (renamed as Ch. Devi Lal Weir), it takes a sharp turn towards west and flows in the westerly direction. The river leaves the district a little to the south west of village Kariwali (block- Ellenabad) and enters Rajasthan & finally lost in the arid belt (thardesert) of Rajasthan. The river is dammed at Ottu from where two prominent canals namely northern ghaggar and southern ghaggar takes off. The river sometimes gets flooded during monsoon and causes extensive damage to crops and property. The total length of river ghaggar in the district is about 85 km. Besides, the area is also drained by the artificial drains, which are used during heavy rains by pumpage to the canals. In water-logged area, these artificial drains have also been proposed to combat with the water logging problems in the area.

2.0 RAINFALL AND CLIMATE

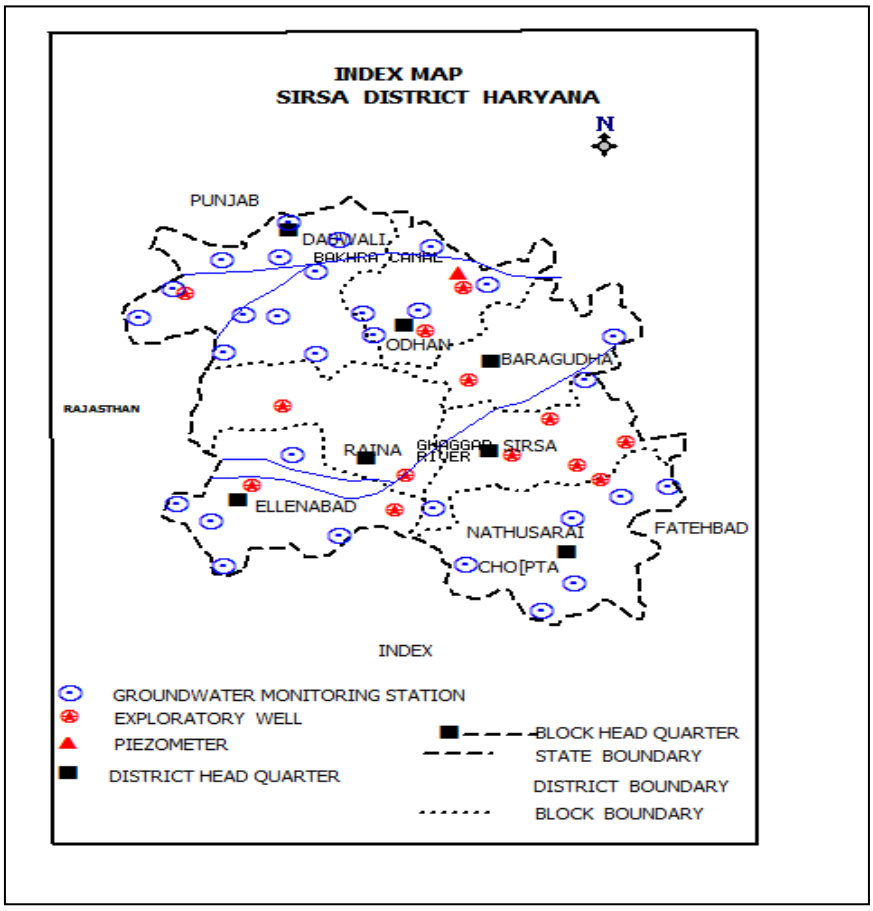
Hydrometeorology

The climate of Sirsa district of tropical desert type arid and hot which is mainly dry hot summer and cold winter except during monsoon period.

season when moist air of oceanic origin penetrate into the district. There are four seasons in a year. The hot weather season starts from mid March to last week of the June followed by the south- west monsoon which lasts upto September. The transition period from September to October forms the post-monsoon season. The winter season starts late in November and remains upto first week of March.

The normal annual rainfall of the district is 318 mm which is unevenly distributed over the area 20 days. The south west monsoon , sets in from last week of June and withdraws in end of September, contributing about 80% of annual rainfall. July and August are the wettest months. Rest 20% rainfall is received during non-monsoon period in the wake of western disturbances and thunder storms. Generally rainfall in the district increases from southwest to northeast .

Normal Annual Rainfall	: 318 mm
Normal monsoon Rainfall	: 253 mm
Temperature	
Mean Maximum	: 41.1°C(May&June)
Mean Minimum	: 5.1 °C(January)
Normal Rain days	: 20



3.0 GEOMORPHOLOGY AND SOIL TYPES

Physiography

Physiographically, the district is characterised by three distinct features i.e. Upland plain, Alluvial bed (flood plain) of river Ghaggar and Sand dune clusters. The area as a whole is almost flat with a gentle slope towards south west direction. The district is mainly drained by the river Ghaggar and some artificial drains.

Soils

The type of soil is an important factor for the growth of plants and crops in any area. The soil system has various criteria to classify the soils of a region such as geology, humidity, rainfall pattern, soil texture, soil salinity etc. The district has two types of soils vizSierozem and Desert soils. The sierozem soils are found in major parts of the district and desert soils are comparatively found in smaller part of the district especially in southern part of the district .

Sierozem Soil are found in the areas where the normal annual rainfall varies from 300 to 500 mm. These soils vary from sandy loam to loamy sands in texture and are marginally fertile. Degree of salinity and alkali hazards is highly variable, though salinity is majorhazaed. These soils occur mainly in northern parts of the district i.e. Odhan, Baragudha&Sirsa blocks and parts of Dabwali, Nathusari Choupta& Rania blocks. Desert Soil are generally found in the areas where the annual rainfall is less than 300 mm. These soils are sandy and extensively cover southern parts of the district vizEllenabad block and parts of Dabwali, Rania & NathusariChoupta blocks. According to the classifications followed by Soil Testing & Research Laboratory, Sirsa, the soils of the district are sandy to sandy loam in texture.

4.0 GROUNDWATER SCENARIO

4.1 HYDROGEOLOGY

The geological formations are unconsolidated alluvial deposits of Quaternary age. The alluvial deposits comprises of sand, silt, clay associated with kankar. Fine to medium grained sand horizon forms the potential aquifer in the area.

The major source of recharge to ground water in the area is inflow of ground water from north eastern and northern parts, rainfall, seepage from canals, return seepage through irrigation and percolation from surface water bodies. The area has both unconfined and confined aquifers. In general the unconfined aquifers occurs down to 60 m depth below ground level in the district. The alluvium acts as ground water reservoir and principal aquifer material comprises fine to medium sand and sand mixed with kankar. This aquifer is either in the form of isolated lenses of sand embedded in clay beds or well connected granular zones that have a pinching and swelling disposition and are quite extensive in nature.

The ground water in unconfined condition is abstracted through hand pumps and shallow tubewellswhere as in deep and confined aquifer through medium and deep tubewells. the thickness of the alluvium deposit varies from 200 to 300 m.

The thicknessof alluvial formation increases towards northwest. Perusal of the data of the exploratory tubewelldrilled in Ghaggar Basin indicate that tubewells tapping

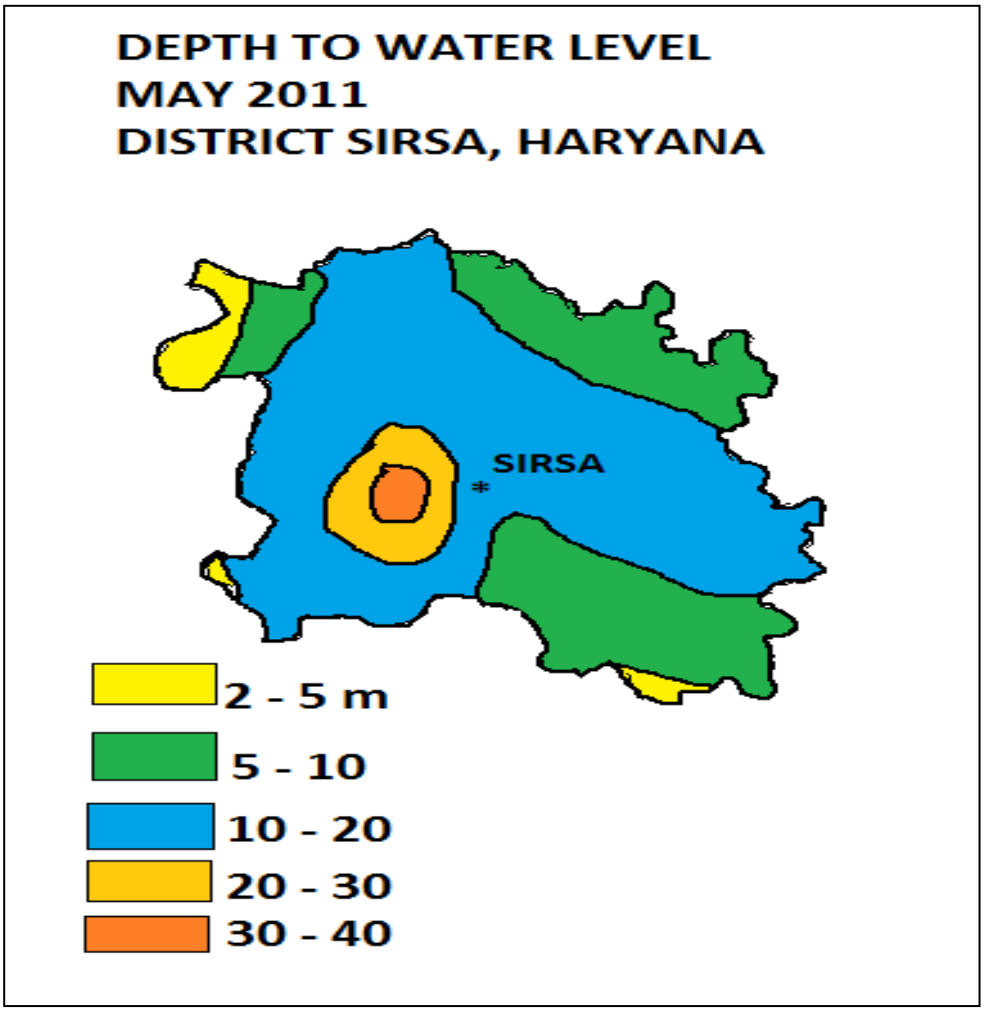
waterbearingzone with in 100 to 200 m depth yield 1500 lpm to 3000 lpm for draw down of 5 to 17 m.

Aquifer parameters viztransmissivity (T), storativity (S), hydraulic conductivity(K) and yield (discharge) of the test well have been determined on the basis of Aquifer Performance Test (APT) conducted on exploratory wells. In the area, 11 exploratory boreholes down to a maximum depth of 306.71m were drilled to determine the aquifer parameters. The yield (discharge) of the test well ranges from 120 lpm to 3000 lpm with a drawdown of 3.66m to 17.47m. The transmissivity value of the aquifers ranged from 327 m^2/day to 2600 m^2/day. The hydraulic conductivity ranged from 5.83m to 83 m/day. The value of the storage coefficientworkedoutto be between $0.638x10^{-3}$ and $27x10^{-3}$.

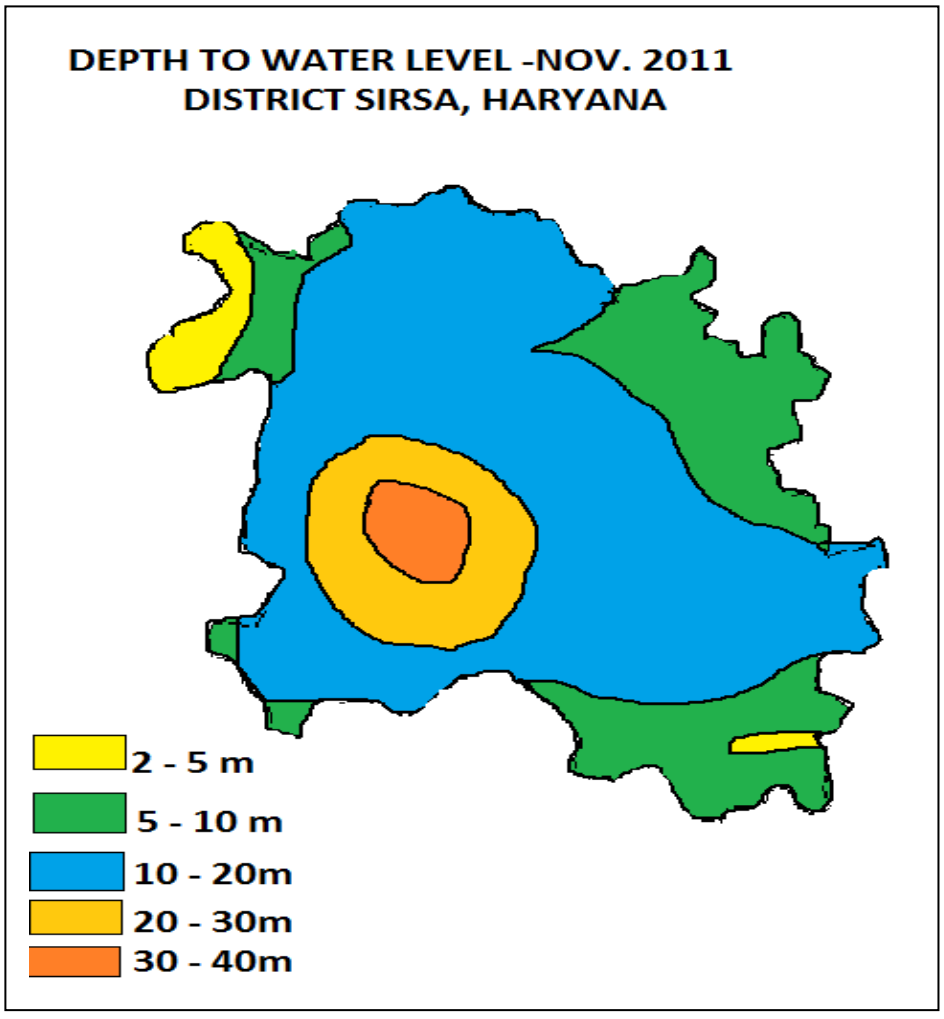
Shallow tubewells constructed in the district have discharge range between 300 and 1000 lpm with a draw down of 1.0 to 3.5m. Whereas, perusal of data of deeper tubewell/ borewells constructed in Ghaggarbasin tapping water bearing zone in depth range 100m to 260m yield 1500 to 3000 lpm with 5 to 17 m of draw down. Hence it can be said that tubewells constructed in vicinity of Ghaggar river has enormous groundwater potential.

4.2 Water level behaviour :

The depth to water level ranges from 2.27 mbgl to 35.67 m bgl in pre monsoon and 4.38 mbgl to 36.90mbgl in post monsoon period. The minimum water level of 2.27mbglhas been observed at village ChikaniDhab, and maximum of 35.67mbgl at village Sri Jeevan Nagar during pre monsoon.



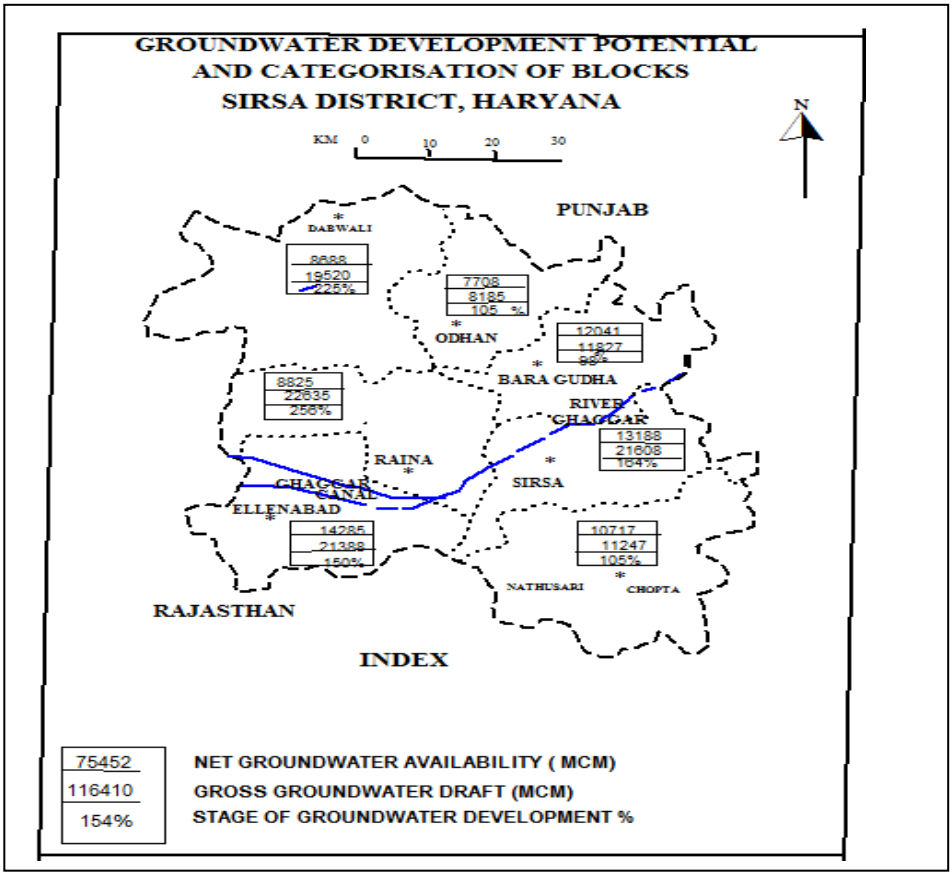
The long term trend in the water level reflected by water level hydrographs are indicative of the change in groundwater storage in phreatic zone with time. Few hydrographs stations of Dabwali, Odhan, Baragudha and NatusariChopta indicate a rising water level trend. The hydrographs stations of Sirsa, Rania and Ellenabad blocks indicate a declining trend, which may be due to over exploitation of ground water. These area require careful management of surface water and conjunctive use of surface water and ground water.In general the ground water elevation varies from 173 to 203 m a.m.s.l. and the regional ground water flow direction is northwest to southwest.



4.3 GROUNDWATER RESOURCES

The blockwise ground water resource potential in the district has been assessed as per GEC-97in year 2009. Out of seven blocks five blocks namely Rania, Sirsa, NsChopta, Dabwali and Ellenabad are over exploited. Baragugha block is Critical and Odhan block is Semi-Critical as per resource assessment year 2009.The stage of ground water development ranges between 98% (Baragudha) to 256% (Raina) in the district. The net ground water availability in the district is 754.52 MCM. The net ground water draft is 1164.10 MCM. District shows an overall

154% ground water development.



GROUND WATER RESOURCES OF SIRSA DISTRICT ,HARYANA

Assessment Unit / Block	Net Annual Ground water Availability (Ham)	Existing Gross Ground water Draft for Irrigation (Ham)	Existing Gross GW Draft for Domestic & Industrial water supply (Ham)	Existing Gross Groundwater Draft for all uses (Ham)	Allocation Domestic industrial upto next 25 years (Ham)	Net GW availability for future irrigation development (Ham)	Stage of Groundwater Development	Category of the Block
Baragudha	12041	11761	66	11827	79	201	98	Critical
Dabwali	8088	19478	42	19520	42	-10832	225	OE
Ellenabad	14285	21233	155	21388	155	-7103	150	OE
NS Chopta	10717	11191	56	11247	56	-530	105	OE
Odhan	7708	8145	40	8185	40	-477	106	Semi-Critical
Rania	8825	22498	137	22635	137	-13810	256	OE
Sirsa	13188	21328	280	21608	280	-8420	164	OE
Total	75452	115634	776	116410	789	-40971	154	OE

4.4 GROUNDWATER QUALITY

CGWB also do annual chemical quality of ground water from samples taken from hydrograph network stations in the district area. The range of mineral concentration is tabulated below. The results of chemical analysis of ground water samples in the phreatic aquifer (dug well zone) indicate that Ground water is alkaline in nature. Ground water is fresh to saline. The electrical conductivity is generally less than 1000µs/cm except at few places it ranges 94 to 6400 µs/cm at 25^0C.Nitrate is observed more than 45 mg/l at Mastain, Hassu, Mangian and Odhan. Iron range 1.02 to 8.91mg/l and more than permissible limits at Talwarakhurd (1.4), Madhosingham (1.02), Rupam (8.96), Gigo rani (1.81) and Gosiana (8.91). Arsenic concentration noted 0.0117 to 0.044 mg/l in groundwater.

The suitability of groundwater for irrigation purpose in general ascertained by considering salinity, SAR and RSC values. Based upon the USSL classification for irrigation water it is found that groundwater of the district can be used for irrigation in well drained soils for salt tolerant crops such as wheat, maize etc. However groundwater from Taruna and Ghuiana falls under C4S4 class of irrigation and is not fit for irrigation and its use may cause Salinity and sodium hazards.

4.5 STATUS OF GROUND WATER DEVELOPMENT

Net area sown in the district is 3940 Sq. km, which is 97.3% of the total cultivable area of the district. Area sown more than once is 3000 sq. km bringing the total cropped area (Gross sown area) to 6940 sq. The entire net area sown is irrigated through tubewells and canals. Canals of the area are irrigating approximately 2640 sq. km area. Paddy constitutes the main kharif crop whereas wheat is the main Rabi crop Entire drinking water supply to all rural as well as urban parts of the district is based on ground water or by canal (where water quality of ground water is saline or poor) The tubewell for water supply constructed by Public Health Department, Haryana for drinking water supply are generally between 60m to 100 m deep or depending uponlocal hydrogeological conditions and available fresh water bearing zone.

The water supply in the town is maintained through both canals and tubewellswater. The average depth of tube well is 100 m their average discharge recorded 10,000 GPH on average pumping 08 h/day. There are two-canal water based scheme. The Bhamboor minor is being used for this purpose. About 80% of population is being covered by piped water supply.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 GROUND WATER DEVELOPMENT

Perusal of the Ground Water Resources available in the district clearly indicate that northwester, central and southern parts of the district has high development of ground water resources, to the extent of making the block

overexploited. Blocks namely Rania, Sirsa, Ns Chopta, Dabwali and Ellanbad blockswhichhas been categorized over-exploited and show ground water development 105 to 256%.

Since the whole area of the district is alluvium and at no place neither basement has been encountered or any cobble, pebble bed, hence appropriate method of drilling in the area would be rotary or reverse rotary.

The ground water at shallow depth up to 40 to 60m is fresh to marginal saline. Tubewells can be constructed upto the depth of 40-100 m for drinking as well as for irrigation purpose depending on the local hydogeological conditions. Shallow tubewellsupto depth of 60m can be constructed to yield fresh to marginally saline water. However at deeper level quality of water has been reported to be saline.

5.2 Water Conservation & Artificial Recharge

Varying water levels and ground water development are observed in Sirsa district. No Artificial Recharge Project has been taken up in the district as yet.As per the assessment of the Central Ground Water Board, a large part of district Sirsa is suitable for Artificial Recharge on the basis of ground water development level. But it would be prudent to take Sirsa, Rania Dabwali, Ns ChoptaandEllenabadblocks of the district in priority as are of over-exploitedcategory.Most suitable structure for Artificial recharge is recharge trenchand recharge shaft of variable size to accommodate available run-off or surplus available water for recharge.

There are a large numbers of tanks and ponds in the district which act as water conservation structures and ground water recharge structures in the district, which are as follows:

Number of Tanks / Ponds	**Average water spread area (ha)**	**No. of days water is available**	**Recharge in Ha.m.**
	Monsoon	**Monsoon**	**Monsoon**
487	578	840	99.87

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS

Two different type of Ground Water Related problems are identified in the district in respect of quality and quantity:-

Declining Water level in the area in major part of Sirsa district. In OE blocks rate of decline is observed in both Pre-monsoon period and Post-monsoon periods. For the purpose of irrigation, groundwater can be used in well drained soil for salt tolerant crops such as wheat, maize etc. However groundwater of Taruna and Ghusiana fall under C4S4 class of irrigation and prone to causing salinity and sodium hazards.

7.0 RECOMMENDATIONS

The following measures are recommended to minimize the declining ground water trend in parts of the Sirsa district as safeguard against environmental degradation.

- More judicious approach for construction of tubewellsshouldbepopularized in the district.

- Artificial recharge to ground water should be taken up in the urban and rural area to avert the further lowering of ground water level since natural recharge to the aquifer system is not adequate to support such ground water withdrawal.

- Detailed geophysical study is required for the delineation of fresh water zones (Phreatic aquifers) in the district.

- Effective water management and selecting most suitable cost effective crop pattern suitable for irrigation including salt tolerant crops. The modern methods of irrigation like sprinkler, drip irrigation etc should be used.

- Local populace to be educated regarding consequences of heavy withdrawal of ground water and need for its effective/economic use.

- The ground water exploration should be taken in flood plains ofriver Ghaggar.

- Micro level ground water regulation and protection studied may be carried out to map the aerial extent of fluoride and other harmful constituents in groundwater..