



Government of India
CENTRAL GROUND WATER BOARD
Ministry Of Water Resources

GROUND WATER INFORMATION BOOKLET
JAMMU DISTRICT, JAMMU & KASHMIR



CENTRAL GROUND WATER BOARD
NORTH WESTERN HIMALAYAN REGION
JAMMU
2013

Prepared by
NELOFAR
Scientist-B

Prepared under supervision of

N.R. Bhagat
Scientist D

Our Vision
Water security through sound
management

GROUND WATER INFORMATION BOOKLET

JAMMU DISTRICT, JAMMU & KASHMIR

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JAMMU DISTRICT AT A GLANCE

<i>S. No</i>	<i>ITEMS</i>	<i>STATISTICS</i>
1.	GENERAL INFORMATION	
	Location	North 32°33'07" & 33° 07'30" latitudes East 74°27'00" & 77°21'00" longitudes
	i) Geographical area (sq. km)	3097
	ii) Administrative Divisions (2001) <ul style="list-style-type: none"> • Number of Tehsil • Number of CD Blocks • Number of Panchayats • Number of Villages • Number of Towns 	5 (Jammu, Samba, R.S. Pora, Bishna, and Akhnoor) 12 396 1162 (Inhabited-1043,Uninhabited-119) 14
	iii) Population (2011 Census) <ul style="list-style-type: none"> • Total population • Population Density (person/sq. km) • Rural & Urban Population • Sex Ratio (Per 1000) • Average Literacy • Population Growth 	18,45,017 persons 596 1033567 & 811450 persons 878 83 % 29.38 %
	iv) Average Annual Rainfall (mm)	1246 mm
2.	GEOMORPHOLOGY	
	Major Physiographic units	<ul style="list-style-type: none"> • Hills • Plains
	Altitude Range	400 – 700 m amsl hilly areas 280 – 400 m amsl in plain areas
	Major Drainages	Basantar, Jammu Tawi, Chenab and Manwar Tawi
3.	AREA UNDER PRINCIPAL CROPS (2008-09) in Sq.Km.	
	Crops Total area sown Area sown more than Once time Net Area sown	Area in Sq. Km. 1,76,3640 89,8500 65140
4.	LAND USE (2009-10) in Sq.Km.	
	<ul style="list-style-type: none"> • Barren and uncultivated • Land put to non-Agricultural uses • Culturable waste • Permanent pasture and other Grazing land • Current fallows • Fallow land more than once • Net area sown 	625.51 327.48 371.71 152.84 108.20 48.70 1139.41
5.	MAJOR SOIL TYPES	
		<ul style="list-style-type: none"> • Mountainous Soil • Loamy Soil
6.	IRRIGATION BY DIFFERENT SOURCES (Area in sq. km)	
	Dug wells & shallow TW Surface water Tanks Other sources Net area irrigated by different sources Total area irrigated under all crops	15.69 567.26 0.07 41.05 624.07 1263.05

S. No	ITEMS	STATISTICS
7.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.3.2012)	
	<ul style="list-style-type: none"> • No. of Dug Wells • No. of Piezometer 	64 19
8.	GEOLOGY	
	Porous formation: Fissured formation	<ul style="list-style-type: none"> • Alluvium-Soft unconsolidated • Siwaliks, Crystalline & Hard rocks
9.	HYDROGEOLOGY	
	Major Water Bearing Formations	
	1. Unconsolidated porous sediments (Alluvium)	
	<ul style="list-style-type: none"> • Yield prospects • GW structures 	High (10-30 lps) Springs, Dug Wells & Tube Wells
	2. Semi consolidated sediments (Siwalik)	
	<ul style="list-style-type: none"> • Yield prospects • GW structures 	Low to Moderate (2-10 lps) Springs & Hand pumps
	Avg. Depth to water level	
	Pre-monsoon	8.49 m bgl
	Post - monsoon	6.78 m bgl
10	GROUND WATER EXPLORATION BY CGWB (As on 31.3.2012)	
	❖ Total No of wells drilled	100 EW.
	❖ Depth Range (m bgl)	Siwalik-77.00 -271.00 Kandi- 45.00 –305.00 Sirowal-26.00-302.00
	❖ Discharge (lpm)	Siwalik -110-870 Kandi- 339 –2574 Sirowal-160-3525
	❖ Transmissivity (m ² /day)	272 – 1197
	❖ Average Storativity	0.00060778
11.	GROUND WATER QUALITY	
	❖ Electrical Conductivity (micro Siemens / cm at 25 ⁰ C)	210-2800
	❖ Chloride (mg/l)	11-405
	❖ Fluoride (mg/l)	0.10-1.00
	❖ Nitrate (mg/l)	0 -230
12.	DYNAMIC GROUND WATER RESOURCES (2009) in Ham	
	❖ Annual Replenish able Ground Water Resources	93132.54
	❖ Net Annual Ground Water Draft	19142.80
	❖ Projected Demand for Domestic and industrial Uses up to 2025	11959.20
	❖ Stage of Ground Water Development	22 %
13.	AWARENESS AND TRAINING ACTIVITY	
	Mass Awareness Programmes & Jal yatra	9 Nos.
	❖ Place / Date	1.Sohal/23.03.2003 2.Purmandal/19.12.2003 3.Rail Head / 13.03.2006 4. Sitlee (Nagrota)/19.03.2007 5.Gangyal/30.03.2009 6.Nud/22.03.2009 7.Suchetgarh/06.08.2010 8.Kot Bhalwal/29.01.2011 9.Vijaypur/04.03.2011

<i>S. No</i>	<i>ITEMS</i>	<i>STATISTICS</i>
	Water Management Training Programmes	08 Nos.
	❖ Place / Date	1. Gandhi Nagar/31.03.2002 2. Sohal/26.03.2003 3. Gandhi Nagar/26.03.2004 4. Muralian/30.03.2005 5. Sitlee (Nagrota)/19.03.2003 6. Shastri Nagar/5.03.2008 7. University of Jammu/03.02.2009 8. Spice Food Court Jammu/15.02.2010
14.	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	04 Nos. 1. Government college for Women, Gandhi Nagar, Jammu 2. public Health Center, Barwal 3. Higher Secondary School, Barwal 4. Airport building, Satwari, Jammu
15.	GROUND WATER CONTROL AND REGULATION	
	Number of OE Blocks	Nil
	No of Critical Blocks	Nil
	No of Blocks notified	Nil
16.	MAJOR GROUND WATER PROBLEMS AND ISSUES	
	Silt problem	Nil
	Depletion of water table	Nil
	Water scarcity & Deep water levels	Kandi Area
	Water logging	Nil
	Industrial pollution	Gangyal and Bari Brahmna Indust. area

GROUND WATER INFORMATION BOOKLET

JAMMU DISTRICT, JAMMU & KASHMIR

1.0 INTRODUCTION

Jammu district derives its name from Raja Jambolochan, “**the founder of Jammu city**”. Jammu city also known as the “*City of Temples*”. The district with its headquarter at Jammu town, lies between 32°33’07” & 33° 07’30” North latitudes and 74°27’00” & 77°21’00” East longitudes and is covered by Survey of India Degree Sheet No. 43K, L & P and Toposheet no. 43 L/5, 9, 10, 11,13, 14 &15 and 43 P/1 & P/2. District is well connected by Air, Rail and road network. National Highway No.1A passes through the district (Plate-I).

The district has a total geographical area of 3097 sq. km out of which 1097 sq. km is covered by hilly terrain and outer plains cover 2000 sq. km which comprises of Kandi and Sirowal belts. The district is bounded by Rajouri district in the west, Reasi & Udhampur districts in the north and northeast and Kathua district in the east and southeast. It has International Border with Pakistan in the West and southwest. The total population of the district is 18.45 lakhs. The district comprises of 5 tehsils (Jammu, R.S. Pura, Akhnoor, Samba, and Bishnah) and 12 Blocks and has 1162 villages out of which 119 are uninhabited. There are 396 panchayats and 14 towns in the districts (as per old Jammu district data). This brochure discussed the general ground water information of old district.

As per 2011 census, the district has an actual population of 18, 45,017 persons which male and female population in the district is 9, 84,675 and 8, 60,342 respectively. The density of Jammu district for 2011 is 596 persons per sq. km. Population wise it ranks first in the State. Male/female sex ratio is 878 per thousand persons in Jammu district. Average literacy rate in Jammu district is 83% and the district has recorded population growth rate of 23.56% during the decade 2001-2011 as compared to 23.70 % at State level. The population growth rate is tabulated below and presented graphically in figure given below.

Table -1 Population growth in Jammu district

Decade	Decadal Growth of Population Percentage	
	District	J&K State
1901-11	4.24	7.16
1911-21	2.26	5.75
1921-31	10.96	10.14
1931-41	15.03	10.36
1941-51	10.23	10.42
1951-61	9.28	9.44
1961-71	42.59	29.65
1971-81	28.92	29.69
1981-91(Est)	30.54	30.89
1991-2001	29.01	29.43
2001-2011	23.56	23.70

Source: Statistical Handbook, Jammu District (2009-10) & Census. Co. in

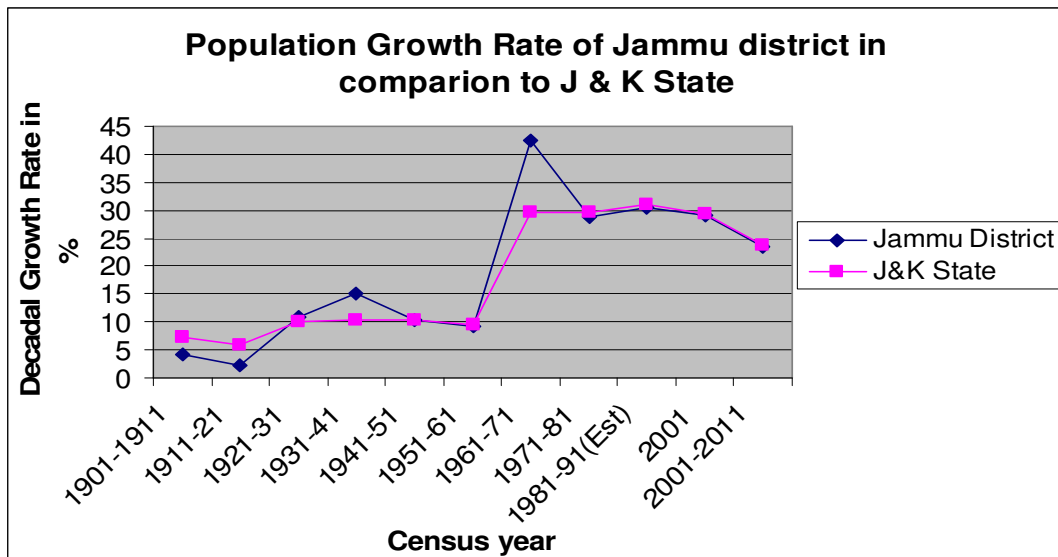


Figure-1 Chart Showing Population Growth Rate of Jammu District

CGWB has carried out extensive hydrogeological studies both by conventional and non-conventional methods in the district. Systematic Hydrogeological Survey in the entire district was completed by Central Ground Water Board has been reappraised periodically during the Annual Action Plans 1996-97,2003-04,2010-11. Apart from this CGWB is also carrying out Short Term Water Supply Investigations and also providing hydrogeological information for defence, central/state government organizations and recommend sites for ground water development.

Under groundwater exploration 100 exploratory wells have been drilled ranging in depth from 26.00 m to 350.00 m. CGWB monitors 83 no's NHNS stations (64 Dug wells, 19 Piezometers). Where ground water levels are monitored four times a year and ground water quality once a year. The district has been explored for aquifer geometry, potentiality and quality parameters by constructing 100 EW and 29 piezometers for water level monitoring. Out of 29 piezometers only 11 piezometers exists. The rest have been fitted with motor/hand pump and filled up.

The region has conducted nine Mass Awareness Programmes and eight Water Management Training Programmes. World Water Day is also often celebrated in Jammu.

2.0 RAINFALL AND CLIMATE

The climate of the district is classified as sub-humid to sub-tropical type of climate. The summer season starts from April and lasts till June is followed by southwest Monsoon that has maximum rainfall of the year spread over the months of July, August and September. The post monsoon season (October and November) also experiences some rainfall and is followed by winter season (December-February). The nearest meteorological observatory is located in Water Management and Research Centre (SKUAST) at Pounichak and taken as representative of the study area.

The sub humid to sub-tropical district receives normal annual rainfall of 1246 mm. June is the hottest month of the year with mean daily temperature ranging between 24.9⁰C and 41.7⁰C and reached up to 47⁰C. January is the coldest month and temperature comes as low as 4.0⁰C. Most of the rainfall is received through the southwest monsoon which lasts from the last week of June to end of September.

During remaining period rainfall is sporadic and scanty. The humidity is lowest in May i.e. 26% and maximum in December and January is 89%. The rainfall is maximum in the months of July and August. Minimum rainfall occurs in November. Average Monthly rainfall of Jammu district is graphically presented in figure given below.

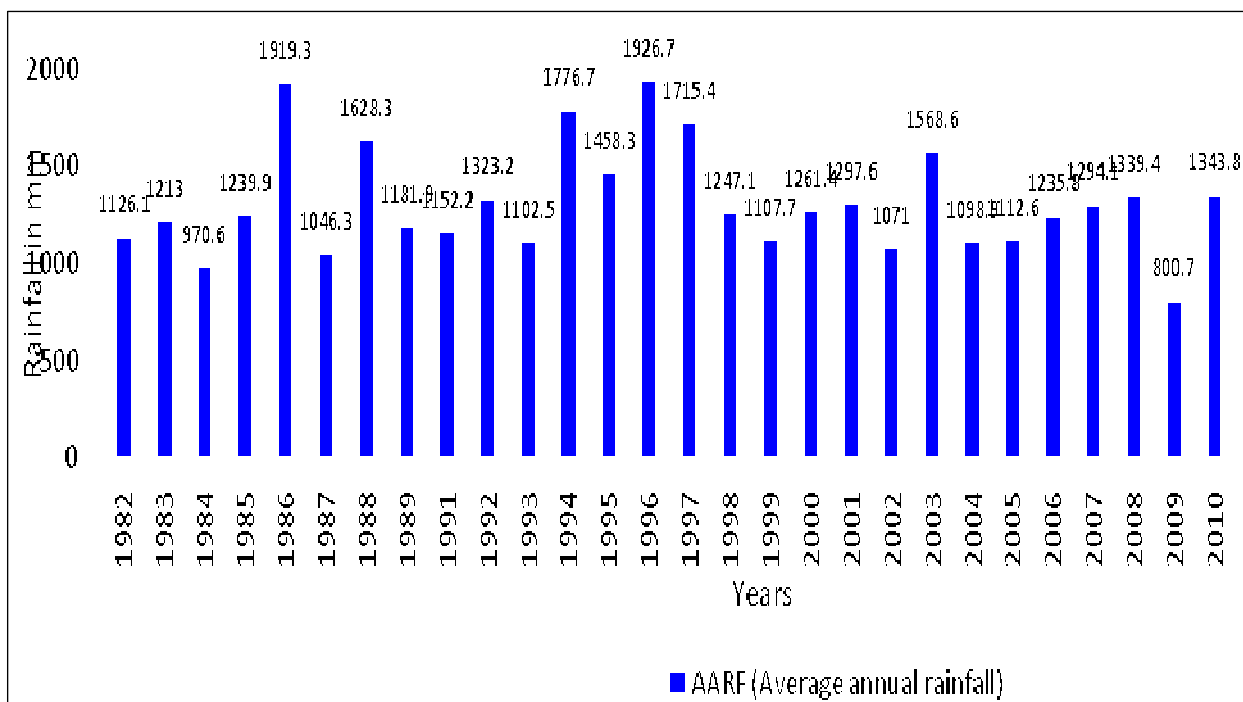


Figure-2 Chart showing Average Annually Rainfall of Jammu district

3.0 GEOMORPHOLOGY & DRAINAGE

District Jammu falls in sub-mountainous region at the foothills of the Himalayas. Jammu district can be divided in two major units viz. Siwalik ranges (Hilly area) and outer plains. Siwalik range rises gradually in the north part of the district and outer plains merges with the Indo-Gangetic plains in the south. Outer Plains can be divided into Kandi and Sirowal belts. The boundary between these two can be demonstrated by a spring line. The major physiographic units can be discussed as under.

i) Northern Hill Area

Out of the total 3097 sq. km geographical area of district, hills constitute 1097 sq. km i.e. about 35.4% of total area. The terrain is rugged with strike valleys and dissected ridge slopes. Altitude of the area varies roughly between 400 and 700 m above mean sea level. Major physiographic slope is towards southwest direction i.e. towards the outer plain area. Nalas of these hills are seasonal and flash floods occur immediately after the rains.

ii) Southern Outer Plains

These are located at the foot of the outer most Siwalik hills and have an altitude varying between 280 and 400 m above mean sea level. Innumerable seasonal nalas traverse the area. These streams are boulder laden and have broad shallow channels having water only for short time after the rains. The plains can further be divided into two parts, the 'Kandi' in the north and the 'Sirowal' in the south and towards international border.

a) Kandi belt

The *Kandi* tract has got steep topographic slopes ranging between 1:90 and 1:120. General altitude of the *Kandi* ranges between 320 to 400 m above mean sea level. Water levels are deep resulting into very less number of ground water structures i.e. dug wells and tube wells. In Kandi area, water levels are quite deep. The *Kandi* imperceptibly merges with the *Sirowal* belt southwards.

b) Sirowal belt

The *Sirowal* tract occupies the southern plainest tract of the district. It has altitude less than 320 m above mean seas level. Topographic gradient is reduced to gentle 1:250 to 1:300. Swampy conditions prevail at places because of immense auto flow of ground water along the spring line marking the contact between the *Kandi* in north and the *Sirowal* in the south.

Drainage

The major rivers flowing through the district are Chenab, Jammu Tawi, Munawar Tawi and Basantar. These rivers act as major drainage lines in the area and enter outer plain part of the district. The Munawar Tawi coming from Rajauri district and drains a very little part in the extreme west of the district and then enters Pakistan. The Chenab River enters from Udhampur and drains the central part of the district and here it divides into many distributaries before leaving the district. Jammu Tawi River coming from Doda district and drains Jammu district (Plate-II).

Other than these rivers, innumerable seasonal nalas traverse the area which are generally boulder laden and have broad shallow channels having water only for short time after rains. All major rivers coming from the hills pass through Outer Plains and enter the Pakistan territory.

4.0 SOIL, LANDUSE AND IRRIGATION PRACTICES

4.1 SOIL

Two types of soils are mainly observed in the district viz. Litho sol and Alluvial soil and description of soils are given below.

i) Lithosols

These soils are found on steep slopes in the foot hills of Jammu district. The soil is gravelly loam to gravelly silty loam. The pH of the soil is nearly neutral in nature i.e. 7.1 to 7.8. The soils have a good water holding capacity.

ii) Alluvial soils

The alluvial soils are mostly found in the flood plains of Ravi, Chenab, Jhelum and Sind rivers and their tributaries. The soils are found in plains Jammu district. These soils have been divided into two groups viz. old alluvial and new alluvial. The old alluvial soils are calcareous and neutrals to alkaline in their reaction (pH 7.6- 8.4) and low to medium in organic carbon and nitrogen. The pH of the new alluvial soil ranges between 7.0-7.7 and is calcareous with low in organic carbon and nitrogen.

4.2 LAND USE PATTERN

Total geographical area is 3097 Sq. Km. and about 1097 Sq. Km. area covered by hilly terrain. 62.53% of the total area is being cultivated. The district is very poor in forest covering only 9.59 Sq. Km which forms only 0.30% of the total area of the district.

Out of total area of the district 20.19% is Barren and uncultivated land and 10.57% area is not available for cultivation. Net area sown is 37% of the total area. The land use pattern of the district is given in Table below.

Table -2 Land use area of Jammu district

S. No	Category	Area in Sq. Km.
1	Total Geographical Area	3097
2	Barren and uncultivated	625.51
3	Land put to nonagricultural uses	327.48
4	Permanent pasture and other grazing land	152.84
5	Land under Misc. tree crop, groves non including in net area sown	24.96
6	Cultivable waste	371.71
7	Current fallows	108.20
8	Fallow land More than Once	48.70
9	Net area sown	1139.41

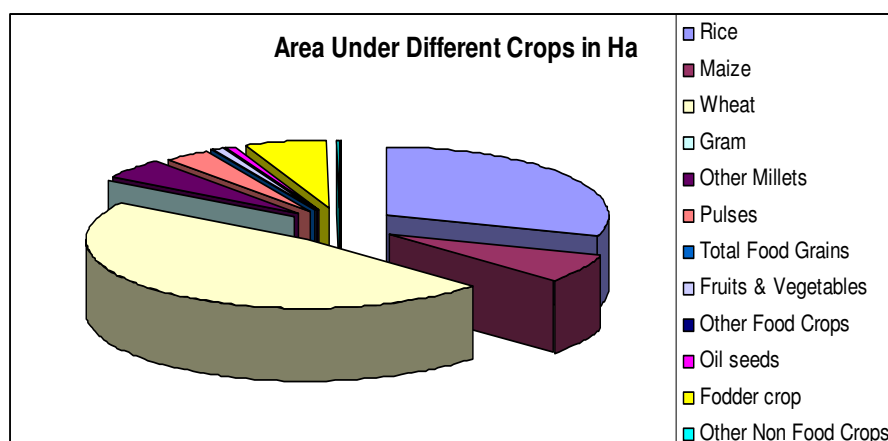
Source: Digest of Statistics 2009-10

4.3 CROPS

The district comes under humid to subtropical zone of the State. Paddy and wheat is principal crops in this area.

Table-3 Area under different crops in Jammu district

Crop	Area in Sq.Km.
Rice	47,9930
Bajra	74530
Maize	23,5360
Wheat	83,0050
Barley	3450
Pulses	4,8770
Fruits & Vegetables	7840
Oil seeds	6840
Fodder crop	7,1750
Other Non Food Crops	1250
Spices	850
Fibres	280
Total Area sown	1,76,3640
Area sown more than once	89,8500
Net Area Sown	65140



Source: Digest of Statistics 2008-09

Figure-3 Pie diagram showing area under different crops in Jammu district

4.4 IRRIGATION

The major sources of irrigation in Jammu district are surface and ground water sources. As per Digest of Statistics 2009-10, the canal irrigation accounts for 567.26 Sq. Km., pond irrigation accounts for 0.07 Sq. Km. The area irrigated by wells 15.69 Sq. Km. Net area irrigated by other sources is 41.05 Sq. Km. The number of various types of sources of irrigation with area under irrigation and crop wise area irrigated for food crops and non-food crops in the district is given in following Tables.

In Jammu area, two major irrigation schemes exist. 1. Ranbir Canal 2. New Pratap Canal. In Akhnoor Tehsil, New Pratap canal is major source of irrigation purpose. In Kandi area, there is water scarcity where ponds are playing an important role.

Table-4 Net area irrigated by different sources in Jammu district in Sq. Km.

Year	Net Area irrigated by (Sq. km)				Total (Sq. km)
	Canals	Tanks	Wells	Others	
2009-10	567.26	0.07	15.69	41.05	624.07

Source- Digest of Statistics 2009-10

Table -5 Crop Wise Area Irrigated (2009-10) in Sq. Km.

Irrigated Area Under							Total Cropped area Irrigated under food crops
Rice	Maize	Wheat	Barley	Other cereals pulses & Millets	Other food crops	Other non food crops	
588.07	4.18	575.80	0.58	8.07	8.43	77.92	596.50

Source - Digest of Statistics 2009-10

5.0 GROUND WATER SCENARIO

5.1 Hydrogeology

Geologically, the area can be explained as the northern hilly area underlain by the Siwalik rocks and the southern outer plain area underlain by the sediments of Recent Sub-Recent times laid down by the present day stream area. Following geological succession occurs in the area.

Table-6 Geological Succession of Jammu district

	<u>Geological Horizon</u>	<u>Lithology</u>	<u>Age</u>
	Alluvium, fan, terrace deposits (<i>Kandi</i> and <i>Sirowals</i>)	Heterogeneous Clastic sediments	Sub-Recent to Recent
Upper Siwaliks	Boulder bed stage	Conglomerates sandstones with intercalations of red clays	Lower to Middle Pleistocene.
	Pinjor Stage	Coarse sandstone, sand rock and massive sandstone beds.	Lower Pleistocene
	Tatrot Stage	Sandstone drab clays alternative beds.	Upper Pliocene
Middle Siwaliks	Dhokpathan Stage	Sandstone & shale with isolated sand nodules	Lower Pliocene
	Nagri Stage	Sandstones & Shale, Hard & compact	Upper Miocene
Lower Siwaliks	Chingi Stage	Bright red shale and sandstones	Middle Miocene
	Kamlial Stage	Hard red sandstones & shale with pseudo conglomerates	Middle to lower Miocene

5.2 Ground Water Occurrence

Groundwater in this district mainly occurs in the Kandi & Sirowal clastic sediments and to some extent in Siwalik rocks. In hard rocks, it occurs as small isolated bodies in the weathered portions and cracks, joints etc. and manifests in the form of springs.

In areas of outer plain groundwater occurs in the saturated parts of alluvium sediments in the pore spaces. It occurs both under water table and confined conditions in the Sirowal and under unconfined conditions in Kandi belt. The flow direction of groundwater is broadly from north to south and corresponds roughly with the topographic slope (Plate-III).

Exploratory drilling operations are being carried out by CGWB to delineate aquifers their extent, depth, geometry and to evaluate potentiality and behaviour of various aquifers present in varied hydrogeological conditions. The CGWB has so far drilled 100 exploratory boreholes in the district. The depth range of exploratory wells in Siwalik belt varies between 77 m bgl and 271 m bgl. In Kandi belt, it varies between 45.0 m bgl and 305 m bgl and in Sirowal belt it varies between 26.0 m bgl and 302.0 m bgl. The transmissivity value varies between 272 and 1197 m²/day. In Siwalik belt, Discharge is generally low and it varies between negligible to 870 lpm. In Kandi belt, Discharge is 0.31(BSF Camp Ploura) to 2574 lpm (Purkhoo) and in Sirowal belt is 160(Shailawali) to 3525 lpm (Sei).

5.3 Depth to Water level

Ground water levels are monitored by C.G.W.B from a network of observation wells four times in a year viz. in January, May, August and November.

Pre-monsoon

During pre-monsoon period, May 2011, depth to water levels varied between 1.61 and 37.40 mbgl. With a general variation in depth to water level in Sirowal belt is 2.08 to 6.12 meters. In Kandi belt, depth to water level varies between 6.46 to 37.40 mbgl and in Siwalik belt it varies between 1.61 and 14.15 mbgl. 02 wells (3.77%) have recorded the water level less than 2.0 mbgl. Majority of observation wells i.e. 27 wells (51%) registered water levels in the range of 2-5 mbgl. Whereas 11 wells (20.77%) registered water levels in the range of 5-10 mbgl. 07 wells (13.2%) are showing deeper water levels i.e.10-20 m bgl. 06 wells (11.3%) are showing deepest water level that is more than 20 m bgl. Distribution/ pattern of water level is presented in Plate-IV.

Post-monsoon

During post monsoon period of the year 2011 viz. during the month of November, the depth to water level varied between 0.25 to 35.27 m bgl. 11 wells (20.3%) have recorded water level less than 2.0 m bgl. Majority of the observation wells that is 25 wells (46.29%) registered water levels in the range of 2-5mbgl. Whereas 07 wells (12.9%) registered water levels in the range of 5-10 m bgl. 07 wells (12.9%) are showing deeper water levels i.e.10-20 m bgl. 04 wells (7.4%) are showing deepest water level that is more than 20 m bgl. Distribution/ pattern of water level is presented in Plate-V.

Water level fluctuation

The rise in water levels between pre-monsoon and post-monsoon ranges between 0.08 and 5.8 m. The rise in water levels is mostly between 0 to 2 m. Fall in water levels of less than 2 m is observed in only one well and it is located in urban Jammu.

Long term water levels

An analysis of observation well data of Central Ground Water Board for pre monsoon period, shows decline in water levels in 72% wells, while 28% wells show rise in water levels during the last decade (2001-2010) based on water level trend (Plate-VI).The decline in water levels varies between 0.05 and 3.82 m. A majority area of the district shows water level decline of less than 2 m, no well show fall in water level >2m. Rise in water levels is observed in parts of Akhnoor, Jammu, Samba Tehsils.

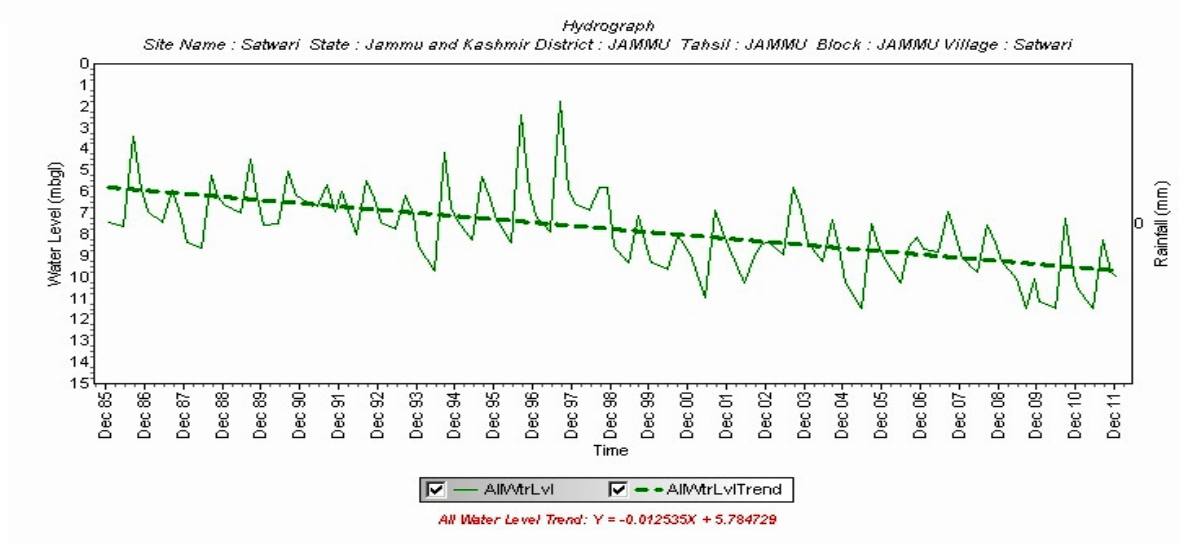
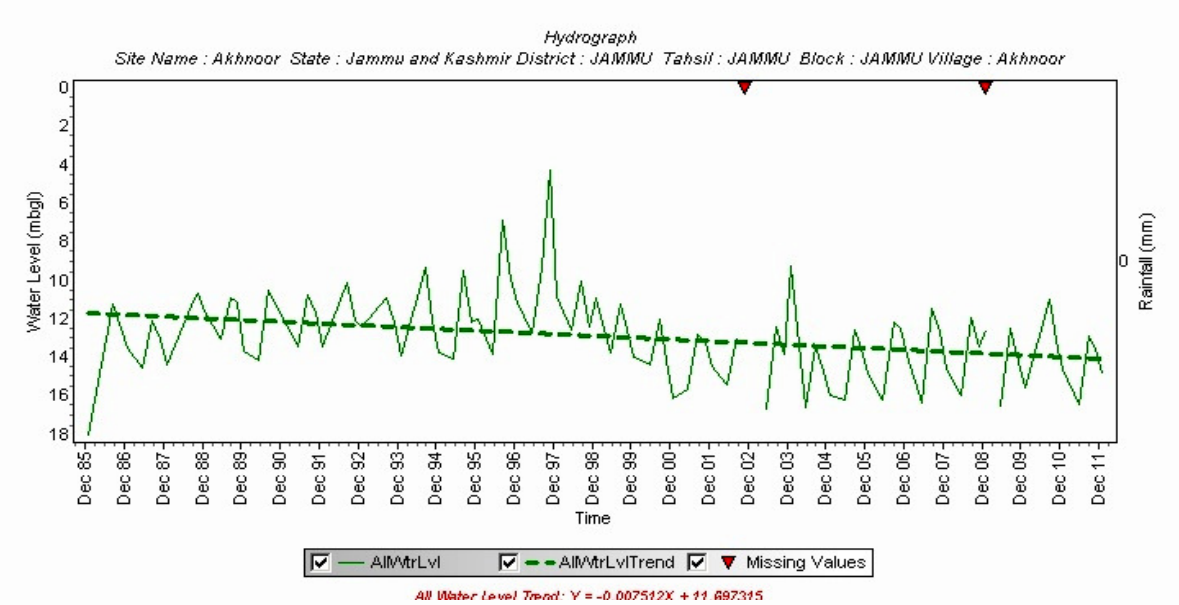
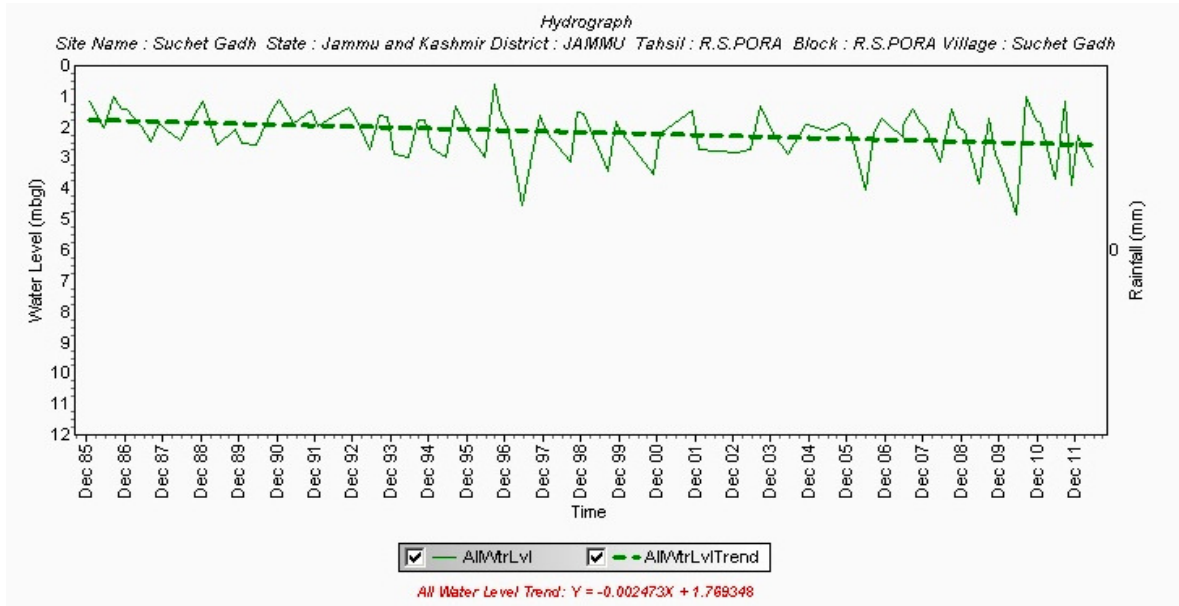
Post monsoon water level (November) analysis for the period from 2001-2010 (last decade) shows that there is a decline in 46% observation wells and 54% wells show rise in water levels (Plate-VII).

TABLE -7 WATER LEVEL FLUCTUATION (PRE AND POST) FOR YEAR 2011

S.No.	Well Name	Water Level		Fluctuation (m)
		Premonsoon (mbgl)	Postmonsoon (mbgl)	
1	Akhnoor	16.40	13.49	2.91
2	Bakore	4.97	3.81	1.16
3	Bengular		6.91	-6.91
4	Bera	4.70	2.13	2.57
5	Bhagwanchak	30.21	27.84	2.37
6	Bishnah	3.52	2.25	1.27

S.No.	Well Name	Water Level		Fluctuation (m)
		Premonsoon	Postmonsoon	
		(mbgl)	(mbgl)	
7	Chamlial	4.90	-	4.9
8	Channi	12.00	6.20	5.8
9	Chowkichora	4.16	1.90	2.26
10	Daboh	4.04	3.23	0.81
11	Devipura	7.21	5.91	1.3
12	Dhanpur	6.12	3.77	2.35
13	Didyal	2.23	1.47	0.76
14	Gudwal	4.07	2.42	1.65
15	Gura	13.80	11.62	2.18
16	Hazuribag	-	6.74	-6.74
17	Jagati	2.20	0.25	1.95
18	Jhiri	6.59	5.91	0.68
19	Jindrah	14.15	12.62	1.53
20	Jourian	5.36	2.59	2.77
21	Kainthpur	4.96	3.99	0.97
22	Kaluchak	6.46	3.87	2.59
23	Kana Chak	4.52	3.34	1.18
24	Katcha-Pind	3.70	2.41	1.29
25	Khour	3.99	1.99	2
26	Kunihala	1.61	1.37	0.24
27	Lam	1.69	1.61	0.08
28	Majua	3.45	2.31	1.14
29	Marjholi	30.00	25.79	4.21
30	Miran Sahib	7.27	6.30	0.97
31	Muthi	2.08	1.45	0.63
32	Nagbani	4.08	3.35	0.73
33	Nagrota	3.21	3.36	-0.15
34	Nandpur	5.00	2.19	2.81
35	Nava Khu	-	-	-
36	Nikowal	5.03	4.71	0.32
37	Nud	4.40	2.29	2.11
38	Palanwala	2.15	1.09	1.06
39	Pangli Colony	3.31	1.88	1.43
40	Pata Khu	23.91	21.44	2.47
41	Patli	7.97	4.50	3.47
42	Poal	3.43	1.94	1.49
43	Purkhoo	19.93	16.97	2.96
44	Quadar Pur	5.30	3.64	1.66
45	Raiyan	23.48	17.78	5.7
46	Rehal	5.59	2.90	2.69
47	Samba	17.63	15.17	2.46
48	Satwari	11.50	9.78	1.72
49	Senth	3.52	2.42	1.1
50	SuchetGadh	3.68	3.87	-0.19
51	Sugetar	2.30	1.78	0.52
52	Supwal	7.24	2.90	4.34
53	Swankha	21.02	19.20	1.82
54	TandaSheeda	4.11	3.76	0.35
55	Taryai	37.40	35.27	2.13
56	Upralakanhal	2.58	2.17	0.41

HYDROGRAPH OF SELECTED WELLS



5.4 Ground Water Resources

The dynamic ground water resources of Jammu have been estimated for Outer Plains only. Rainfall is the major source of groundwater recharge apart from the influent seepage from rivers, seepage from canals, seepage from irrigated fields and inflow from upland areas whereas discharge from ground water mainly takes place from wells and tube wells, effluent seepages of ground water in the form of springs and base flow in streams etc. In Jammu, recharge from rainfall is of the order of 49839.99 ha m whereas

The recharge from other sources is 43295.55 ha m and total ground water recharge is worked out for the district is 93132.54 ha m as given in the Table-8. The total ground water draft for domestic & industrial use for Jammu District is of the order of 8566.80 ha m whereas for irrigation use is 10576.00 ha m. The total ground water draft for all uses is of order of 19142.80 ha m. Net Annual ground water Availability is 83819.29 ha m and overall stage of ground water development in the district is 22.83 %. Allocation for Domestic and Industrial requirement supply for 2025 is 11959.20 ha m and Net Ground Water Availability for future Irrigation Development is 61284.09 ha m.

Total Ground Water Availability of Jammu district has been estimated considering the Dynamic Ground Water Resources plus in storage Ground Water Resources. The total Fresh Ground Water Resources available in the Jammu district is 1704338 ha m (In storage) and Net Annual Ground Water Availability is 83819.29 ha m (Dynamic) so Total Fresh Ground Water Availability of Jammu district is 1788157 ha m.

Ground water resources and irrigation potential for Jammu district have been computed as per GEC-97 methodology. The resources for the year 2009 are as follows.

Table-8 Ground Water Resources of Jammu district as on March 2009

1.	Area considered for GW Assessment	2000.00	Sq.km
2.	Annual Replenishable GW Resource during monsoon & non-monsoon period	93132.54	Ha m
3.	Natural Discharge	9313.25	Ha m
4.	Net Annual Ground Water Availability	83819.29	Ha m
5.	Annual Ground Water Draft	19142.80	Ha m
6.	Demand for Domestic and Industrial uses (Projected up to 2025)	11959.20	Ha m
7.	Ground Water Availability for Future Irrigation	61284.09	Ha m
8.	Stage of Ground Water Development	22.83	%
9.	In storage Ground water resource	1704338	Ha m
10.	Total Ground Water Resource Availability(4+9)	1788157	Ha m

The stage of ground water development in Jammu district is 23% and falls under “Safe” category (Plate -X). Thus, there is scope for further ground water development.

Table-9 Increase in groundwater development with time

S.No.	Year	Gross draft (MCM)	Stage of GW Development (%)
1.	2004	13490.19	17.65
2.	2009	19142.80	22.83

5.5 Ground Water Quality

Mineralization of ground water depends upon the lithology, texture and nature of formation through which water moves. The ground water is generally used for domestic and irrigation purpose. CGWB monitors ground water quality of shallow aquifers at 64 National Hydrograph Networks Stations. In May 2010 total 50 NHS water sample were analysed in Jammu district. The E.C. (electric conductivity) of ground water which is a degree of mineralization varies from 210 to 2800 micromhos / at 25°C. Carbonate ions are reported in those samples in which pH value is more than 8.30 whereas in rest of samples have only bicarbonate ions. In majority of samples show nitrate concentration less than 45 mg/l only. Two water samples (i.e. Devipur and Samba) of Jammu district are associated with Nitrate concentration more than 45 mg/l but less than 100 mg/l and two water samples (i.e. Bishnah and Gho-Brahma) are reported nitrate concentration more than 100mg/l.(Plate-VIII)

Majority of water samples show iron concentration less than permissible limit but 09 water samples show value of iron concentration more than permissible limit ranges between 1.08-8.45mg/l. (Plate-IX)

Table-10 Ground Water Quality of NHS (May 2010)

Sl. No	Parameter	Permissible limit	Ranges	No. of samples	Percentage (Out of total analyzed sample)	Range	
						Min	Max
1	Sp. Conductance $\mu\text{s/cm}$ at 25°c	-	<750	41	82%	200 (Tandaseeda)	280 (Suchetgarh)
			750-2250	8	16%		
			2251-3000	1	2%		
			>3000	0	--		
2	Chloride Mg/l	250-1000 mg/l	<250	49	98%	3.5 (Dhanpur)	405 (Suchetgarh)
			251-1000	1	2%		
			>1000	0	--		
3	Fluoride Mg/l	1.5 mg/l	<1.00	50	100%	Traces (Tandaseeda)	0.8 (UparlaKanhal)
			1.01-1.50	0	--		
			>1.50	0	--		
4	Nitrate Mg/l	45 mg/l	<45	46	92%	0 (Bengular)	230 (Gho-Brahmana)
			45-100	2	4%		
			>100	2	4%		
5	Iron Mg/l	1.00 mg/l	<1.00	40	80%	0	8.4 (Muthi)
			1.01-1.50	3	6%		
			>1.50	7	14%		
6	pH		<7	0	--	7.50 (Nagrota)	9 (Devipur)
			7	0	--		
			>7	50	100%		
7	Total Hardness Mg/l		0-60	1	2%	60 (Sugetar)	700 (Suchetgarh)
			60-120	12	24%		
			121-180	17	34%		
			>180	20	40%		
Total analyzed sample = 50							

Ground water quality in the district is in general good both for irrigation and domestic purpose. From the samples collected from ground water sources viz. wells, tube wells, hand pumps and springs other chemical parameters are within the permissible limits except a few samples. Thus it can be concluded that the overall quality of groundwater is good and suitable for domestic and irrigation use except small part of the district.

5.6 Status of Ground Water Development

Jammu district is endowed with bountiful water resources viz. perennial rivers, nalas still the district is facing water problems. This shows that ground water resources of district are not being developed in a scientific manner to utilize the resource to their optimum capacity. The villages in Kandi area are facing shortage of water even for drinking purposes. Apart from development of resources, conjunctive use etc. is a very important factor in management of ground water resources. Public awareness about this depleted source is required. A management plan is recommended to mitigate water supply problems in the district.

Ground water development in the district on moderate scale is restricted along the major streams and rivers. In these areas, all the major irrigation and drinking water supplies depend on tube wells and dug wells in addition to various water supply schemes based on rivers / galas.

PHED and I&FC department being a nodal agency in the State concerned with domestic and irrigation water supply, have drilled number of shallow and deep tube wells and wells yielding discharge between 8-21 lps. These State departments have also drilled hand pumps in the district with the depth ranging from 30 to 45 m depending upon lithology of the area with a discharge varying from 0.5 to 2 lps. Few of them are energized with submersible pumps fitted in them.

Table-11 Irrigation & domestic draft by various types of abstraction structures

Sl. no	Assessment Unit	Assessment Sub-unit	Type of Structures	Irrigation draft		Domestic draft		Industrial draft
				No. of Structures	Draft (mcm)	No. of Structures	Draft (mcm)	
1.	Jammu district	Command	DW (manual lift)	---	---	---	---	635.67
			DW with electric/diesel pump	---	---	114	72.00	
			STW	7051	10576.5	388	1822.5	
			Total	7051	10576.5	502	1894.5	635.67
		Non-Command	DW (manual lift)	-	-	-	-	-
			DW with electric/diesel pump	-	-	-	-	-
			STW	-	-	-	-	--

Source- Dynamic Ground Water Resources 2009

6.0 GROUND WATER MANAGEMENT STRATEGY

6.1 Ground Water Development

Based on the annual ground water availability for future irrigation use, it is proposed that ground water development structure viz, dug wells, dug cum bore wells and bore wells can be constructed in the district. Location of structure may be decided based on local hydrogeological conditions and topography of the area after scientific surveys.

The district being partially under plain and hilly terrain, traditional sources of ground water are mainly dug wells, tube wells which have played a major role since past in providing assured irrigation and water supply. In some of the areas, at present groundwater structures are the only sources for water supply for irrigation, domestic and industrial use. However, modern means for tapping the ground water have been emphasized in recent years. During last 15-20 years, Irrigation and Public Health Department have constructed number of bore wells fitted with pump in the area to meet the water requirement especially in peak summer.

Outer plains occupy more than 75% of the area of the district. During the very past years, the traditional ground water sources have served the settlements. Ground water development on moderate scale is seen in the areas particularly in the outer plains.

6.2 Water Conservation & Artificial Recharge

Ground water extraction through wells, hand pumps, tube-wells are major sources of water supply to both rural and urban areas but the availability of water during summer is limited particularly in low rainfall or drought years in Kandi belt and requires measures to augment this resource. Depending upon climatic conditions, topography, hydrogeology of the area, suitable structure for rain water harvesting and artificial recharge to ground water is required. Roof top rainwater harvesting need to be adopted in hilly water scarce area and in urban areas and proper scientific intervention for development of groundwater is required in water scarce areas. In *Kandi* belt, number of village ponds or *talabs* and are in disuse. These ponds can serve as an effective recharge pond if rehabilitated and de-silted.

In urban areas or hilly areas roof top rainwater harvesting structures like storage tanks are recommended while in low hill ranges, check dam and roof top rainwater harvesting structures can be adopted.

Kandi region of the district faces acute shortage of drinking water round the year. To recharge and conserve groundwater resources, Central Ground Water Board has earlier taken up a few pilot schemes on Artificial Recharge to groundwater. Such schemes were completed in which roof top water was collected and stored in aquifer at Kot Bhalwal (Aknoor) in rural area while at Nirman Bhawan in Jammu city. Some more schemes were also completed in other parts viz. Government College for Women at Gandhi Nagar, Air port building at Satwari, Jammu etc.

Rainwater harvesting basically capture, diversion and storage of rainwater mainly for drinking, domestic and other uses like irrigation, industrial uses. Many types of rainwater harvesting schemes can be designed and constructed for collection of rainwater. The recharge plan of Jammu is given in table.

Table-12 Recharge Plan for Jammu District

S. No	Details of project	No. of structures to be constructed
1.	Construction and Development of Kandi ponds/tanks	100
2.	Gabion structures/ Checkdams/ Underground Bandharas	25
3.	Rain Water Harvesting and Artificial Recharge Structures	100
4.	Diversion of flows from Perennial Nalas/Springs in RCC storage tanks in Terrace farming areas	15
	Total	240

Source–Jammu district report 2011 -12 (unpublished)

7.0 GROUND WATER RELATED ISSUES & PROBLEMS

The district being hilly and mountainous. The most of the rainfall goes waste as runoff. This has resulted in varying degree of recharge to the ground water. In such hard rock terrain, since the aquifers are discontinuous and of different geological/hydrogeological setup, the ground water scenarios are different in various parts of the districts.

Most of the ground water issues and problems so far noted in the district are localized and need to be treated independently by taking micro level studies in a particular area. Some of the common issues are deeper water level in some of the areas as noticed in northwestern part, pollution of water sources due to unplanned disposal of garbage & lack of sewerage system.

8.0 AWARENESS & TRAINING ACTIVITY

Mass Awareness Programme (MAP) & Water Management Training Programme (WMTP) by CGWB

❖ Fresh Water Year 2003

United Nation Organisation had declared year 2003 as “International Fresh Water Year” Keeping this in view, Government of India also declared 2003 as “Fresh Water Year”. Under this head, North Western Himalayan Region, Jammu had taken up many activities.

- ❖ The Central Ground Water Board, North Western Himalayan Region, Jammu, organized an Exhibition-cum Mela on 19th December 2003 at village Purmandal in district Jammu. It was inaugurated by Shri Yashpal Kundal, Hon’ble Minister of State for Animal and Sheep Husbandry. The theme of the Exhibition was “FRESH WATER FOR ALL” in which declining percentage of fresh water, the difficulties and solutions were shown by displaying different model, various maps, charts, report and publications including geophysical instruments and their demonstration to common public. About 400 people including officers of PHE, the residents of Purmandal village and school students, officers and staff of the Board to make the programme successful.
- ❖ A Mass awareness programme on rainwater harvesting was conducted at Government Senior Secondary School, Bhararu on 6.1.2004 where Sh. Kaul Singh Thakur, Hon’ble Minister for Irrigation & Public Health, Government of HP was the Chief Guest. The function was attended by officers and staff of I&PH, HPSEB apart from school children. Lectures were delivered by the Chief Guests and

scientists of CGWB on ground water conservation and management. In all, more than 2000 persons including students attended to the programme. Students from VI-XII participated in painting and debate competition on ground water.

- ❖ A Mass awareness cum training programme on rainwater harvesting was conducted at Krishi Vigyan Kendra, Bajaura on 29.3.2004 where Sh. S.S. Chauhan, Member, CGWB was the Chief Guest. Sh. Tej Pratap Singh, Vice Chancellor, CSKKVV Palampur presided over the function. Officers and staff of department of Agriculture and the farmers from nearby villages of Bajaura attended the function. Lectures were delivered by the Chief Guests and scientists of CGWB on ground water conservation and management. In all, about 1000 persons attended to mass awareness programme and 50 persons during training programme.
- ❖ Training cum mass awareness programme on rainwater harvesting and artificial recharge to ground water was conducted at Government Senior Secondary School, Katindi on 11.12.2004 & 12.12.2004 where Sh. Kaul Singh Thakur, Hon'ble Minister for Irrigation & Public Health, Govt of HP was the Chief Guest. Schoolteachers, staff and officers attended function from various Government departments apart from school children. Lectures were delivered by Chief Guest, Regional Director and delegates on rain water harvesting, water conservation and management. In all about 50 persons mainly teachers and officers attended to the training programme and about 1000 persons attended to mass awareness programme.
- ❖ A Mass Awareness Programme on Rainwater Harvesting and Water Management was conducted on 17.2.2006 at Government Senior Secondary School Panarsa. The Chief Guest to the programme was Sh. Kaul Singh Thakur, Hon'ble Minister (I&PH), Government of Himachal Pradesh. The function was attended by large gathering of school childrens and villagers and officers from Department of Agriculture. Lectures were delivered during the programme focusing on the need for harvesting water for various uses and artificial recharge to groundwater for future use. The exhibition displaying roof top rainwater harvesting models and other displays were arranged to aware gathering on the theme. More than 1500 persons attended the function. Students from VI-XII actively participated in painting and debate competition on ground water during programme.
- ❖ A Mass Awareness Program at Jawahar Navodaya Vidyalaya, Nud in tehsil Samba on 22nd March 2009. With focal theme of Water Conservation and Rainwater Harvesting. A Jal Yatra was also organized by CGWB, Jammu where about 300 students of JNV, Nud, participated in these drawing and slogan writing competitions and in Jal Yatra. The best paintings and slogans were selected and awards were distributed. About 400 students of JNV, Nud, teachers and villagers participated in this Mass Awareness programme on 22-03-2009.
- ❖ JAL YATRA was organised in Munni Kamal Public School, Gangyal, Jammu on 30th March 2009. Where Students, Staff, and Parents of about 200 participants participated in this programme. The Officers and Staffs were actively participated in these Yatra. The students were carrying slogans related to Ground Water Issues and Artificial Recharge during procession.

- ❖ A mass awareness program was organized at village Suchetgarh of Ranbir Singh Pora Block of Jammu district which is located in very remote area on the international border on 6th August 2010 with the involvement of the Block Development Officer and Panchayat Secretary. The program was organized at the Community Centre of Suchetgarh and the main target audience for the campaign was women because it is the women who usually make thrifty use of water since they go and fetch it themselves and know that every drop counts. About 80 ladies including school teachers of Middle school, Suchetgarh, 15 girl students 15 villagers along with an NGO and Block Inspector, R.S. Pora, and 10 officers and officials of CGWB attended the program.
- ❖ A one day mass awareness programme Program on **water Conservation** at Government Higher secondary School, Kot Bhalwal, Jammu was organized on 29th January, 2011. The Chief Guest of programme was Smt Tahira Shawl Principal, Government Higher Secondary School, Kot Bhalwal, Sh Narinder Singh, Sarpanch village Kot Bhalwal was guest of honour. Sh. Abhijit Ray, Regional Director, CGWB, Jammu presided over the programme. The program dealt on Water Conservation, Rainwater harvesting, Artificial Recharge, About 400 students of Class IX, X XI, XII, villagers attended the programme. A painting competition was held on the occasion on the theme of “Water conservation.” About 50 students participated in the competition and prizes were given to 1st 2nd & 3rd Position & 10 consolation prizes were given.
- ❖ A mass awareness programme Program on **water Conservation** at Government Higher Secondary School, Vijaypur, Samba on 04th March, 2011. The Chief Guest of the programme was Sh. Dev Anand, Principal, Government Higher Secondary School, Vijaypur. Sh. Abhijit Ray, Regional Director, CGWB, Jammu presided over the function. Officers from CGWB delivered talks on water conservation practices, importance and techniques. A painting competition was also organised before function on “Water Conservation”. The first three best paintings were given first, second and third prizes and 10 consolation prizes were also given to the students during the program.
- ❖ Water Management training programme on rainwater harvesting and water management was conducted on 23.12.2006 at Padhar. The Chief Guest to the programme was Sh. O.P.Chauhan, Superintending Engineer, I&PH. The training programme was attended by Junior Engineers, Assistant Engineers, Sub-divisional Engineers from I&PH department. About 80 persons attended to the training programme. The Regional Director delivered lectures and power point presentations and scientists of CGWB focusing on need for harvesting water for various uses and artificial recharge to groundwater including case studies. The exhibition displaying roof top rainwater harvesting models, various posters and other displays were arranged to aware the target group towards water conservation and adopting rain water harvesting.
- ❖ A training programme on the Rain water Harvesting and Artificial Recharge to Ground Water was conducted on 05.03.2008 at Radha Bhawan, Jammu district Jammu. About 40 Engineers and water resources technical experts from PHE,

I&FC, Military Engineering Services and Indian Air Force participated in the programme. Lectures and power point presentations were delivered by the Regional Director and scientists of CGWB focusing on the need for Rain water Harvesting and Artificial Recharge to Ground Water for various uses and including case studies.

- ❖ A two days training program was organised on the “Rain Water Harvesting and Artificial Recharge to Ground Water” at *Department of Environmental Sciences, University of Jammu*, Jammu on 3rd & 4th February 2009. The Chief Guest of the programme was Dr.B.P.Singh Saigal, Dean Academic Affairs & Professor of Law, University of Jammu. Lectures and power point presentations were delivered by the Regional Director and scientists of CGWB focusing on need for Artificial Recharge to the Ground Water with special reference to Kandi areas of J&K.
- ❖ A training programme on “Roof Top Rain Water Harvesting & Artificial Recharge to Ground Water” on 15th December, 2010 in the Hall of Spice Food Court, Jammu. The Chief Guest of the program was Sh. Abhay Kumar, Director, Soil Conservation Department, Jammu. Sh. Abhijit Ray, Regional Director, CGWB, Jammu presided over the programme. Officers of Central Ground Water Board delivered lectures to the participants and then certificates were distributed to the trainees.

Participation in Exhibition, Mela, Fair etc

To create awareness CGWB exhibited its models, posters, displays etc during mass awareness programmes and ground water management training programme conducted in the district.

Presentation & Lectures delivered in public forum / Radio/TV/Institution of repute/Grassroots association /NGO/Academic institutions etc.

Presentation and lectures were delivered amongst gathering during MAP and WMTP conducted in the district.

8.0 AREAS NOTIFIED BY CGWA / SGWA

The stage of ground water development in of Jammu district is 22% only and falls in safe category. Thus, no area or block has been notified for groundwater development point of view by CGWA/SGWA.

9.0 RECOMMENDATIONS

- ❖ In valley areas, in addition to traditional ground water structures like dug wells & springs, shallow to medium depth tube wells can be constructed for developing the ground water resource.
- ❖ In hilly terrain, springs and perennial nallas are major sources of water. Shallow to medium depth bore wells fitted with hand pump are useful ground water structures for meeting domestic needs and are feasible at favorable areas.
- ❖ Traditional resources like springs need to be revived developed & protected on scientific lines for various use. The discharge of such springs can be sustained by Construction of small check dams or subsurface dykes across nallahs/tributaries in the downstream at favorable locations.
- ❖ Small ponds/tanks/talavs can be utilized for recharging ground water. These structures can be constructed for harvesting water and utilized for both recharging and meeting domestic needs.

- ❖ Roof top rainwater harvesting practices must be adopted in hilly areas since the district receives ample rainfall. Because of hilly terrain, maximum rainfall goes off as runoff and a very small quantity contributes towards ground water replenishment.
- ❖ Rainwater harvesting in general & RTRWH in particular is an ideal solution for augmenting water resources particularly in slopy, hilly & chronic water scarce areas. Thus, there is a need to create awareness for water conservation and augmentation and proper waste disposal for protecting water sources.
- ❖ Mining of riverbeds should be prohibited as it leads to fall in the water levels & it also damages natural river system.
- ❖ People's participation is a must for any type of developmental activities. So they should be made aware for proper utilization and conservation of water resources available. In addition, micro level efforts are required for proper implementation of development programme.
- ❖ The forest should be safe guarded in the recharge area.
- ❖ Construction activities should be avoided in the recharge area.
- ❖ Abandoned dug wells may be used to recharge shallow aquifer.
- ❖ Public should be made aware of water conservation practices.

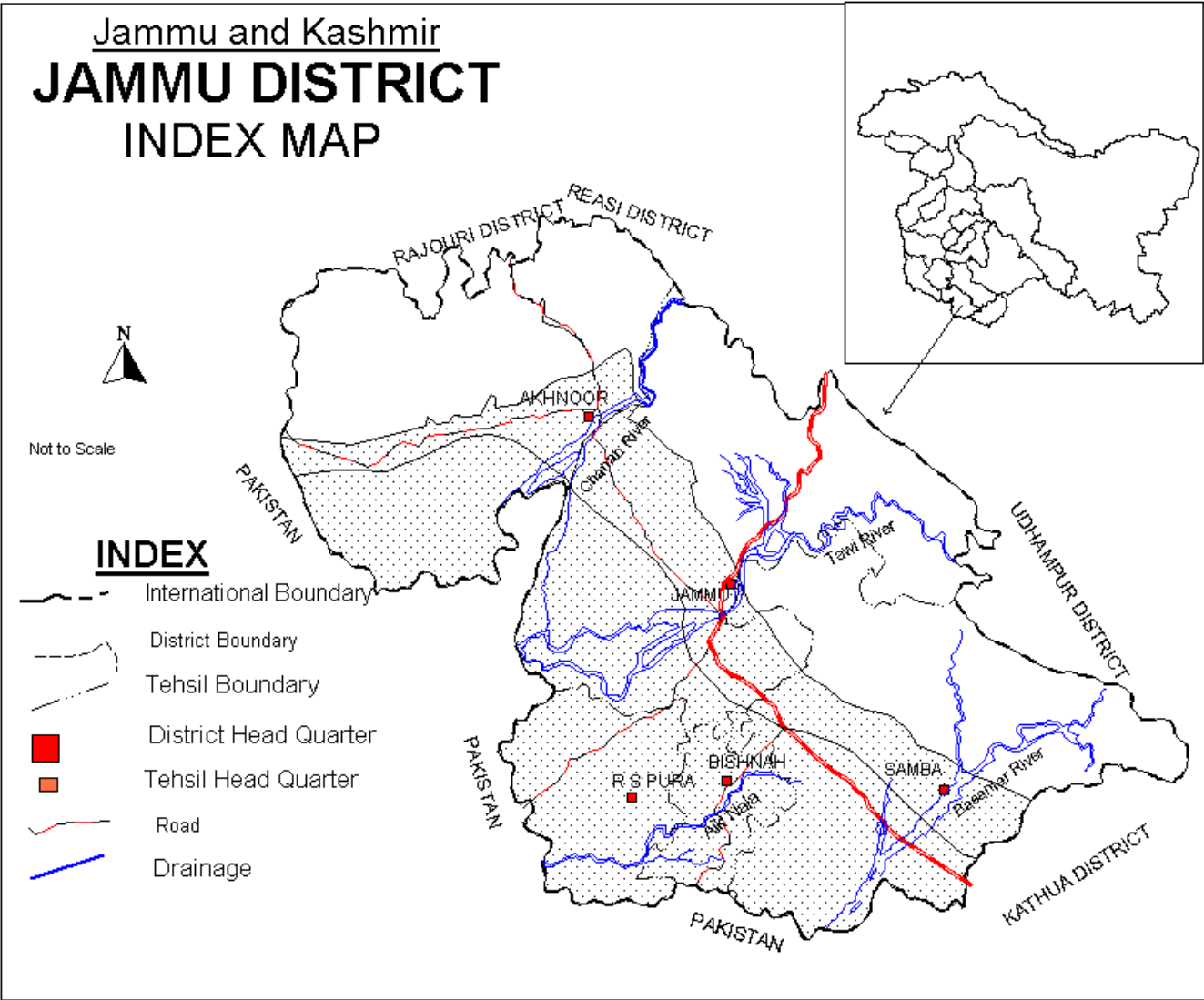
SAVE WATER SAVE LIFE

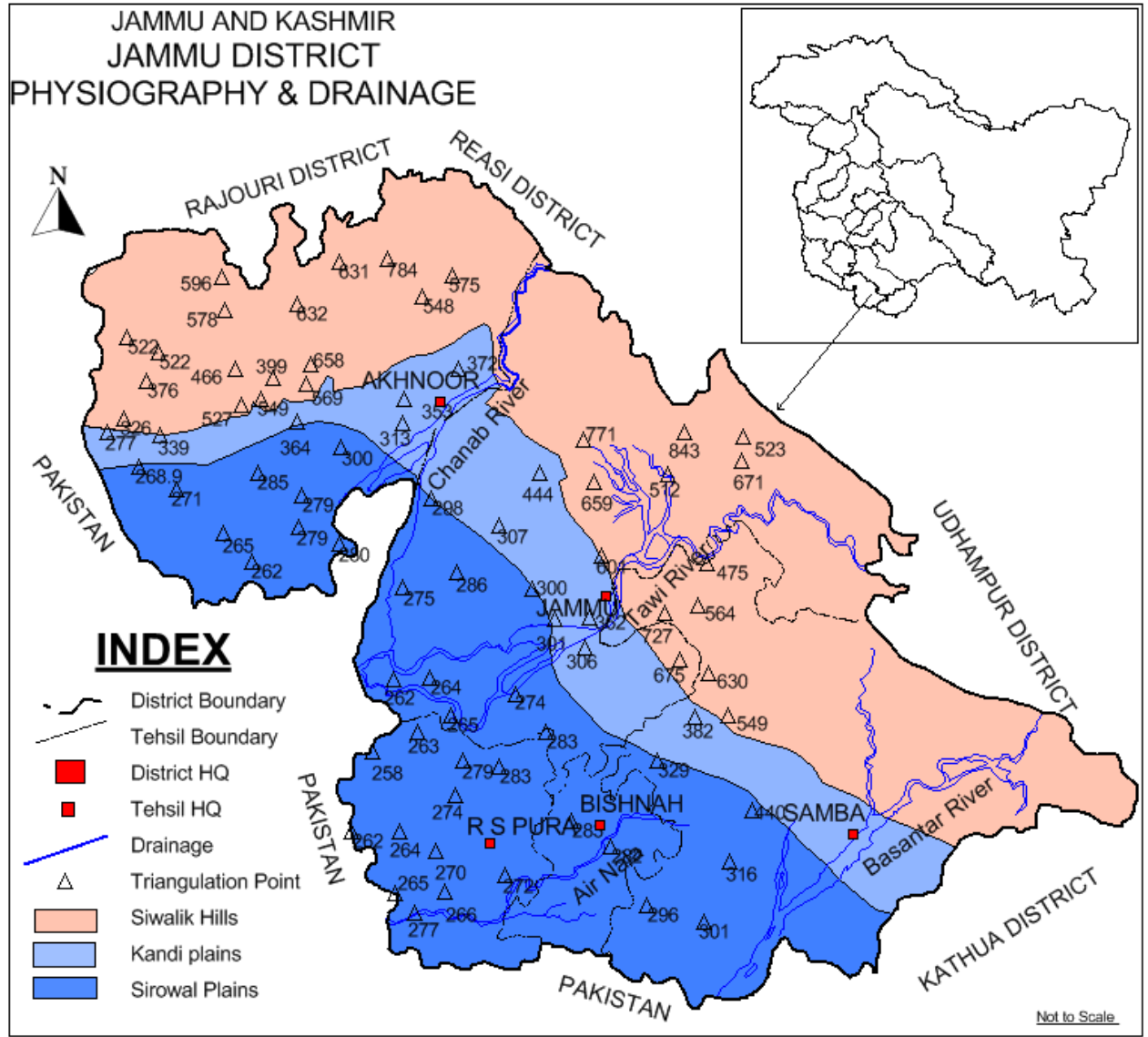
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BROCHURE OF JAMMU DISTRICT JAMMU & KASHMIR STATE

CONTRIBUTORS

The Brochure of Jammu District of J&K State has been prepared by Nelofar Scientist 'B', North Western Himalayan Region, Jammu. Valuable contribution of Ms. Priya Kanwar, Assistant Hydrogeologist in the preparation of this Brochure is also acknowledged. This Brochure has been scrutinized by Sh N.R. Bhagat, Scientist 'D' & H.O.O, NWHR, Jammu.





Jammu and Kashmir JAMMU DISTRICT HYDROGEOLOGY MAP

