Government of India
Ministry of Water Resources
CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET
UDHAMPUR DISTRICT, JAMMU & KASHMIR

NORTH WESTREN HIMALAYAN REGION
JAMMU
2014

GROUND WATER INFORMATION BOOKLET
UDHAMPUR DISTRICT, JAMMU & KASHMIR

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Water security through sound management

GROUND WATER INFORMATION BOOKLET
Udhampur District, Jammu & Kashmir

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GROUND WATER INFORMATION BOOKLET

UDHAMPUR DISTRICT, JAMMU & KASHMIR

DISTRICT AT A GLANCE

S. NO	ITEMS	STATISTICS
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	4540
	ii) Administrative Divisions (2001) • Number of Tehsil • Number of CD Blocks • Number of Panchayats • Number of Villages • Number of Towns	 05 (Reasi,Udhampur,Chenani, Ramnagar, Gool Gulab Garh) 11 351 602 (Inhabited-594, Habited-8) 8
	iii) Population (2011 Census) • Total population • Population Density (person/sq km) • Rural & Urban Population • Sex ratio • Population Growth • Literacy	 870071 persons 211 80.28% &19.72% 863 20.86% 69.90%
	iv) Average Annual Rainfall (mm)	1490.33 mm
2.	GEOMORPHOLOGY	
	Major Physiographic units	• High Hill Ranges • Meanders • Terraces • Valleys (Dune)
	Altitude Range	600 – 3000 m amsl
	Major Drainage • Chenab • Ravi	 Ans river, Tawi river Basantar river Ujh river
3.	LAND USE (2009-10) sq km	
	• Forest area • Cultivated Area • Net area sown	1917 1163 707
4.	MAJOR SOIL TYPES	
		• Mountainous Soil • Sub-Mountainous Soil

S. NO	ITEMS	STATISTICS
5.	IRRIGATION BY DIFFERENT SOURCES (Digest of Statistics 2009-10)	
		Area (Sq. Km.)
	Dug wells & shallow TW	Nil
	Surface water	48.07
	Tanks	0.07
	Other sources	2.29
	Net area irrigated by different sources	**50.43**
6.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.3.2012)	
	• No. Of Dug Wells • No. Of Piezometers	21 Nil
7.	PREDOMINANT GEOLOGICAL FORMATIONS	
		• Quaternary Alluvium • Tertiary (Siwaliks, Murrees) • Older Crystalline & Metamorphic rocks
8.	HYDROGEOLOGY	
	Major Water Bearing Formations	
	1. Fissured Formation	Covers major part (65%)
	• Yield prospects • GW structures	2-30 lpm Springs, Dug wells, Tube wells & Hand pumps
	2. Porous Formation	Covering (35%)
	• Yield prospects • GW structures	(93-1800 lpm) Tube wells & Hand pumps
	Avg. Depth to water level	2.00 m - 11.40 m bgl
9.	GROUND WATER EXPLORATION BY CGWB (Since 2009)	
	• No of wells drilled	21 Exploratory well
	• Depth Range (m)	29.00 - 200.00
	• Discharge (lpm) • Transmissivity (m^2/day)	Meager - 1200.00 92.32-3323.9
10.	GROUND WATER QUALITY	
	Presence of Chemical constituents more than permissible limits (e.g. EC, F, and Fe etc.)	Nil
11.	AWARENESS AND TRAINING ACTIVITY	
	Mass Awareness Programmes • Place / Date	5 Nos. 1) Town Hall, Udhampur /16.3.02 2) Higher Secondary School, Reasi / 30.12.04 3) Town Hall, Ramnagar / 20.3.07 4) PHE Complex, Mansar / 22.3.07 *5)* Govt. Higher Secondary School, Ghordi/18.02.2012
	Water Management Training Programmes	04 Nos.

S. NO	ITEMS	STATISTICS
	• Place / Date	1) Town Hall, Ramnagar / 20.3.07 2) PHE Complex, Mansar / 22.3.07 3) Hotel Dolphin,Udhampur from 07th-11th December, 2010 4) The Office of Chief Engineer, MES, Udhampur zone on 11.02. 2011.
12.	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	
		RTRWH at Mata Vaishno Devi Bhawan taken up under CCS.
13.	DYNAMIC GROUND WATER RESOURCES (2009) in ham	
	• Annual Replenishable Ground Water Resources during monsoon & non-monsoon season	6096.89
	• Net Annual Ground Water Availability	5487.20
	• Projected Demand for Domestic and industrial uses up to 2025	3366.00
	• Stage of Ground Water Development	37.61%
	• Total In -storage Ground Water Resources	3001
	• Total Annual Ground Water Resources	8488.20
14.	GROUND WATER CONTROL AND REGULATION	
	Number of OE Blocks Number of Critical Blocks Number of Notified Blocks	Nil Nil Nil
15.	MAJOR GROUND WATER PROBLEMS AND ISSUES	Ground water potential is poor.

GROUND WATER INFORMATION BOOKLET
UDHAMPUR DISTRICT, JAMMU & KASHMIR

1.0 INTRODUCTION

The town Udhampur, headquarter of the district has been named after Raja Udham Singh, the eldest son of Maharaja Gulab Singh, the founder of Dogra rule in the state of Jammu and Kashmir. Udhampur district is situated in south eastern part of Jammu and Kashmir state and is bounded in the west by Rajauri district, in the north by Anantnag district, in the north east by Doda district, in the south east by Kathua district and in south west by Jammu district. The district headquarter at Udhampur town lies between 32°34' & 39° 30' North latitudes and 74°16' & 75°38' East longitudes and is covered by parts of Survey of India degree-sheet numbers 43O, 43K, 43P and 43L.

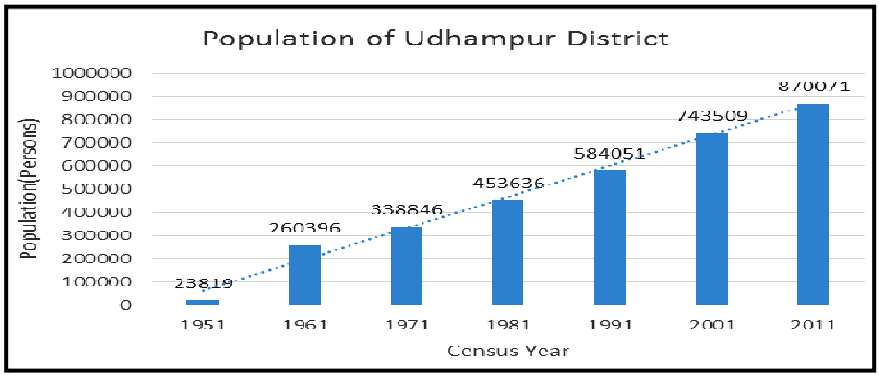
The district has a total geographical area of 4540 sq km. In 2007, Udhampur district has been bifurcated into Reasi and Udhampur districts. The areas of Reasi district and Udhampur district were reduced. This booklet discusses the general ground water information of old Udhampur district. The National Highway NH-IA connects the area with the rest of the country (Plate I). All tehsil and block headquarters of the district are well connected by roads. The district is divided in to 5 tehsils (Udhampur, Ramnagar, Chenani, Reasi and Gool Gulabgarh) and 07 blocks, 204 panchayats and 602 villages. There are 8 towns in the district Udhampur viz. Chenani, Katra, Ramnagar, Reasi, Rehamble and Udhampur. The district has the distinction of having holi mata Vaishno Devi Shrine. Patnitop and Kud are the summer hill resorts of the district where as the lake viz. Mansar Lake enhances the beauty of the district.

As per the 2011 Census, the population of the district is 870,071 persons which are about 6.93% of the total State population. The population density of the district is 211 persons per sq km. The percentage of urban population is only 29.15%. The rural and urban population is 525859 and 116627 respectively. The district has sex ratio of 863 and literacy rate as 69.90%.

Table – 1 Population of Udhampur district

S.No.	District	Census Year	Population (Persons)
1.	Udhampur	1951	23819
2.		1961	260396
3.		1971	338846
4.		1981	453636
5.		1991 (interpolated)	584051
6.		2001	743509
7.		2011	870071

Source –Digest of statistics



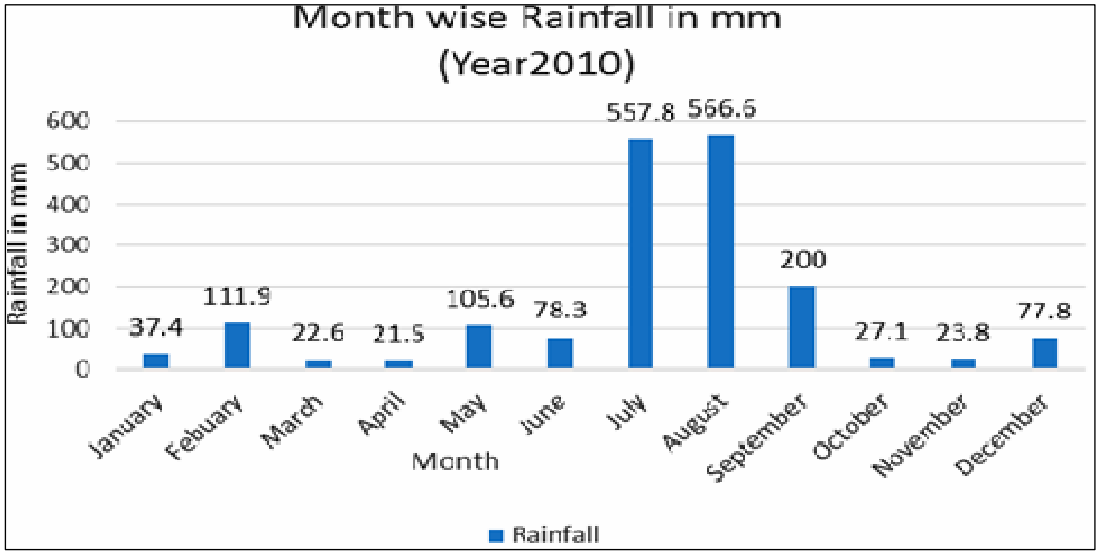
Since the district lies in the mighty Himalayan Range, very small portion of the district (only 17% of total reporting area) is available for cultivation. Agriculture is the main source of livelihood as nearly more than 70% of working population is engaged in agriculture. According to village papers, Total area of district is 4310.11sq km, Forest area is 1917.74 sq km, area not available for cultivation is 1075.35 sq km, net area sown is 696.32 sq km and the areas under miscellaneous tree crops is 181.30 sq km. Total area under forest in the district is near about 44.49%.

Maize is main Kharif crop which comprises of 50.1% of the total cropped area. Other Kharif crops viz. Bajra is sown in small area. Rice is sown in only 98.52 Sq.km (8.8%) especially in the terraces deposits, wheat constitutes 36.2% of the total cropped area. About 5.0% of the total area sown in the district is irrigated which shows that 95% of cultivation is till dependent on rainfall. Canals provide bulk of irrigation. Khuls (diversion canal) is a traditional irrigation system in district Udhampur. The net area irrigated (2009-10) by different source is 50.43 sq.km Out of this, area irrigated by canals is 48.07 sq.km, by tank it is 0.07 sq.km and from other sources it is 2.29 sq.km.

2.0 CLIMATE & RAINFALL

Due to variation in altitude from 600 to 3,000 meters above mean sea level. There is a wide variation in climatic conditions in different parts of the district experiencing a typical temperate climate in high altitude which experience snowfall and cold winter whereas tropical climate at low altitude. The summer season starts from April to June followed by rainy season from July to September. The October and November although generally dry and most pleasant season of the year. The winter season begins from December and ends in March. The high altitude areas experience very cold winter and mild summer. The temperature in the snowfall zone varies between sub-zeros to about 35°C. Sub-tropical climate prevails in the low altitude area where there is cold winter but scorching summers. In Udhampur, temperature rises continuously after January and May is the hottest month (max. 42°C, min. 23°C) and January is coldest month (max. 17.4°C and min 2.8°C) of the year.

Normal annual rainfall at Udhampur is 1400 mm. Mostly rainfall (~70% of the total annual rainfall) is received from southwest monsoon. The monsoon usually arrives in the first week of July and remains active up to September. Rainfall is also received during winter season due to western disturbances. Monthly rainfall of Udhampur district for the year of 2010 is plotted on graph given below.



3.0 GEOMORPHOLOGY AND DRAINAGE

Physiographically, the district is characterized by mountain ranges trending NW-SE direction, deep narrow valley and terraces, valley fill deposits with gentle slopes. The district is covered partly by Pir Panjal ranges and partly by Outer Himalayas. The altitude of Udhampur district varies from 600 to 3000 meters above mean sea level. The gentle terrain occurs in southern and southwestern part while in northern part is covered by complex and high mountainous terrain. Major slope of the terrain is towards south and southwest. The hilly terrains with high hills exist in the northern and eastern part of the area and vary in elevation from 1100 m to 2400 m amsl. Structural hills belonging to Murree and Siwalik groups are mostly longitudinal with altitude varying between 700 m to 2200 m amsl. Five river terraces are occurring on either bank of Chenab River. In this area between Talwara and Derababa these are developed in pairs along the riverbank, known as paired terraces. Near Reasi, a Bida etc. non-cyclic terrace moderately dissected by various streams. The alluvial terraces are also observed along is the Tawi River. Meanders are seen in the lower reaches, scrolls, paleo-channels are common in Chenab and Tawi-Sutlej.

DRAINAGE

The district is drained by a number of perennial rivers and ephemeral streams. They form part of Indus major basin and Chenab sub-basin. Chenab River and its tributaries viz., Tawi River, Basantar River and Ujh River (tributary of Ravi) are perennial rivers draining the district (Plate-II). These streams originate from northern mountainous regions and flows in southwestern direction. These rivers are fed by number of first to fourth order streams in the study area. Number of local streams or nalas remain dry in summer but create havoc due to flash floods especially in rainy seasons. They carry huge load of boulders, pebbles, sand and silt during monsoon period.

4.0 SOIL, LAND USE AND IRRIGATION PRACTICES

SOIL TYPES

Table-2 Soil types and their charcteristics

S. No	Soil type	Characteristics
1	Sandy loam	Medium O. M. content, Low to medium N and Medium phosphorus and High in K content. Illite is dominating clay mineral.
2	Clay loam	Medium O. M. content, Low to medium N and Medium phosphorus and High in K content. Illite is dominating clay mineral.

LAND USE PATTERN

The land use pattern of the district is given as below in table.

Table-3 Land Use Pattern of last three years

Year	Area not available for cultivation (in ha)		Other un-cultivated land excluding fallows (in ha)			Fallow Land (in ha)		Net Area Sown (in ha)
	Land put to non agriculture uses	Barren and Unculti vable land	Permanent pasture and other grazing land	Land under Misc tree crop, groves not including in net sown area	Cultura ble waste land	Other tha current fallows	Current fallows	
2007-08	51840	18426	6725	12236	11277	422	5600	48508
2008-09	51840	18426	6725	12236	11277	822	7224	46484
2009-10	50222	19151	3422	11484	12211	289	13152	45103

Source –Digest of Statistics

IRRIGATION

The net area irrigated (2009-10) by different source is 50.43 sq.km, out of this, area irrigated by canals is 48.07 sq.km, by tank is 0.07 sq.km and other sources is 2.29 sq.km.

Table-4 Total area irrigated by different sources (in sq.km)

S. No.	Year	District	By Canals	By Tanks	By Wells	Other Sources Area	Total Area
1.	2007-08	Udhampur	35.95	0.03	0.03	8.36	44.37
2.	2008-09	Udhampur	42.77	0.07	-	1.42	44.26
3.	2009-10	Udhampur	48.07	0.07	-	2.29	50.43

Source- Digest of Statistics

CROPS

Maize, Wheat and Paddy are the principal crops of the district. Maize is harvested in Kharif season whereas wheat in Rabi season. Area under different crops are given in Table-5 below and shown in figure-1.

Table -5 Area under different crops in Udhampur district

Crops (sq.km.)	Year 2007-08	Year 2008-09
Rice	1037	985.2
Bajra	92.1	93.2
Maize	5972.8	5558.4
Wheat	4008.8	4019.1
Barley	82.6	110.2
Milets & Pulses	243.2	321.4
Total food grains	11436.5	11087.5
Fruits & Vegetables	72.4	54.6
Oil seeds	243.8	260.7
Fodder crop	71.7	84.9
Other Non Food Crops	0.7	00.8
Spices	73.0	49.9
Fibres	5.3	1.6
Total Area sown	**11904.2**	**11548.1**
Area sown more than once	**4418.8**	**4431.9**
Net Area Sown	**7485.4**	**7116.2**

Source- Digest of Statistics

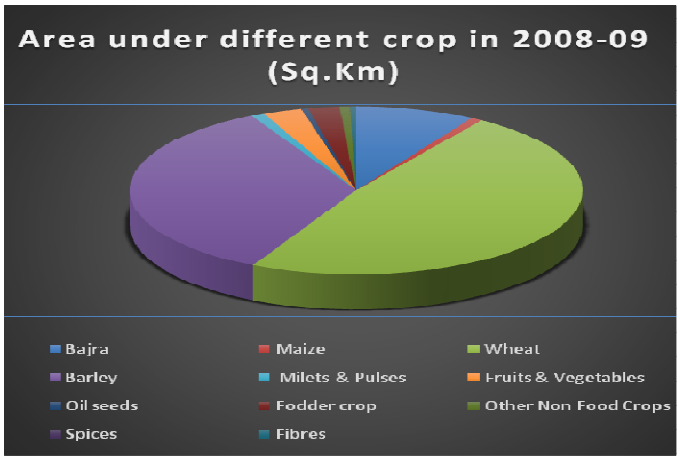


Figure -01 Chart showing area under different crops

5.0 GROUND WATER SCENARIO

5.1 HYDROGEOLOGY

Geologically, Stratigraphic Succession in the district ranges from Archean to Recent period as under.

Table -6 Stratigraphic Succession in Udhampur district.

Age	Group/Formation	Lithology
Recent to Sub-recent	Alluvium/Terrace deposit	-
Pliocene to Pleistocene	Upper Siwalik	Sandstone, mudstone, pebble beds and boulder, conglomerate
Late Miocene	Middle Siwalik	Sandstone with interbedded mudstone
Late Miocene to Middle Miocene	Lower Siwalik	Sandstone, mudstone, conglomerates
Early Miocene to Pliocene	Murree Group	Sandstone, claystone, shale, sandstone
----------Unconformity----------		
Eocene	Subathu formation	Nummulitic limestone, shale sandstone
Precambrian	Salkhala Group	Phyllite, Schist, Gneiss and Quartzite with granodioritic intrusive
Precambrian	Sirban limestone	Dolomitic limestone with quartzite on top

Major part of the district is occupied by rocks belonging to Murree and Siwalik formations of tertiary period. Sirban limestone occupies the area north west of Udhampur town near Reasi. The occurrence of Quaternary alluvium is generally confined to the area bordering the flood plains of the rivers and nalas. Two major terraces deposits occur in the study area. River deposits are observed from Arnas to Akhnoor and Katra along Chenab River. They are grouped in to Vaishno Devi formation, Akhnoor formation and Chenab formation and mainly comprises of boulders, pebbles, cobbles, gravels of angular to sub-angular shape mainly of carbonate rocks. Between Siwalik hill ranges, alluvial terrace deposits occur which are called Udhampur Dun deposits and are important from ground water point of view.

5.2 GROUND WATER OCCURRENCE

Ground water in the area occurs under water table condition in alluvium and confined condition in the underlying rocks of the older age. The ground water occurrence is mainly controlled by topography, drainage, structure and lithology. In the area, ground water occurs in the pore spaces of saturated part of the alluvium and underlying Siwalik groups of the rocks. Springs are common in hard rock/sedimentary formation formed either along predominantly weathered zones at the contact of formation in low topographic areas. Rainfall & snowmelt is the main source of recharge to ground water body.

Hard rock of Murree, Siwalik and older rocks comprises of fissured formations where ground water occurs in weathered, jointed and fractured parts. Hilly and mountainous areas with steep slopes form run off zones. In general, the ground water potential in Siwalik and Murree formation are poor. In these areas springs are main ground water sources. In porous formations, primary porosity mainly controls the occurrence and movement of ground water. Ground water mainly occurs under water table condition with variable depth to water level depending upon hydro-morphic set up. The yield of shallow dug wells is in general low to moderate. Pre-monsoon depth to water level ranges from 2 to 24 m bgl. Overall ground water

recharge in the valley area is adequate and no decline of water level is observed. Perched aquifers are reported in the area. CGWB has drilled 18 exploratory wells having depth upto 200m (Dhanori) in different formations. The discharge from these wells varies from meager to 20 lps.

Springs are the main ground water sources widely distributed at varying altitudes. Majority of springs occur along fracture zones. The discharge of springs varies from less than 1 lps to more than 10 lps. In general, springs from limestone or fracture zones have higher discharges and traditionally been used a dependable source of water supply (Plate-III).

5.3 DEPTH TO WATER LEVEL

Based on the data of water levels of permanent hydrograph network stations, it is observed that the depth to water levels vary widely in different hydro-geomorphic conditions depending upon rainfall, the draft and topography of the area. Ground water levels are monitored by C.G.W.B from a network of observation wells four times in a year in January, May, August and November.

Pre-monsoon

During pre-monsoon period i.e in the month of May, 2011, 20 wells have been analyzed and depth to water levels varied between 1.1 and 24.87 mbgl. 03 wells (15%) have recorded the water level is less than 2.0 mbgl. Majority of the observation wells that is 11 wells (55%) registered water levels in the range of 2-5 mbgl. Whereas 05 wells (25%) registered water levels in the range of 5-10 mbgl. 01 wells (5%) are showing deepest water levels i.e. >20 m bgl. Distribution pattern of the water level is presented in Plate-IV.

Post-monsoon

During post monsoon period of the year 2011 i.e during the month of November, 19 wells have been analyzed and depth to water level varied between 0.27 to 25.1 m bgl. 09 wells (47.3%) have recorded the water level less than 2.0 mbgl. Whereas 07 wells (36.8%) registered water levels in the range of 2-5mbgl.02 wells (10.5%) registered water levels in the range of 5-10 mbgl. 01 wells (5.26%) are showing deepest water levels i.e.>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 0.25 to 2.95 m. The rise in water levels is mostly between 0 to 2 m. falls in water levels of less than 2 m is observed in only two wells. Distribution pattern of the water level is presented in Plate-VI.

Long-term water levels

An analysis of observation wells of Central Ground Water Board for pre monsoon period shows decline in water levels in 31.25% wells, while 68.75% wells show rise in water levels during the last decade (2001-2010) based on water level trend. Distribution pattern of the water level is presented in Plate-VII.

Post monsoon water level (November) analysis for the period from 2001-2010(last decade) shows that there is a decline of water level in 40% observation wells. Based on water level trend for the last decade 60% wells show rise in water levels. Distribution pattern of the water level is presented in Plate-VIII.

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

S.No	Location	Pre-Monsoon (mbgl)	Post-Monsoon (mbgl)	Fluctuation (m)
1.	Aliyah	3.4	1.69	1.71
2.	Badola	3.55	1.82	1.73
3.	Battal Ballian	9.95	9.6	0.35
4.	Bhamla	4.5	2.16	2.34
5.	Chhani-mansar	3.49	1.22	2.27
6.	Dadua	3.78	3.02	0.76
7.	Dehari	1.3	0.92	0.38
8.	Garhi	1.1	0.27	0.83
9.	Katra	4.1	2.9	1.2
10.	Kiayal	6.22	-	6.22
11.	Kuperlah	2.64	1.79	0.85
12.	Manwall	8.4	6.1	2.3
13.	Nagrota Panjgrain	1.8	1.55	0.25
14.	Nanora	2.42	2.13	0.29
15.	Phangyal	5.8	3.3	2.5
16.	Ramnagar	7.5	4.55	2.95
17.	Riasi	24.87	25.1	-0.23
18.	Salabra	2.58	1.3	1.28
19.	Seen Thakaran	3.4	1.91	1.49
20.	Talwara	2.55	4.3	-1.75

HYDROGRAPHS OF SELECTED WELLS

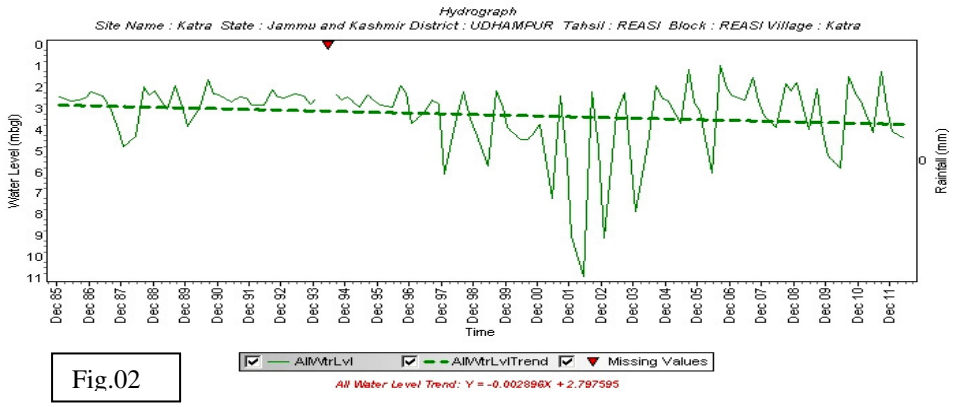


Fig.02

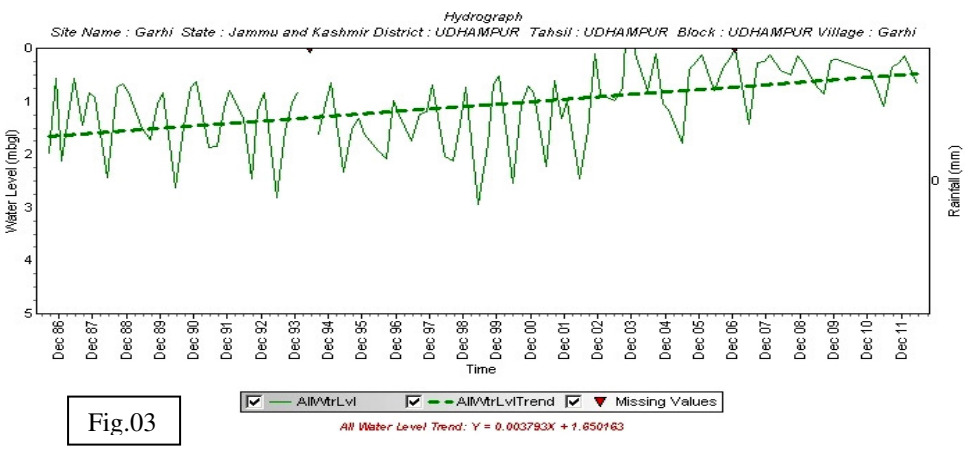


Fig.03

Springs

Ground water also emerges in the form of springs at contact of pervious and impervious beds along fault planes and other structural features. A good number of springs are present in the district. Springs are formed when water table is intercepted at topography and river terraces. In the district, the springs are found at joints and fissures whereas in the limestone formation (Sirban Limestone) springs are seen in solution cavity and cavernous structures.

5.4 GROUND WATER RESOURCES

The dynamic ground water resources of Udhampur district have been estimated for Valley areas only. Rainfall is the major source of groundwater recharge apart from influent seepage from rivers, seepage from canal, 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 Udhampur district, recharge from rainfall is of the order of 2980.64 ha m whereas recharge from other sources is 3116.25 ha m and total ground water recharge is worked out for the district is 6096.89 ha m as given in the table. The total ground water draft for domestic & industrial use for Jammu district is of the order 2046.00 ha m whereas for irrigation use is 18.00 ha m. The total ground water draft for all uses is of order of 2064.00 ham. Net Annual ground water Availability is 5487.20 ham and the overall stage of ground water development in the district is 37.61%. Allocation for Domestic and Industrial requirement supply for 2025 is 3366.00 ha m and Net Ground Water Availability for future Irrigation Development is 2103.20 ham.

Total Ground Water Availability of Udhampur district has been estimated considering the Dynamic Ground Water Resources plus In-storage Ground Water Resources. The total fresh In-storage Ground Water Resources available in the Udhampur district is 3001 ham and Net Annual Ground Water Availability is 5487.20 ham (Dynamic) so the Total Annual Ground Water Availability of Udhampur district is 8488.20 ham (Figure-04).

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

Table 8- Ground Water Resources as on March 2009

1.	Area considered for GW Assessment	454000	Ham
2.	Annual Replenish able GW Resource during monsoon & non-monsoon period	6096.89	Ham
3.	Natural Discharge	609.68	Ham
4.	Net Annual Ground Water Availability	5487.20	Ham
5.	Annual Ground Water Draft	2064.00	Ham
6.	Demand for Domestic and Industrial uses (Projected up to 2025)	3366.00	Ham
7.	Ground Water Availability for Future Irrigation	2103.20	Ham
8.	Stage of Ground Water Development	37.61	%
9.	In-storage Ground Water Resource	3001	Ham
10	Total Ground Water Resource Availability (4+9)	8488.20	Ham

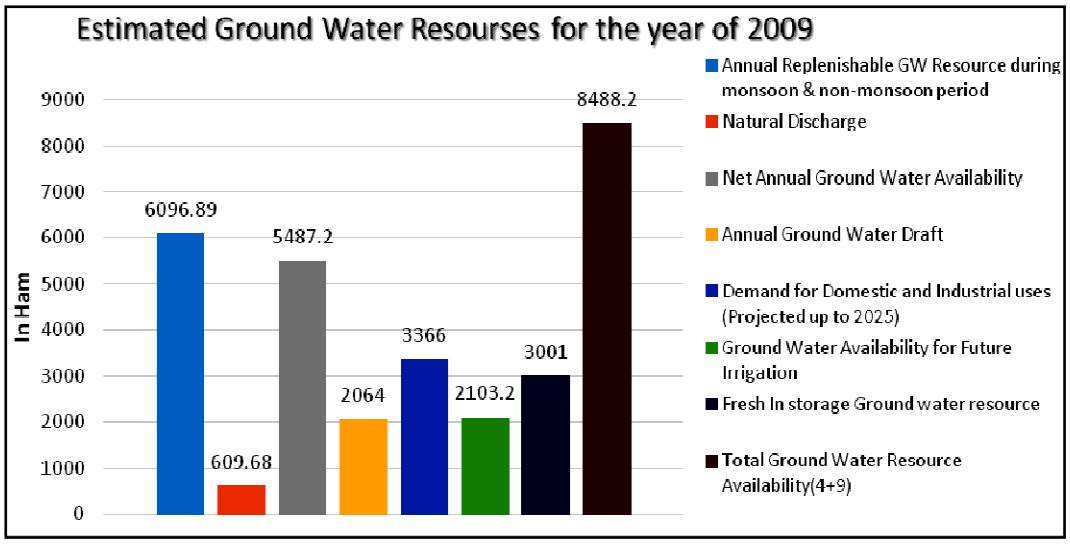


Fig. 04 Ground Water Resources as on March 2009

The stage of ground water development in Udhampur district is 37.61% and fall under "Safe" category. Udhampur district shows second highest stage of ground water development in the Jammu & Kashmir State.

5.5 GROUND WATER QUALITY

The salient features of the results of analysis of water samples collected from various ground water sources viz. springs, dug wells and shallow wells fitted with hand pumps are presented below. Mineralization of ground water depends upon 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 20 National Hydrograph Networks Stations. In May 2010, total 15 NHS water sample analyzed of Udhampur district. The Electrochemical Conductivity (E.C) of ground water (which is a degree of mineralization) varies between 170-1020 µ S /Cm at 25°C (Plate IX). Majority of samples show E.C value ranging from 170-750 µS/cm except for some part of Udhampur valley. Carbonate ions are reported in those samples in which pH value is more than 8.30, whereas rest of the samples have only bicarbonate ions. All samples show nitrate concentration less than maximum permissible limit of BIS i.e. less than 45 mg/l.

Table-9 Range of Chemical Quality Parameters in Udhampur district

S. No.	Chemical Constituents	Unit	Type of water samples	
			Dug-well Range	Spring Range
1.	pH		7.6-8.85	7.02-8.60
2.	Electrical Conductivity	µS/cm	170-1020	140-830
3.	CO_3	mg/l	Tr-36	0-12
4.	HCO_3	mg/l	98-360	61-531
5.	Total Hardness ($CaCo_3$)	mg/l	70-340	65-345
6.	Iron	mg/l	Tr-1.5	ND
7.	Chloride	mg/l	7.1-50	3.5-35
8.	Nitrate	mg/l	1.2-31	Tr-38
9.	Fluoride	mg/l	Tr-1.70	Tr-0.78
10.	Magnesium	mg/l	2.4 – 51	1.2– 44
11.	Calcium	mg/l	8-56	22 – 108
12.	Potassium	mg/l	1-18	0.1 – 19
13.	Sodium	mg/l	3.2-122	1.0-19

It may be seen that overall quality of ground water is good both for domestic and irrigation purpose except few samples of water from hand pumps where iron, fluoride is more than the permissible limit of 1.0 mg/l and 1.5 mg/l respectively. Thus there is a need to quality surveillance from water supply sources particularly for nitrate (NO_3), fluoride (F) and iron (Fe) content. The spot values of chloride and iron found in analysis of water samples is shown in Plate-X.

5.6 STATUS OF GROUND WATER DEVELOPMENT

In Udhampur district, stage of ground water development is 37%. In these areas, all the major irrigation and drinking water supply depend on diversion canals, khuls, tube wells, borewells, springs and river water. PHED and I&FC are nodal agencies in the State Government who had made 04 tube wells and 28 dug well (Digest of statistics 2008-09) as abstraction structures and Gross ground water draft for all uses is 2064 ham.

6.0 GROUND WATER MANANGEMENT STRATEGY

6.1 GROUND WATER DEVLOPEMENT

- The untouched hilly part of the Udhampur District occupied by Siwalik formation need to be explored by CGWB. (Now being developed by the State government)

- Since, there are data gaps in monitoring of depth to water levels, it is recommended to install piezometers to observe behavioral changes of water levels over a long period of time in order to know the trends.

- Isolated micro-valley fills across minor rivers/streams are also suitable for percolation wells.

- Valley fill deposits along Chenab River are the most suitable for construction of tube wells.

- Based upon climatic conditions, topography, hydrogeology of the area rainwater harvesting & RTRWH are ideal solutions for augmenting water resources particularly in sloppy hilly areas & chronic water scarce areas.

- There is thus need to create awareness for water conservation and augmentation and proper waste disposal for protecting water sources.

- In addition, micro level efforts are required for proper implementation of development programme.

6.2 WATER CONSERVATION & ARTIFICIAL RECHARGE

Ground water extraction through wells, hand pumps, tube-wells, bowlis & springs is a major part of water supply to both rural and urban areas but availability of water during summer is limited in hilly uplands particularly in drought years and requires immediate attention to augment this resource. Based upon climatic conditions, topography, hydrogeology of the area, suitable structure for rain water harvesting and artificial recharge to ground water are

required. Roof top rainwater harvesting need to be adopted in urban areas and proper scientific intervention for spring development and revival is required in water scarce areas.

All the old tanks/ ponds are required to be revived. These practices will help to conserve surface water with resources otherwise being lost and revive depleting/drying of springs.

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

7.0 GROUND WATER RELATED ISSUES & PROBLEMS

The district being hilly and mountainous, most of the rainfall goes waste as runoff. This has resulted in varying degree of recharge to ground water. In such hard rock terrain, since aquifers are discontinuous and having 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 and poor ground water potential.

8.0 AWARENESS & TRAINING ACTIVITY

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

- Mass awareness programme on rainwater harvesting was conducted at Town Hall, Udhampur on 16.3.2002. Officers and staff of PHE, Local people apart from school children attended the function. Lectures were delivered by the Chief Guests and Scientists of CGWB on ground water conservation and management. In all, more than 200 persons including students attended to the programme.

- Mass awareness programme on rainwater harvesting was conducted at Govt. Higher Secondary School, Reasi Udhampur district on 30-12-2004. Officers and staff of PHE, Local people apart from school children attended the function. Lectures were delivered by the Chief Guests and Scientists of CGWB on ground water conservation and management. In all, more than 250 persons including students attended to the programme.

- Mass awareness programme on rainwater harvesting was conducted at Town Hall, Ramnagar, Udhampur district on 30-3-2007. Officers and staff of PHE, Local people apart from school children attended the function. Lectures were delivered by the Chief Guests and Scientists of CGWB on ground water conservation and management. In all, more than 200 persons including students attended to the programme.

- Mass awareness programme on rainwater harvesting was conducted at PHE Complex, Mansar Udhampur district on 22-3-2007. Officers and staff of PHE, Local people apart from school children attended the function. Lectures were delivered by the Chief Guests and Scientists of CGWB on ground water conservation and management. In all, more than 150 persons including students attended to the programme.

- Mass Awareness Program on "Ground Water Conservation and Protection" in tribal area at Govt. Higher Secondary School, Ghordi, Tehsil Ramnagar, Udhampur District on 18th February, 2012, which also included Jal Yatra and Painting Competition on 'Conserve & Protect Water'. A total of 30 selected students from various schools in & around Ghordi village participated in the Painting Competition on 'Conserve & Protect Water'. There paintings were depicting the messages of ways & means to conserve water. A group of around 135 people comprising of 100 students, teachers and 25 local villagers took part in 'Jal Yatra'.

- Training programme on rainwater harvesting and artificial recharge to ground water was conducted at Town Hall, Ramnagar on 20.3.2007. The training was attended by school teachers, staff and officers from various government departments. Regional Director and delegates delivered lectures on rainwater harvesting, water conservation and management. In all about 50 persons mainly teachers and officers attended to the training programme.

- Training programme on rainwater harvesting and artificial recharge to ground water was conducted at PHE Complex, Mansar Udhampur District on 22.3.2007. Teachers, staff and officers from various Government departments attended the training. Regional Director and delegates delivered lectures on rainwater harvesting, water conservation and management. In all about 50 persons mainly teachers and officers attended to the training programme.

- A training programme on Roof Top Rain Water Harvesting & Artificial Recharge to Ground Water was conducted in the office of Chief Engineer, MES, Udhampur zone on 11th February, 2011. The Chief Guest of the programme was Major General A K Chaturvedi, Chief Engineer, Northern Command. Brigadier C Bharti, S C, Chief Engineer, Udhampur Zone Sh. S R Ramavat, Principal Director, Udhampur Zone were guests of honour. Sh. Abhijit Ray, Regional Director, CGWB, Jammu presided over the programme. The training program dealt on Water Conservation, Rainwater harvesting, Roof Top Rainwater Harvesting, Artificial Recharge to ground water, About 35 Army officers of the rank of Director/Assistant Director/GE/AGE/JE of MES, Udhampur attended the programme. Certificate of Participation were distributed to the participants.

- Under the 'Rajiv Gandhi National Ground Water Training Institute', Central Ground Water Board, North Western Himalayan Region, Jammu organized a 5 days Orientation Training Program on "Ground Water Development & Management" at Hotel Dolphin, Udhampur from 07th to 11th December, 2010. The training program dealt on Rainwater harvesting, Artificial Recharge, Drilling Concepts and Experiences, Ground Water Quality, Water conservation, Geophysical Surface Surveys, Borehole logging etc. A one-day field visit was also organized to Sanasar area, demonstrating various hydrogeological conditions, water sample collection techniques etc. About 36 numbers of Scientists / Engineers of various departments like PHED, I&FC, SKUAST, Agriculture Departments of Jammu & Srinagar attended this training program. Sh. N. K. Rohmetra, Superintending Engineer, PHE, Hydraulic Circle, Udhampur and Sh. Abhijit Ray, Regional Director, CGWB, Jammu distributed the certificates of successful completion of training to the participants. Sh. N. K. Rohmetra, SE, PHE thanked the Ministry of Water Resources, Government of India, on behalf of District Administration for organizing such a training program at the district level first time in the State.

- **Participation in Exhibition, Mela, Fair etc**
  In order to create awareness, CGWB has been exhibiting its models, posters, displays etc. during mass awareness programmes and ground water management training programmes conducted in the district.

- **Presentations & Lectures delivered in public forum / Radio/TV/Institution of repute/Grassroots Association /NGO/Academic Institutions etc**

  Presentations and lectures were delivered amongst gathering during mass awareness programmes (MAP) and water management training programmes (WMTP) conducted in the district.

9.0 AREAS NOTIFIED BY CGWA / SGWA

The stage of ground water development in Udhampur district is 37.61% only and the district falls in safe category. Thus, no area or block has been notified for ground water development point of view.

10.0 RECOMMENDATIONS

The broad recommendations are made for scientific and systemic management for integrated development of ground water resources in the area. These recommendations include

1. Terrace plain of the area faces a shortage of water for both domestic and irrigation use. Following steps may solve this.

i) Planning for exploitation of groundwater should be made on the basis of local natural conditions in the area. South of Udhampur town contain very fine material overlying Siwalik rocks. Where only dug well and to some extent hand pumps will be successful. Such a case is also considered for spring development as major ground water source but their discharge is presently deteriorating. So, it is recommended that the proper plantation in the catchment area of spring should be done as per the long-term strategy.

ii) Some of the springs are untapped or not properly tapped. To minimize the wastage of spring water it should be tapped properly.

iii) Some bund may be made in catchment area of spring by which rain water wasted as surface runoff will be recharged to ground water. This will enhance discharge of springs.

iv) Protected and development of existing village ponds/ tanks/ talabs can be revived and utilized for augmenting water resources and recharging ground water. These structures can harvest water and utilized for meeting domestic and local needs.

v) Mining of the riverbeds should be prohibited as it leads to fall in the water levels & it also damages natural river system.

2. Hydrograph network stations in terrace plain are not sufficient and their measuring points, depths of well, reduced levels should be changed. It is recommended that these hydrograph stations may be surveyed again. It is also recommended that some new hydrograph stations should be established so this will help in a better and actual assessment of magnitude of ground water fluctuation in the area.

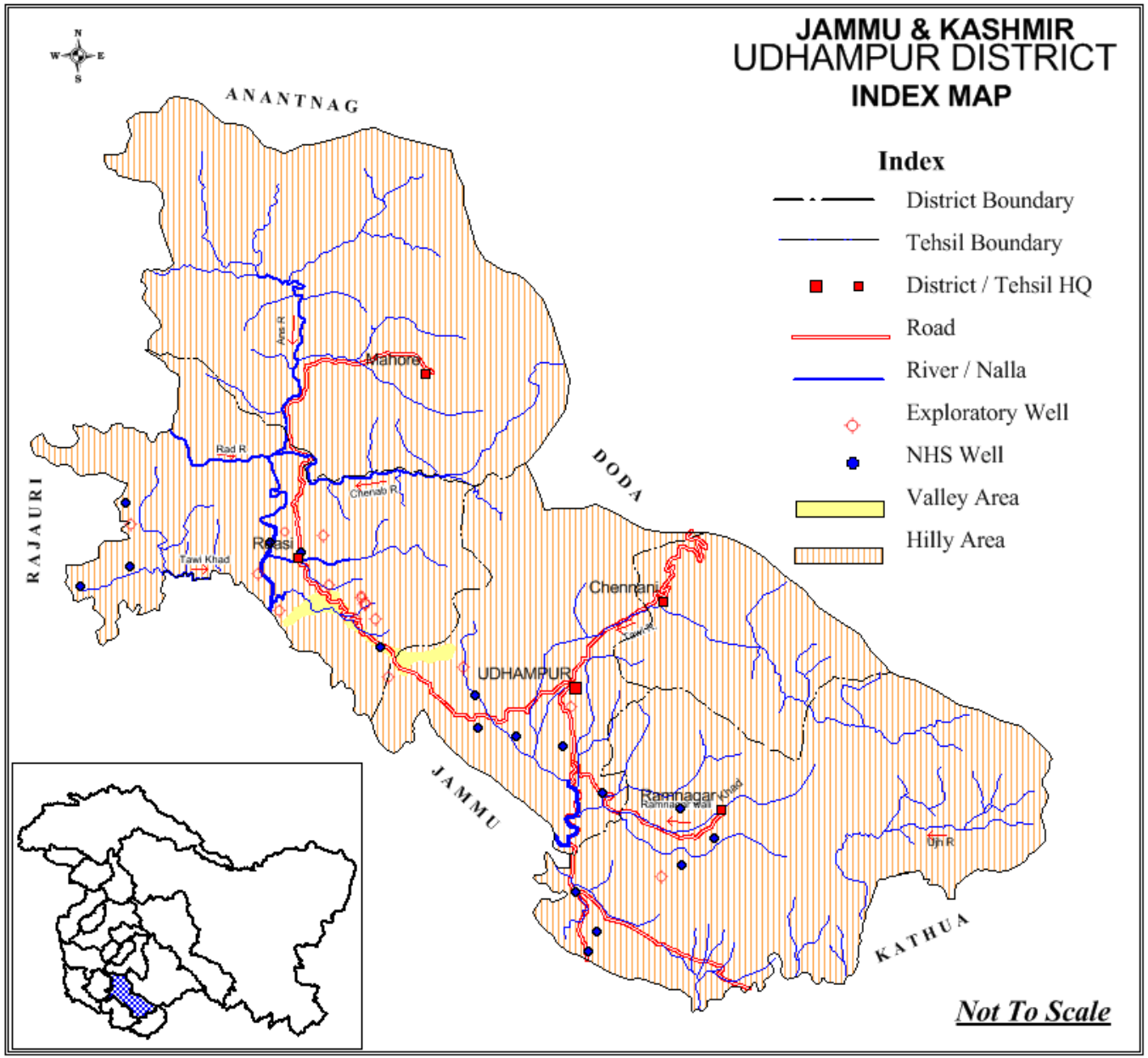
3. The nature of subsurface formation in the present area is very complex. Therefore, a site selection for construction of any water source structure is required. It is very essential that a thoughtfully designed well assembly should be lowered in the Tube well. For this purpose proper sampling at the time of drilling and time v/s drilling depth graph should be drawn.

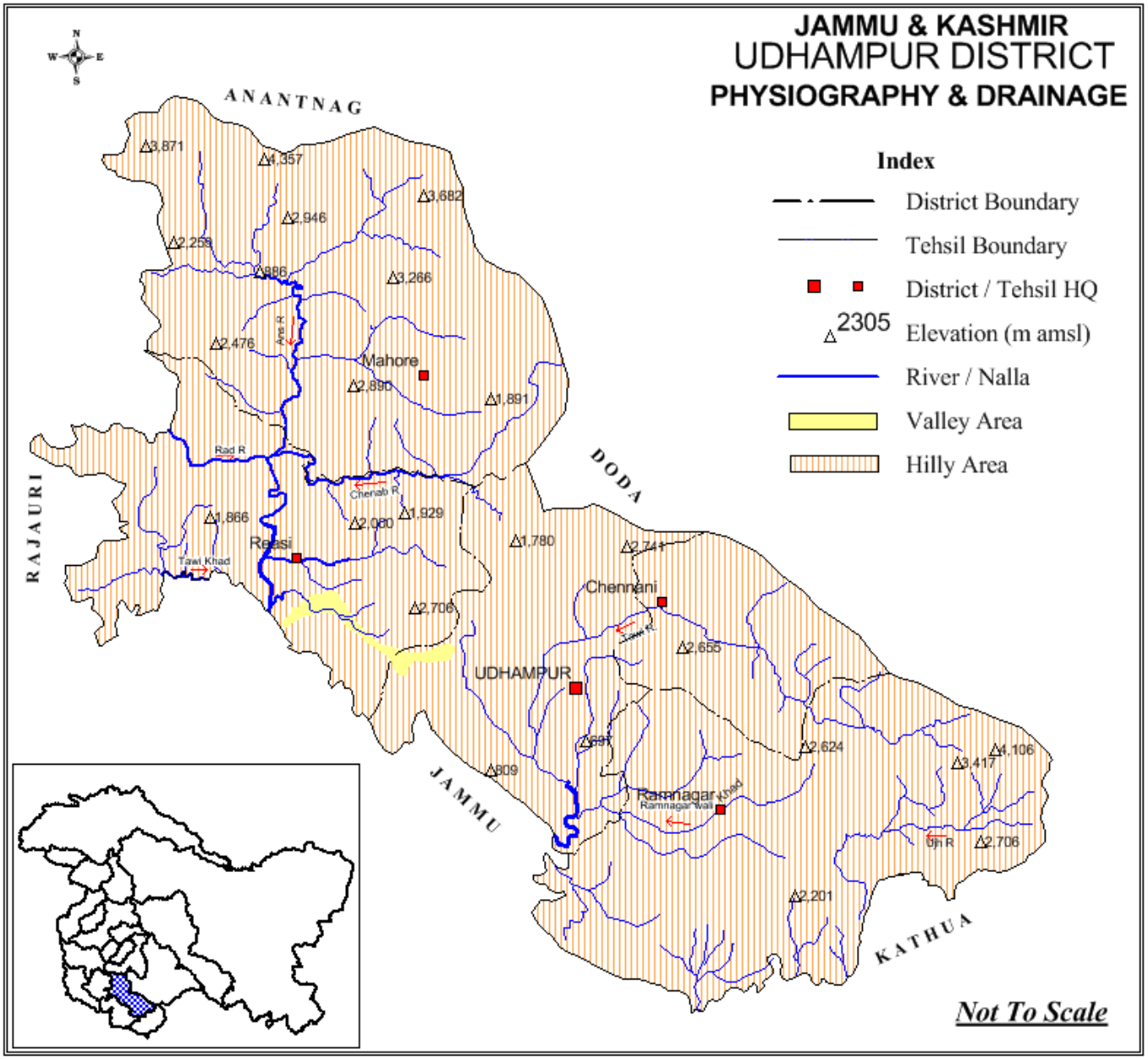
4. A major part of rainfall takes place during a short period of a year. It is recommended that a rainwater harvesting may be done so that this water will be used during lean period of rainfall.

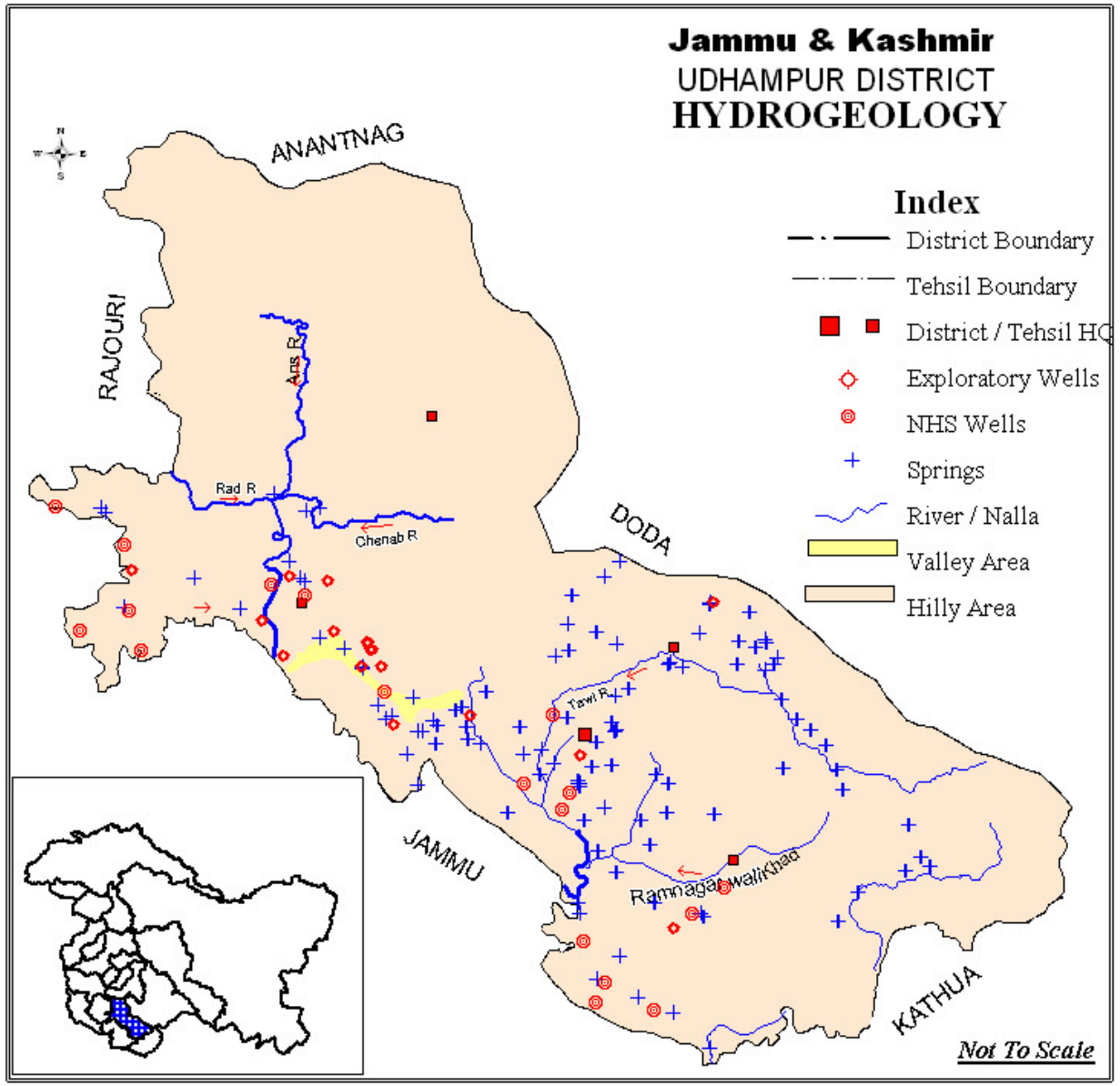
5 Ground water is confined to weaker zones in hard rock formation. These weaker zones viz. thrust, shear plains has large amounts of water. It is therefore very important to mark locations of these weaker zones before selecting a tube well site.

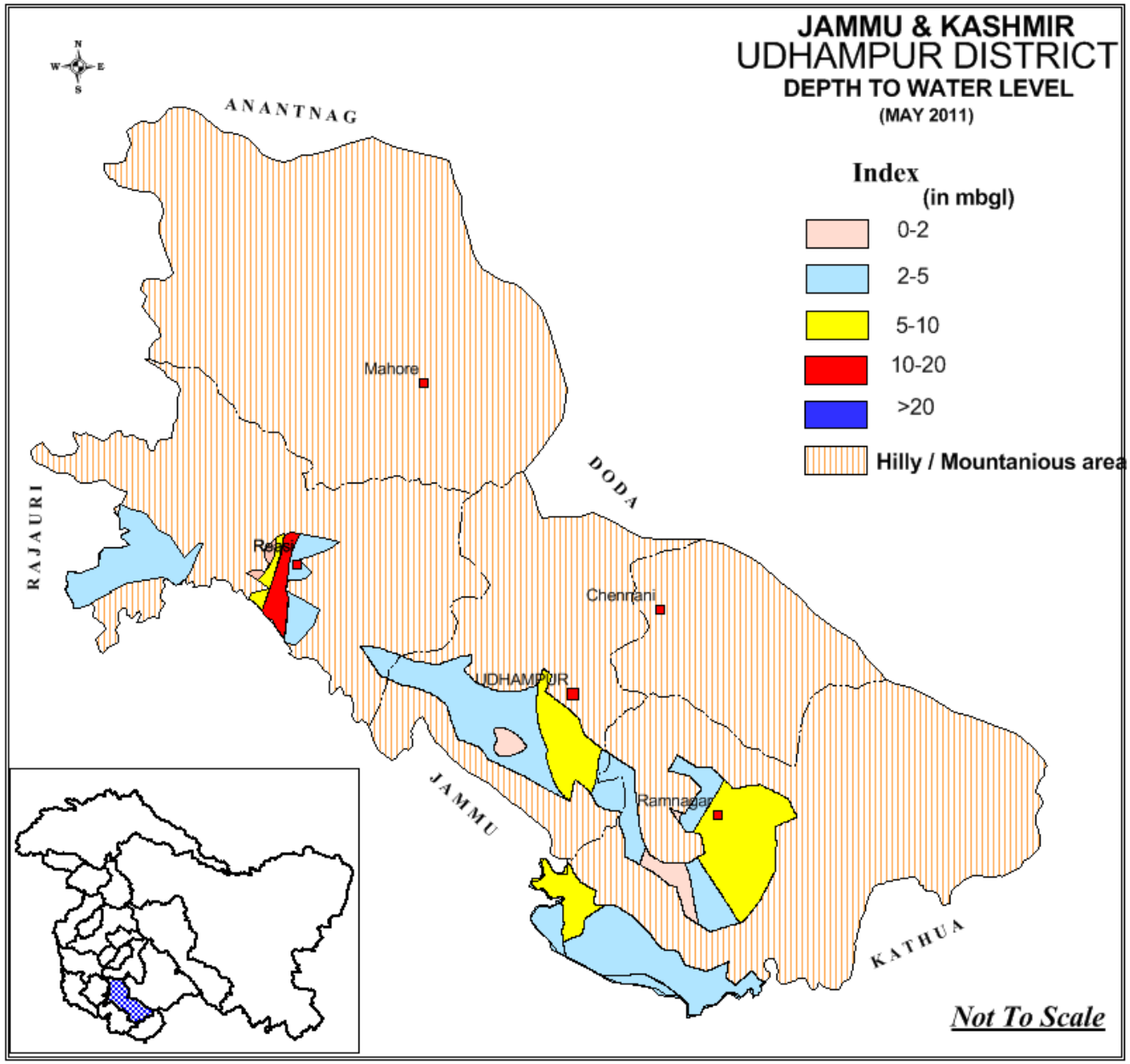
6. The terraces formed along banks of Tawi River and other perennial Nallas are the potential areas for ground water development and at places suitable for construction of tube well provided grain size is coarse and has considerable thickness.

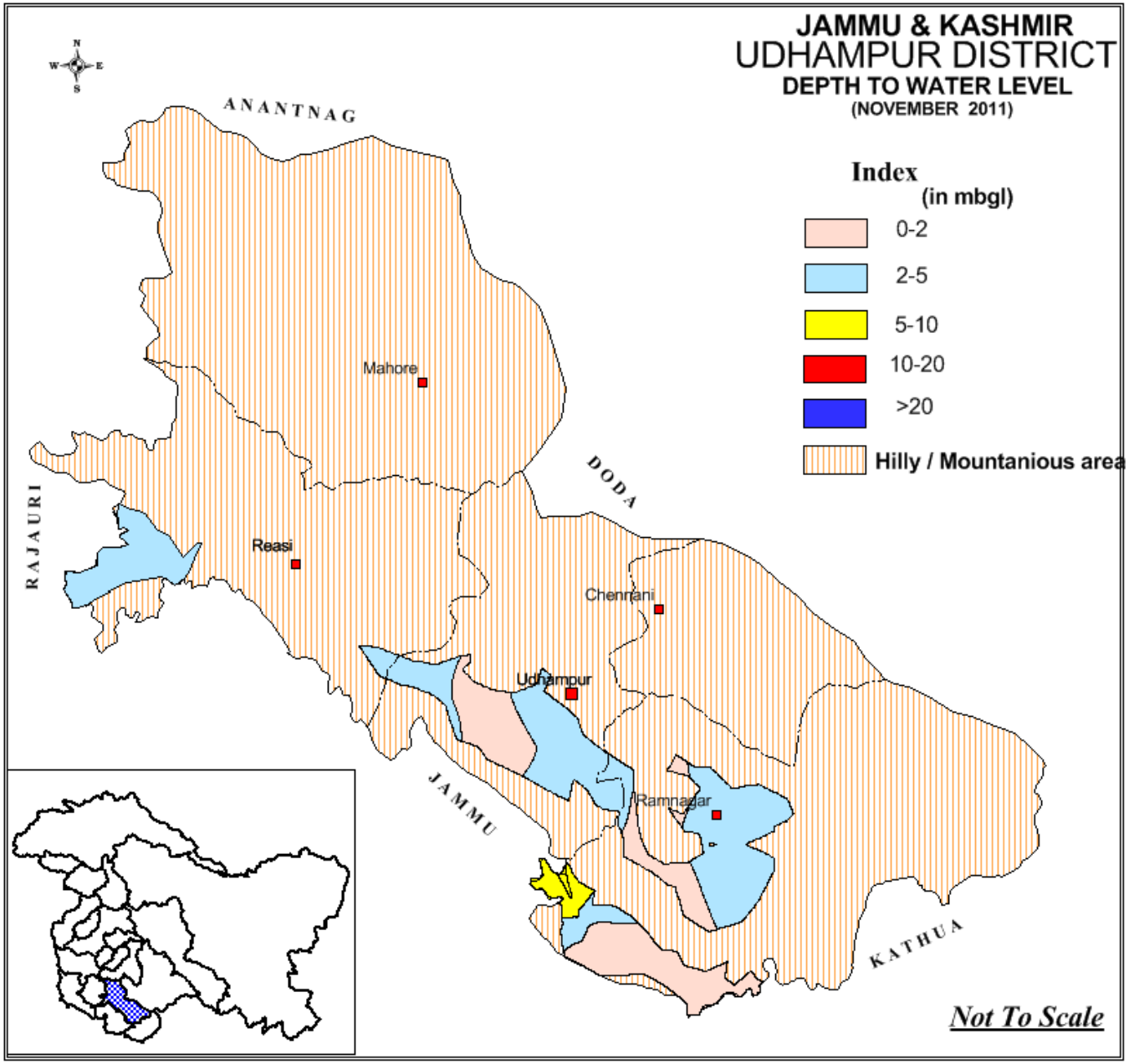
SAVE WATER – SAVE LIFE

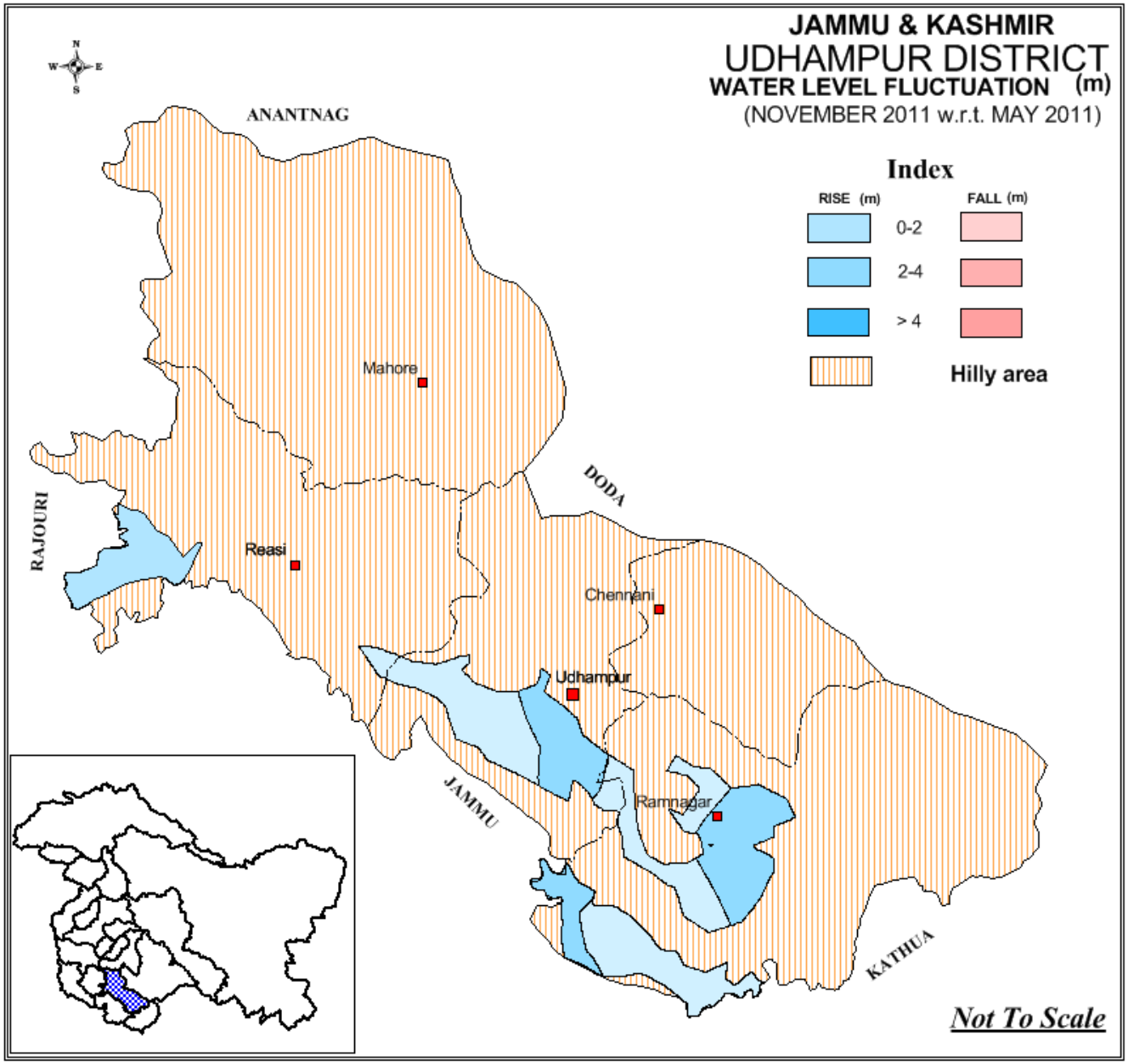

JAMMU & KASHMIR
UDHAMPUR DISTRICT
INDEX MAP
Index
District Boundary
Tehsil Boundary
District / Tehsil HQ
Road
River / Nalla
Exploratory Well
NHS Well
Valley Area
Hilly Area
ANANTNAG
RAJAURI
DODA
JAMMU
KATHUA
Mahore
Rad R
Ans R
Chenab R
Reasi
Tawi Khad
Chenrani
Tawi R
UDHAMPUR
Ramnagar
Ujh R
Not To Scale

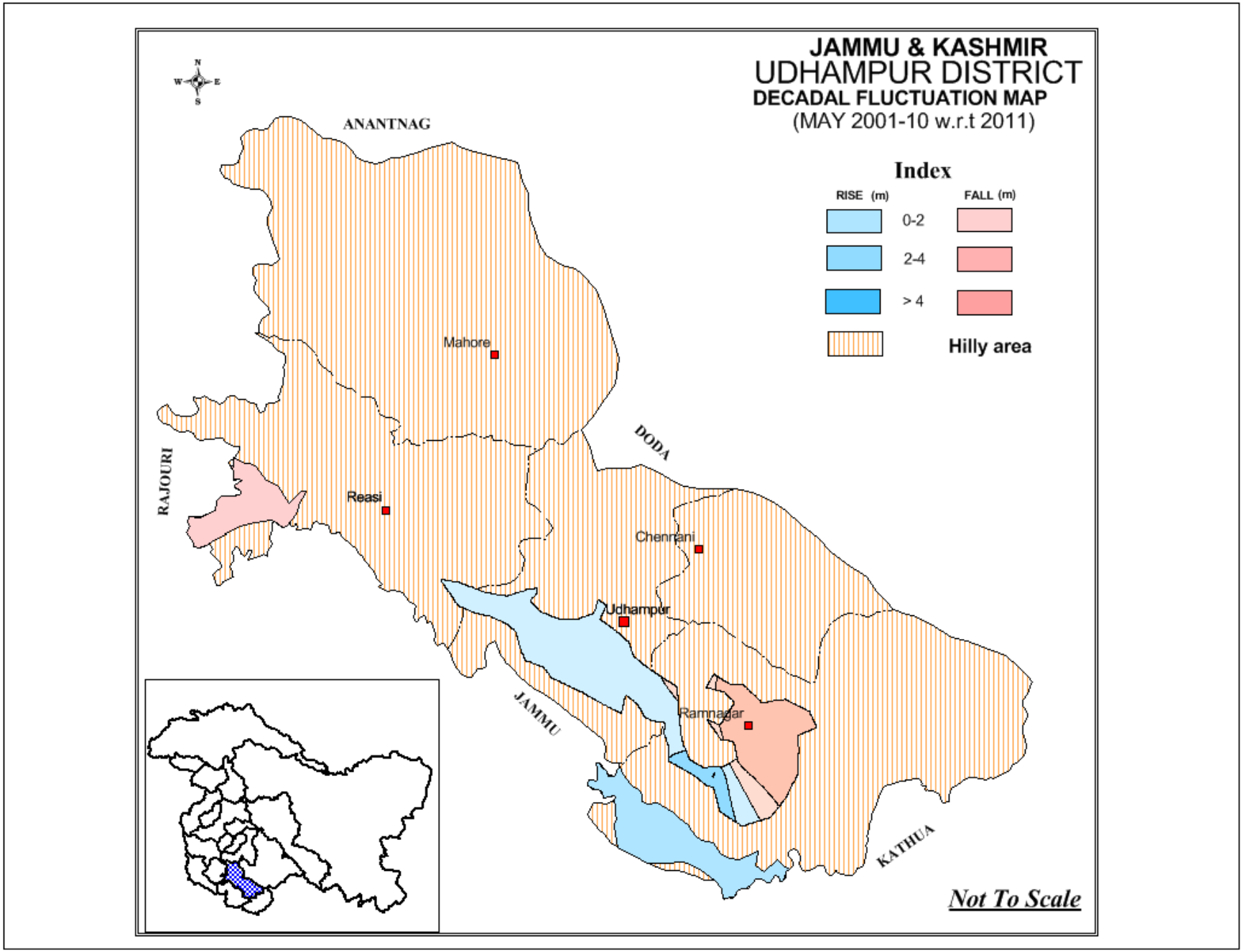

JAMMU & KASHMIR
UDHAMPUR DISTRICT
PHYSIOGRAPHY & DRAINAGE
Index
District Boundary
Tehsil Boundary
District / Tehsil HQ
2305 Elevation (m amsl)
River / Nalla
Valley Area
Hilly Area
ANANTNAG
RAJAURI
DODA
JAMMU
KATHUA
Mahore
Reasi
Chennani
UDHAMPUR
Ramnagar
Rad R
Chenab R
Tawi Khad
Tawi R
Ujh R
Ans R
Ramnagar Nala
△3,871
△1,357
△3,682
△2,946
△2,259
△886
△3,266
△2,476
△2,890
△1,891
△1,866
△2,080
△1,929
△1,780
△2,741
△2,706
△2,655
△691
△2,624
△4,106
△3,417
△809
△2,706
△2,201
Not To Scale

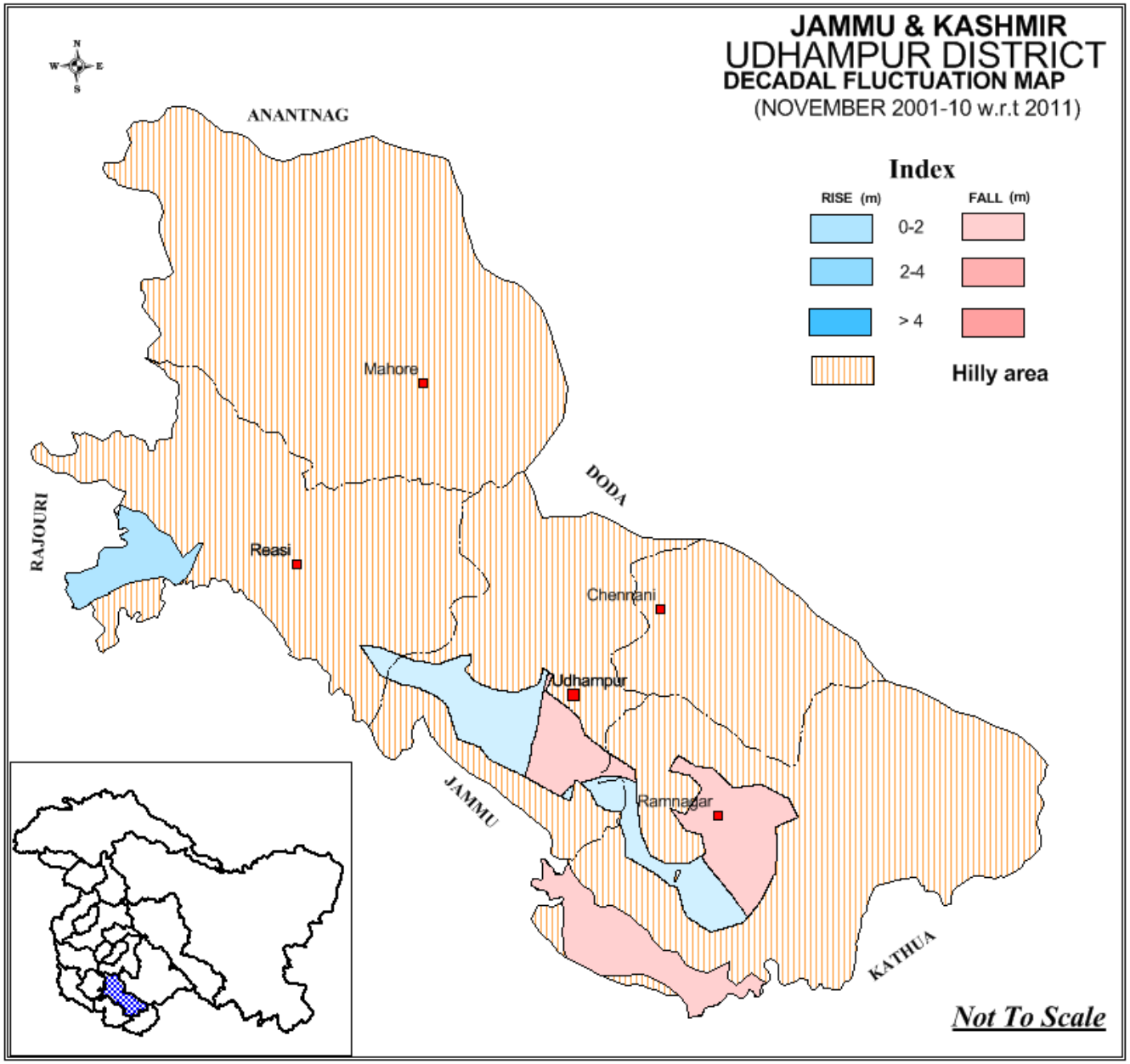

Jammu & Kashmir
UDHAMPUR DISTRICT
HYDROGEOLOGY
Index
District Boundary
Tehsil Boundary
District / Tehsil HQ
Exploratory Wells
NHS Wells
Springs
River / Nalla
Valley Area
Hilly Area
ANANTNAG
RAJOURI
DODA
JAMMU
KATHUA
Ans R
Rad R
Chenab R
Tawi R
Ramnagar
Walikhad
Not To Scale


JAMMU & KASHMIR
UDHAMPUR DISTRICT
DEPTH TO WATER LEVEL
(MAY 2011)
Index
(in mbgl)
0-2
2-5
5-10
10-20
>20
Hilly / Mountanious area
ANANTNAG
RAJAURI
DODA
JAMMU
KATHUA
Mahore
Reasi
Chenrani
UDHAMPUR
Ramnagar
Not To Scale


JAMMU & KASHMIR
UDHAMPUR DISTRICT
DEPTH TO WATER LEVEL
(NOVEMBER 2011)
Index
(in mbgl)
0-2
2-5
5-10
10-20
>20
Hilly / Mountanious area
ANANTNAG
RAJAURI
DODA
JAMMU
KATHUA
Mahore
Reasi
Chenrani
Udhampur
Ramnagar
Not To Scale


JAMMU & KASHMIR
UDHAMPUR DISTRICT
WATER LEVEL FLUCTUATION (m)
(NOVEMBER 2011 w.r.t. MAY 2011)
Index
RISE (m)
FALL (m)
0-2
2-4
> 4
Hilly area
ANANTNAG
Mahore
DODA
RAJOURI
Reasi
Chennani
Udhampur
JAMMU
Ramnagar
KATHUA
Not To Scale


JAMMU & KASHMIR
UDHAMPUR DISTRICT
DECADAL FLUCTUATION MAP
(MAY 2001-10 w.r.t 2011)
Index
RISE (m)
FALL (m)
0-2
2-4
> 4
Hilly area
ANANTNAG
Mahore
DODA
RAJOURI
Reasi
Chenrani
Udhampur
JAMMU
Ramnagar
KATHUA
Not To Scale


JAMMU & KASHMIR
UDHAMPUR DISTRICT
DECADAL FLUCTUATION MAP
(NOVEMBER 2001-10 w.r.t 2011)
Index
RISE (m)
FALL (m)
0-2
2-4
> 4
Hilly area
ANANTNAG
Mahore
DODA
RAJOURI
Reasi
Chenrani
Udhampur
JAMMU
Ramnagar
KATHUA
Not To Scale

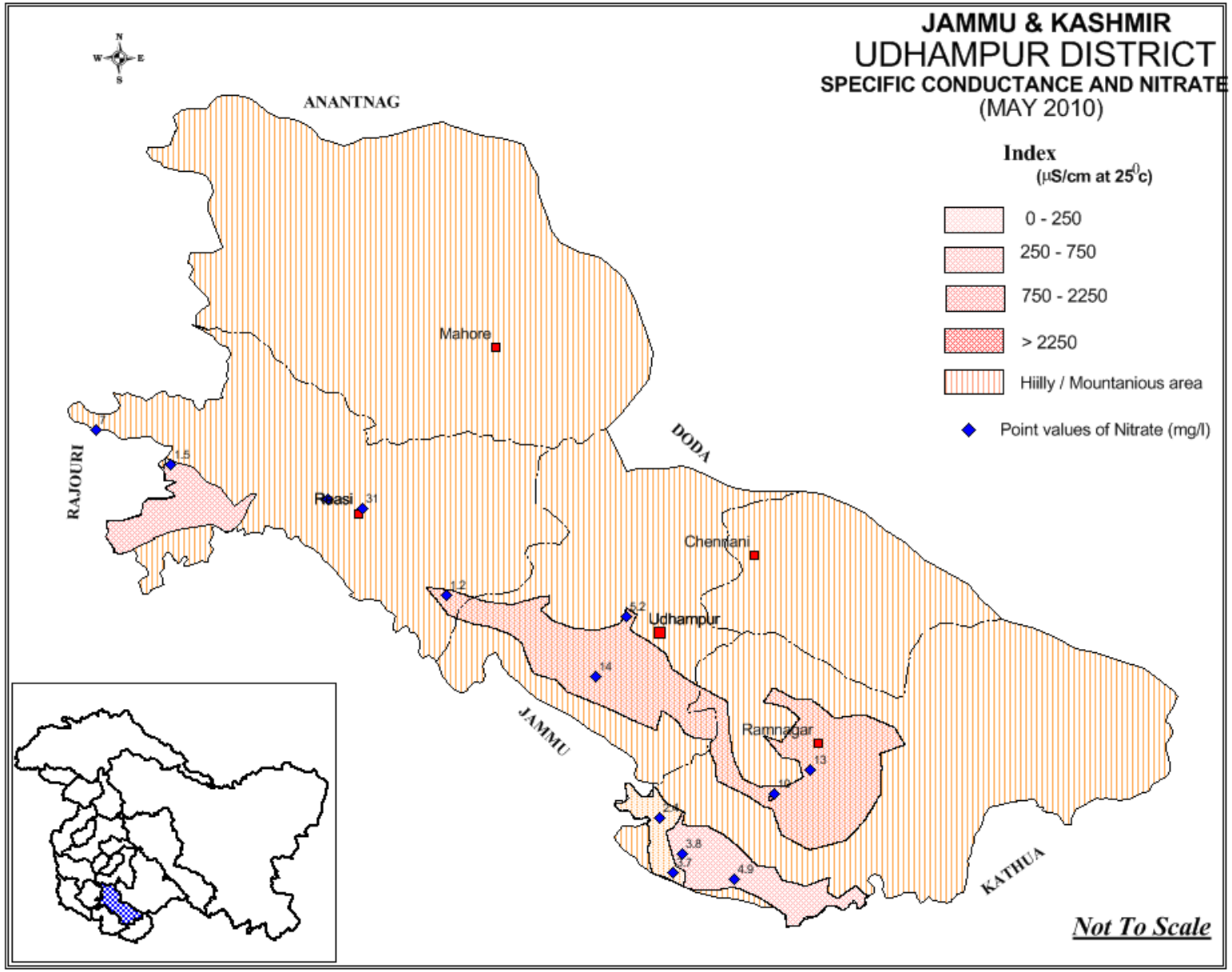
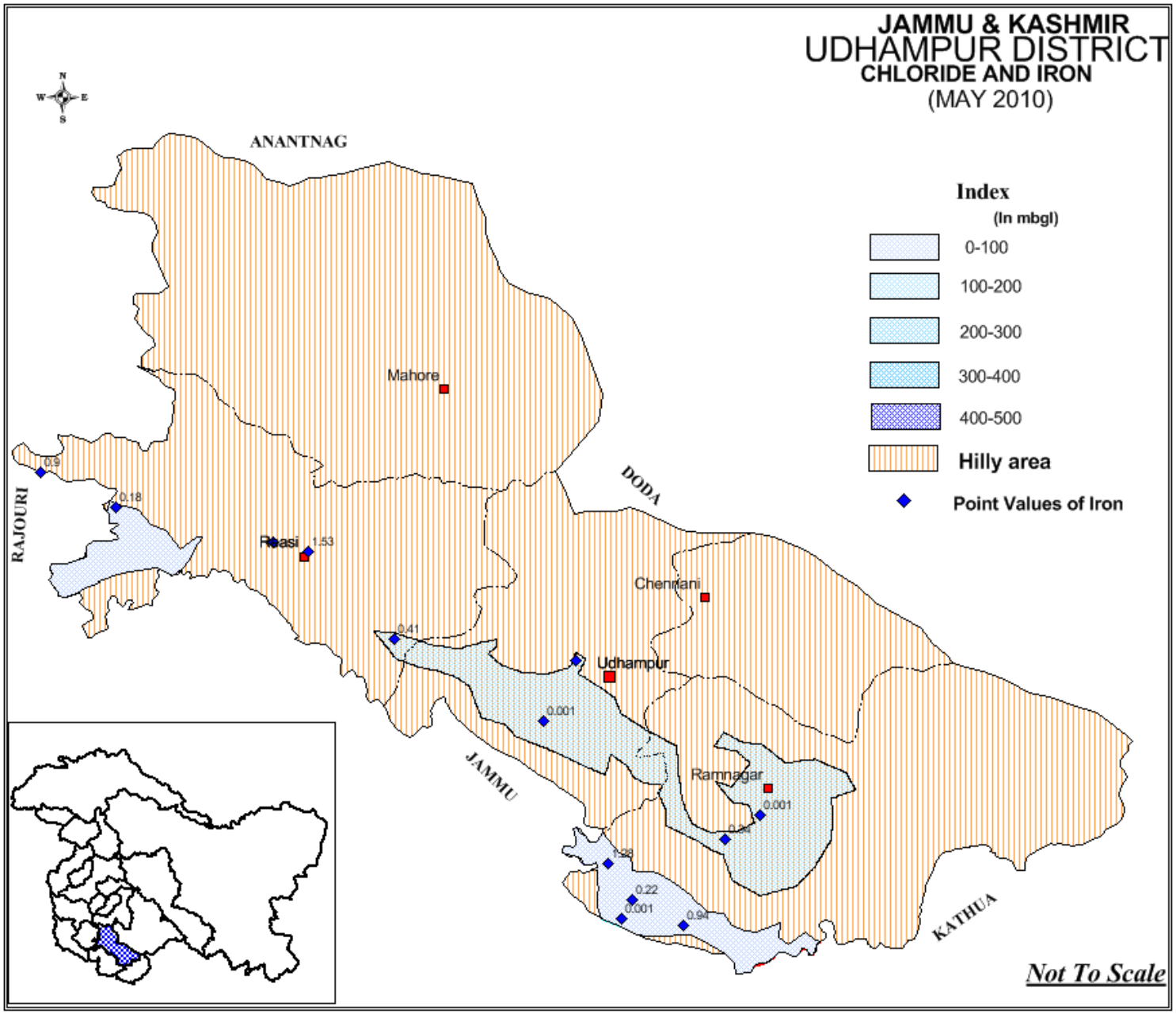

JAMMU & KASHMIR
UDHAMPUR DISTRICT
SPECIFIC CONDUCTANCE AND NITRATE
(MAY 2010)
Index
(µS/cm at 25°c)
0 - 250
250 - 750
750 - 2250
> 2250
Hiilly / Mountanious area
Point values of Nitrate (mg/l)
ANANTNAG
RAJOURI
DODA
JAMMU
KATHUA
Mahore
Reasi
Chennani
Udhampur
Ramnagar
1.5
3.1
1.2
5.2
1.4
1.3
3.8
4.1
4.9
Not To Scale

Plate-X


JAMMU & KASHMIR
UDHAMPUR DISTRICT
CHLORIDE AND IRON
(MAY 2010)
ANANTNAG
Index
(In mbgl)
0-100
100-200
200-300
300-400
400-500
Hilly area
Point Values of Iron
Mahore
RAJOURI
DODA
JAMMU
KATHUA
Reasi
Chennani
Udhampur
Ramnagar
0.9
0.18
1.53
0.41
0.001
0.001
0.94
0.22
0.001
0.94
Not To Scale