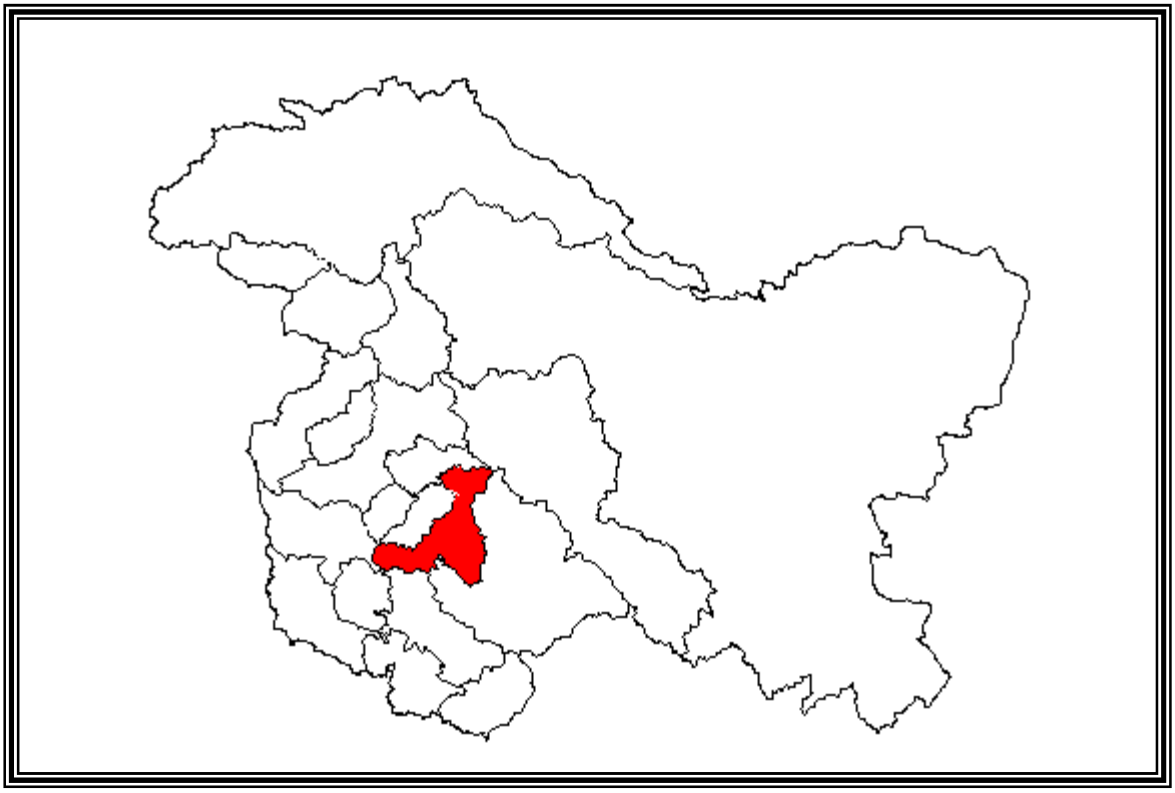
Government of India
Ministry Of Water Resources
CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET

ANANTNAG DISTRICT, JAMMU & KASHMIR



NORTH WESTERN HIMALAYAN REGION
JAMMU

March 2013

GROUND WATER INFORMATION BOOKLET

ANANTNAG DISTRICT, JAMMU & KASHMIR

CONTENTS

ANANTNAG DISTRICT AT A GLANCE

Sl. No	ITEMS	STATISTICS
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	3,984
	ii) Administrative Divisions (2009-10) • Number of Tehsil • Number of CD Blocks • Number of Panchayats • Number of Villages Inhabited Un-inhabited	 5 13 456 620 605 15
	iii) Population (2001 Census) • Total population • Population Density (person/sq km) • Muslim & others Population • Sex Ratio	 11,72,434 persons 294 98.51% & 1.49% 922
	iv) Average Annual Rainfall (mm)	1103.0 mm
2.	GEOMORPHOLOGY	
	Major Physiographic units	• High Karewa Plateau lands • Sharp ridges of hard rock • Intervening valleys & River Terraces
	Average Height	1700 m amsl
	Major Drainages • Indus Basin • Jhelum Sub-Basin	 Jhelum, Breng, Lidar,Vishav,Sandarn rivers
3.	LAND USE (2009-10) sq.km *(Source- Digest of Statistics 2009-10)*	
	• Forest area • Gross Irrigated area • Canal • Tanks • Wells • Other Source • Net area sown	2068 309.45 272.61 9.07 0.12 27.65 1572.72
4.	MAJOR SOIL TYPES	• Soils developed on Karewa tops and upland areas are medium to fine textured and known as Hapludalf • Soils found on plains are clay loam in nature and are dark brown

Sl. NO	ITEMS	STATISTICS
5.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (Monitored up to 2012) • Number of Dug Wells • Number of Piezometers	 02 Nil
6.	PREDOMINANT GEOLOGICAL FORMATIONS	• Quaternary Alluvium • Karewa formations • Older Metamorphics
7.	HYDROGEOLOGY	
	Major Water Bearing Formations	
	1.Unconsolidated layered formations- (Karewa formations – Both upper and Lower Karewas)	Covering (25%)
	• Yield prospects • GW structures	Low to Moderate (10-20 lps) Handpumps, Dugwells & Tubewells
	2. Unconsolidated porous sediments (Alluvium)	Intermontaine small valleys and main Kashmir Valley area (50%)
	• Yield prospects • GW structures	Low to Moderate (10-55 lps) Handpumps, Dugwells & Tubewells
	3. Consolidated Formations/ Hard Rocks (Panjal Traps, Dogra slates, Zewan beds/ Gondwana formations)	Covering about 25% of the district
	• Yield prospects • GW structures	Very Low (<2 lps) Springs & Dugwells
	Avg. Depth to water level • Pre-monsoon • Post – monsoon	 4.50 m bgl 4.00 m bgl
8.	GROUND WATER EXPLORATION BY CGWB (As on 31.12.2012)	
	• No of wells drilled	17 EW
	• Depth Range (m)	19.50 - 300.29
	• Discharge (lps)	2.5 - 55.0
	• Transmissivity (m^2/day)	69.0

Sl. NO	ITEMS	STATISTICS
9.	GROUND WATER QUALITY	
	Range of Chemical constituents in Ground water • EC (micro mhos/cm) • pH • Chloride (mg/l) • Fluoride (mg/l)	 183-841 6.9 5.7-104 0.1-1.0
10	DYNAMIC GROUND WATER RESOURCES (2009) in ham (valley area only)	
	• Annual Replenishable Ground Water Resources	45645.96
	• Net Annual Ground Water Draft	4860.60
	• Projected Demand for Domestic and industrial Uses up to 2025	7062
	• Stage of Ground Water Development	10.64% Safe
11	AWARENESS AND TRAINING ACTIVITY	
	• Mass Awareness Programmes	Nil
	• Water Management Training Programme	Nil
12	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	Nil
13	GROUND WATER CONTROL AND REGULATION	
	• Number of OE Blocks	Nil
	• No of Critical Blocks	Nil
	• No of blocks notified	Nil
14	MAJOR GROUND WATER PROBLEMS AND ISSUES	
	• Quality Problem	Presence of high Iron content are the main hazards

GROUND WATER INFORMATION BOOKLET

ANANTNAG DISTRICT, JAMMU & KASHMIR

1.0 INTRODUCTION

Anantnag district is southern most district of Kashmir province separated from the Jammu Province by the mighty Pir- Panjal Range & connects both the regions by the famous Jawahar Tunnel. The district with its head quarters at Anantnag forms the southern part of Kashmir valley and is located between $33^0$17'20" and $34^0$15'30" North latitude and between $74^0$30'15'' and $75^0$35'00'' East longitude and is covered by SOI Degree sheet no. 43 K, N, O. The district is bounded by Poonch district in the west, Srinagar district in the North & Kargil district in the North East and Doda district in the East, by Pulwama district in the North West and Rajouri & Udhampur districts in the South & South East. The district is approachable NH IA and is interconnected by metalled roads from all parts of the Valley.

The district is also famous for Holy Amarnath Cave situated in Pahalgam tehsil where Lacs of pilgrims visit every year from all over the country. A Kashmiri Muslim family discovered the cave.

The district has a total geographical area of 3,984 sq km, comprising of 620 villages (605 inhabited and 15 un-inhabited villages). Administratively, the district is divided into 05 tehsils (Anantnag, Kulgam, Bijbehra, Pahalgam & Dooru) and 13 blocks (Achabal, Breng, Dechnipora, D. H. Pora, Kulgam, Khovripora, Qazigund, Quimoh, Shahabad, Shangus, Devsar & Pahloo).

As per 2001 census, the district has a population of 11,72,434 persons with density of population 294 persons per sq. kms The male and female population in the district is 6,10,017 and 5,62,417 respectively with a male/female sex ratio of 922.

The main source of irrigation is canals and an area of 30,945 hectares is brought under irrigation by various sources like canals, tanks, wells and other sources. A sizeable part of the cultivated area of the district is not having the assured irrigation facilities and the agriculturists have to depend on the vagaries of weather.

Central Ground Water Board has carried out extensive hydro geological studies both by conventional and non-conventional methods in the district. Under Ground Water Exploration, 16 exploratory wells have been drilled ranging in depth from 19.50 m to 300.29 m. CGWB monitored 10 NHS, which were regularly monitored up to the year 1989 where ground water levels, fluctuations and quality were monitored.

2.0 CLIMATE AND RAINFALL

The climate of the district is Temperate cum Mediterranean type. In the higher reaches the temperature remains cold through out the year. Average minimum and maximum temperature varies from –11°C to 33°C. The winter season starts from the middle of the November and severe winter conditions continues till the middle of February / March. The district receives an average annual precipitation of about 1103 mm in the form of rain and snow for about 70 days.

3.0 GEOMORPHOLOGY AND SOILS

Anantnag district is hilly and mountainous towards the northeast and southwest with broad intermountain valley. The altitude of the hill ranges up to 3000 m amsl. The valley area in the central part of the district has flat to mildly undulating topography with its elevation about 1700 m amsl and has an area about 900 sq. km. The master slope in the area is towards north west.

The district forms part of the Jhelum sub basin of Indus basin. River Jhelum is the major river, originating at the place Verinag, with its tributaries viz., Lidder, Vishav, Sandarn rivers drains the area. Soil is poor in hilly areas and fertile in plain areas. Productivity in higher ranges is poor while in central regions is fertile.

4.0 GROUND WATER SCENARIO

4.1 GEOLOGY

The rock formations underlying the district ranges in age from Cambrian to Quaternary. The brief generalized geological succession in the district is given below

Stratigraphic Unit	*Litho logy*	*Thickness (m)*	*App. Age*
Alluvium	Clay, Silt and sand	15	Recent
Upper Karewa	Alternate greenish sandy and grey clay bed layers with calcareous Laminae	750	Plio-pliestocene
	Second fluvio-glacial boulder bed	130	
Lower Karewa	Clay (bluish grey) & Conglomerates with coarse to fine sand (greenish in colour) alternate with grey sandy clays. *Lignite and peat material*	2000	Plio- Pleistocene
	First fluvio-glacial Boulder bed	200	
Panjal Trap	Agglomeratic slates, grits and effusive rocks		Permo-Carboniferous

Panjal traps forming hilly and mountainous terrain of the district with hard formations of igneous and metamorphic rocks. The Karewas and alluvium of Quaternary and Tertiary age (Plio-Pleistocene) underlie the valley area and consists of alternate bands of sand, silt, gravel & clay, interspersed at two to three levels locally by glacial boulder beds. This formation is important from ground water point of view and sustains the water supply system in the area. This formation of Plio-Pleistocene age lies dis-conformably over the older rocks ranging in age from Cambrian to Triassic.

4.2 HYDROGEOLOGY

Hydro-geologically, the district is divided into two distinct and well-defined aquifer systems, viz., hard rock or fissured aquifer constituted mainly by semi-consolidated to consolidated rock units and soft sedimentary or porous aquifer constituted mainly by unconsolidated sediments.

The fissured formation includes the semi-consolidated to consolidated rock formations exposed in the district are igneous, metamorphic and sedimentary origin. These forms low and high hill ranges through out the district. Fractured and jointed igneous, metamorphic rocks and the scree/talus deposits in the foothills form low to moderate potential aquifers with poor to moderate yields. Occurrence and movement of the ground water is mainly controlled by secondary porosity originated due to fracturing and faulting and related tectonic disturbances and weathering. Ground water oozes in the form of springs, seepages in the hilly areas and is utilizing for domestic purposes. There are numerous springs in the district generally concentrated along the contact zones and also in the hilly area. At some places shallow hand pumps and tube wells are constructed for ground water development. The yield of the shallow tube wells and hand pumps constructed along these secondary porous zones varies from 0.5 to 3.0 lps.

The unconsolidated sediments comprising of fluvio-glacial and lacustrine deposits of Karewas and recent alluvium, terrace deposits and alluvial fan deposits constitute the porous aquifer system of the district. The sediments consist of sand, gravel, cobbles, pebbles, boulders interlayered with thick clay beds forms the prolific aquifer system. Occurrence and movement of ground water is mainly controlled by the primary inter-granular porosity in the soft sedimentary Quaternary alluvium and the Karewa formations. This unconsolidated sedimentary deposit forms multi-layer major aquifer system in the area. The sedimentary formation is +300m thick in the district as revealed by the study and ground water exploration carried out by CGWB. Ground water in the district occurs in phreatic and confined conditions in these formations. The depth of the tube wells ranges from 19.50 m at Khannabal to 300.29 m at Vessu. The water table occurs under artesian conditions at some areas. The yield of the tube wells ranges from 150 lpm at Marhamma to 1928 lpm at Ladarmal. The depth to water level ranges from 2.50 m agl (artesian free flowing) at Charsoo to 6.48 m Khannabal.

4.3 DEPTH TO WATER LEVEL

The water level from the national network of hydrograph stations (10 no) set up in the valley area of the district are available up to year 1989. A perusal of the data shows that in major part of the valley area the depth to water levels are shallow, less than 5 m bgl. The depth to water level however, ranges from 0.19 m at Anantnag to 17.80 m bgl at Rambelpur. In valley areas, open wells and tube wells are the main ground water withdrawal structures.

4.4 SPRINGS

The name of the district "Anantnag" itself indicates countless springs & streams. (Anant means countless & Nag means spring) The most famous spring is located at Verinag at the foot hills of Pir-Panjal Range & is the origin of the Jhelum river.

4.5 GROUND WATER RESOURCES

Precipitation in the form of rain and snow in the district is the major source of ground water recharge apart from the influent seepage from the perennial rivers, streams and lakes, irrigated fields and inflow from upland areas. Discharge of ground water mainly takes place from wells, tube wells and effluent seepages of ground water in the form of springs and base flow in streams.
The Ground Water Resources for the district were computed in the year 2009 for valley areas only as per the GEC-1997 methodology and are given below

1	Total Geographical Area	Ha	3,98,400
2	Valley Area	Ha	85,000
3	Annual Replenishable Ground water Resources	Ham	45645.96
4	Net Annual Ground Water Draft	Ham	4860.60
5	Projected Demand for Domestic & Industrial Uses up to 2025	Ham	7062.00
6	Stage of Ground Water Development	%	10.64

The stage of ground water development in the valley portions of the district is 10.64 % and falls in the safe category. Thus, there is scope for further ground water development.

4.6 GROUND WATER QUALITY

CGWB monitors the quality of ground water of shallow aquifers through National Hydrograph Network Stations. In addition to these, water samples are collected during the scientific studies whenever taken up. The range of chemical parameters in the district is summarized below

S.No	Parameter		Range	
			Min	Max
1	pH		6.9	7.45
2	EC	µS/cm	183	740
3	HCO_3	mg/l	113	481
4	Cl	mg/l	5.7	104
5	NO_3	mg/l	Trace	04
6	F	mg/l	0.1	1.0
7	Ca	mg/l	29	127
8	Mg	mg/l	2.6	35
9	Na	mg/l	3.2	60
10	K	mg/l	0.4	41
11	TH as $CaCO_3$	mg/l	93	368

Ground water quality in the district is generally good both for irrigation and domestic purposes. From the samples collected from ground water sources Viz., wells, tube wells, hand pumps and springs, it is observed that the EC in the GW is less than 800 µS/cm at 25°C. However, in ground water or aquifer strata at deeper levels in (lower Karewa) at places contain methane gas that makes the water non-potable at times.

4.7 STATUS OF GROUND WATER DEVELOPMENT

Ground water development in the district is on moderate scale restricted to the valley portions. All the major irrigation and drinking water supplies depend on the tube wells, dug wells in addition to various water supply schemes based on rivers/Nallahs.

Public Health Engineering and Irrigation and Flood control departments are the nodal agencies in the state concerned with the water supplies for drinking and irrigation respectively. In hilly areas the supplies depends upon the springs and shallow tube wells and hand pumps. In valley portions these state departments drilled number of tube wells with the depth ranges from 50-100 meters, with discharges varies from 5 lps to 10 lps. Apart from the tube wells number of Hand pumps with the depth ranging from 30-60 m depending upon the lithology of the area with a discharge varying from 0.5 lps to 2 lps. feeds the drinking water requirements of the district.

Central Ground Water Board had constructed 10 exploratory wells up to the year 1989. Exploratory activities again resumed from AAP 2005-2006 under accelerated exploratory drilling programme and drilled 07 exploratory wells in the district. The depth of wells ranges from 19.50 m to 300.29 m with a discharge varying from 150 lpm to 1628 lpm.

5.0 GROUND WATER MANAEMENT STRATAGY

5.1 GROUND WATER DEVELOPMENT

Most of population of the district is concentrated in valley portion drained by major river Liddar and its tributaries. In the past, development of ground water was mainly through dug wells and percolation wells along the riverbeds, nallahs and also some springs has played a major role for sustainable domestic and irrigational purposes. In some of the areas, at present too these are the only sources of water.
However, in recent years modern means of ground water development have been employed. Public Health Engineering has been constructing number of hand pumps and shallow-moderate depth tube wells for large-scale water supplies.

5.2 WATER CONSERVATION AND ARTIFICIAL RECHARGE

Extraction of ground water through dug wells, hand pumps, tube wells, and the springs are the major sources of water supply to both rural and urban areas, but the availability of the water during summer is limited particularly in drought areas and requires immediate attention to augment this resources. Based on the 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 needed to be adopted in the urban areas and proper scientific intervention for spring development and revival is required in water scarce areas.

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

6. GROUND WATER RELATED ISSUES AND PROBLEMS

The Karewa formations, which underlie the district, are deposited under fluvio-glacial and lacustrine conditions. Due to the deposition under the lacustrine environment, occurrence of Methane gas is the common phenomenon in the various part of the district. The lateral and vertical extent of the sediments of Karewa formation varies and represents different hydro-geological set up. In the hard rock areas, the aquifers are discontinuous and localized and of different hydrogeological set up.

Some of the common issues are the occurrence of Methane gas and accompanied silt, quality related problems particularly for 'Fe' and occurrence of silty aquifers and boulders for development of ground water. These ground water issues and problems are localized and need to be focused by taking micro level studies in a particular area.

7. AWARENESS AND TRAINING ACTIVITY

So far neither Mass Awareness Programme (MAP) nor Water Management Training Programme (WMTP) has been conducted by CGWB in the district.

8. AREAS NOTIFIED BY CGWA/SGWA

The stage of ground water development in the district is 10.64% only and falls in safe category. Thus, no area or block has been notified for ground water development.

9. RECOMMENDATIONS

- In valley areas, in addition to the traditional ground water structures like dug wells and springs, shallow to medium depth tube wells can be constructed for developing the ground water resources. Ground water resources can also be developed by constructing infiltration galleries (Percolation wells).

- In hilly terrain, springs and perennial nallahs are the major sources of water. Medium to shallow bore holes and hand pumps are useful ground water structures for meeting the domestic needs.

- Monitoring of water levels and chemical quality at representative areas is required to keep a watch on any adverse effect that ground water development may have in future.

- 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 the nallahs/tributaries in the downstream at favourable locations.

- Small ponds/tanks can be utilized for recharging ground water. These structures can be constructed for harvesting water and utilized for both recharging and meeting the domestic needs.

- Roof top rainwater harvesting practices must be adopted in hilly areas since the district receives precipitation in the form of snow and rain.

- Rainwater harvesting in general & RTRWH in particular is an ideal solution for augmenting water resources particularly in sloppy hilly & chronic water scarce areas. There is thus need to create awareness for water conservation and augmentation and proper waste disposal for protecting water sources

- 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.

Plate-I

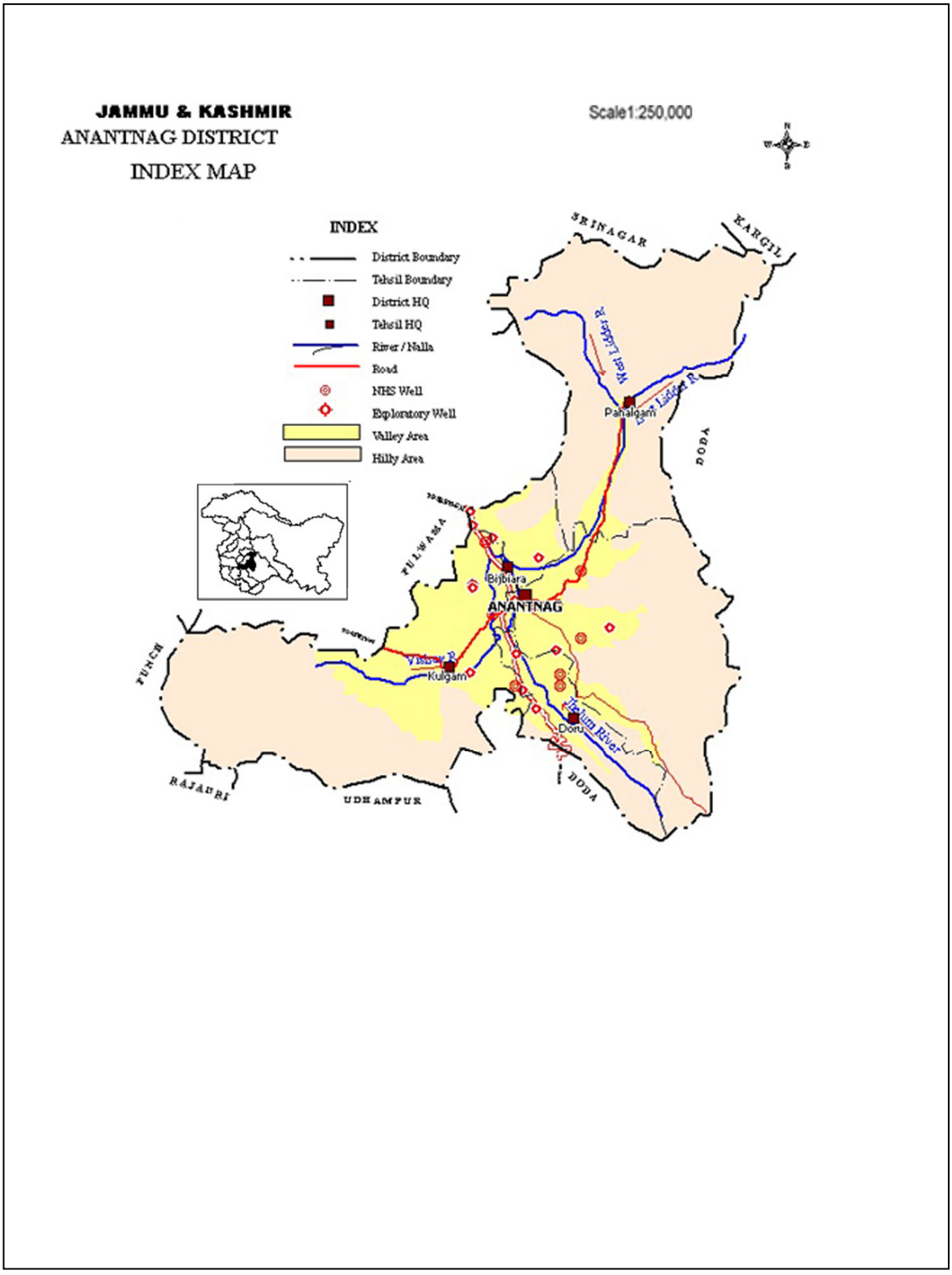
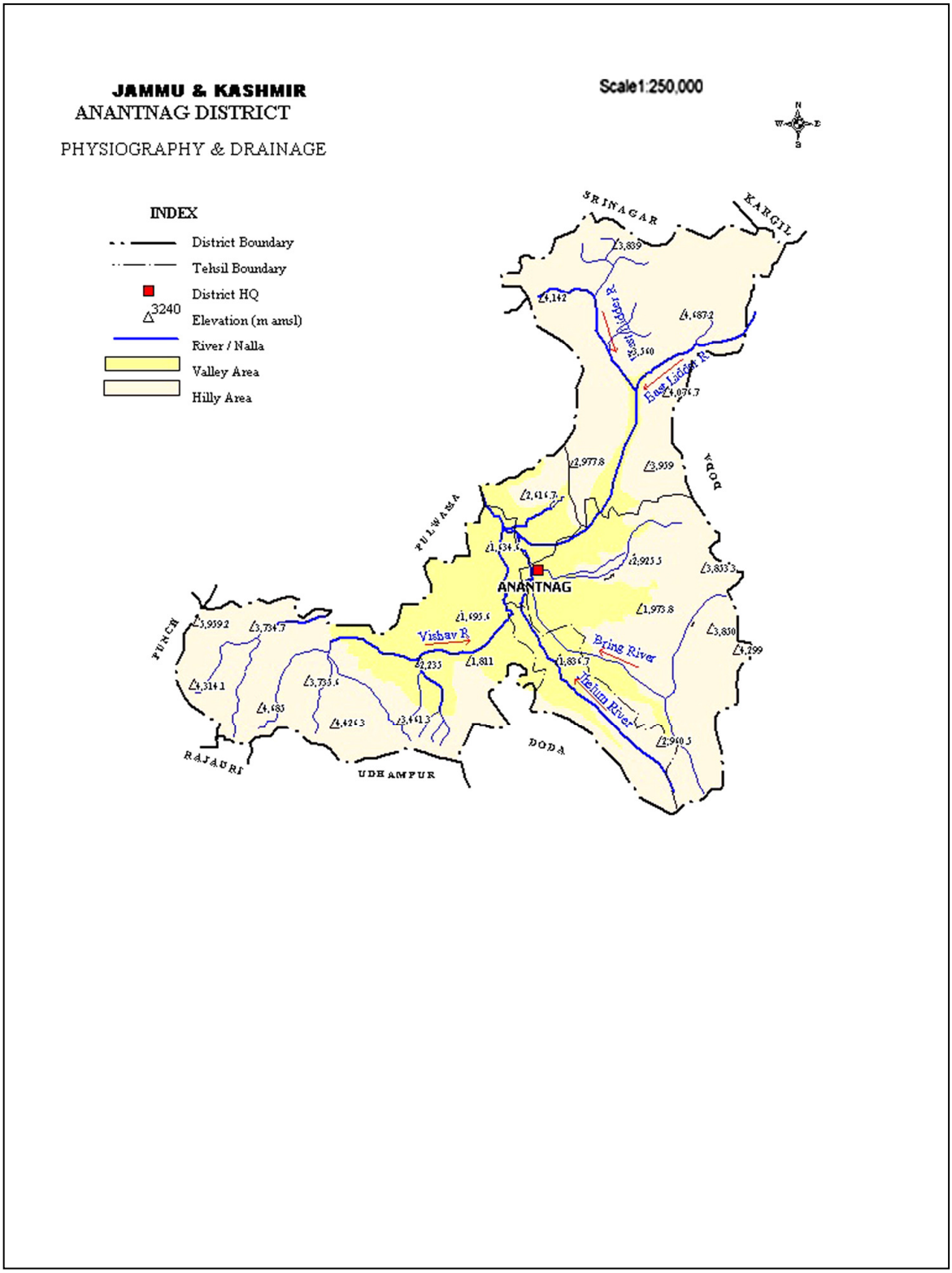

JAMMU & KASHMIR
ANANTNAG DISTRICT
INDEX MAP
Scale1:250,000
INDEX
District Boundary
Tehsil Boundary
District HQ
Tehsil HQ
River / Nalla
Road
NHS Well
Exploratory Well
Valley Area
Hilly Area
SRINAGAR
KARGIL
DODA
PULWAMA
PUNCH
RAJAURI
UDHAMPUR
Pahalgam
Bijbiara
ANANTNAG
Kulgam
Doru
Jhelum River

Plate-II


JAMMU & KASHMIR
ANANTNAG DISTRICT
PHYSIOGRAPHY & DRAINAGE
Scale1:250,000
INDEX
District Boundary
Tehsil Boundary
District HQ
3240
Elevation (m amsl)
River / Nalla
Valley Area
Hilly Area
SRINAGAR
KARGIL
DODA
PULWAMA
ANANTNAG
PUNCH
RAJAURI
UDHAMPUR
DODA
Vishav R
Bring River
Jehlum River
East Lidder R
3,889
4,142
4,487.2
3,340
4,074.7
2,977.8
3,959
2,614.7
1,434.4
2,925.5
3,833.3
1,973.8
3,830
4,299
1,495.6
3,939.2
3,734.7
4,314.1
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4,685
4,424.3
3,441.3
2,235
1,811
1,884.7
2,960.5

Plate-III

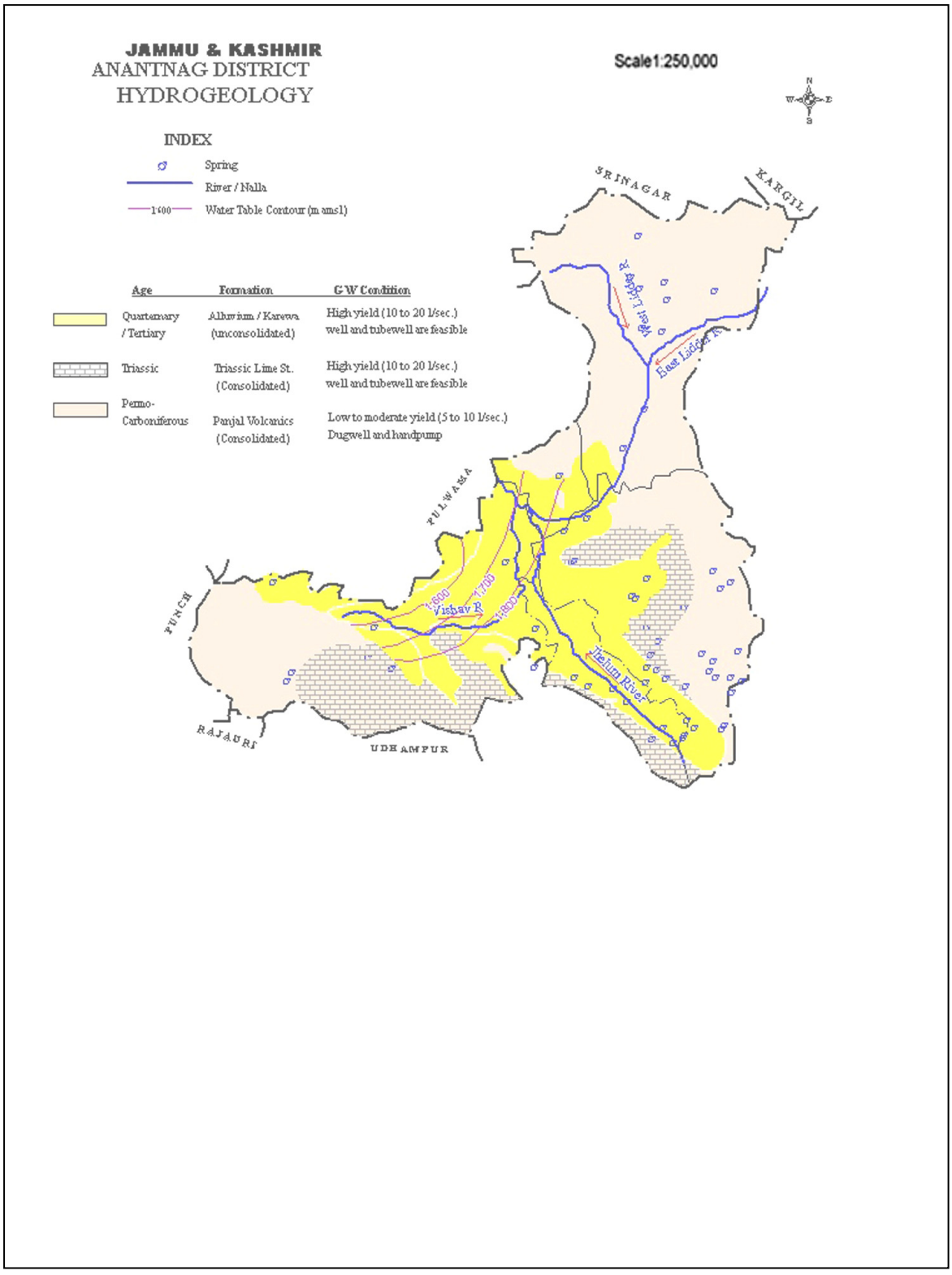
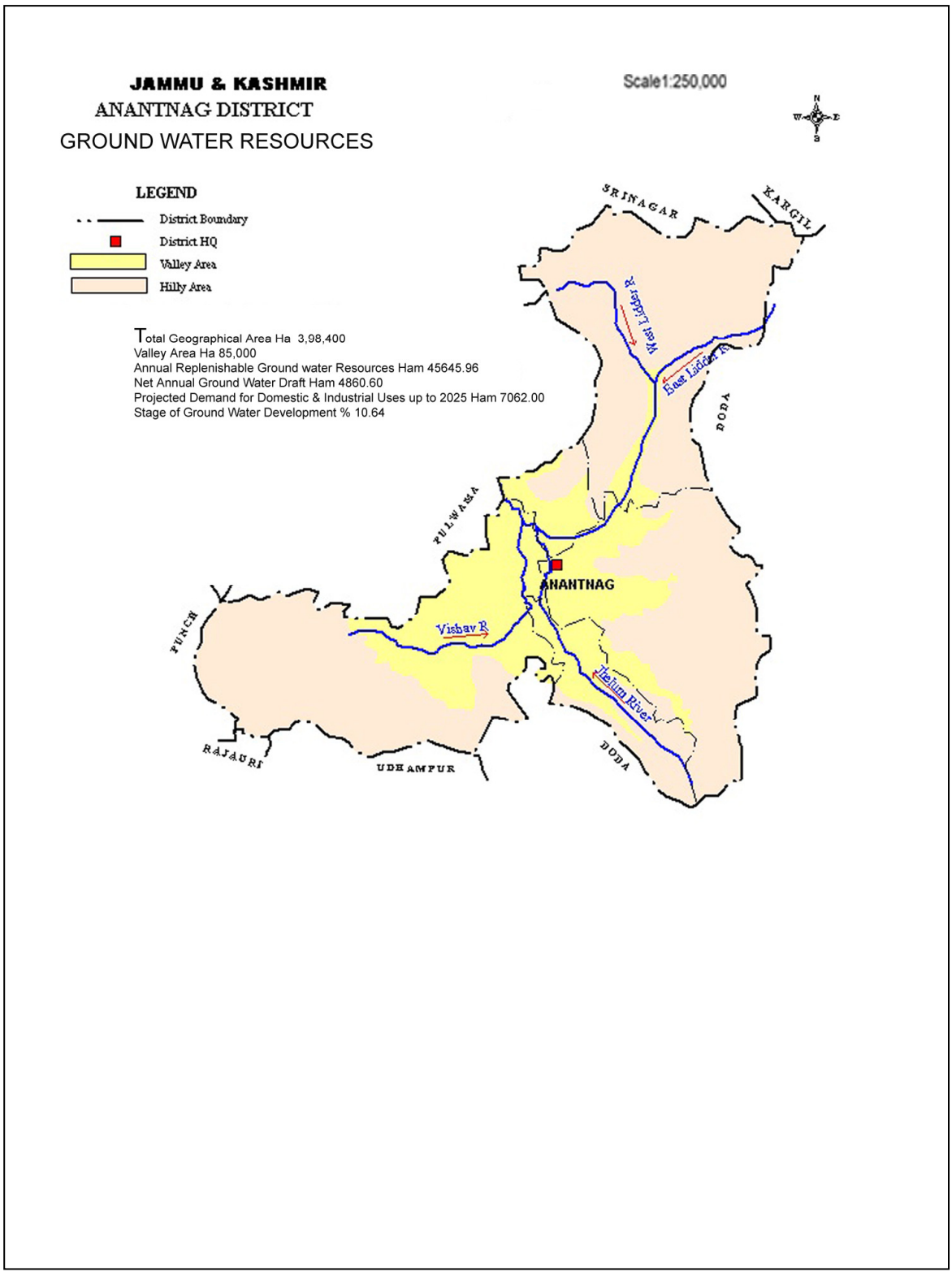

JAMMU & KASHMIR
ANANTNAG DISTRICT
HYDROGEOLOGY
Scale1:250,000
INDEX
Spring
River / Nalla
1600
Water Table Contour (m amsl)
Age
Formation
GW Condition
Quartenary / Tertiary
Alluvium / Karewa (unconsolidated)
High yield (10 to 20 l/sec.) well and tubewell are feasible
Triassic
Triassic Lime St. (Consolidated)
High yield (10 to 20 l/sec.) well and tubewell are feasible
Permo-Carboniferous
Panjal Volcanics (Consolidated)
Low to moderate yield (5 to 10 l/sec.) Dugwell and handpump
SRINAGAR
KARGIL
PULWAMA
PUNCH
RAJAURI
UDHAMPUR
Vishav R
Lidder R
East Lidder R
Jhelum River
1600
1700
1800

Plate-IV


JAMMU & KASHMIR
ANANTNAG DISTRICT
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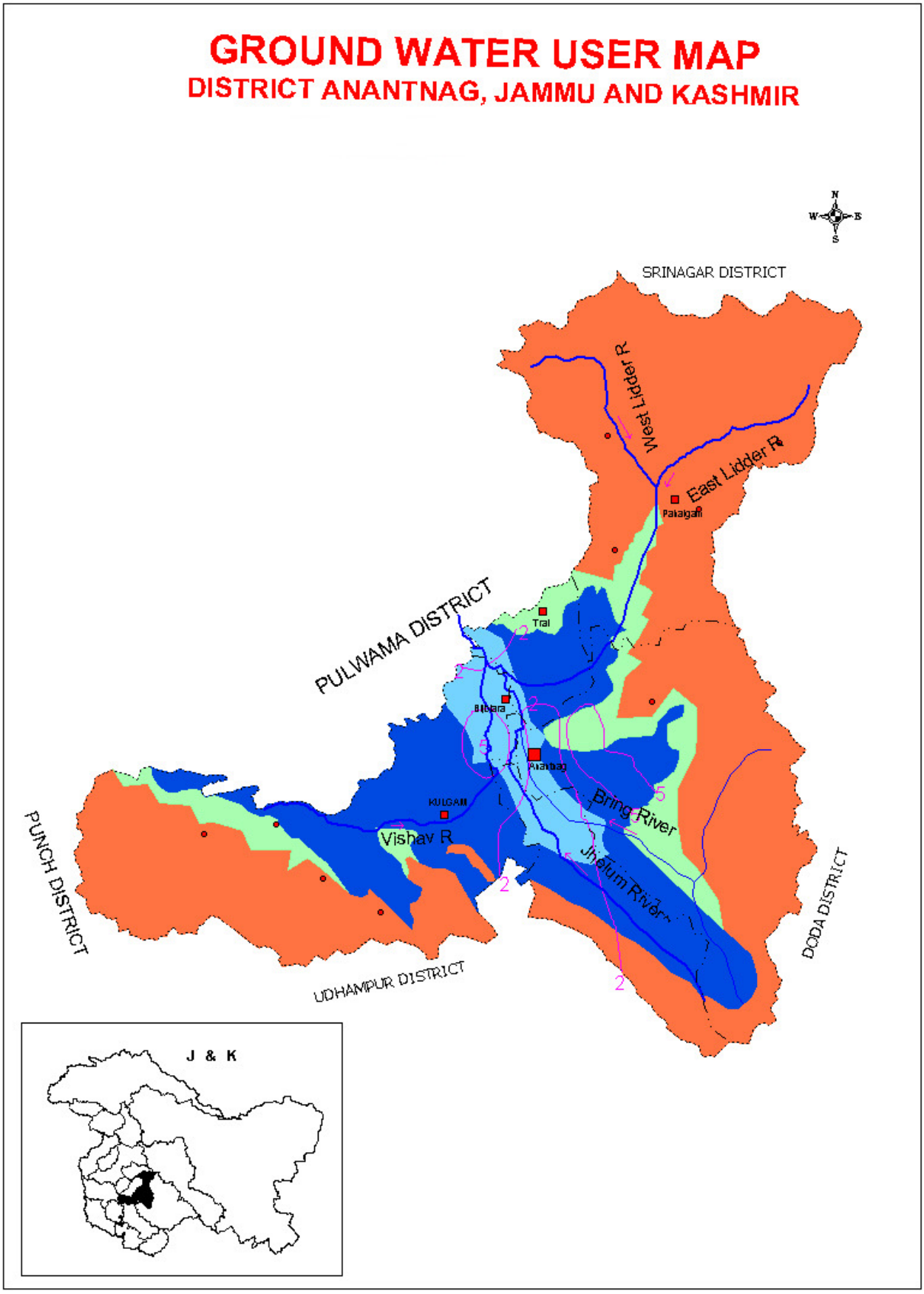
PULWAMA
ANANTNAG
Vishav R
Jhelum River
PUNCH
RAJAURI
UDHAMPUR
DODA

Plate-V


GROUND WATER USER MAP
DISTRICT ANANTNAG, JAMMU AND KASHMIR
N
W
E
S
SRINAGAR DISTRICT
West Liddar R
East Lidder R
Pahalgam
PULWAMA DISTRICT
Tral
Bijbiara
Anantnag
KULGAM
Vishav R
Bring River
Jhelum River
PUNCH DISTRICT
UDHAMPUR DISTRICT
DODA DISTRICT
J & K

LEGEND

DISTRICT ANANTNAG

	Wells feasible	Rigs suitable	Depth of well (m)	Discharge (lpm)	Suitable artificial recharge structures
	Tube well	Percussion, Rotary, DTH with Odex	80 to 120*	500 to 1200	Check dam, Recharge Shaft/pit
Soft rock aquifers	Dug Well	Manual/Poclain	10 to 15	400 to 1200	
	Tube well	DTH with Odex	70 to 100*	250 to 1000	
Hard rock aquifers	Dug Well	Manual/Poclain	5 to 8	200 to 500	
	Spring Development			300 to 4000	
Hilly area					
5 Water level contour (m bgl) (Pre monsoon decadal mean, 1993-2002)					
Springs					
Tehsil boundary					Tehsil HQ
District boundary					District HQ
Major Drainage					

OTHER INFORMATIONS

Total area	3984 sq.km
No. of tehsils	5
Major drainage	Jhelum, Lidder, Vishav Rivers
Population	11,72,434 (2001 Census)
Rainfall	1103.0 mm
Temperature	-4.9^0 C to 31.6^0 C
Regional geology	Soft rock : - Alluvium, Karewas
	Hard rock : - Panjal traps
Ground water quality	EC<1250 micro mhos/cm at 25^{0}C
Stage of GW development	10.64%
Name of watershed/ tehsil showing intensive GW	Nil

Note : * limited to explored depth /

Areas with depth to water level > 8 m bgl are suitable for artificial recharge