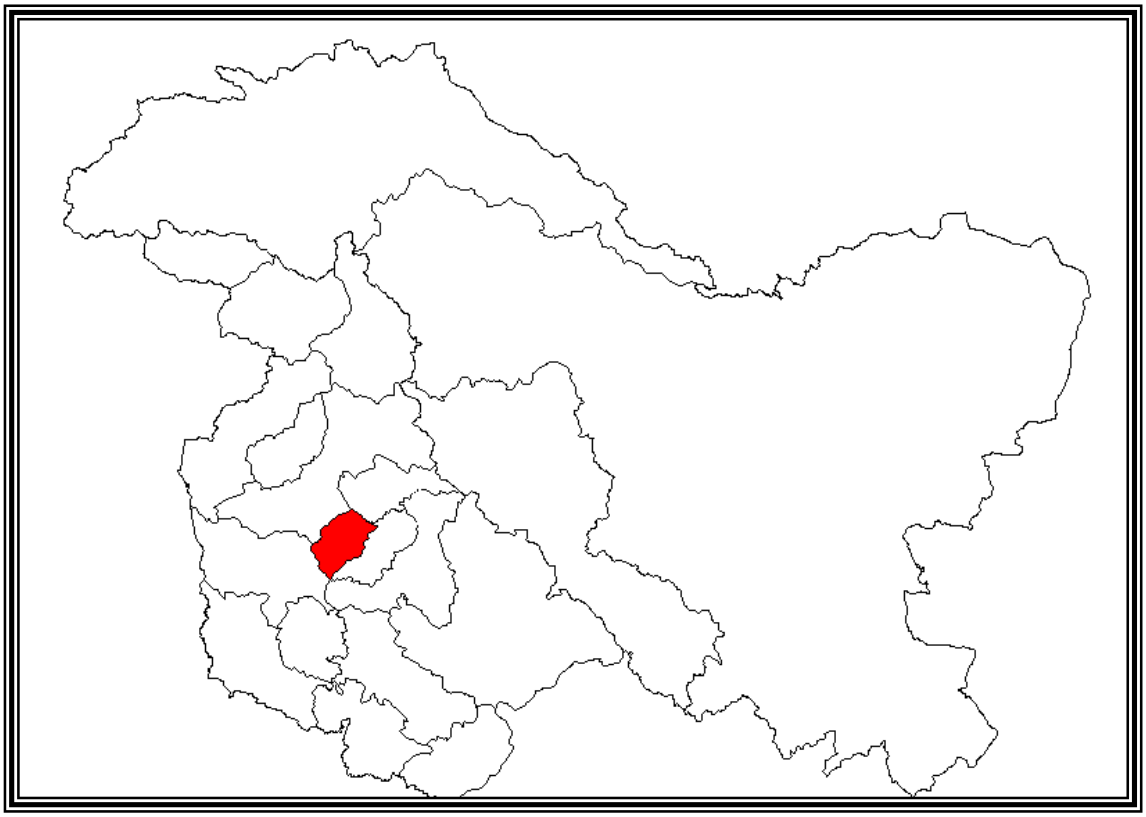
Government of India
Ministry of Water Resources

CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET

BADGAM DISTRICT, JAMMU & KASHMIR



NORTH WESTERN HIMALAYAN REGION
JAMMU

MARCH 2013

GROUND WATER INFORMATION BOOKLET

BADGAM DISTRICT, JAMMU & KASHMIR

CONTENTS

BADGAM DISTRICT AT A GLANCE

Sl. No	ITEMS	STATISTICS
1.	**GENERAL INFORMATION**	
	i) Geographical area (sq km)	1371
	ii) Administrative Divisions (2009-10) • Number of Tehsil • Number of CD Blocks • Number of Panchayats • Number of Villages Inhabited Un-inhabited	 3 8 283 483 470 17
	iii) Population (2001 Census) • Total population • Population Density (person/sq km) • Muslim & others Population • Sex Ratio	 6,29,309 persons 459 98.09% & 1.91% 930
	iv) Average Annual Rainfall (mm)	671.1
2.	**GEOMORPHOLOGY**	
	• Major Physiographic units	• High Karewa Plateau lands • Sharp ridges of hard rock • Intervening valleys & River Terraces
	• Average Height	1630 m amsl
	Major Drainages • Indus Basin • Jhelum Sub-Basin	 Dudhganga, Shaliganga, Sokhnag Rivers
3.	LAND USE (2009-10) sq.km (Source- Digest of Statistics 2009-10)	
	• Forest area • Gross Irrigated area • Canals • Tanks • Wells • Other source • Net area sown	477 300.26 278.34 5.20 9.87 6.85 888.08
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 dark brown in colour

Sl. No	ITEMS	STATISTICS
5.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.12.2012) • No. of Dug Wells • No. of Piezometers	 02 Nil
6.	PREDOMINANT GEOLOGICAL FORMATIONS	• Quaternary Alluvium • Karewa formations
7.	HYDROGEOLOGY	
	Major Water Bearing Formations	
	1. Unconsolidated layer Formations (Karewa formations – Both upper and Lower Karewa formation)	Covering (50%)
	• Yield prospects • GW structures	Low yield prospects (<10%) Handpumps, Dugwells & Tubewells
	2. Unconsolidated porous sediments (Alluvium)	Intermountain small valleys and main Kashmir Valley area (50%)
	• Yield prospects • DW structures	Low to Moderate (10-20 lps) Handpumps, Dugwells & Tubewells
	Avg. Depth to water level • May • November	 3.00 m bgl 2.50 m bgl
8.	GROUND WATER EXPLORATION BY CGWB (As on 31.12.2012)	
	• No of wells drilled	23 EW
	• Depth Range (m)	12.00 - 390.00
	• Discharges (lps)	2 – 50.0
	• Transmissivity (m^2/day)	97 – 635
9.	GROUND WATER QUALITY	
	Range of Chemical constituents in Ground water • EC (micro mhos/cm) • pH • Chloride (mg/l) • Fluoride (mg/l) • Iron (mg/l)	 490-950 7.00-7.40 7.1-50 0.02-0.48 Tr-12.8

Sl. No	***ITEMS***	***STATISTICS***
10.	DYNAMIC GROUND WATER RESOURCES (2009) in ham (valley areas only)	
	• Annual Replenishable Ground Water Resources	25182.88
	• Net Annual Ground Water Draft	7532.20
	• Projected Demand for Domestic and industrial uses up to 2025	10612.80
	• Stage of Ground Water Development	29.91% Safe
12.	AWARENESS AND TRAINING ACTIVITY	
	• Mass Awareness Programmes	Nil
	• Water Management Training Programmes	Nil
13.	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	Nil
14.	GROUND WATER CONTROL AND REGULATION	
	• Number of OE Blocks	Nil
	• No of Critical Blocks	Nil
	• No of blocks notified	Nil
15.	MAJOR GROUND WATER PROBLEMS AND ISSUES	
	• Quality Problem	• High land table Karewas are not suitable for development of groundwater resources as the discharges are very low with high drawdown. • Tube wells are encountered with silt problem. • Presence of high Iron content are the main hazards

GROUND WATER INFORMATION BOOKLET
BADGAM DISTRICT, JAMMU & KASHMIR

1.0 INTRODUCTION

Badgam district is one of the six districts of Kashmir province. The district with its head quarters at Badgam forms the southern part of Kashmir valley and is located between $33^0$43'00" and $34^0$11'00" North Latitude and between $74^0$25'00'' and $74^0$55'00'' East Longitude and is covered by SOI Degree sheet no. 43 J & 43 K. The district is bounded by Poonch district in the west, Srinagar district in the north & north-east and Anantnag district in the east, by Baramulla district in the north west and by Pulwama district in the south & south-east. The district is approachable by metalled roads from all parts of the state.

The district has a total geographical area of 1,371 sq km, comprising of 483 villages (470 inhabited and 13 un-inhabited villages). Administratively, the district is divided into 03 tehsils (Badgam, Chadoora & Beerwah) and 08 blocks (Badgam, Khansahib, Chadoora, B.K.Pora, Nagam, Beerwah, Khag & Narbal).

As per 2001 census, the district has a population of 6,29,309 persons with density of population 459 persons per sq. km. The male and female population in the district is 3,26,050 and 3,03,259 respectively with a male / female sex ratio of 930. The schedule caste population in the district is 466 persons. The district has recorded population growth of rate of 34.07% during the decade 1991-2001 as compared to 29.98% at state level.

The main source of irrigation is canals and an area of 30,026 hectares is brought under irrigation by various sources like canals, tanks, wells and other sources.

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, 23 exploratory wells have been drilled ranging in depth from 12 m to 390 m. CGWB was monitoring the ground water regime through 4 number of National Hydrograph monitoring stations till the year 1989.

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 671.1 mm in the form of rain and snow for about 70 days.

3.0 GEOMORPHOLOGY AND SOILS

Badgam district is hilly and mountainous towards the northeast and southwest with broad intermountain valley. The altitude of the hill ranges up to 3700 m amsl. The valley area in

the central part of the district has flat to mildly undulating topography with its elevation about 1630 m amsl and has an area of about 1,050 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 with its tributaries drain in the area. There are three major tributaries viz., Dudhganga, Shaliganga, Sokhnag Nalas.

4.0 GROUND WATER SCENARIO

4.1 GEOLOGY

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

.Stratigraphic Unit	***Lithology***	***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 Karewa formation 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

Hydrogeologically, 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 sScree/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 fitted for ground water development. The yield of the shallow tube wells and hand pumps constructed along these secondary porous zones varies from 50 to 200 lpm.

The unconsolidated sediments comprising of fluvio-glacial and lacustrine deposits of Karewa formation 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 and form 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 more than 300m thick in the district as revealed by the ground water exploration studies 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 12 m at Ichkut to 390 m at Tasrar-e-Sharif. The water table occurs under free flow conditions in some areas. The yield of the tube wells ranges from 150 lpm at Kakinmar to 3136 lpm at Bemina for drawdowns ranging from 7.05 m to 14.0 m respectively. The depth to water level ranges from 1.0 m agl (artesian free flowing) at Bemina to 10.42 m a Tasrar – e-Sharif. The transmissivity values ranges from 97.83 m^2/day to 635 m^2/ day.

4.2 DEPTH TO WATER LEVEL

The water level from the national network of hydrograph stations (4 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 0.76 m at Gohapuri to 5.03 m bgl at Humhama. In valley areas, open wells and tube wells are the main ground water withdrawal structures.

4.3 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	1,37,100
2	Valley Area	Ha	85,000
3	Annual Replenishable Ground water Resources	Ham	25182.88
4	Net Annual Ground Water Draft	Ham	7532.20
5	Projected Demand for Domestic & Industrial Uses up to 2025	Ham	10612.80
6	Stage of Ground Water Development	%	29.91

The stage of ground water development in the valley portions of the district is 29.91% and falls in the safe category. Thus, there is scope for further ground water development.

4.4 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		Shallow G.W.		Deep G. W.	
			Min	Max	Min	Max
1	pH		7.37	8.30	7.60	8.5
2	EC	µS/cm	220	1920	180	630
3	HCO_3	mg/l	116	616	104	384
4	Cl	mg/l	5.3	277	3.60	28
5	NO_3	mg/l	04	99	4.50	11
6	F	mg/l	Trace	0.24	Trace	0.68
7	Ca	mg/l	30	244	24	82
8	Mg	mg/l	4.8	39	3.60	51
9	Na	mg/l	3.8	112	2.8	59
10	K	mg/l	0.4	18	0.3	1.30
11	TH as $CaCO_3$	mg/l	100	770	93	330
12	Fe	mg/l	Trace	1.31	Trace	1.72

Ground water quality in the district is generally good both for irrigation and domestic purposes. Ground water from deeper aquifer is contaminated with Fe at few places and at some places contains methane gas also.

4.5 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 15 tube wells up to the year 1989. Exploratory activities again resumed under accelerated exploratory drilling programme and drilled 8 tube wells in the district. The depth of tube wells ranging from 12 m to 390 m with a discharge varying from 150 lpm to 3136 lpm.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 GROUND WATER DEVELOPMENT

As the major part of the district is flat & valley area and is drained by major river Jhelum and its tributaries. There is an enough scope for development of groundwater resources. In the past, development of ground water was mainly through dug wells and percolation wells along the riverbeds, nallas and also development of some springs. 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 is constructing number of hand pumps and 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 tap rainwater harvesting structures can be adapted.

6.0 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.

7.0 AWARENESS AND TRAINING ACTIVITY

So far neither Mass Awareness Programme (MAP) nor Water Management Training Programme (WMTP) is conducted by CGWB.

8. 0 AREAS NOTIFIED BY CGWA/SGWA

The stage of ground water development in the district is 29.91% and falls in safe category. Thus, no area or block has been notified for ground water development.

9. 0 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 nallas 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 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 nallas / 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

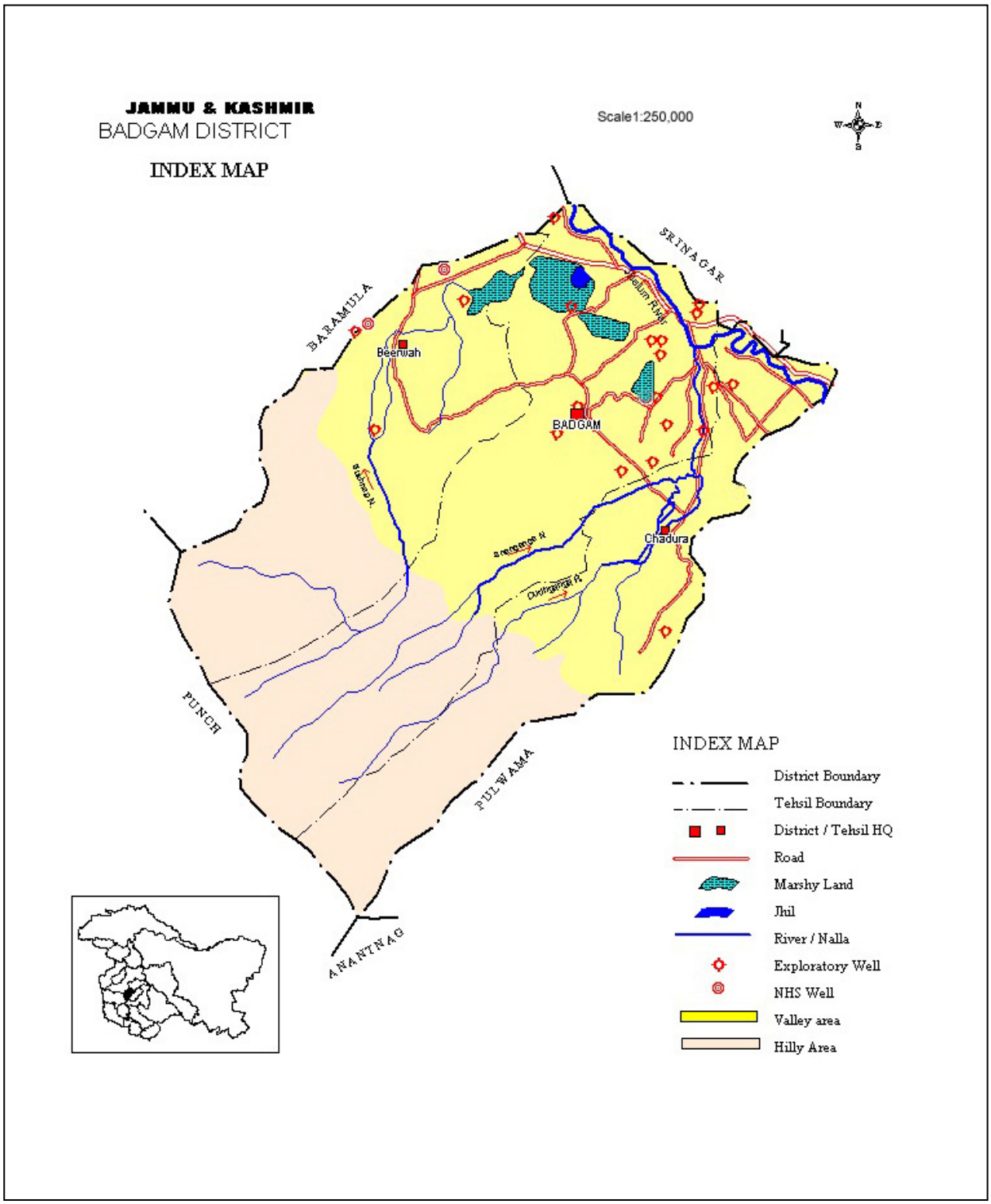

JAMMU & KASHMIR
BADGAM DISTRICT
INDEX MAP
Scale1:250,000
N
W
E
S
BARAMULA
SRINAGAR
Jhelum River
Beerwah
BADGAM
Chadura
PUNCH
PULWAMA
ANANTNAG
INDEX MAP
District Boundary
Tehsil Boundary
District / Tehsil HQ
Road
Marshy Land
Jhil
River / Nalla
Exploratory Well
NHS Well
Valley area
Hilly Area

Plate-II

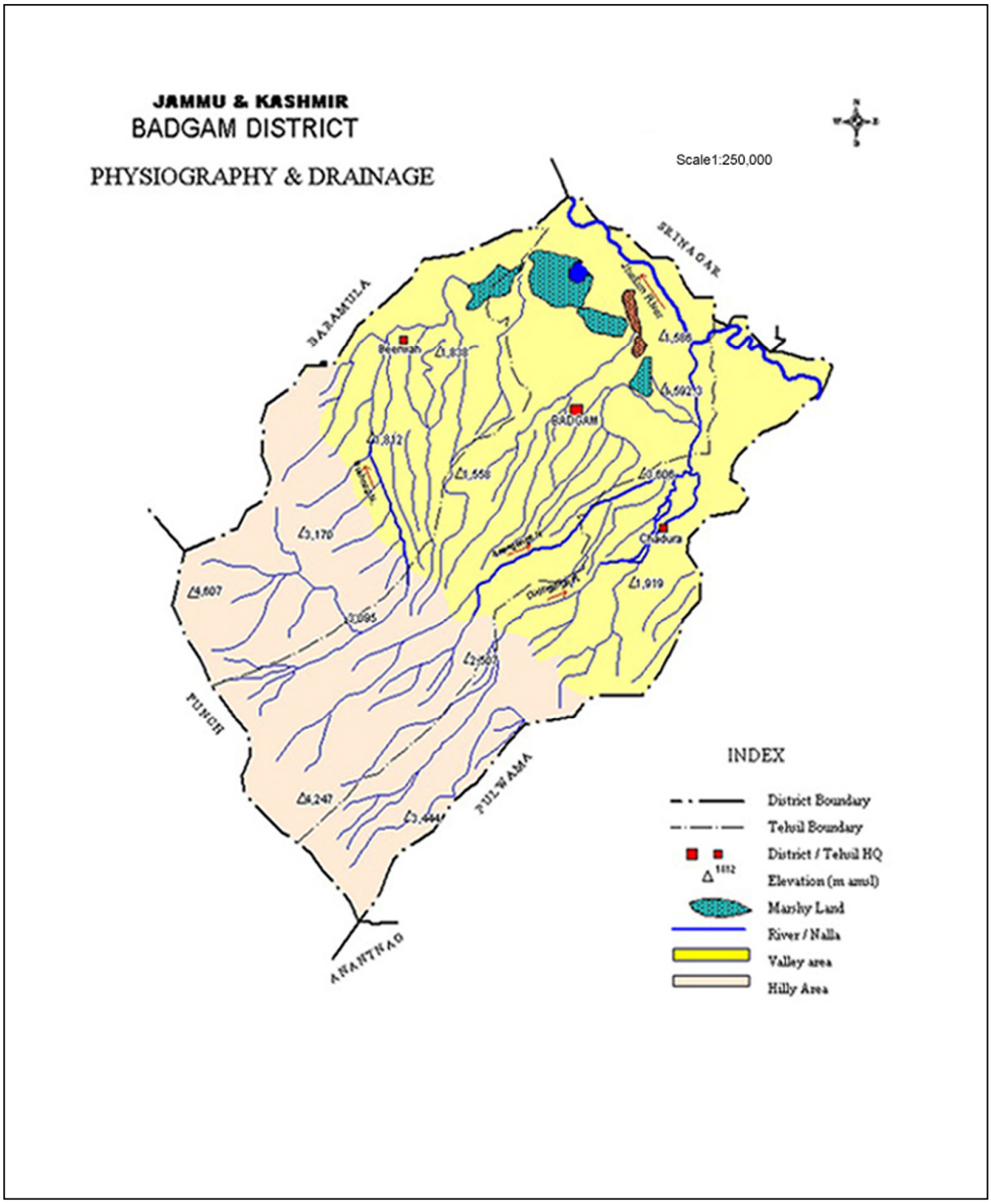
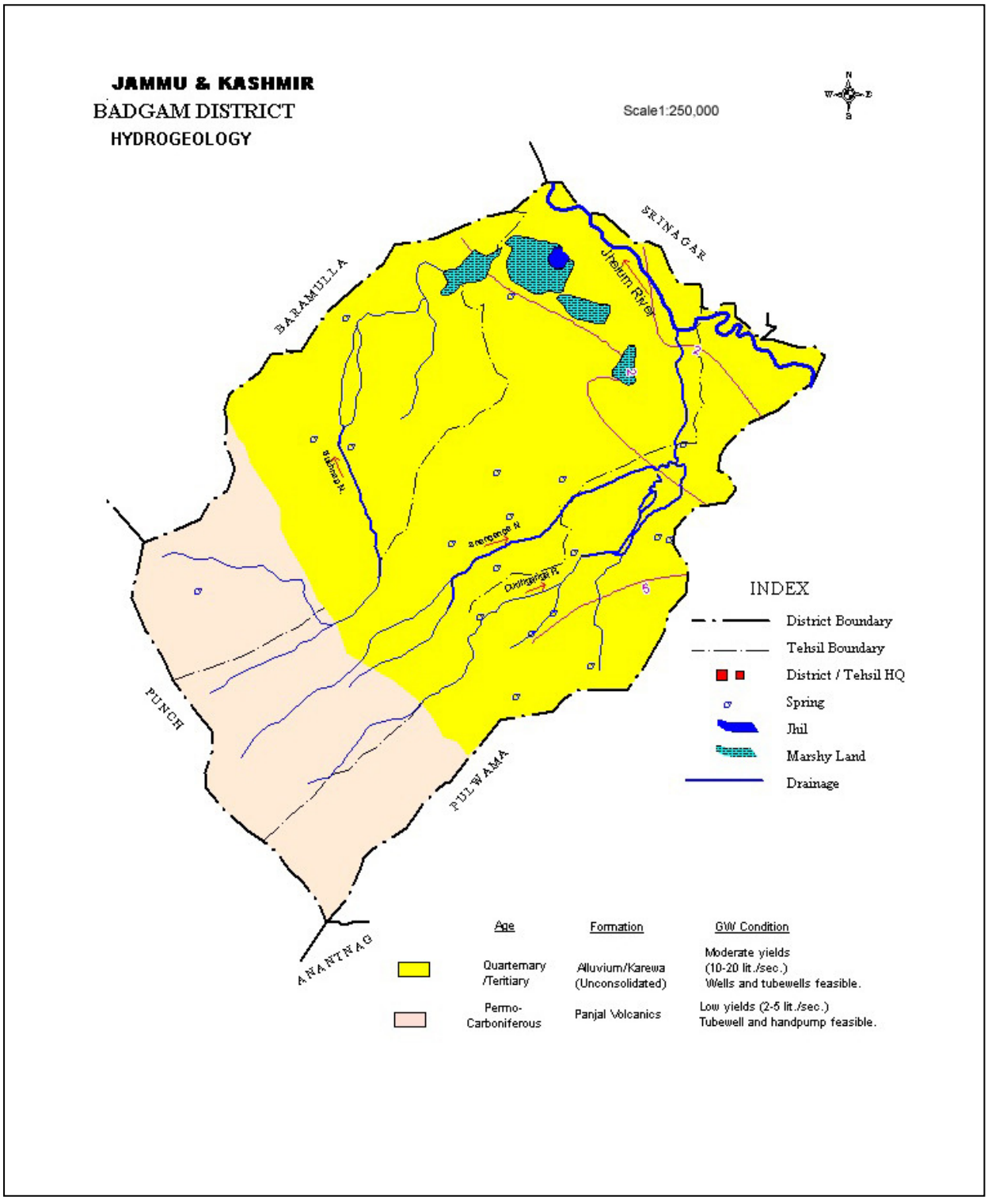

JAMMU & KASHMIR
BADGAM DISTRICT
PHYSIOGRAPHY & DRAINAGE
Scale1:250,000
BARAMULA
SRINAGAR
PUNCH
PULWAMA
ANANTNAG
Beerwah
BADGAM
Chadoura
INDEX
District Boundary
Tehsil Boundary
District / Tehsil HQ
Elevation (m amsl)
Marshy Land
River / Nalla
Valley area
Hilly Area

Plate-III


JAMMU & KASHMIR
BADGAM DISTRICT
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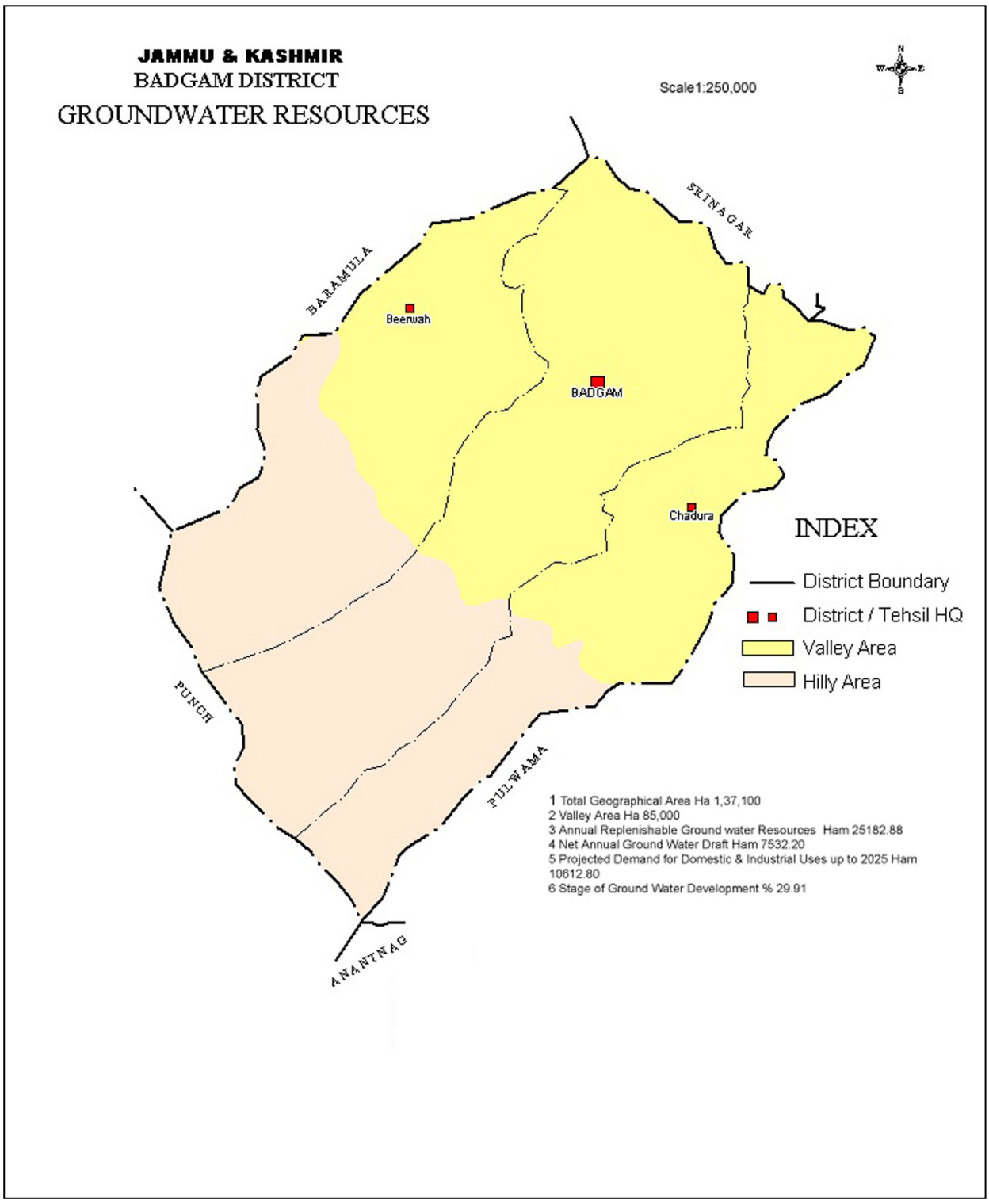
Tehsil Boundary
District / Tehsil HQ
Spring
Jhil
Marshy Land
Drainage
Age
Formation
GW Condition
Quarternary /Teritiary
Alluvium/Karewa (Unconsolidated)
Moderate yields (10-20 lit./sec.) Wells and tubewells feasible.
Permo-Carboniferous
Panjal Volcanics
Low yields (2-5 lit./sec.) Tubewell and handpump feasible.

Plate-IV


JAMMU & KASHMIR
BADGAM DISTRICT
GROUNDWATER RESOURCES
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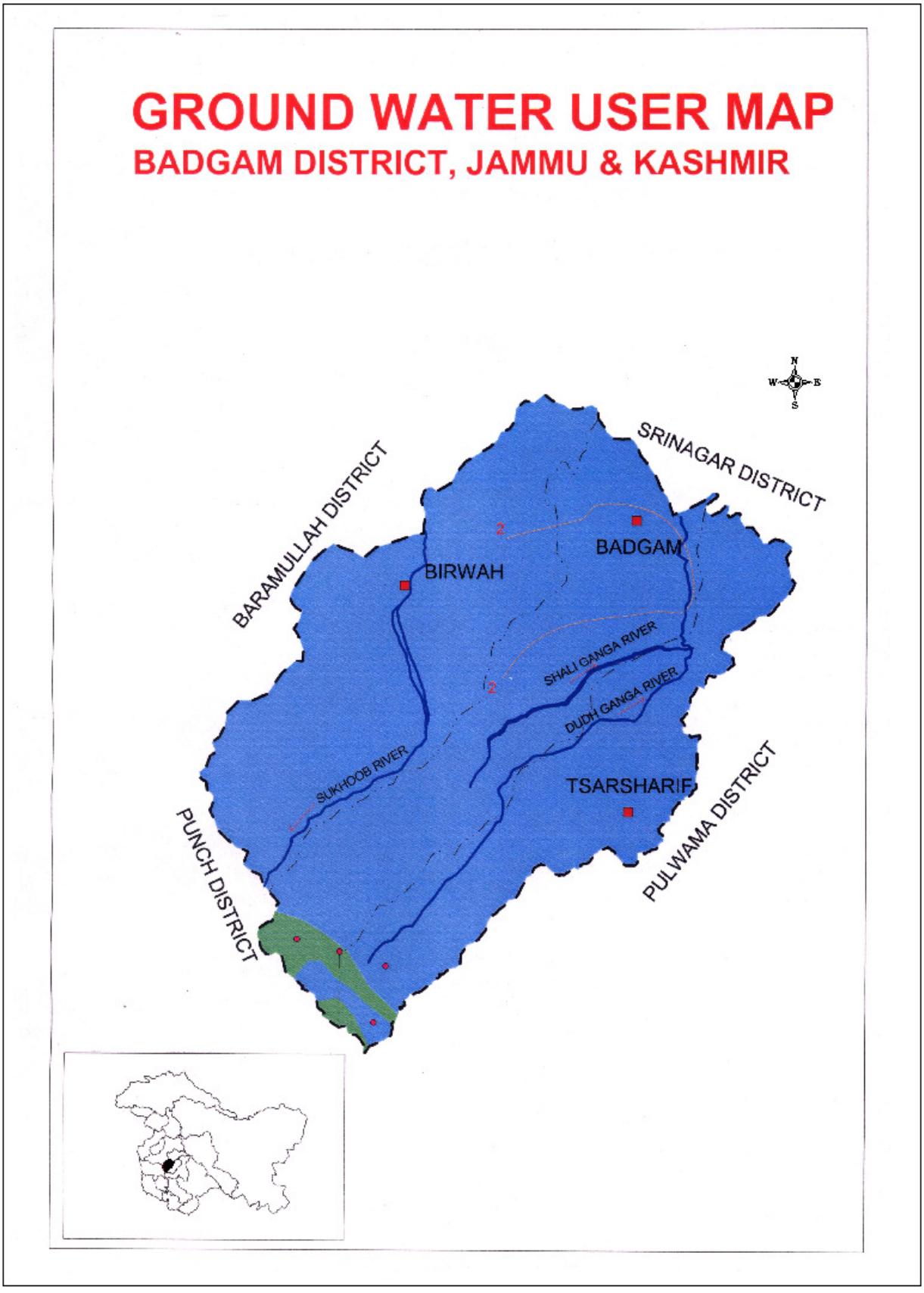
6 Stage of Ground Water Development % 29.91

Plate-V


GROUND WATER USER MAP
BADGAM DISTRICT, JAMMU & KASHMIR
N
W
E
S
BARAMULLAH DISTRICT
SRINAGAR DISTRICT
BADGAM
BIRWAH
SHALI GANGA RIVER
DUDH GANGA RIVER
SUKHOOB RIVER
TSARSHARIF
PUNCH DISTRICT
PULWAMA DISTRICT

LEGEND

DISTRICT BADGAM

	Wells feasible	Rigs suitable	Depth of well (m)	Discharge (lpm)	Suitable artificial recharge structures
Soft rock aquifers	Tube well	Percussion, Rotary, DTH with Odex	80 to 120*	400 to 1000	Check dam, Recharge Shaft/pit
	Dug Well	Manual	10 to 15	300 to 1000	
Hard rock aquifers	Tube well	DTH with Odex	70 to 90*	450 to 1000	
	Dug Well	Manual	10 to 20	250 to 1000	
	Spring Development			30 to 1500	

5 Water level contour (m bgl)
(Pre monsoon decadal mean, 1993- 2002)

Springs

Tehsil boundary

District boundary

Major Drainage

Tehsil HQ

District HQ

OTHER INFORMATIONS

Total area	1371 sq.km
No. of tehsils	3
Major drainage	ShaliGanga, Dudh Ganga, Sukhnag Rivers
Population	6,29,309 (2001 Census)
Rainfall	671.1 mm
Temperature	-5..9^0 C to 30.6^0 C
Regional geology	Soft rock : - Alluvium, Karewas
	Hard rock : - Panjal traps
Stage of GW development	29.91 %
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.