भारत सरकार

Government of India

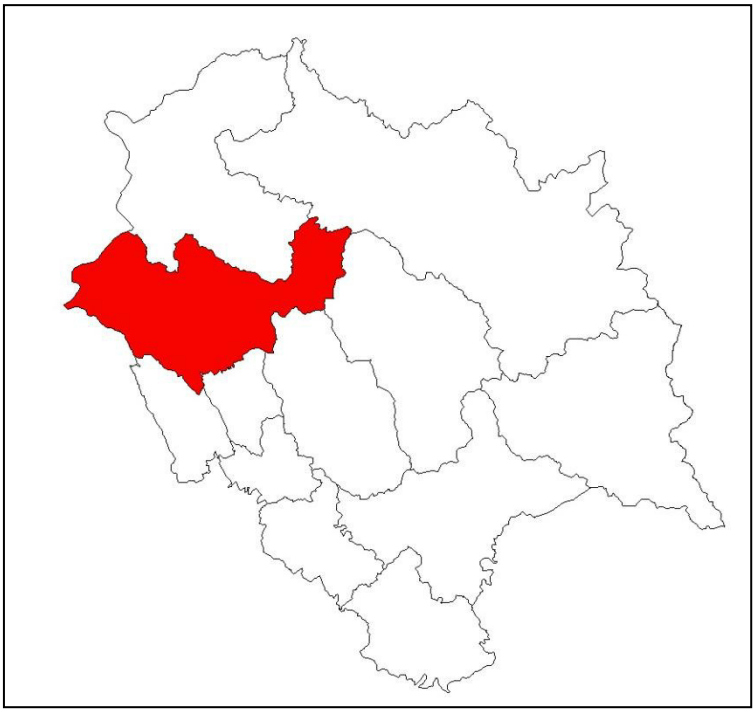
जल संसाधन मंत्रालय

Ministry of Water Resources

केंद्रीय भूमिजल बोर्ड

CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET
KANGRA DISTRICT, HIMACHAL PRADESH



उतरी हिमालय क्षेत्र

NORTHERN HIMALAYAN REGION

धर्मशाला

DHARAMSALA

सितम्बर, 2013

September, 2013

"संचित जल, सुरक्षित कल "

" जल संरक्षण वर्ष - 2013"

Contributors

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Our Vision

Water security through sound management

GROUND WATER INFORMATION BOOKLET
Kangra District, Himachal Pradesh

CONTENTS

DISTRICT AT A GLANCE

KANGRA DISTRICT AT A GLANCE

Sl. No	ITEMS	Statistics
1.	**GENERAL INFORMATION**	
	i) Geographical area (sq km)	5,739
	ii) Administrative Divisions (2001) a) Number of Tehsil + Sub-tehsils b) Number of CD Blocks d) Number of Villages Inhabited Un-inhabited	 14 + 5 14 3,868 3,619 249
	iii) Population (2011 Census) a) Sex Ratio b) Urban Population c) Rural Population d) Schedule Caste e) Schedule Tribes	15,10,075 persons 1,012 5.7 % 94.3 % 21.15 % 5.6 %
	iv) Average Annual Rainfall (mm)	1,751
2.	**GEOMORPHOLOGY**	
	Major Physiographic units	➢ Wet sub-temperate zone ➢ Humid sub-temperate zone ➢ Humid sub-trophical zone ➢ Sub humid subtropical zone
	Major Drainage basins	Beas, Ravi
3.	**LAND USE (ha.)**	
	a) Forest area (2008-09)	2,32,500
	b) Total cropped area (2008 – 09)	2,17,700
4.	**MAJOR SOIL TYPES**	➢ Histosols ➢ Altisols ➢ Alfisols ➢ Aridisols ➢ Entisols
5.	**AREA UNDER PRINCIPAL CROPS (2008-09)** **In Hectare**	➢ Wheat: 93,859 ➢ Rice: 36,855 ➢ Maize: 58,455 ➢ Pulses: 3,116 ➢ Barley: 2,871 ➢ Common millets: 148
6.	**IRRIGATION BY DIFFERENT SOURCES**	
	Net irrigated area (2008-09)	36,444 ha
7.	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB** (As on 31.03.2013) No. of Dug Wells No. of Piezometers	 28 Nil

8.	**PREDOMINANT GEOLOGICAL FORMATIONS**	➢ Quaternary Alluvium, Tertiary (Siwaliks) ➢ Older Crystalline & Metamorphic rocks of Pre – Cambrian age
9.	**HYDROGEOLOGY**	
	Major Water bearing formations (valleys) Major Ground Water Sources Pre-monsoon depth to water level (May, 12) Post-monsoon depth to Water level (Nov., 12)	Valley fills/ Sediments Wells & Tube wells 1.56 – 15.44 m bgl 0.48 – 12.30 m bgl
	Major Water bearing formations Major Ground Water Sources	Secondary Porosity in Tertiary and Precambrian formations Quarternary-Alluvium and morainic deposits Springs
10	**GROUND WATER EXPLORATION BY CGWB** (as on 31.03.2013)	
	No of wells drilled	79
	Depth Range (m bgl)	23.5 – 432
	Discharge (litres per minute)	0.54 - 3410
	Transmissivity (m^2/day)	7.28 – 2985
11.	**GROUND WATER QUALITY**	
	Presence of Chemical constituents more than permissible limits (eg. EC, F, As, Fe)	Nil
	Quality of Ground Water	Good
12.	**DYNAMIC GROUND WATER RESOURCES (GEC 1997 as on March 2011)**	
	Indaura Valley (26545 ha)	
	Annual Ground Water Availability	10520.18 Ham
	Annual Ground Water Draft	5263.72 Ham
	Stage of Ground Water Development	50.03 %
	Nurpur Valley (23775 ha)	
	Annual Ground Water Availability	7639.43 Ham
	Annual Ground Water Draft	3021.53 Ham
	Stage of Ground Water Development	39.55 %
13.	**AWARENESS AND TRAINING ACTIVITY**	
	S.No **VENUE** **DATE** **MASS AWARENESS PROGREMMES** 1. Jawali July 2003 2. Hotel Dhauladhar, Dharamsala 15.03.2003 3. Rice Research Station, Malan 29.03.2003 4. ChinmayaTapowan Ashram, Sidhbari 24.03.2004	

	5. Industrial Training Institute, Shahpur — 14.03.2005 **WATER MANAGEMENT TRAINING PROGRAMME** 1. Industrial Training Institute, Shahpur — 14.03.2005 2. Agricultural Research Station, Jachh — 28.03.2007 3. Rain Water Harvesting, Dharamshala — 28.03.2008 4. Tier II Training Programme, Kangra — 18 to 22.03.2013 5. Awareness raising training programme under HP II, Kangra — 26.03.2013 **ADVERTISEMENT** Through Mass media advertisement by salogans through All India Radio — 2009,2010,2011 **WORKSHOPS** **S. No. Topic Date** 1. RTRWH &Spring recharge, Palampur, — 19 to 20. 02.2010 2. Artificial Recharge & catchment treatment, Palampur — 28.03.2011 3. Managed aquifer recharge in Valleys & Hills of Himachal Pradesh, Dharamsala — 06.03.2013	
14.	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	
	• Recharge projects implemented	5
	• Recharge projects under implementation	5
15.	**GROUND WATER CONTROL AND REGULATION**	
	Number of OE Blocks	Nil
	No of Critical Blocks	Nil
	No of blocks notified	Nil

GROUND WATER INFORMATION BOOKLET
KANGRA DISTRICT, HIMACHAL PRADESH

1.0 INTRODUCTION

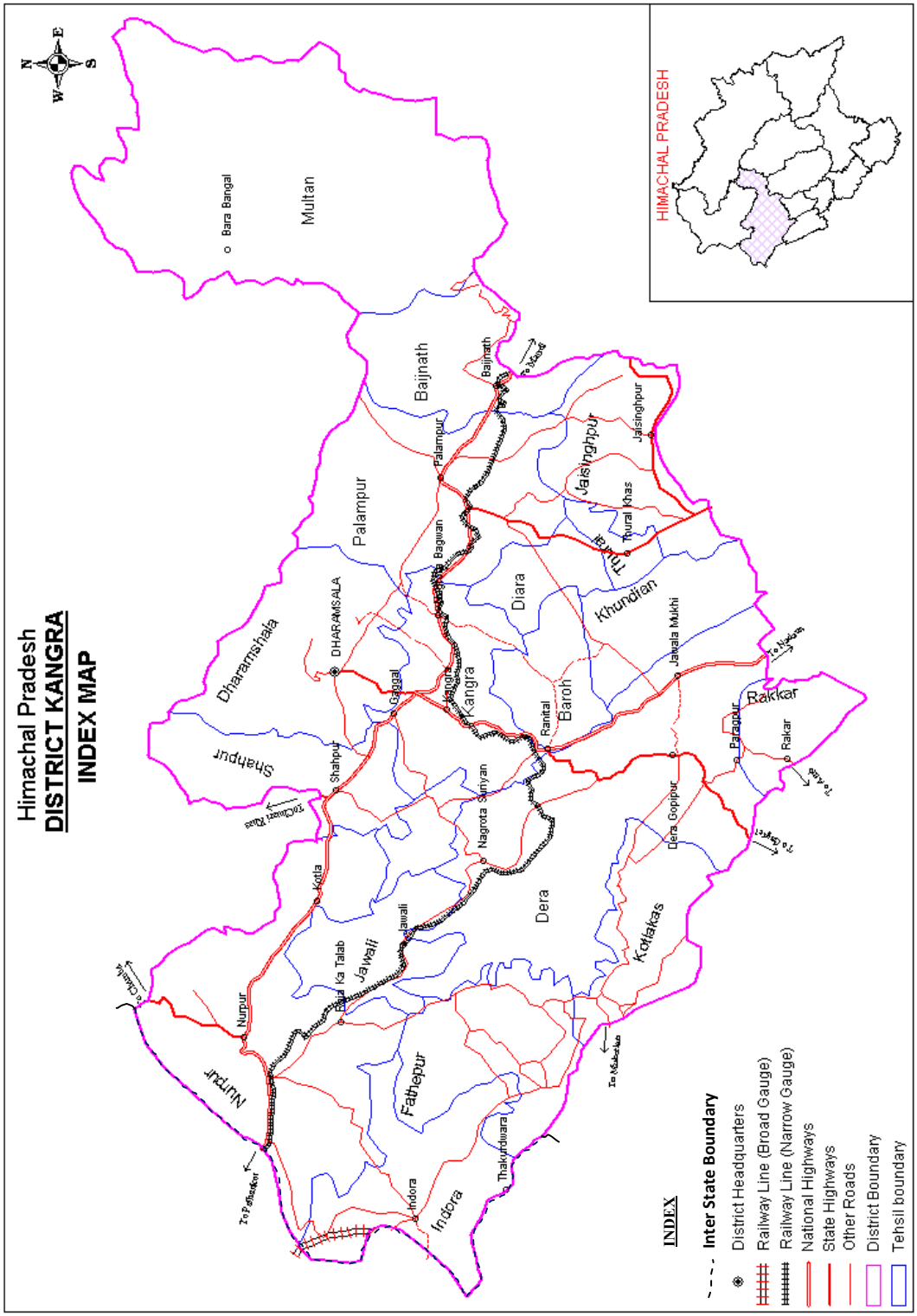
The present Kangra district came into existence on 1st of September 1972 and is located in the Shivalik Hills. The district is predominantly agrarian and around 82% of its population, depends on agriculture and its allied activities for their livelihood. The district lies in the western part of Himachal Pradesh and located between latitudes 31° 41' 00" and 32° 28' 05"; and longitudes 75° 35' 34" and 77° 04' 46", in the low foothills of the Himalayas and falls in Survey of India degree-sheet no 43P, 44M, 52D, 52H & 53A. The Dhauladhar range adjoins the district on one side. The Beas is one of the larger rivers of this district, and contributes to the fertility of the land here. The district is bounded by the following districts of Himachal Pradesh namely Chamba to the north, Lahul and Spiti to the northeast, Kullu to the east, Mandi to the southeast, and Hamirpur and Una to the south. The district shares its border with the states of Punjab on the southwest, and Jammu and Kashmir on the northwest.

The area of the district is 5,739 sq. km with Dharamsala as its Headquarter. There are 3868 villages in the district. The district has been divided into 8 Sub-divisions [Kangra, Palampur, Dharamsala, Nurpur, Dehra, Baijnath, Jawali, Jaisinghpur]. There are 14 tehsils [Kangra, Baroh, Palampur, Dharamsala, Shahpur, Nurpur, Indora, Dehra, Khundian, Jaswan, Baijnath, Jawali, Fathephur, Jaisinghpur] & 5 sub-tehsils [Harchakkian, Dhira, Thural, Rakkar, Multan]. Further, for development purposes the district has been subdivided into 14 CD blocks viz., Kangra, Rait, Nagrota Bagwan, Baijnath, Bhawarna, Lamba Gaon, Panchrukhi, Nurpur, Indora, Dehra, Nagrota Surian, Pragpur, Fatepur, Sulah.

As per 2011 census, the district has a population of 15,10,075 persons with a population density of 263 persons per sq km. Population wise it ranks first in the State. The male and female population in the district is 7,50,591 and 7,59,484 respectively, with a sex ratio of 1012 females per 1000 males. The schedule cast population in the district is 21.15 % and the schedule tribe population is 5.6%.

The Beas River forms the major drainage system in the district. The river Beas and its tributaries drain almost the entire district, except the north eastern part which is drained by the river Ravi. There are two important lakes in the district, namely Dal Lake and Kareri.

The major sources of irrigation are small water channels or the *Kuhls* in the district and an area of 36,444 hectare is brought under irrigation by various sources like canals, tanks, wells and other sources. A part of the cultivated area of the district is not having any assured irrigation facilities and the agriculturists have to depend on the vagaries of weather.



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2.0 CLIMATE & RAINFALL

The climate of the district varies from sub-tropical to sub-humid. Winter extends from December to February and summer extends from March to June while July to September are the rainy months. The average annual rainfall of the district is 1751 mm, out of which 83% occurs during June to Sept. Snow fall is received in the higher reaches of Dhauladhar ranges.

The minimum and maximum temperature at Dharamshala varies from 2.9°C in January to 32.9°C in May.

3.0 GEOMORPHOLOGY & SOIL TYPES

Kangra district presents an intricate mosaic of mountain ranges, hills and valleys. It is primarily a hilly district, with altitudes ranging from 350 m amsl to 4880 m amsl in the hills of Dauladhar.

Physiographically, the district can be divided into six units-*viz.* (i) high hills, which cover almost 60% of the district (ii) Fluvio glacial outwash terraces, which is located in the north eastern part of the district (iii) structural terraces, in the central part (iv) valley fills (v) piedmont plain and (vi) flood plain.

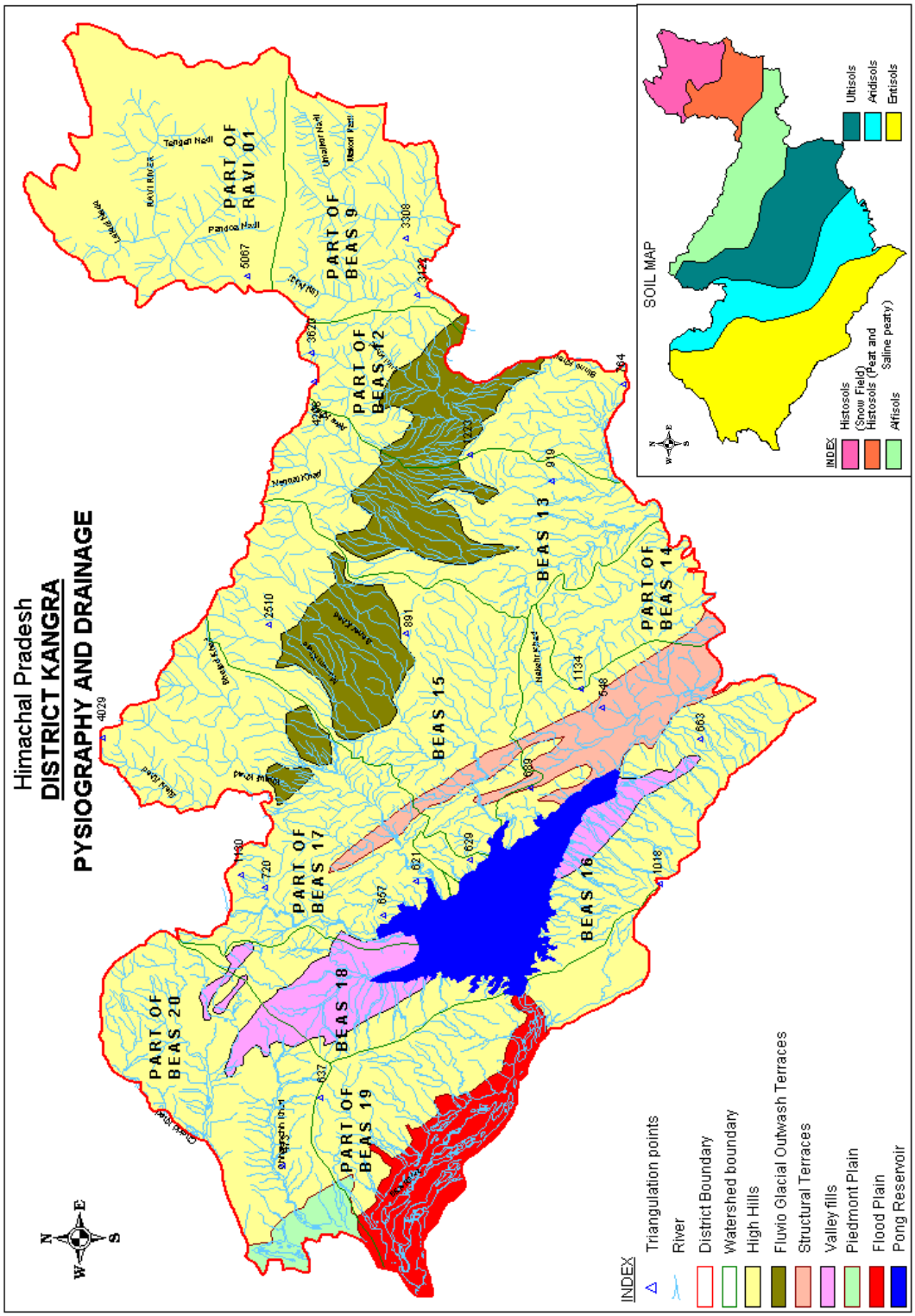
Six type of soils are observed in the district, they are :- 1. Histosols (Snow field, Peaty and Saline Peaty), 2. Ultisols (Brown red and yellow), 3. Alfisols (Sub Mountain), 4. Ardisols (Grey Brown), 5. Entisols (Younger alluvium).

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

The rock formations occupying the district range from pre-Cambrian to Quaternary period. The generalized geological succession in the district is given below.

Age	*Formation*	*Lithology*
Post Tertiary (Quaternary)	Fluvio-glacial/glacial/Interglacial deposits	Moraine & Fluvial deposits
Tertiary	Upper Siwaliks	Conglomerate, Boulder and Sandstone
	Middle Siwaliks	Micaceous sandstone and shale
	Lower Siwaliks	Hard Sandstone and Shale
	Dharamshala	Maroon Sandstone and Shale
----------Main Boundary Fault----------		
	Subathu	Red and green shales
	Intrusive	Granites and gneisses
----------Chandpur thrust----------		
	Chamba and Chandpur	Slate, Phyllite, Quartzite and schist
Pre-Tertiary	Shali and Sundernagar	Limestone and Quartzite
	Jutogh	Schist's and Gneisses
----------Jutogh Thrust----------		
Pre-Cambrian		Granites and Gneisses



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The Hydrogeological frame work of the district is essentially controlled by the geological setting, distribution of rainfall, snow fall, which facilitates circulation and movement of water through inter-connected primary and secondary porosity of the rocks constituting the aquifers.
Based on the geological diversities and relative ground water potentialities of different geological formations, the district can broadly be divided into two Hydrogeological units

i. Fissured formations
ii. Porous formations

i. Fissured Formations:

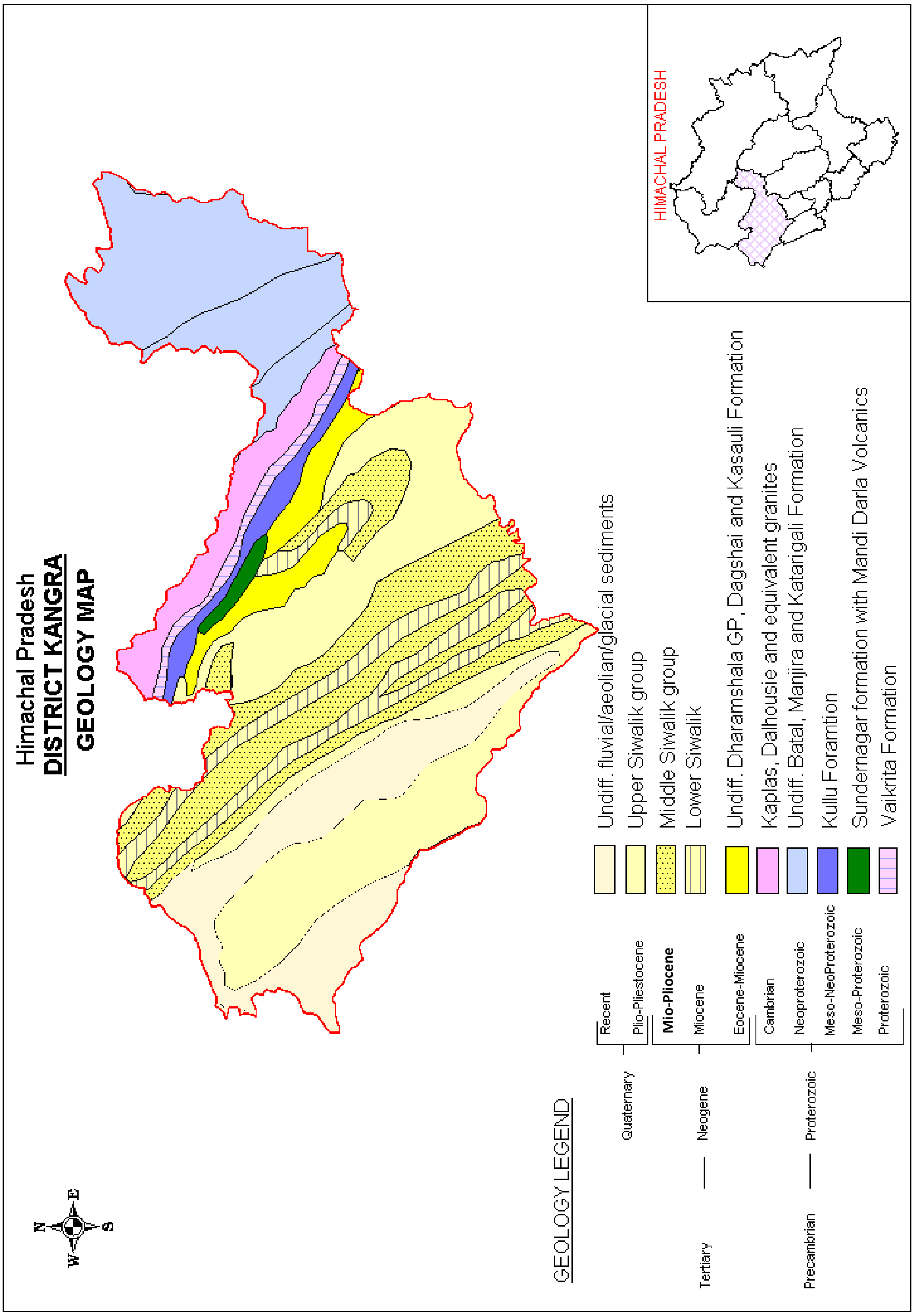
Fissured formations comprise hard rocks belonging to Jutogh, Shali limestones, Chails, Chandpurs, Kangra-Darla volcanic, Subathus, Dharamsala and Siwaliks. These formations consist of schist, quartzite, slates, phyllites, limestones, granites, gneisses, sandstones, conglomerates and shales. These rocks are generally massive and consolidated, devoid of primary porosity and permeability's. Secondary porosity and permeability has developed due to the tectonic activities along the fractured joints and fault zones .Weathered zone rarely form an aquifer because of less thickness of the weathered mantle. In this hard rock terrain ground water occurs either, along structurally week zones, viz. fracture zones, faults, joints or along the contacts of different formations. The ground water in such areas is discharged through the springs in the topographically favourable areas. The thrust zones (Main boundary Fault/Palampur Thrust) and other faults at lower topography are the important areas for ground water development. Springs located along the thrust zone in Dharamsala and Palampur areas are having a discharge of more than 40 lps, indicative of their high potentialities.

In Siwalik formations, the contact zones of various formations and fault zones form potential ground water horizons, especially between Nadaun in the east and Nurpur in the west. Important springs at Trilokpur (30 lps) and Nagni (25 lps) are located at the intersection of Jawalamukhi thrust and north-south trending faults.

Compact conglomeratic formations are generally devoid of water, but hand pumps have been successfully installed in low topography area and along fractured zones. The boreholes drilled for installing handpumps have yielded from less than 1 lps to about 20 lps. Discharge is generally higher in Jawalamukhi area along the thrust zone. Depth to water varies from free flowing condition at Darshanpur(Trilokpur) to about 30 m in the bored wells. Depth to water in shallow zones (dugwells-NHS), generally varies from less than 1 m to 15.44 m. Water level is shallower in topographic lows.

ii Porous Formations:

Quaternary sediments as fluvio-glacial and fluvitile deposits occur as valley fill deposits, overlying the older rocks. Morainic and fluvio-glacial deposits are distributed in Kangra-Palampur valley and in the higher altitude areas, while fluvitile deposits occur either along Beas River or its tributaries in low altitude areas.



Himachal Pradesh
DISTRICT KANGRA
GEOLOGY MAP
HIMACHAL PRADESH
N
E
S
W
GEOLOGY LEGEND
Quaternary
Recent
Undiff. fluvial/aeolian/glacial sediments
Plio-Pliestocene
Upper Siwalik group
Tertiary
Neogene
Mio-Pliocene
Middle Siwalik group
Miocene
Lower Siwalik
Eocene-Miocene
Undiff. Dharamshala GP, Dagshai and Kasauli Formation
Precambrian
Proterozoic
Cambrian
Kaplas, Dalhousie and equivalent granites
Neoproterozoic
Undiff. Batal, Manjira and Katarigali Formation
Meso-NeoProterozoic
Kullu Foramtion
Meso-Proterozoic
Sundernagar formation with Mandi Darla Volcanics
Proterozoic
Vaikrita Formation

4.2 Ground Water Resources

Rainfall is the major source of groundwater recharge, apart from the influent seepage from the rivers, 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.

Ground water resources and irrigation potential for *Indaura and Nurpur* valley in Kangra district, have been computed as per the GEC-97 methodology and the resources for the year 2011, are as follows.

Indaura Valley (26,545 ha)	
Annual Ground Water Availability	10,520.18 Ham
Annual Ground Water Draft	5,263.72 Ham
Stage of Ground Water Development	50.03 %
Nurpur Valley (23,775 ha)	
Annual Ground Water Availability	7,639.43 Ham
Annual Ground Water Draft	3,021.53 Ham
Stage of Ground Water Development	39.55 %

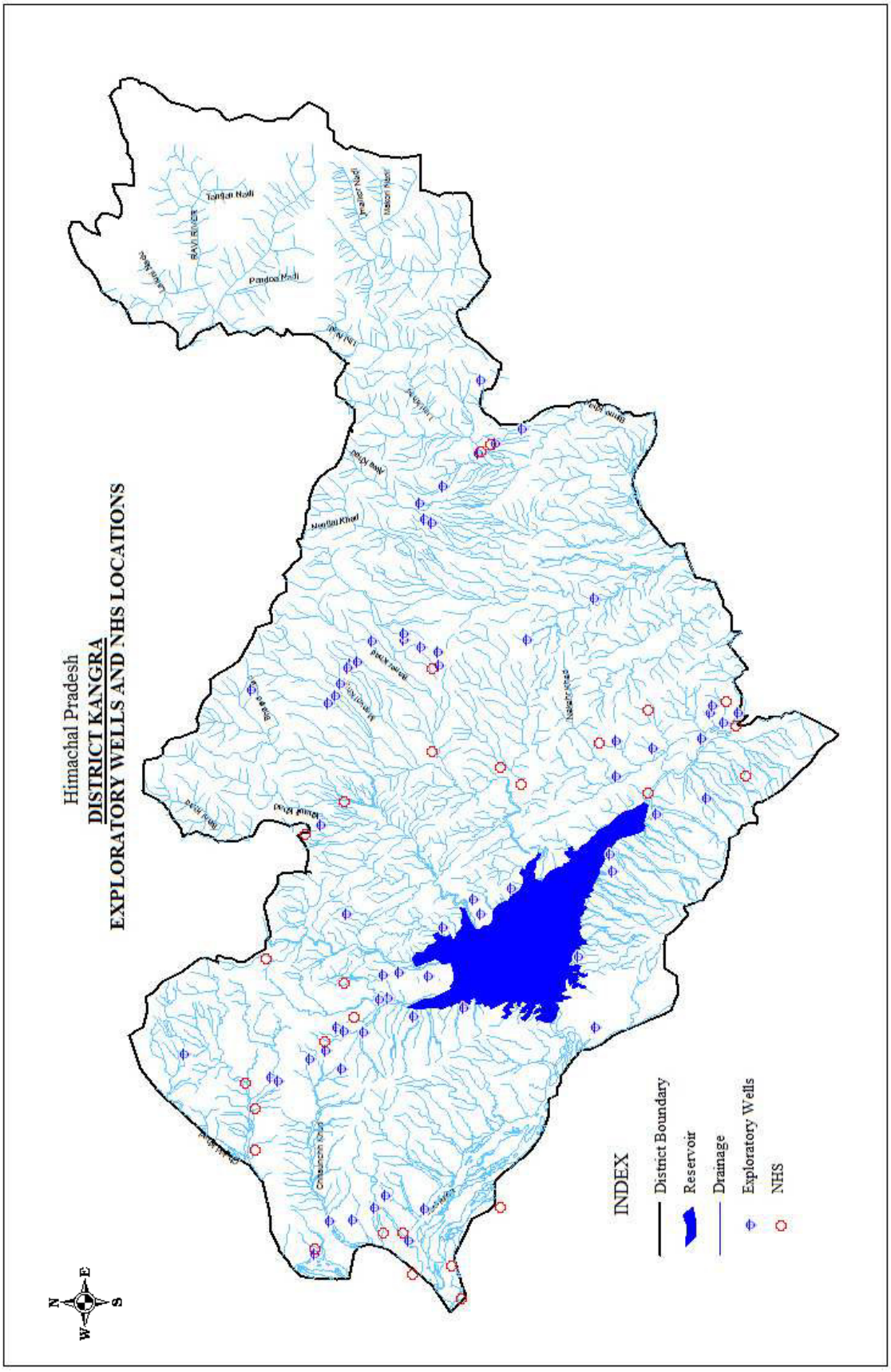
The stage of ground water development in Indaura and Nurpur valley in Kangra district is 50.03% & 39.55 % respectively, and falls under "Safe" category. There is thus a scope for further ground water development.

4.3 Ground Water Quality

Water samples were collected from Ground Water Monitoring Stations during May, 2012, for chemical analysis from 28 National Hydrograph Network Stations, located in Kangra district. The minimum and maximum ranges of the results are tabulated below and are within the permissible limit of safe drinking water set by Bureau of Indian Standard (BIS).

	pH	EC µS/cm at 25°C	HCO_3	Cl	So_4	NO_3	F	Ca	Mg	Na	K	Total Hardness as $CaCO_3$
			(in mg/l)									
Min	7.55	120	37	7.09	Tr	Tr	Tr	10	3.6	6.3	0.6	45
Max	8.46	910	513	110	71	28	0.54	112	56	105	38	370

Overall, ground water quality in the district is good, both for irrigation and domestic purpose. From the samples collected from shallow and deeper aquifers, the EC in ground water is generally below 1000 µS/cm at 25 C, except at a few locations. The other chemical parameters are also within the permissible limits.



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5.0 STATUS OF GROUND WATER DEVELOPMENT

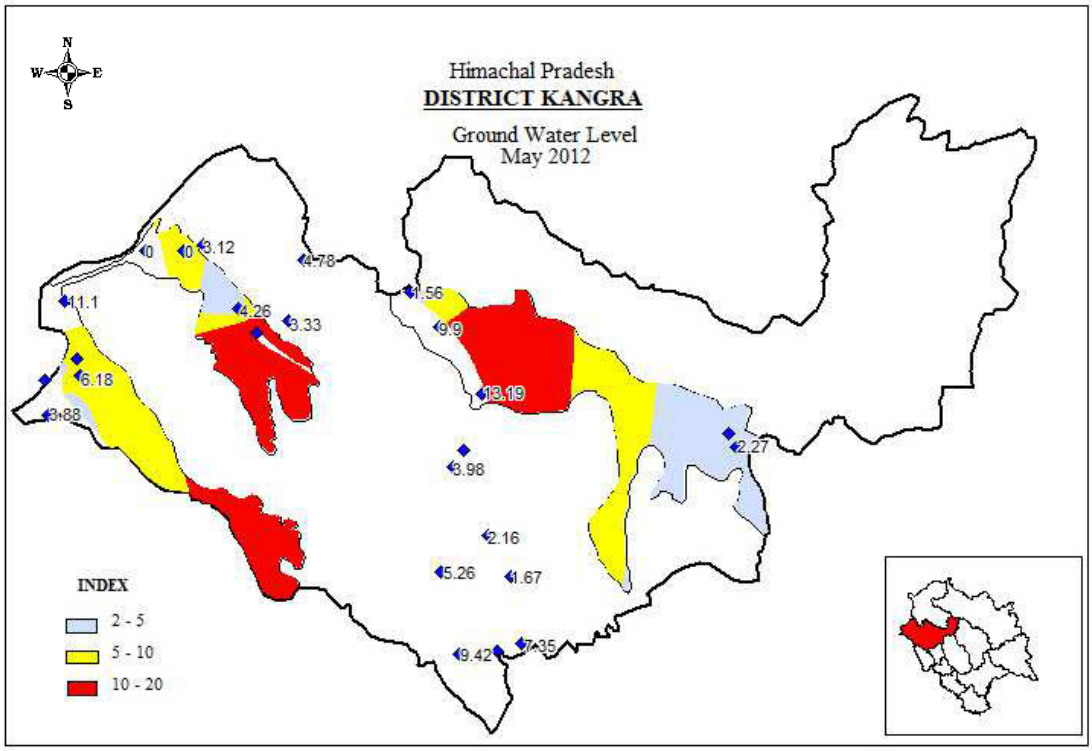
Precipitation is the principal source of Ground water recharge to aquifer systems in the district. The return flow from the irrigation systems like tube well irrigation, surface water lift irrigation, kuhl irrigation are the main sources of ground water recharge. Inflow seepage from khads, rivers, and water reservoirs (pong dam) also contribute to the ground water reserves. In the district, all the major irrigation and drinking water supplies depend on the tube wells, and dug wells, in addition to various water supply schemes based on rivers / nallas.

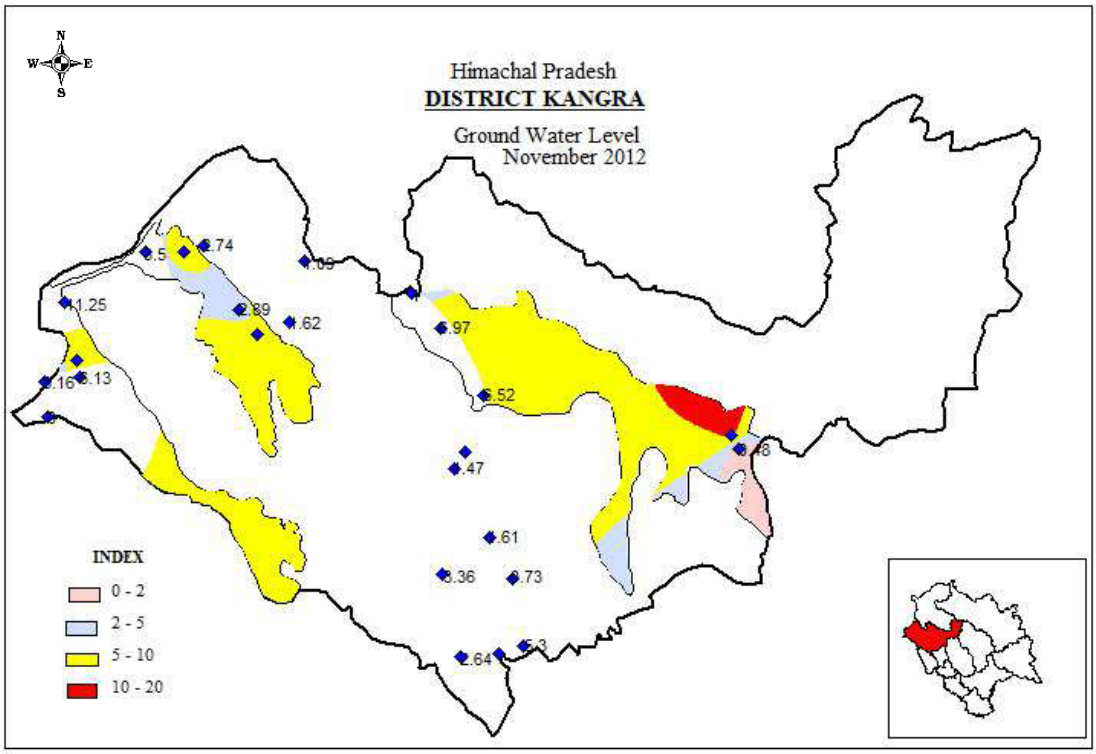
Irrigation & Public Health Department being a nodal agency in the State, dealing with water, taps number of springs yielding discharge less than 1 lps to more than 40 lps, which are perennial and water supply schemes are based on these springs. Generally, these springs are tapped at the source, so that the water can be supplied under gravity. These springs are generally contact or depression types.

State departments has also drilled hand pumps in the district, with the depth ranging from 30 to 60 m, depending upon the lithology of the area and discharge varying from 0.5 lps to 2 lps. Few of them are energized with submersible pumps.

CGWB has constructed, so far 79 exploratory/observation wells in the district, in the depth range of 23.5 m to 432 m bgl. The discharge of these wells was noted between 0.54 lpm to 3,410 lpm, for a drawdown of less than 1 to 60.55 m. Transmissivity ranges from 7.28 to 2,985 m^2/day.

In Kangra district, CGWB monitors 28 hydrograph stations for groundwater regime monitoring, under its National Network. The water levels are monitored four times and ground water quality once, during pre-monsoon period every year. In pre-monsoon (May 2012), the depth to water level range was from 1.56 to 15.44 m bgl and in post-monsoon (November 2012), from 0.48 to 12.30 m bgl.





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6.0 GROUND WATER MANAGEMENT STRATEGY

6.1. Ground Water Development

The district being hilly and mountainous with few valleys, traditional sources of ground water has played a major role since past. However, the ongoing civilization has emplaced some modern means for tapping the ground water.

High hill ranges occupy more than 70 % of the area of the district. During the past years, the traditional ground water source has served the settlements. These include the nalla's, springs, Chasma's, khatris etc. In some of the areas, at present these are the only sources for the survival of the settlements. During the last 15-20 years of development, Irrigation and Public Health Department has constructed number of small depth bore wells, fitted with hand pumps in these areas for ground water use.

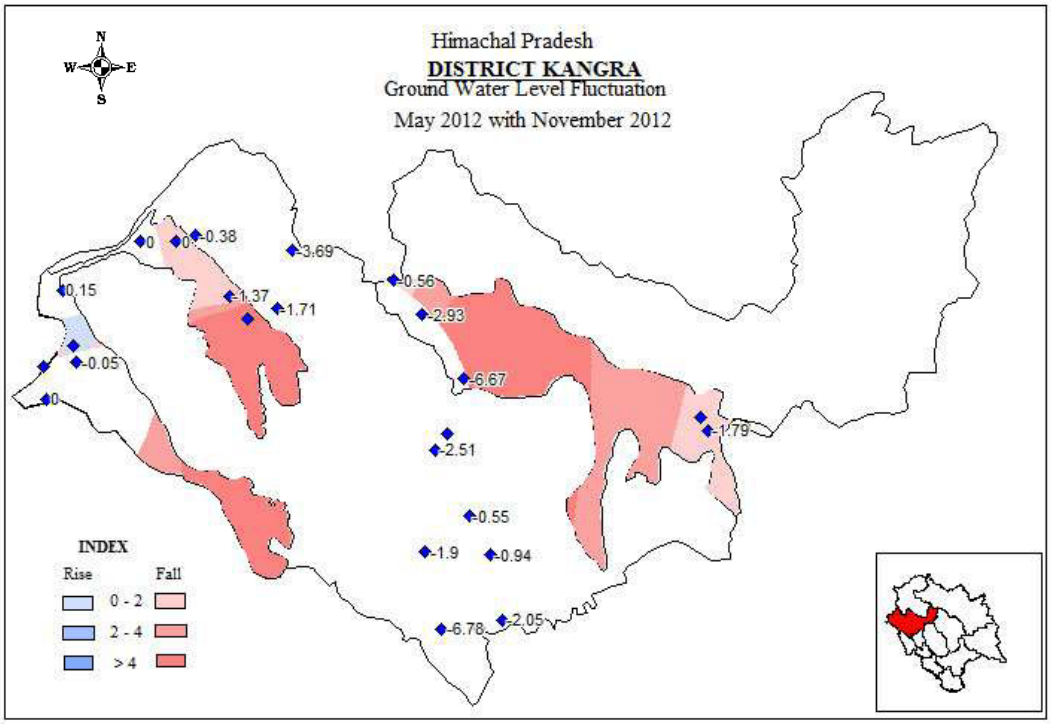
Large scale development for ground water is seen in the valley areas, particularly in the Indaura, Nurpur, Kangra and Palampur Valleys. There exists a wide scope to explore the potentialities of rest of the areas for ground water.

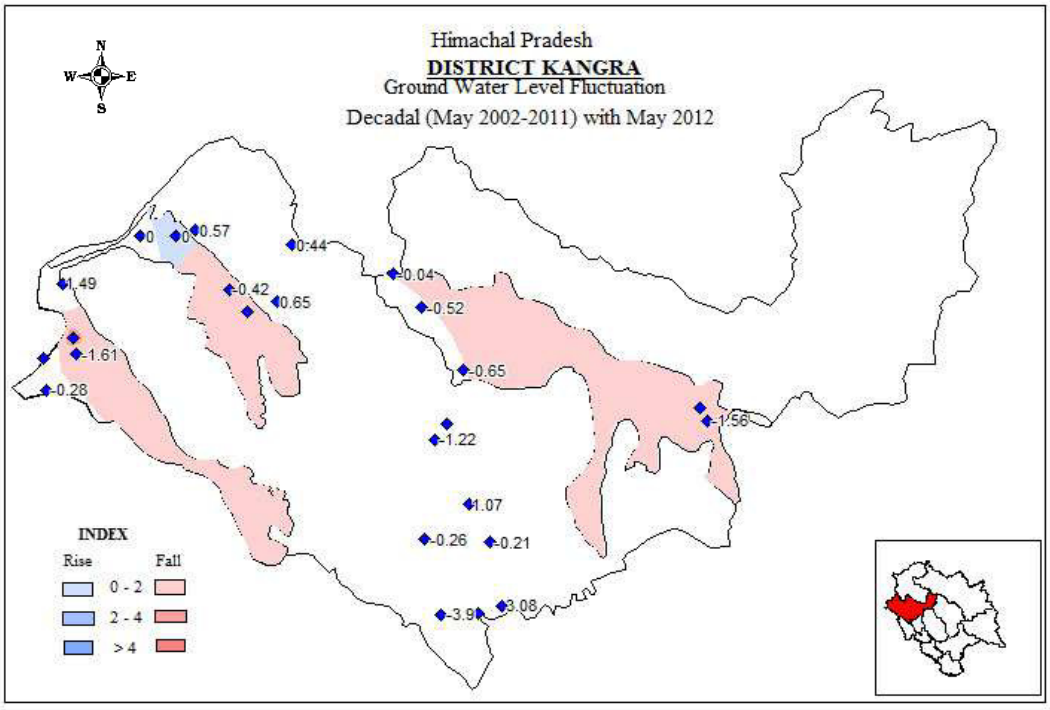
It is also important to note that, the State agencies have established number of irrigation and water supply schemes on various major rivers, tributaries and khads. This has reduced the dependency of the people on ground water. The need, however is supported by shallow depth bore wells, fitted with hand pumps. The entire hilly area of the district is feasible for only drilling shallow to medium depth bore wells.

6.2 . Water Conservation & Artificial Recharge

Ground water extraction through dug wells, hand pumps, tube-wells, *bowries* and the springs are the major sources of water supply to both rural and urban areas, but the availability of water during summer is limited, particularly in drought years and requires immediate attention to augment this resource. Based upon the climatic conditions, topography, hydro-geology of the area, suitable structures 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.

In the hilly areas structures like nalla bunds, gabbion structures, check dams, check dam cum ground water dams, subsurface dykes, revival of ponds are recommended, while in low hill ranges, check dam and roof top rain water harvesting structures can be adopted. So far, CGWB has implemented 5 Artificial Recharge and Rain Water Harvesting schemes at Naherkhad in village Renta Dhawala, Sugal Nala in village Adhwani, Bhati nala in village Kathog, Palampur and Indaura. 5 projects were taken up under XIth plan, which are under implementation by I&PH Department of the State Govt. i.e. at Mandir nala (Jawalamukhi temple), Thera nala at Toru, Kona nala at Duhuk, Jajhar nala at Duhuk and Piyungal nala.





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7 GROUND WATER RELATED ISSUES & PROBLEMS

The district being hilly and mountainous, most of the rainfall goes waste as runoff. This has resulted in variable 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 the micro level studies in a particular area. The most common issue is deep water levels in some of the areas like Bharmour, Mohtli, Paprola and Kangra. Many a times, such problems are human induced and needs to take care of.

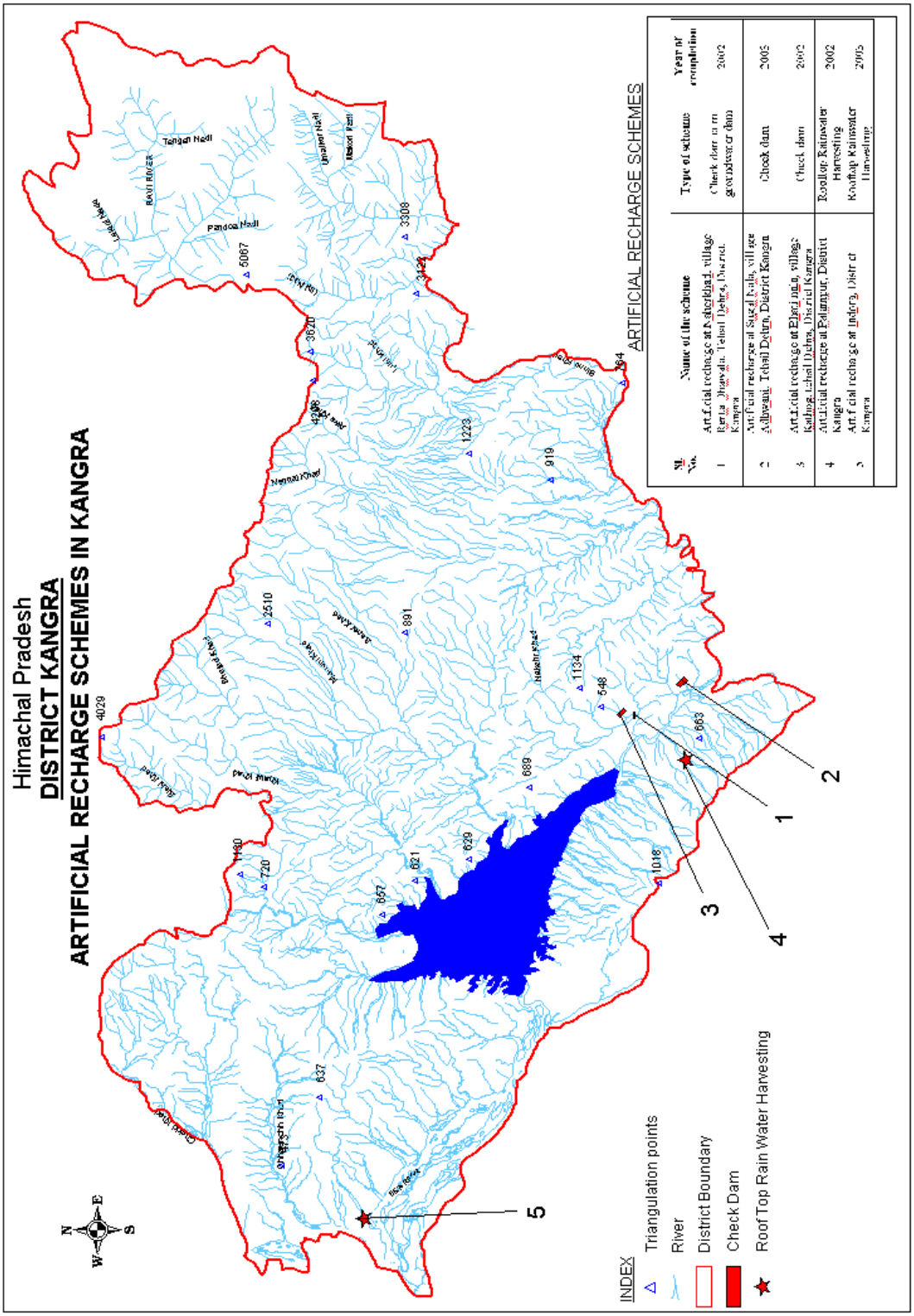
8 AWARENESS & TRAINING ACTIVITY

Mass Awareness Programme (MAP) & Water Management Training Programme (WMTP) organized by CGWB, are as follows:

S.NO	VENUE	DATE
MASS AWARENESS PROGREMMES		
1.	Jawali	July 2003
2.	Hotel Dhauladhar, Dharmsala	15.03.2003
3.	Rice Research Station, Malan	29.03.2003
4.	Chinmaya Tapowan Ashram, Sidhbari	24.03.2004
5.	Industrial Training Institute, Shahpur	14.03.2005
WATER MANAGEMENT TRAINING PROGRAMME		
1.	Industrial Training Institute, Shahpur	14.03.2005
2.	Agricultural Research Station, Jachh	28.03.2007
3.	Rain Water Harvesting, Dharamshala	28.03.2008
4.	Tier II Training Programme, Knagra	18 to 22.03.2013
5.	Awareness raising programme, under HP II, Kangra	26.03.2013
ADVERTISEMENT		
1.	Through Mass media advertisement by slogans through All India Radio	2009,2010,2011
WORKSHOPS		
1.	RTRWH & Spring recharge, Palampur,	19 to 20. 02.2010
2.	On spring recharge & rejuvenation by Artificial Recharge	28.03.2011

	& catchment treatment, Palampur	
3.	On managed aquifer recharge in Valleys and Hills of Himachal Pradesh, Dharamshala.	06.03.2013

So far five Mass Awareness Programmes, five Water Management Training Programmes and three Workshops have been organized in the district which were attended by large gathering of school children, villagers, local people, officers and officials of IPH and Agricultural Department. The exhibition displaying roof top rain water harvesting model and other displays, were arranged to aware the gathering on the themes.



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9 AREAS NOTIFIED BY CGWA / SGWA

The stage of ground water development in Indaura and Nurpur valley of Kangra district is 50.03% & 39.55% respectively and falls in safe category. Thus, no area or block has been notified for groundwater development point of view.

10 RECOMMENDATIONS

There exists ample scope for developing the ground water resource in the district. This will help in fulfilling the domestic water requirement along with the agricultural and irrigational needs. There is a need to have a well-planned ground water development programme for successful implementation. Some of the major recommendations are;

- In valley areas, in addition to traditional ground water structures like dug wells and springs, medium to deep tube wells can be constructed for developing the ground water resource for domestic and irrigational use.
- In hilly terrain, springs and nallas are the major sources of water. Shallow to medium depth bore wells with hand pump are useful ground water structures for meeting the domestic needs.
- Traditional water source i.e. springs, can be revived and developed for domestic use. The discharge of such springs can be sustained by construction of small check dams or subsurface dykes across the nallahs/tributaries at favourable locations.
- Small ponds/tanks/talabs can be utilized for recharging and meeting the domestic needs.
- Roof top rainwater harvesting practices can be adopted in hilly areas since the district receives ample rainfall. Because of hilly terrain, maximum rainfall goes as runoff, and a very small quantity contributes towards ground water replenishment.
- People's participation is a must for any type of developmental activities. So they should be made aware of for proper utilization and conservation of water resources available in the area.

For Technical Assistance Relating to Rainwater Harvesting & Artificial Recharge to Ground Water

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