जल वर्ष 2007 Water Year 2007

स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल

CONSERVE WATER - SAVE LIFE

Government of India
Ministry Of Water Resources
CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET
KANGRA DISTRICT, HIMACHAL PRADESH

NORTHERN HIMALAYAN REGION
DHARMSALA
2008

जल वर्ष 2007 Water Year 2007

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CONSERVE WATER - SAVE LIFE

Contributors

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Our Vision

Water security through sound management

Ground Water Information Booklet

Kangra District, Himachal Pradesh

CONTENTS

GROUND WATER INFORMATION BOOKLET
KANGRA DISTRICT, HIMACHAL PRADESH

1.0 INTRODUCTION

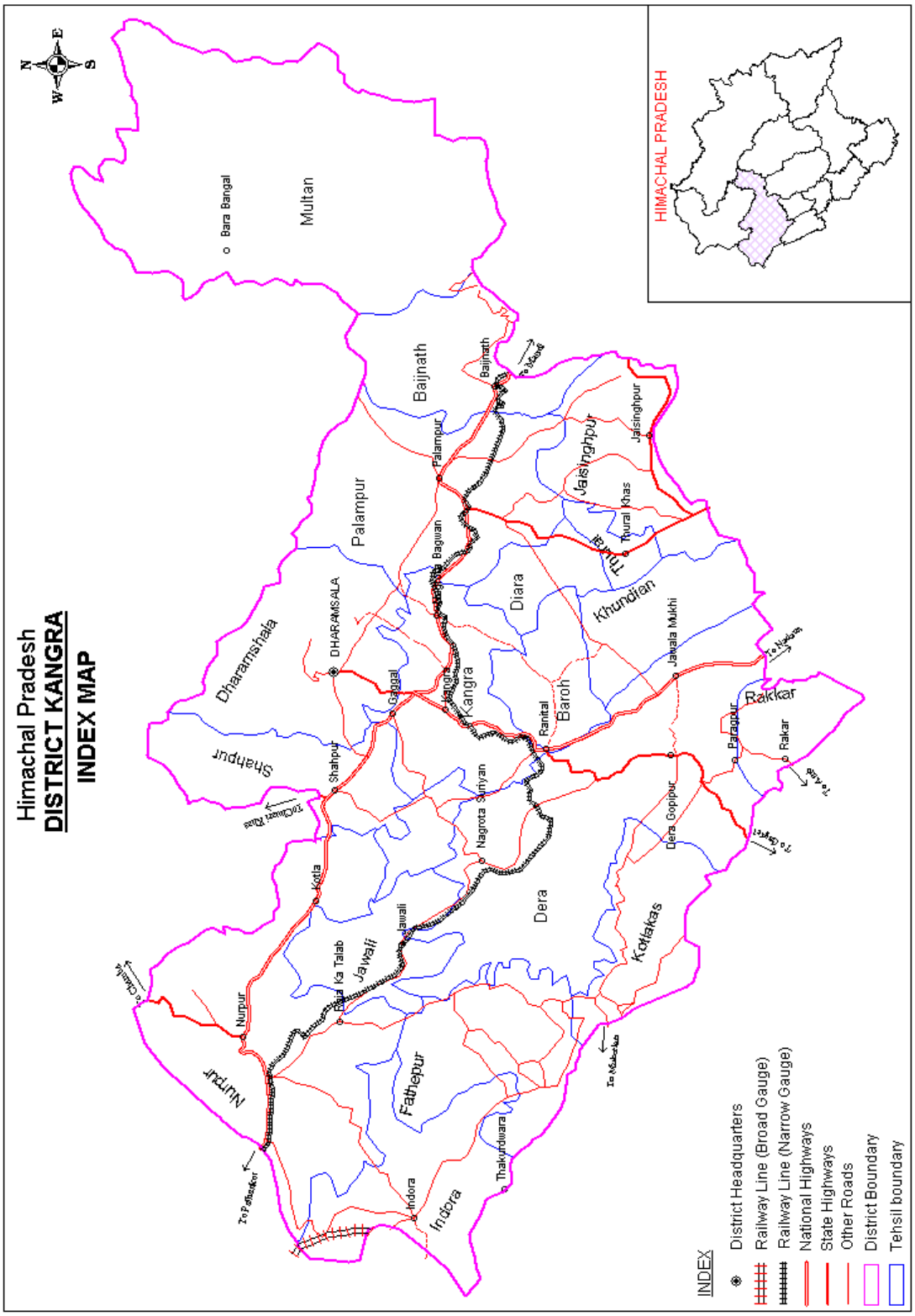
Kangra district, which came into existence in 1972 is located in the Shivalik Hills. The present Kangra district came into existence on the 1st September 1972. The district is predominantly agrarian and around 82% of its population depends on agriculture and its allied activities for their livelihood. The district lies in the western part of Himachal Pradesh and located between lattitudes 31° 41' 00" and 32° 28' 05"; and longitudes 75° 35' 34" and 77° 04' 46", in the low foothills of the Himalayas and is covered by 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 Himachal Pradesh districts of 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 a border with the states of Punjab on the southwest, and Jammu and Kashmir on the northwest.

The area of the district is 5739 sq. km with Dharmsala as its Headquarters. There are 3868 villages in the district. The district has been divided into 8 Sub-divisions [Kangra, Palampur, Dharmsala, Nurpur, Dehra, Baijnath, Jawali, Jaisinghpur]. There are 14 tehsils [Kangra, Baroh, Palampur, Dharmsala, 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 in to 14 CD blocks viz., Kangra, Rait, Nagrota Bagwan, Baijnath, Bhawarna, Lamba Gaon, Panchrukhi, Nurpur, Indora, Dehra, Nagrota Surian, Pragpur, Fatepur, Sulah.

As per 2001 census, the district has a population of 13,39,030 persons with density of population 233 person per sq km. Population wise it ranks first in the State. The male and female population in the district is 6,61,254 and 6,77,776 respectively with a male/female sex ratio of 1025. The schedule cast population in the district is 20.9 % and the schedule tribe population is 0.1%.

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

The major sources of irritation are small water channels or the K*uhls* in the district and an area of 35,922 hectare 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.


Himachal Pradesh
DISTRICT KANGRA
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HIMACHAL PRADESH
Bara Bangal
Multan
Baijnath
Palampur
Dharamshala
Shahpur
Nurpur
Jawali
Fatehpur
Indora
Thakurdwara
Dera
Kotlakas
Diara
Khundian
Baroh
Rakkar
Jaisinghpur
Tural
Kangra
Ranital
Nagrota Suriyan
Dera Gopipur
Jawala Mukhi
Paragpur
Rakar
Baijnath
Palampur
Bagwan
Jaisinghpur
Tural Khas
DHARAMSALA
Gaggal
Kangra
Shahpur
Kotla
Jawali
Ka Talab
Nurpur
Indora
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Jawala Mukhi
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Rakar
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Railway Line (Broad Gauge)
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National Highways
State Highways
Other Roads
District Boundary
Tehsil boundary

2.0 CLIMATE & RAINFALL

The climate of the district varies from sub-trophical to sub-humid. Winter varies from December to February and summer extends from March to June while July to September are rainy months. The average rainfall in the district occurs between July to September. The average rainfall in the district during 2005 was 1765.1 mm. Snow fall is received in the higher reaches of Dhauladhar ranges.

Average minimum and maximum temperature 3°C and 45°C

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

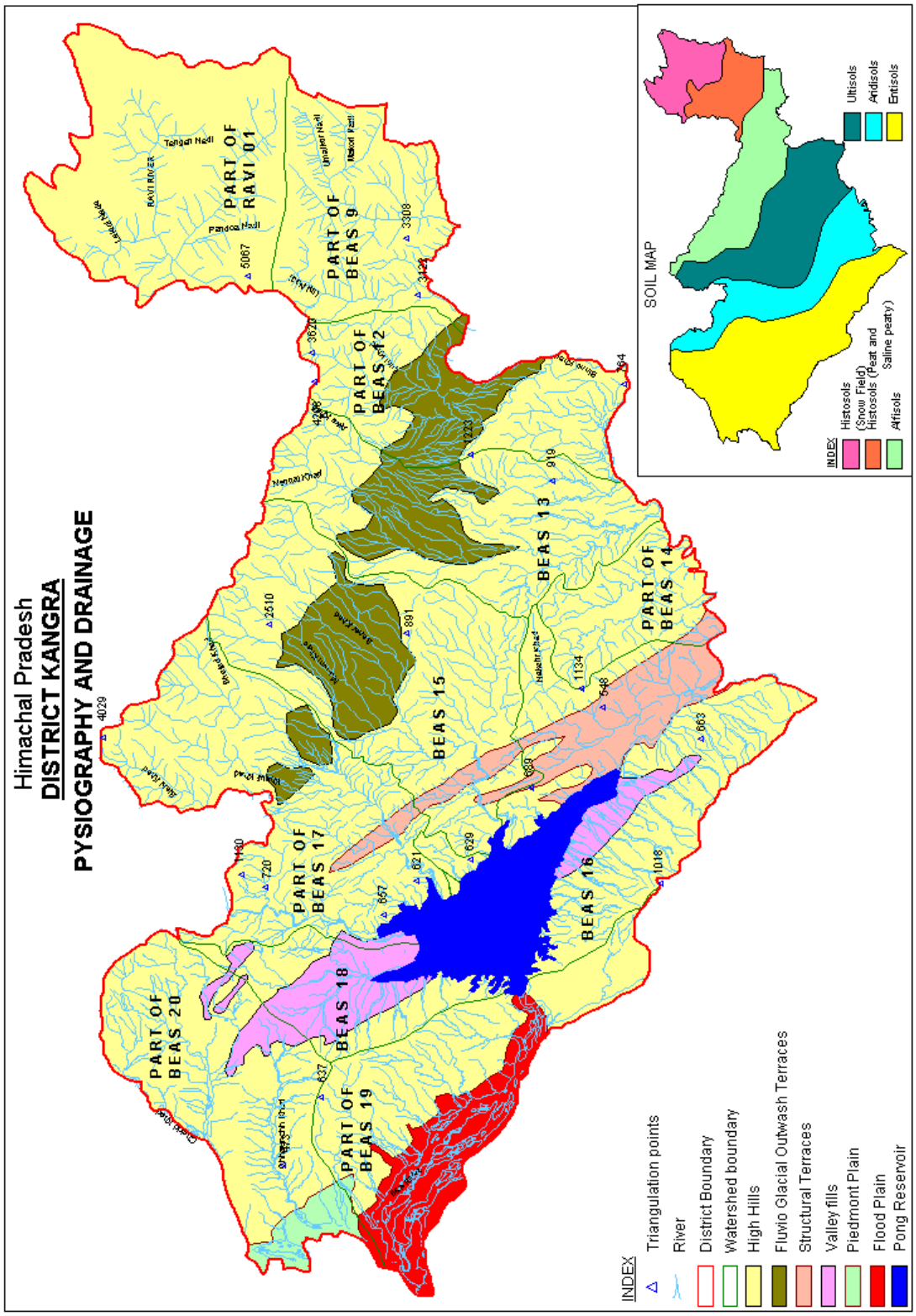
Six type of soils are observed in the district they are 1. Histosols (Snow field, Peaty and Saline Peaty), 2. Ultisols (Brown red and yellow), 3. Alfisols (Sub Mountain), 4. Ardisols (Grey Brown), 5. Entisols (Younger alluvium).

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	Schists and Gneisses
----------Jutogh Thrust----------		
Pre-Cambrian		Granites and Gneisses


Himachal Pradesh
DISTRICT KANGRA
PYSIOGRAPHY AND DRAINAGE
PART OF RAVI 01
PART OF BEAS 9
PART OF BEAS 12
BEAS 13
PART OF BEAS 14
BEAS 15
BEAS 16
PART OF BEAS 17
BEAS 18
PART OF BEAS 19
PART OF BEAS 20
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High Hills
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Piedmont Plain
Flood Plain
Pong Reservoir
SOIL MAP
Ultisols
Aridisols
Entisols
INDEX
Histosols (Snow Field)
Histosols (Peat and Saline peaty)
Alfisols

The Hydrogeological frame work of the district is essentially controlled by the geological setting, distribution of rainfall, snow fall, which facilities circulation and movement of water through inter-connected primary and secondary 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:

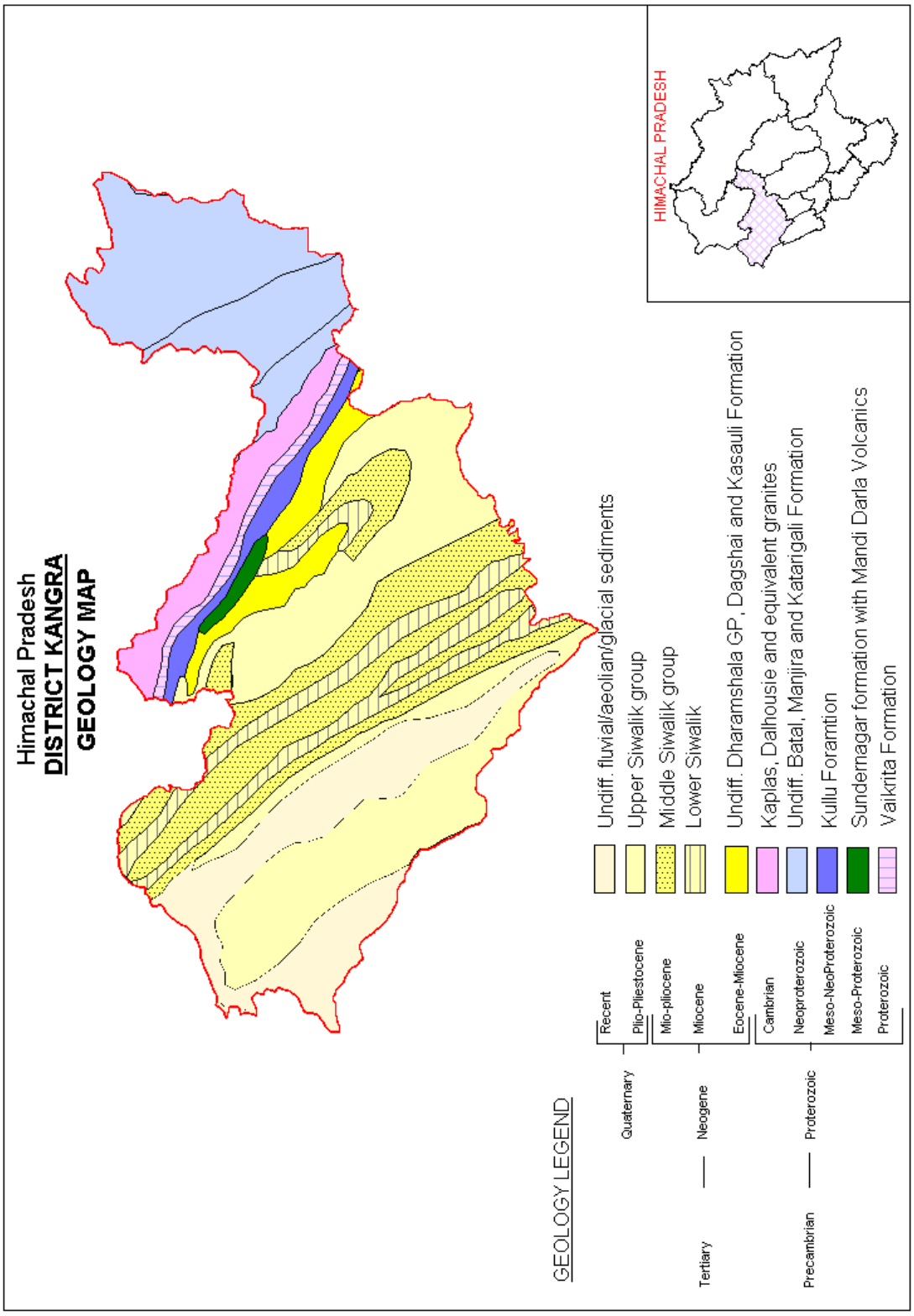
Fissured formations are constituted by hard rock formations belonging to Jutogh, Shali limestone's, Chails, Chandpurs, Kangra-Darla volcanic, Subathus, Dharamhala and Siwaliks. These formations are consisting of schists, quartzite's, slates, phyllites, limestones, granites, gneisses, sandstones, conglomerates and shales. These rocks are generally massive and consolidated and 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 the less thickness of the weathered mantle, in this hard rock terrain ground water occur either along structurally week zones, viz. fracture zones, faults, joints or along the contacts of differnt 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 Dharmsala and Palampur area 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 the potential ground water horizons 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 form 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 meter in the bored wells. Depth to water in shallow zones (dugwells-NHS) generally varies from less than one meter to 10 meters. Water level is shallower in topographic lows.

ii Porous Formations:

Quaternary sediments as fluvio-glacial and fluviatile deposits are occurring 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 fluviatile deposits are occurring either along Beas river or its tributaries in low altitude areas.


Himachal Pradesh
DISTRICT KANGRA
GEOLOGY MAP
HIMACHAL PRADESH
GEOLOGY LEGEND
Quaternary
Recent
Plio-Pliestocene
Tertiary
Neogene
Mio-pliocene
Miocene
Eocene-Miocene
Precambrian
Proterozoic
Cambrian
Neoproterozoic
Meso-NeoProterozoic
Meso-Proterozoic
Proterozoic
Undiff. fluvial/aeolian/glacial sediments
Upper Siwalik group
Middle Siwalik group
Lower Siwalik
Undiff. Dharamshala GP, Dagshai and Kasauli Formation
Kaplas, Dalhousie and equivalent granites
Undiff. Batal, Manjira and Katarigali Formation
Kullu Foramtion
Sundernagar formation with Mandi Darla Volcanics
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 *Indora and Nurpur* valley in Kangra district have been computed as per the GEC-97 methodology the resources for the year 2004 are as follows.

1.		Area (Indora and Nurpur Valley) considered for GW Assessment	ha m	27,000
2.		Annual Replenishable Ground Water Resource	ha m	10,239
	A.	Monsoon Season	ha m	7,812
		i) Recharge from Rainfall	ha m	7,663
		ii) Recharge from other sources	ha m	149
	B.	Non-monsoon Season	ha m	2,427
		i) Recharge from rainfall	ha m	2,127
		ii) Recharge from other sources	ha m	300
3.		Natural Discharge during Non-monsoon Season	ha m	1,024
4.		Net Annual Ground Water Availability	ha m	9,215
5.		Annual Ground Water Draft	ha m	2,435
		i) Irrigation	ha m	1,800
		ii) Domestic & Industrial	ha m	635
6.		Projected Demand for Domestic and Industrial uses up to 2025	ha m	888
7.		Ground Water Availability for Future Irrigation	ha m	6,527
8.		Stage of Ground Water Development		26 %

The stage of ground water development in Indora and Nurpur valley in Kangra district is 26% and falls under “Safe” category. There is thus scope for further ground water development.

4.3 Ground Water Quality

CGWB monitors the ground water quality of shallow aquifers at 28 National Hydrograph Networks Stations located mostly in Kangra district. In addition to these, water samples are collected during the scientific studies whenever taken up.

District		pH	EC µS/cm at 25°C	HCO_3	Cl	NO_3	F	Ca	Mg	Na	K	Total Hardness as $CaCO_3$
				(mg/l)								
Kangra	Min	7.25	132	49	7.1	0.32	0.20	16	2.4	3.9	0.40	75
	Max	8.48	871	443	92	21.2	0.67	120	67	55	26	374

Overall ground water quality in the district is in general good both for irrigation and domestic purpose. From the samples collected from ground water sources viz., well, tube wells, hand pumps and springs, the EC in ground water is generally below 1000 µS/cm at 25 C. Other chemical parameters are also within the permissible limits.

Himachal Pradesh

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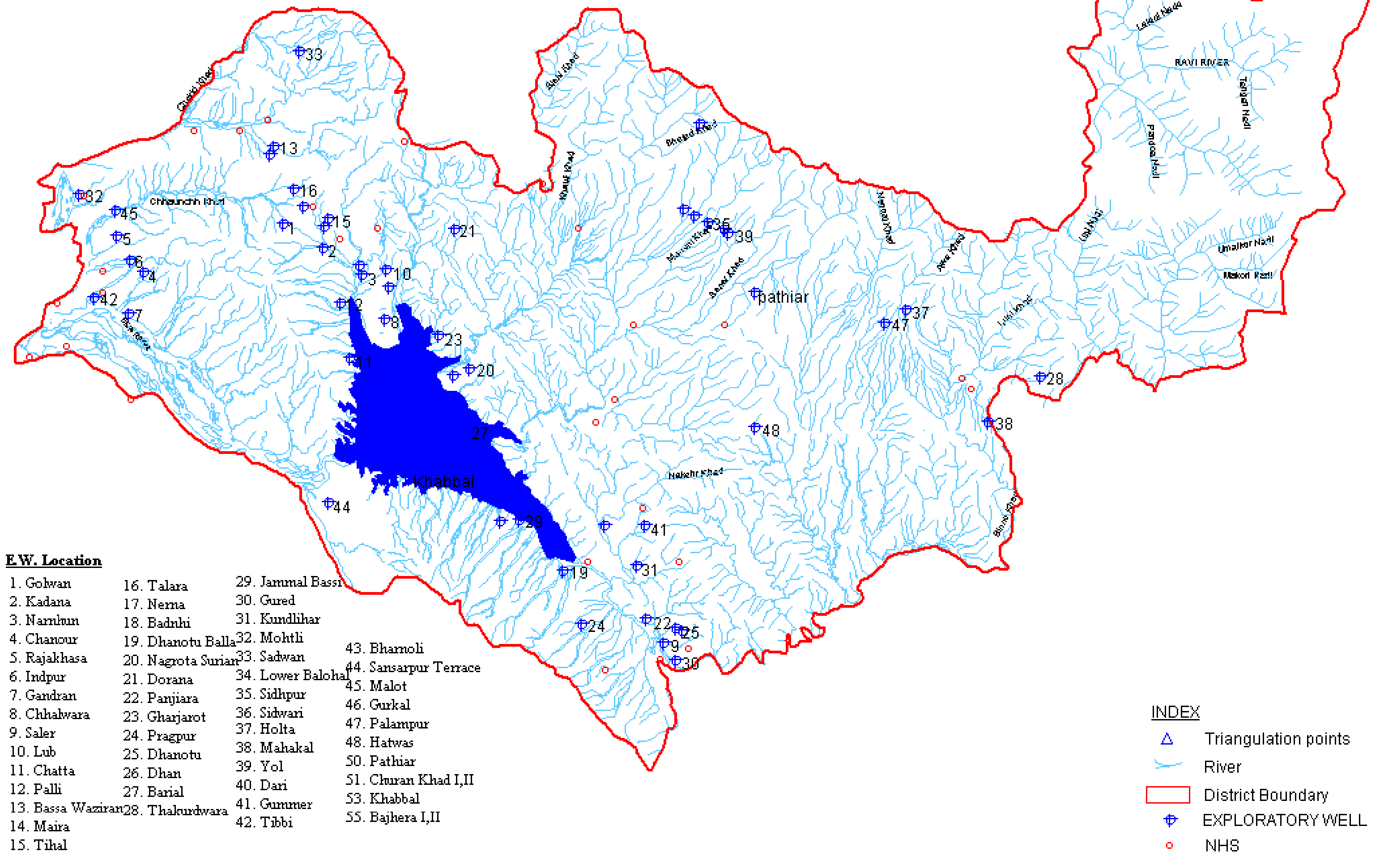
EXPLORATORY WELL AND NHS LOCATIONS



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 well 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 concerned with water, tapped 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 springs.

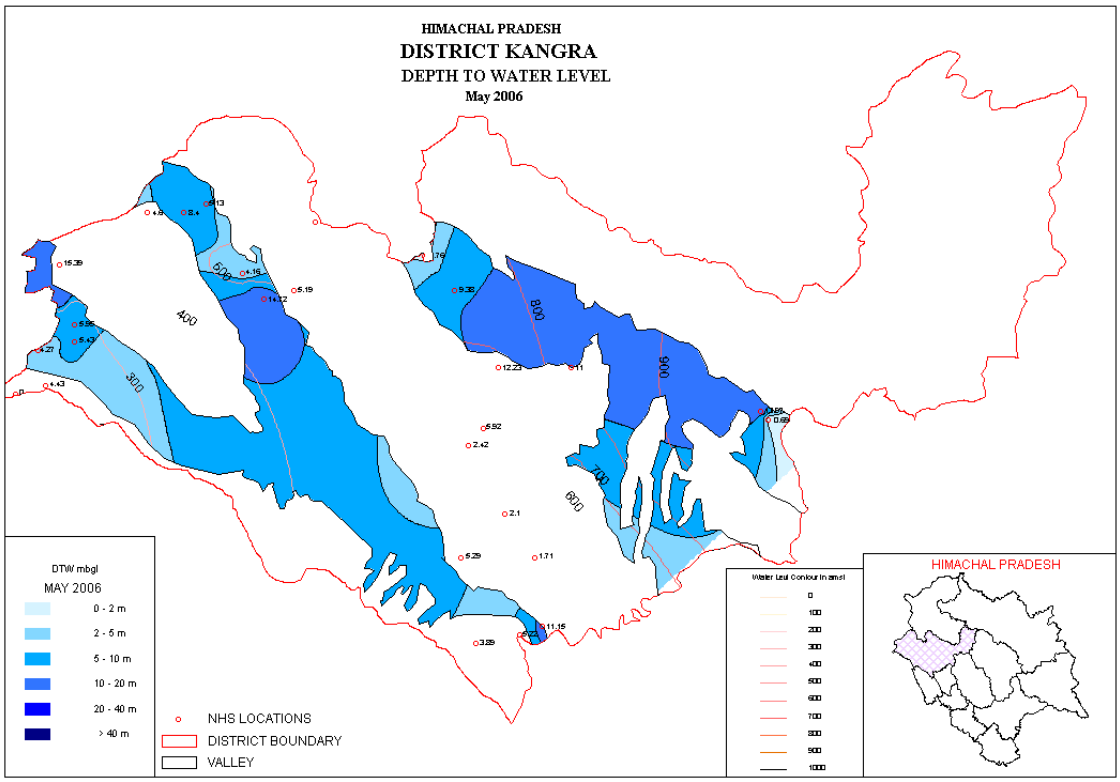
State departments has also drilled handpumps in the district with the depth ranging from 30 to 60 m depending upon the lithology of the area with a discharge varying from 0.5 lps to 2 lps. Few of them energized with submersible pumps.

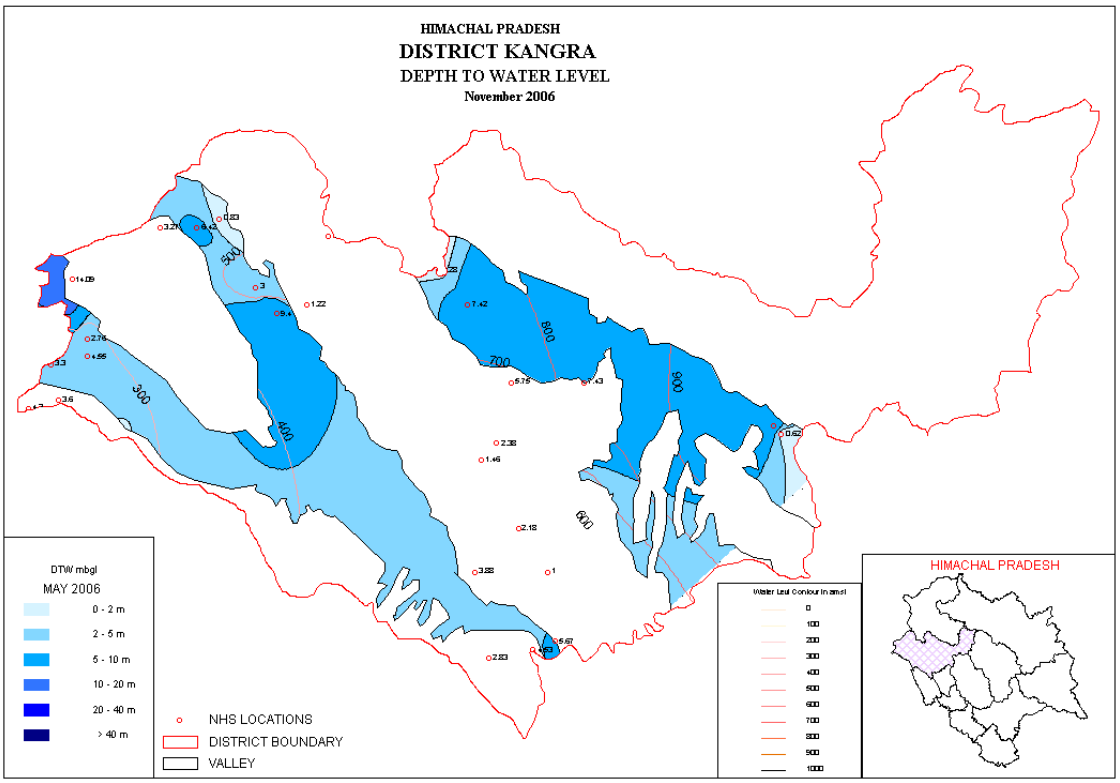
CGWB has so far constructed 53 number of exploratory wells and two number of Observatory wells in the district in the depth range of 50 to 432 m bgl. The discharge of these wells was noted between less than 1 lps to more than 55 lps for a drawdown of less than 1 to more than 32 m for Transmissivity ranging between 10 to 1971 m^2/day.

In Kangra district CGWB maintains 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 Premonsoon (May 2006) the depth to water level ranges from 0.69 mbgl (Pandther) to 15.39 mbgl (Mohtli) and average water level during the period is worked out to be 6.34 mbgl.

In postmonsoon (November 2006) the depth to water level ranges from 0.62 mbgl (Pandther) to 14.09 mbgl (Mohtli) and average water level during the period in the district is worked out to be 4.15 mbgl.

Decadal fluctuation of water level has been worked out by comparing mean of 10 years DTW data recorded during May 1998 to May 2006 with DTW recorded during May 2006. 85% of the wells showed fall in water level from 0.02 to 3.45 m and the remaining 15% of the wells showed rise in water level from 0.96 to 3.02 m. Average fall & rise is 1.51 m & 2.33 m respectively.


HIMACHAL PRADESH
DISTRICT KANGRA
DEPTH TO WATER LEVEL
May 2006
DTW mbgl
MAY 2006
0 - 2 m
2 - 5 m
5 - 10 m
10 - 20 m
20 - 40 m
> 40 m
NHS LOCATIONS
DISTRICT BOUNDARY
VALLEY
Water Level Contour in amsl
HIMACHAL PRADESH


HIMACHAL PRADESH
DISTRICT KANGRA
DEPTH TO WATER LEVEL
November 2006
DTW mbgl
MAY 2006
0 - 2 m
2 - 5 m
5 - 10 m
10 - 20 m
20 - 40 m
> 40 m
NHS LOCATIONS
DISTRICT BOUNDARY
VALLEY
Water Level Contour in amsl
HIMACHAL PRADESH

6.0 GROUND WATER MANAGEMENT STRATEGY

6.1. Ground Water Development

The district being hilly & 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 nallas, springs, Chasmas, khatis. In some of the areas, at present too these are the only sources for the survival of the settlements. During the last 15-20 years of ground water development, Irrigation and Public Health Department has constructed number of small depth bore wells fitted with hand pumps in these areas.

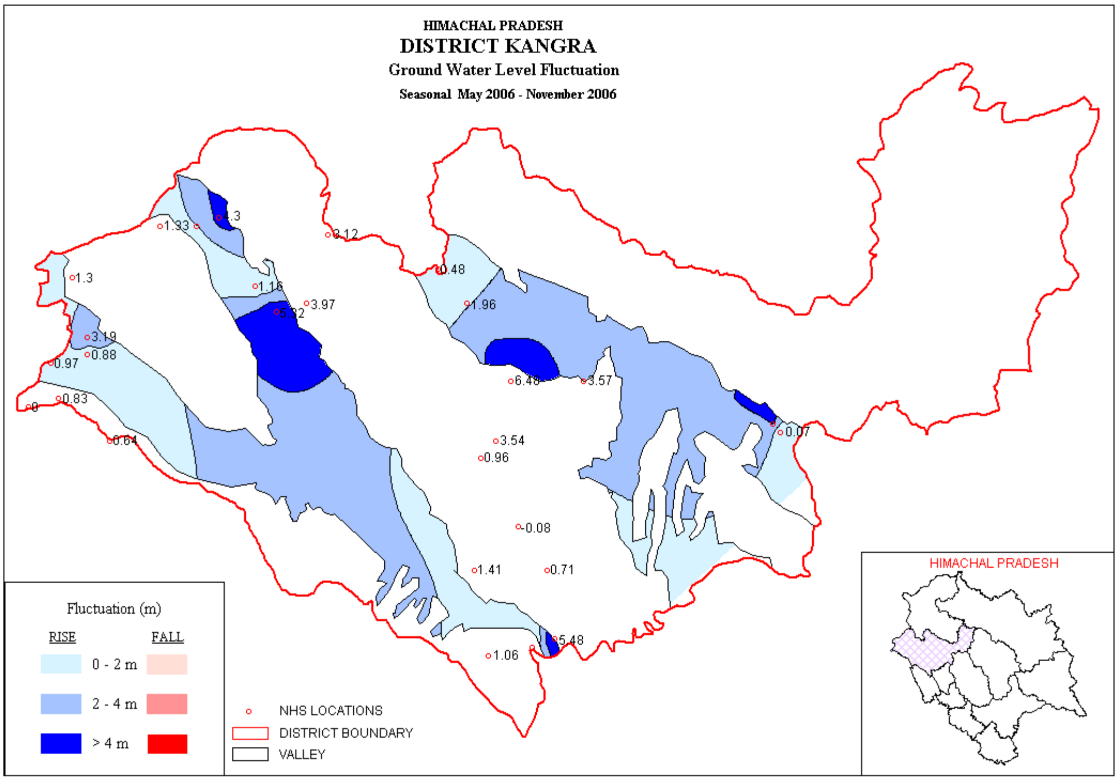
Large scale development for ground water is seen in the valley areas particularly in the Indora and Nurpur Valley, Kangra valley and Palampur Valley. There exists a wide scope to explore the potentialities of rest of the areas for ground water.

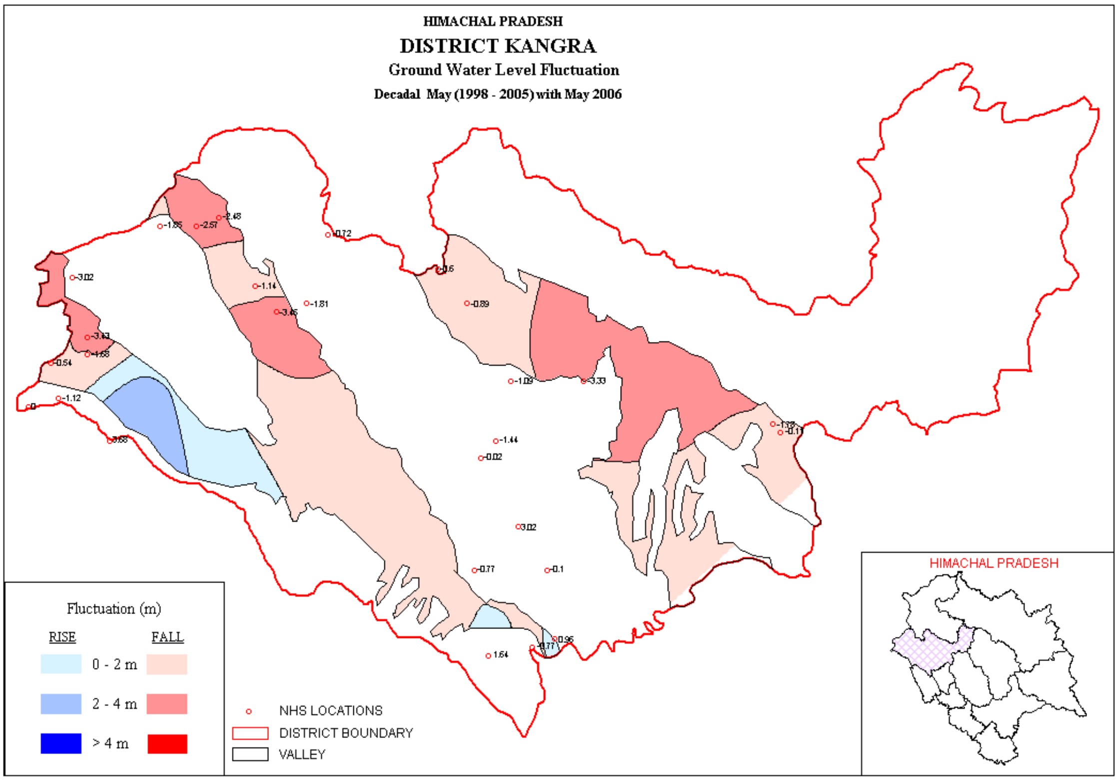
It is also important to note that the state agencies have established number of irrigation and water supply on various major rivers, tributaries and khads. This has reduced the dependency of the people on the ground water. The need however is supported by shallow depth bore wells fitted with hand pumps. 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, bawries 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 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.

In the hilly areas structures like nalla bunds, gabion 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. Its Salient features are given below.


HIMACHAL PRADESH
DISTRICT KANGRA
Ground Water Level Fluctuation
Seasonal May 2006 - November 2006
1.3
1.33
1.3
3.12
1.16
3.97
3.19
0.88
0.97
0.83
0
0.64
0.48
1.96
6.48
3.57
0.07
3.54
0.96
0.08
1.41
0.71
5.48
1.06
Fluctuation (m)
RISE
FALL
0 - 2 m
2 - 4 m
> 4 m
NHS LOCATIONS
DISTRICT BOUNDARY
VALLEY
HIMACHAL PRADESH


HIMACHAL PRADESH
DISTRICT KANGRA
Ground Water Level Fluctuation
Decadal May (1998 - 2005) with May 2006
Fluctuation (m)
RISE
FALL
0 - 2 m
2 - 4 m
> 4 m
NHS LOCATIONS
DISTRICT BOUNDARY
VALLEY
HIMACHAL PRADESH

Sl. No.	Name of the scheme	Type of scheme	Year of completion
1	Artificial recharge at Naherkhad, village Renta Dhawala, Tehsil Dehra, District Kangra	Check dam cum groundwater dam	2002
2	Artificial recharge at Sugal Nala, village Adhwani, Tehsil Dehra, District Kangra	Check dam	2003
3	Artificial recharge at Bhati nala, village Kathog, tehsil Dehra, District Kangra	Check dam	2002
4	Artificial recharge at Palampur, District Kangra	Rooftop Rainwater Harvesting	2002
5	Artificial recharge at Indora, District Kangra	Rooftop Rainwater Harvesting	2003

7 GROUND WATER RELATED ISSUES & PROBLEMS

The district being hilly and mountainous, most of the rainfall goes waste as runoff. This has resulted in various 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 of the common issues are deeper water level in some of the areas like Bharmour, Mohtli, Paprola and Kangra. Many times such problems are human induced are needs to taken care of.

8 AWARENESS & TRAINING ACTIVITY

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

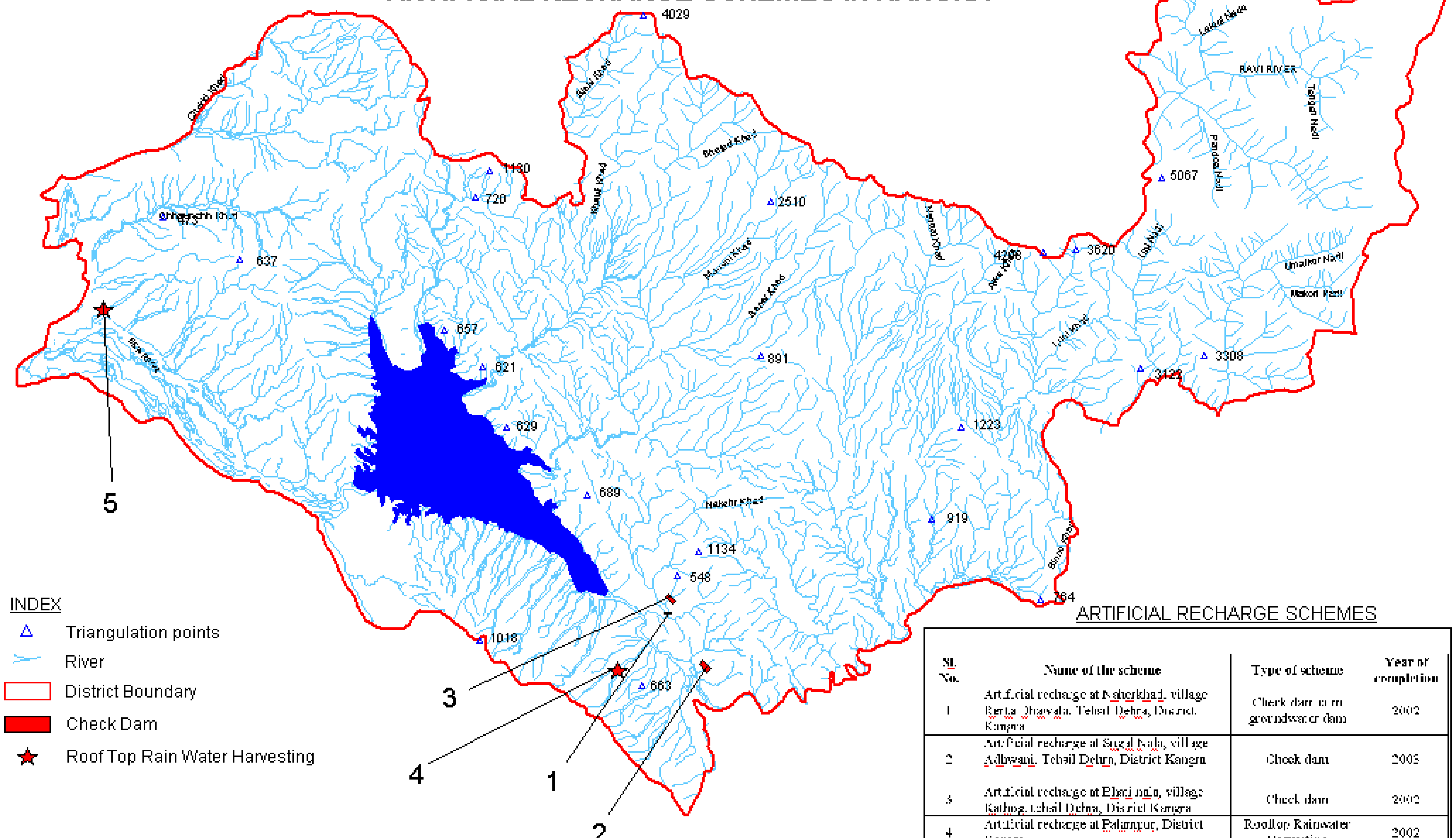
S.NO	VENUE	DATE
MASS AWARENESS PROGREMMES		
1.	Jawali	July 2003
2.	Hotel Dhauladhar, Dharmsala	15.03.2003
3.	Rice Research Station, Malan	29.03.2003
4.	Chinmaya Tapowan Ashram, Sidhbari	24.03.2004
5.	Industrial Training Institute, Shahpur	14.03.2005
WATER MANAGEMENT TRAINING PROGRAMME		
1.	Industrial Training Institute, Shahpur	14.03.2005
2.	Agricultural Research Station, Jachh	28.03.2007

So far four Mass Awareness Programme on Rainwater Harvesting and Water Management were conducted at Jawali, Dharmsala, Malan, Sidbhari and one Water Management Training Programme was conducted at Jachh and one Mass Awareness cum Water Management Training Programme were conducted at Shahpur. Large gathering of school children and villagers, local people and officers and officials of IPH and agricultural Department attended the function. Lectures were delivered during the

Himachal Pradesh

DISTRICT KANGRA

ARTIFICIAL RECHARGE SCHEMES IN KANGRA



ARTIFICIAL RECHARGE SCHEMES

Sl. No.	Name of the scheme	Type of scheme	Year of completion
1	Artificial recharge at Nakerkhad, village Berta Jhawala, Tehsil Dehra, District Kangra	Check dam cum groundwater dam	2002
2	Artificial recharge at Sugal Nala, village Adhwani, Tehsil Dehra, District Kangra	Check dam	2003
3	Artificial recharge at Ehri nala, village Kathog, tehsil Dehra, District Kangra	Check dam	2002
4	Artificial recharge at Palampur, District Kangra	Rooftop Rainwater Harvesting	2002
5	Artificial recharge at Indora, District Kangra	Rooftop Rainwater Harvesting	2005

Programme focusing on the need for harvesting water for various uses and artificial recharge to groundwater for future use. The exhibition displaying roof top rain water harvesting model and other displays were arranged to aware the gathering on the theme.

9 AREAS NOTIFIED BY CGWA / SGWA

The stage of ground water development in Indora and Nurpur valley of Kangra district is 26% only 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, springs, medium to deep tube wells can be constructed for developing the ground water resource for domestic, agricultural 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 resources like 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 in the downstream.
- Small ponds/tanks/talabs can be utilized for recharging and meeting the domestic need. Manually these structures can be constructed for harvesting water and can be ultimately utilized for both 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 of 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 for proper utilization and conservation of water resources available. In addition, efforts from all part of the people are required for proper implementation of development programme.

स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल

CONSERVE WATER - SAVE LIFE

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

Contact:

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