# GROUND WATER INFORMATION BROCHURE OF LEH DISTRICT JAMMU AND KASHMIR STATE

## CONTENTS

## LEH DISTRICT AT A GLANCE

| *S.NO* | **ITEMS** | ***Statistics*** |
|---|---|---|
| *1.* | GENERAL INFORMATION | |
| | i) Geographical area (Reported area) in Sq.km | **82665*Includes 37555 Sq.km (illegal occupation of China in Leh Dist.)=45110 Sq.Km** |
| | ii) Administrative Divisions (2009-10) | |
| | • Number of Tehsils & Sub-Tehsils (2011) | 6 |
| | • Number of CD Blocks (2009-10) | 9 |
| | • Number of Panchayats (2009-10) | 93 |
| | • Number of Villages (2009-10) | 114 |
| | • Number of Inhabited Villages (2001) | 112 |
| | iii) Population (2011 Census) | |
| | • Total population (2011) | 147104 persons |
| | • Total Male and Female (2011) | 92907 & 54197 |
| | • Population Density (persons/Sq.km) (2011) | 3 |
| | • Population Growth Rate (2001-2011) | 25.48% |
| | • Literacy rate (2011) | 80.48% |
| | • Rural & Urban Population (2011) | 57.04% & 42.96% |
| | • Buddhists, Islam, Hindus & Others (%) 2011 | 45.3%,41.8%,8.2%&4.7% |
| | • Sex Ratio (2011) | 583 |
| | iv) Climate(2011) | Cold Continental Arid Climate |
| | v) Average Annual Precipitation (2011) | |
| | a)Snow fall in mm (2011) | 150 mm |
| | b) Rainfall in mm(2011) | 102(4.02’’) |
| | vi) Temperature $^{o}$C($^{o}$ F) (2011) | -28(-18.4) to 33(91.4) |
| | vii) Harsh winter (2011) | October to Early March |
| 2. | GEOMORPHOLOGY | |
| | Major Physiographic units | • **High able lands** with U- shaped valleys developed from erosion and deposition by glaciers.<br>• **Important plains** are Leh Plain, More Plain, Hanle Plain, Dipsang Plain and Soda Plain.<br>• **Sharp ridges** of hard rock<br>• **Intervening valleys** & **River Terraces**<br>• **Valleys fill deposits. Scree and Talus deposits** |
| | Altitude Range | **5934 to 8510** m AMSL |
| | Major Drainages | Indus,Shyok and Nubra |
| 3. | LAND USE (2009-2010) | |
| | • Forest area | 2900 Ha(estimated) |
| | • Net area swon | 10196 Ha |
| | • Area under food grains | 8427 Ha |
| | • Fruits and Vegetables | 448 Ha |
| | • Oil seeds | 86 Ha |
| | • Fooder | 2095 Ha |
| 4. | MAJOR SOIL TYPES | Sandy loam (Major area)<br>Silty clay (limited area)<br>Clay loam(limited area) |

| | | |
|---|---|---|
| 5. | IRRIGATION BY DIFFERENT SOURCES<br>(Minor 2009-10 Census) (Sq.Km) | |
| | • Dug wells & Shallow Tube wells<br>• Surface water<br>• Spring<br>• Other sources | Nil<br>101.96<br>Nil<br>Nil |
| 6 | NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.03.2011)<br>• No. of Dug wells<br>• No. Piezometers | <br>Nil<br>Nil |
| 7 | PREDOMINANT GEOLOGICAL FORMATIONS | Zanskar Sediments, Lamayaru Flysch, Indus Flysch, Drass Volcanics, Ladakh Batholith, Khardunga Volcanics, graitoids, Kargil Molasse. |
| 8 | HYDROGELOGY | |
| | Major Water Bearing Formations | |
| | 1.Consolidated Formations/Hard Rocks | |
| | • Yield prospects<br>• GW structures | Low yield-100 to150 lpm<br>Hand pumps and Tube wells |
| | 2. Unconsolidated layered formations-Valley fill deposits- Gravel, Boulders, Talus & Scree material, Moraine deposits in Terraces and U shaped valleys | |
| | • Yield prospects<br>• GW structures | Moderate yield-300 to 500 lpm<br>Hand pumps and deep Tube wells |
| | 3. Unconsolidated Porous sediments (Alluvium) adjacent to major River<br>• Yield prospects<br>• GW structures | <br>Moderate yield-500 to 600 lpm<br>Handpumps, Dug wells and Tube wells |
| 9. | GROUND WATER EXPLORATION BY CGWB (As on 31.03.2012) | |
| | • No. of Wells drilled | 25 EW & 1 OW |
| | • Depth Range (m) | 10.00 to 84.00 |
| | • Discharge (lps) | Meagre discharge to 64 Lps |
| 10 | GROUND WATER QUALITY | |
| | Range of Chemical constituents in ground water<br>• EC (micro mhos/cm)<br>• pH<br>• Chloride (mg/l)<br>• Fluoride (mg/l) | <br>47-460<br>6.90-7.80<br>7.1-21<br>Tr-1.63 |
| 11 | DYNAMIC GROUND WATER RESOURCES<br>in ham (as on March,2011) | |
| | • Annual Replenishable Ground Water Resources | 4104.43 |
| | • Net Annual Ground Water Draft | 51.60 |
| | • Projected Demand for Domestic and industrial Uses up to 2025 | 55.28 |
| | • Stage of Ground Water Development | 1.40 % Category -Safe |
| 12 | AWARENESS AND TRAINING ACTIVITY | |
| | Mass Awareness Progammes | NIL |
| | Water Management Training Progammes | NIL |
| 13 | EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING | |
| | 1. Snow Water Harvesting | |

| | | |
|---|---|---|
| 14 | GROUND WATER CONTROL AND REGULATION | Being hilly terrain, Blocks not identified |
| | Number of OE Blocks | Nil |
| | Number of Critical Blocks | Nil |
| | Number of Notified Blocks | Nil |
| 15 | MAJOR GROUND WATER PROBLEMS AND ISSUES | |
| | 1. Presence of loose and collapsing bouldery formation causing difficulties in drilling | |
| | 2. Deep water levels in Talus, Scree and Moraine deposits | |
| | 3. High hydraulic gradient resulting rapid outflow of ground water and causing hardship during dry season (August to November) | |

## 1.0 INTRODUCTION

Ladakh Region consists of two districts Leh and Kargil. Leh with an area of 45110 Sq Km makes it largest district in the country in terms of area. It is situated between 32 degree to 36 degree North Latitude and 75 degree to 80 degree East Longitude. The district is bounded by Pakistan occupied Kashmir in the West, China in the north and eastern part, Kargil in the west and Lahul Spiti of Himachal Pardesh in South East. It is at a distance of 434 Kms from Srinagar and 474 Kms from Manali. Administratively, the district consists of six tehsil and sub tehsil, nine CD blocks (Leh, Khaltsi, Nobra, Nyoma, Durbuk, Kharoo, Saspol, Panamic and Chuchol) and 93 Village Panchayats. The district comprises of Leh town and 112 inhabited villages. As per the census 2011, the population of the district is 147104 persons with density of population 3 persons per sq. km. The male and female population in the district is 92907 & 54197 persons respectively with male and female sex ratio of 583.

The main source of irrigation is by canals and an area of 10196 hectares is brought under irrigation by canals. Ground water based irrigation is nil in this district. About 2482 ha of land is under wheat crop, 127 ha of land is under barley, 5216 ha area is under millets, 276 ha of area is under pulses and 346 ha area is under fruits in this district. Canals irrigate all these crops.

Central Ground Water Board has carried out extensive hydro-geological studies under Ground Water Management Studies in Nubra valley area. CGWB has constructed number of exploratory deep tube wells in this district including Siachin base camp. CGWB has carried out hydrogeological investigations in number of defense establishments in this district and recommended suitable areas for ground water development.

### CLIMATE AND RAINFALL

Ladakh lies on the rain shadow side of the Himalayan. Where dry monsoon winds reaches Leh after being robbed of its moisture in plains and the Himalayan Mountain. The district combines the condition of both arctic and desert climate. Therefore, Ladakh is often called "*COLD DESERT*"

The main features of this *COLD DESERT* are

Wide diurnal and seasonal fluctuations in temperature with - 40°C in winter and + 35°C in summer. Precipitation is very low with annual precipitation of 10 cm mainly in the form of snow. Air is very dry and relative humidity ranges from 6-24%. Due to high altitude and low humidity the radiation level is very high. The global solar radiation is as high as 6-7 Kwh/mm (which is among the highest in the World). Dust storms are very common in the afternoon. Soil cover is thin, sandy and porous. The entire area is devoid of any natural vegetation. Irrigation is mainly through channels from the glacier and melted snow.

### GEOMORPHOLOGY AND SOILS

The area is rugged and mountainous with little or no vegetation. The mountains are of sedimentary rocks and are in process of disintegration due to weathering. The altitude varies between 5934-8510 m AMSL. It is drained by Nubra and Shyok Rivers. The former river takes its origin from Siachian glacier and later originates from South and Central Rimo glacier. The lower altitude is in valley and foothill and highest being peaks of the Karakoram Range. The area constitutes of well-delineated southeast northwest and northeast trending parallel mountain range such as Laddakh and Karakoram Range. The area has distinction of highest motorable road in the world passing through Khardungla (5490 m amsl).

**Drainage**

The area is part of Indus River basin. Two main rivers flowing in this area are Nobra and Shyok Rivers. Nubra is a perennial river and is originated from Siachan Glacier and flows from North West to South East direction. Many nalas originating from the higher peaks of the mountains flow into Nobra. The nalas are locally termed as Lungpa. The main perennial Lungpas are Warshi Lungpa originating from Warhi glacier, Phukpochhe lungpa originating from Phukpochhe glacier, Panamic lungpa originating from Panamic glacier, Chameshan lungpa originating from Stondok & Phukatang glacier and Sumur lungpa originating from snow fall at the higher reaches. All these have origin from Karakoram Range and flow in North East to South West direction. The other nalas which flow from South-West to North East direction are Nyungsted lungpa originating from Nyungsted glacier, Khimi lungpa originating from Khimi glacier and Kubed lungpa originating from Kubed glacier.

Shyok River is also a perennial river and it originates from South Rimo Glacier and Central Rimo Glacier. On the way it meets many small glaciers such as Chong Glacier, Thangman Glacier and Tash Glacier. It initially flows in North West to South East direction. It takes a turn toward North-West near village Shyok. It meets Nobra River near Disket. In Nobra block, there are many perennial and ephemeral rivulets. The main rivulets which flow from north to south and meets Shyok River are Starga lungpa, Fastman lungpa originating from Thursa Glacier, Warshi Lungpa originating from Urdolep Glacier. The rivulets flowing from South to North in direction and join Shyok River are Khalsr Dok, Tashi lungpa, Sumdo lungpa, Glachurap lungpa, Taru lungpa, Yaglung lungpa and Malasha lungpa.

**Lake**

There is a lake in the valley called as Panamic Lake. This lake is of small dimension.

**Soils**

The soils of the district are sandy to loamy in nature, deficient in organic matter and low in phosphorus and potash. They are mixed with boulders and gravels. It is shallow, weak and friable. Being sandy it is vulnerable to all types of erosion. Soils developed on river terraces are highly porous and coarse grained in nature. Fertility of the soil varies from place to place. The growing season is very short.

## 3.0 GROUND WATER SCENARIO

## 4.1 GEOLOGY

The rocks are igneous, metamorphic and sedimentary in nature. They have Tertiary granitic batholith of Ladakh and Karakoram. Five magmatic cycles have been established. Viz. Shyok basic volcanics composed of basalt and andesite. Khardung acidic volcanics of non-marine lava flows, emplacement of granite on regional scale and porphyritic andsetie eruption of the Saltoro hills. The area remained magmatically active from Cretaceous to post-Oligocene period. The Upper Cretaceous to Eocene flysch sediments are exposed along south of Saltoro hills. They are shale and limestone. The Stratigraphic of Indus and Nubra Valley is given in the table below.

**Table-1 Stratigraphic Succession of Indus Valley and Nubra Valley**

| Period | Nubra Valley | Indus Valley |
|---|---|---|
| Pleistocene - Miocene | Saltoro Molasses, andesite, acid and basic dykes | Kargil Molasse |

| | | |
|---|---|---|
| Oligocene-Eocene | Khardung Volcanics Granite of Saltoro | Ladakh Batholith |
| Early Eocene Cretaceous | Saltoro flysch , Ophiolitic melange and Shyok Volcanics | Indus flysch, Indus Ophiolitic melange and Drass Volcanics |
| Triassic Permian | Karakoram meta-sediments | Lamayuru flysch ,Zanskar sediments |

## 4.2 HYDROGEOLOGY

The district is underlain by consolidated formation in maximum part. Ground water in these formations occur in fissures and fractures developed due to repeated tectonic activity. Large scale ground water development is not possible in consolidated formations but limited development of ground water resources can be taken up. As the settlement pattern of people in this district mainly concentrated in the river valleys and few broad valleys formed due to erosional activity of glaciers. The ground water development in these areas is of utmost importance. The unconsolidated formations like alluvium, scree and talus deposits present along the river valleys which plays a vital role in terms of occurrence and movement of ground water. Ground water resources in these formations can also be developed on sustainable basis. The moraine formations consist of boulders and clastics in a matrix of gravel, sand, silt and clay which from the aquifer. Depth to water level in moraine formations is very deep which varies from 60 m bgl to 75 m bgl. The valley fill deposits are mainly boulders and gravel mixed with silt and sand. This is mainly transported material lying unsorted in the recent river valleys. Ground water occurs as unconfined conditions in valley fill deposits. Depth to water is very shallow to as deep as 25 m bgl and is related with river water level.

Leh plains are underlain by moraine deposits consisting of boulders, cobbles, pebbles embedded in an arenaceous matrix and lake deposits comprising predominantly of clays, sandy clays and silt. Varved clays overlie the sediments and silts of lacustrine origin again succeeded by moraine boulders and cobbles in disintegrated, loose sandy matrix and alluvial deposits. The Nubra and Shyok valleys are underlain by Glacio-fluviatile deposits. These deposits are sand, gravel and glacial boulders. Apart from Glacio-fluviatile deposits, sand dunes are also found along southern side of Shyok River near Disket and Hunder. Flood plain from north of Kalsar to Sammor comprises of fluvial sand, gravel, pebbles and boulders. The porous formation along Nobra and Shyok River are also promising potential horizons for ground water development.

Ground Water Exploration by CGWB is confined to Leh Plains and Nubra Valley. During 1973 to 1997, 16 exploratory wells have been drilled in the district. It is concluded that depth to water level in the constructed wells ranges from 1.30 m bgl at Zorawar fort to 43.36 m bgl at ITBP-II. The yield obtained from these wells ranged from 197 lpm for 16.57 m drawdown at Skalzangling to 1600 lpm for a drawdown of 3.0 m at Pituk site. Ground water exploration activities again resumed in the Leh district during 2005-06. 8 exploratory tube wells and 01 Observation well were constructed in Leh plains and Nubra Valley. The Depth of tube wells ranges from 43 m at Siachen to 84 m at Patter Sahib and the yield varies from 1000 lpm at Patter Sahib to 1200 lpm at Siachen Base-III. The transmissivity values ranges between 204 to 28465 $m^2$/day. In Nubra valley, PHE department has constructed a number of hand pumps for meeting water supply to the villagers. The depth of these hand pumps range between 21.336 m in Disket to 51.816 m in Disket Khemathong. The depth to water level ranges between 9.75m in Disket to 34.74m in Quarter Disket. The ground Water exploration data are as follows.

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**Table- 2 Ground Water Exploration Data of Leh district**

| S.No | Location | Elevation | Depth | WL | Q (lpm) | DD | T |
|---|---|---|---|---|---|---|---|
| 1 | ITBP-I | 3247 | 62.5 | 29.57 | 890 | 3.71 | 2136 |
| 2 | Zorawar Fort | 3208 | 70 | 1.5 | 775 | 12.25 | 204 |
| 3 | Sakara | 3617 | 54 | 14.17 | 905 | 8.64 | 380 |
| 4 | Shankar Gompa | 3554 | 73 | 3.18 | 636 | 3.64 | 0 |
| 5 | Skalzangling | 3510 | 71.5 | 6.73 | 197 | 16.57 | 0 |
| 6 | Ditukmes/Pituk | 3190 | 65 | 18 | 1600 | 3 | 0 |
| 7 | 16 BRTF,Leh | 3196 | 65 | 6.03 | 1173 | 7.4 | 0 |
| 8 | School of Buddhist philosophy (Chowdmasar) | 3225 | 56 | 10.05 | 550 | 10 | 0 |
| 9 | Thiksey, 753 BRTF | 3289 | 62 | 27 | 900 | 2.08 | 2376.3 |
| 10 | Sakti,51 RCC | 3774 | 40.25 | Auto flow | 1006.78 | 3.72 | 480 |
| 11 | Patther Sahib | 3523 | 86 | | | | |
| 12 | Partapur-I | 3176 | 60 | | | | |
| 13 | Partapur-II | 3114 | 49 | 0.47 | | | |
| 14 | 221-Transit Camp, | 3157 | 50 | 0.16 | | | |
| 15 | Siachen-I | 3542 | 43.5 | 2.07 | | | |
| 16 | Siachen – II | 3523 | 44 | 0.77 | | | |
| 17 | Sasoma | 3237 | 44.5 | | | | |

## 4.3 Springs

Hydrogoelogical investigation during 2004-05, eighteen springs were inventoried. A perusal of the data reveals that the yields of these springs range from 1.5 lps (Yulkum) to 290 lps (Boudang). These springs normally are being used for domestic purpose but they also serve as sources of irrigation. The springs are the prominent seepage zone of the area and they receive their recharge from glaciers located at the higher altitude. These springs are present at the contact of valley fill deposits and the older formations. They are also found along weak zones such as fractures, faults and thrust zones. Hot water springs are located near Pananic and Changlum along thrust zones. Hot water springs are yielding 9 to 20 lps at nearly boiling water Temperature 95 ºC at the source. Which infers that the ground water is oozing from the deep-seated thrust zone.

## 4.4 Ground Water Resources

Ground water development through construction of tube wells and hand pumps is very much possible in this district. Till date ground water development in this district was in ancient stage. People mainly depend on surface water sources and springs for meeting water supply requirements. Thus the stage of ground water development is least. As per the data provided by PHE department, the number of villages covered by piped water supply is 112 and population covered is 0.70 lakhs. PHE has constructed 42 tube wells and 7 dugwells during 2001-02, 13 tube wells and 7 dugwells in every year during 2002-03, 2003-04, 2004-05, 2005-06. The Ground Water Resources for the district were computed as on March, 2011 for valley areas only as per the GEC-1997 methodology and are given below.

**Table-3 Dynamic Ground Water Resources Data of Leh district as on March, 2011**

| | | | |
|---|---|---|---|
| 1 | Total Geographical Area | Ha | 3993000 |
| 2 | Annual Replenishable Ground water Resources | Ham | 4104.43 |
| 3 | Net Annual Ground Water Draft | Ham | 51.6 |
| 4 | Projected Demand for Domestic & Industrial Uses up to 2025 | Ham | 55.28 |
| 5 | Stage of Ground Water Development | % | 1.40 % |
| 6 | Category | | Safe |

## 4.4 Ground Water Quality

CGWB has carried out scientific Ground Water Management Studies in parts of Leh district. The quality of ground water in the area is fresh and potable. The Electric Conductance ranges between 37 µ mho/cm (Khardung Chik-chik) to 760 µ mho/cm (Panamic Yogma). The exceptional value of 1073 µ mho/cm is recorded in water sample of lake (Panamic Lake). The pH values ranges between 7.1 (Murgi) to 8.8 (Skampuk-TW). The pH value of lake water sample at Panamic Yogma village is recorded to be 9.2.

## 4.5 Status of Ground Water Development

Ground water development in the district is on moderate scale restricted to the valley portion. All the major irrigation and drinking water supplies depend on natural springs, rivers and nallas. Recently, PHE department constructed hand pumps in villages to mitigate the drinking water problem. Public Health Engineering and Irrigation & Flood control departments are the nodal agencies in the district for the drinking water supplies and irrigation. The depth of the hand pumps is about 60 to 70 m bgl. A few tube wells tapping valley fill deposits are also present in this district which is being used mainly for domestic water requirements.

# 5. GROUND WATER MANAEMENT STRATAGY

## 5.1 Ground Water Development

Most of the district is concentrated in valley portion which is drained by Indus River and its tributaries. In the past, development of ground water was mainly through dug wells and percolation wells along the Rivers, nallas. Some springs have played a major role for sustainable domestic and irrigational supplies. 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 to moderate deep tube wells for large-scale water supplies.

## 5.2 Snow Water Harvesting and Artificial Recharge

Snow water harvesting is a technique of preservation of snow and delaying melting so that snow melt water is available for longer duration in a year. Selection of sites for snow harvesting depends on isolation of an area, wind direction, wind velocity and Relative Humidity.

In the hilly areas, roof top rainwater harvesting structures like storage tanks are recommended while in areas of low hill ranges check dams and snow water harvesting structures can be adopted. These structures were already constructed by local people on their own initiation and at some places government of Jammu and Kashmir has constructed few snow water harvesting structures.

## 6.0 GROUND WATER RELATED ISSUES AND PROBLEMS

Springs were getting dried up and snow fall during winter period was also reduced because of global climatic changes and causing hard ship to the people. They are traditional sources of water supply for villages and habitats. To mitigate the water supply crisis, hand pumps and tube wells were constructed at suitable locations by deploying the suitable rigs (DTH or percussion). To avoid failure of tube wells, selection of sites and surface geophysical surveys were carried out while constructing deep tube wells. Shallow as well as deep tube wells were constructed for water supply in Valley fill deposits and Moraine deposits which are highly productive formations for construction of tube wells.

## 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

As the district is hilly and mountainous, ground water resources are limited. At present, the development of ground water resources is very meagre. The ground water resources of valley fill deposits, moraine deposits and terrace deposits can be developed. Proper recharge structures like check dams and nala bunds can be constructed for artificial recharge to ground water. Till date no area or block has been notified for ground water development.

## 9.0 RECOMMENDATIONS

- In Valley areas like Suru valley, Drass valley and Indus valley ground water resources can be developed by constructing infiltration galleries/Percolation wells and dugwells. Shallow tube wells can also be constructed by deploying the percussion or DTH rigs.
- In hilly terrain, springs and perennial nallas are the major sources of water. These springs shall be developed based on modern scientific knowledge and they can be to be protected.
- Deep tube wells of 100 to 120 m depth are recommended to be constructed for water supply in terraces underlain by moraine formations. Hand pumps of 70 to 80 m depth are also recommended in small hamlets to meet the water supply requirements.
- Irrigation channels carrying water from higher reaches need to be maintained properly and if required, they may be cemented so that the water can be safely transported to greater distances. Along the channels, small ponds can be constructed at suitable locations so that water can be stored in these shallow ponds which can also act as recharge structures for terraces deposits.
- Monitoring of springs both for discharge and quality shall be taken up regularly. Scientific studies shall be taken up in this district to study the source area and recharge characters of springs.
- Traditional resources like springs needs to be revived, developed & protected on scientific lines for various uses. All the springs shall be enumerated and listed properly and data shall be properly maintained. 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 favorable 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.

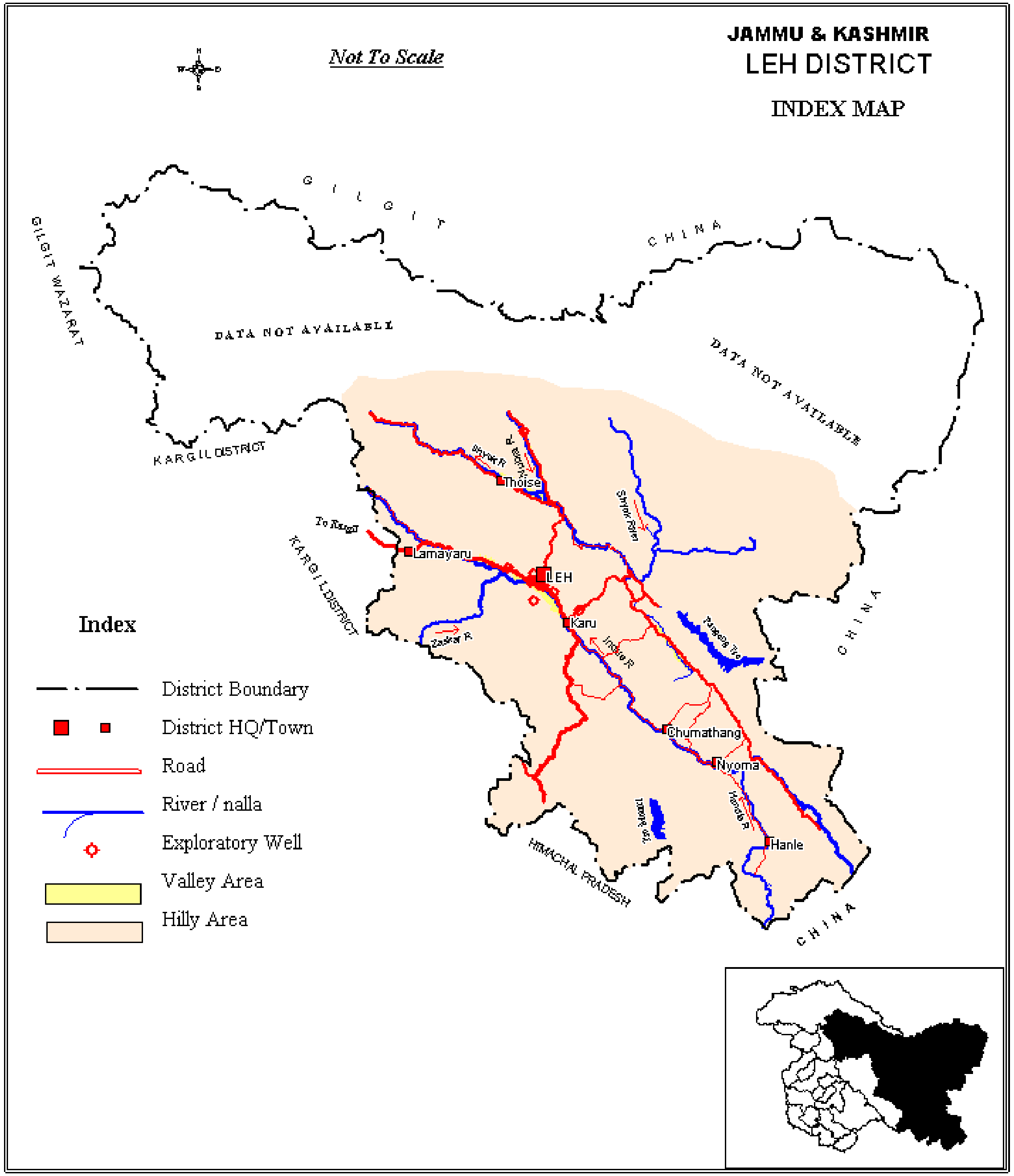
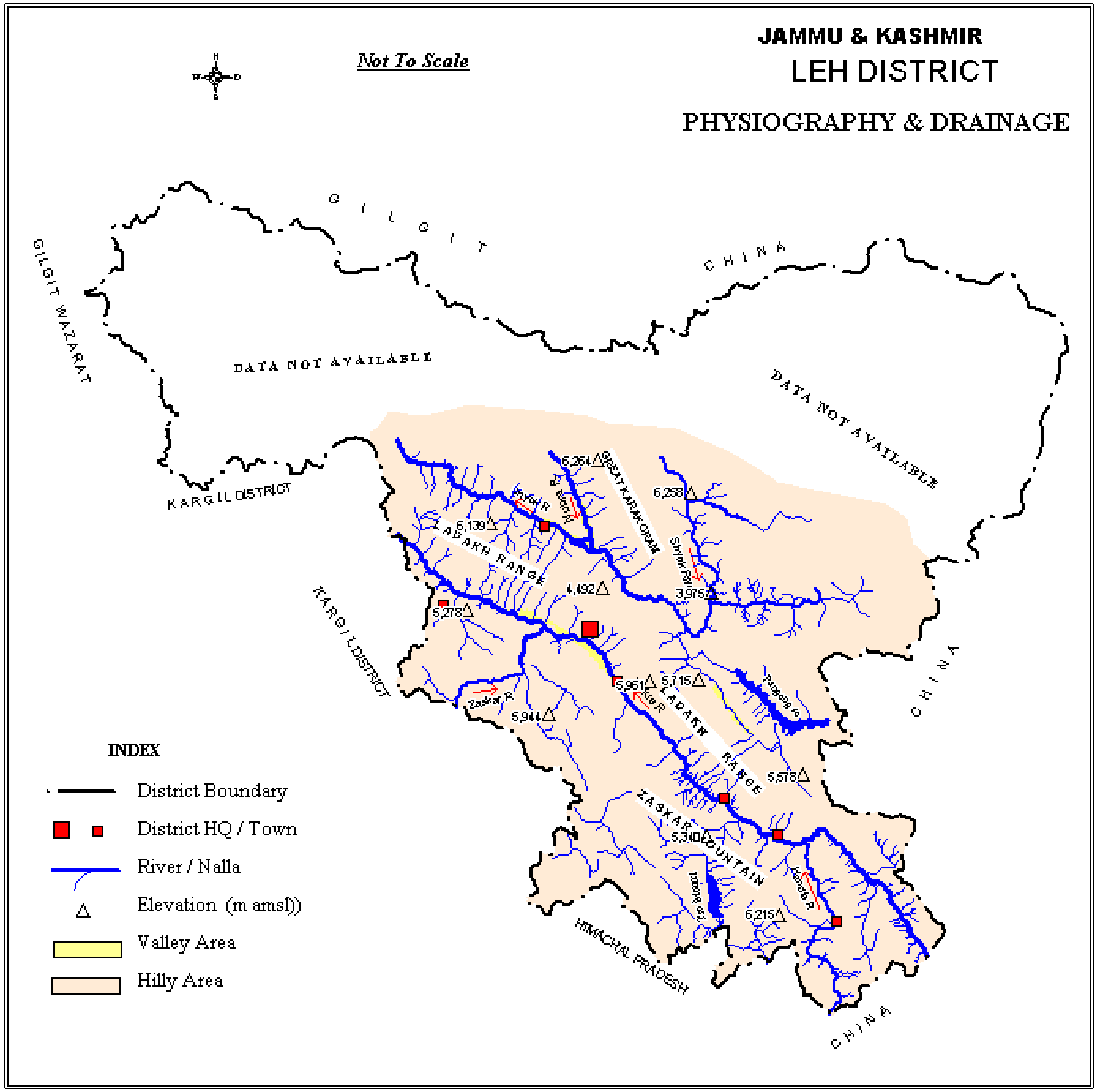

JAMMU & KASHMIR
LEH DISTRICT
INDEX MAP
Not To Scale
GILGIT
GILGIT WAZARAT
CHINA
DATA NOT AVAILABLE
DATA NOT AVAILABLE
KARGIL DISTRICT
KARGIL DISTRICT
To Kargil
HIMACHAL PRADESH
Thoise
Lamayaru
LEH
Karu
Chumathang
Nyoma
Hanle
Index
District Boundary
District HQ/Town
Road
River / nalla
Exploratory Well
Valley Area
Hilly Area

Plate II



JAMMU & KASHMIR
LEH DISTRICT
PHYSIOGRAPHY & DRAINAGE
Not To Scale
GILGIT
GILGIT WAZARAT
CHINA
DATA NOT AVAILABLE
DATA NOT AVAILABLE
KARGIL DISTRICT
KARGIL DISTRICT
CHINA
CHINA
HIMACHAL PRADESH
LADAKH RANGE
LADAKH RANGE
ZASKAR MOUNTAIN
6,264
6,258
6,139
4,492
3,975
5,278
5,961
5,715
5,944
5,578
5,340
6,215
INDEX
District Boundary
District HQ / Town
River / Nalla
Elevation (m amsl)
Valley Area
Hilly Area

Plate IV

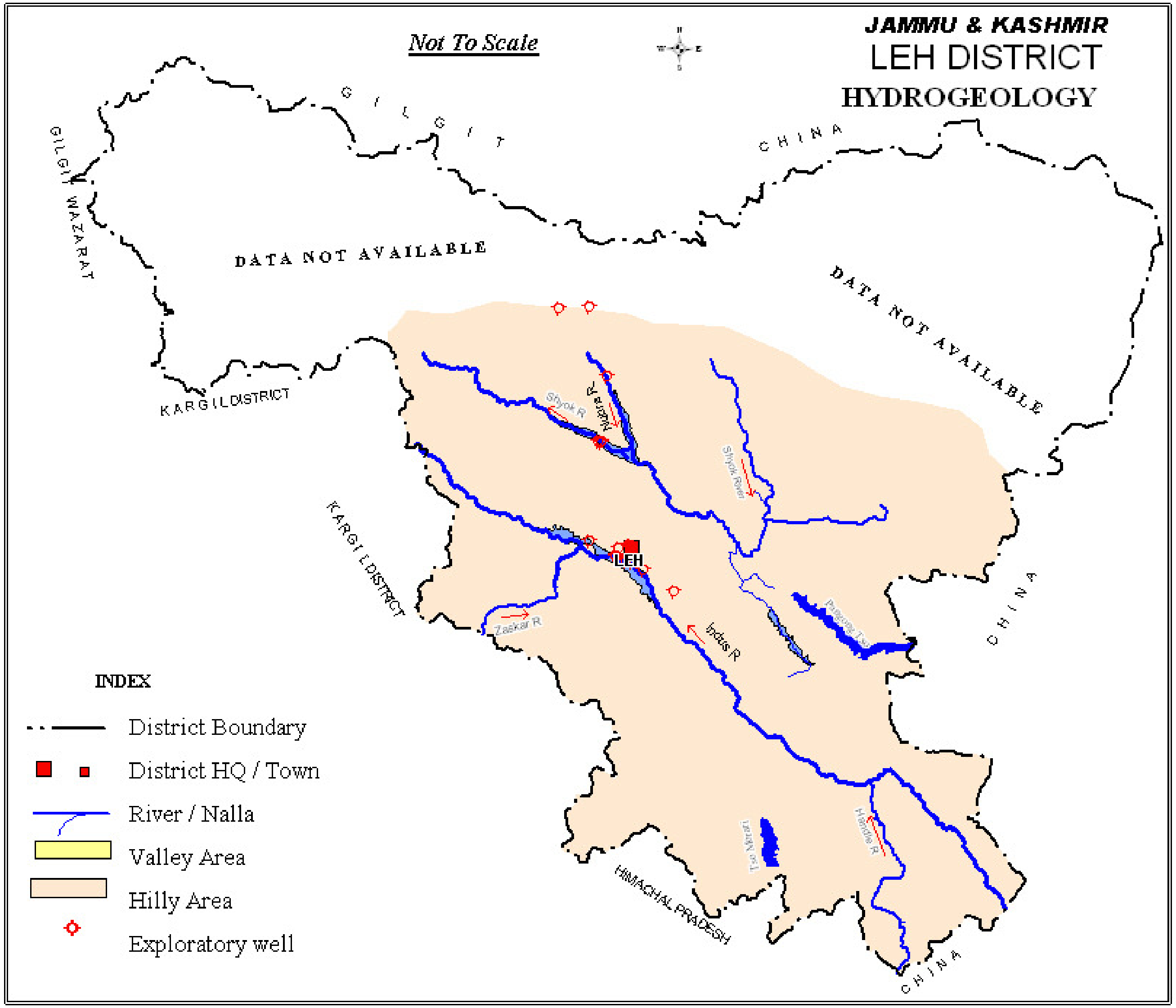
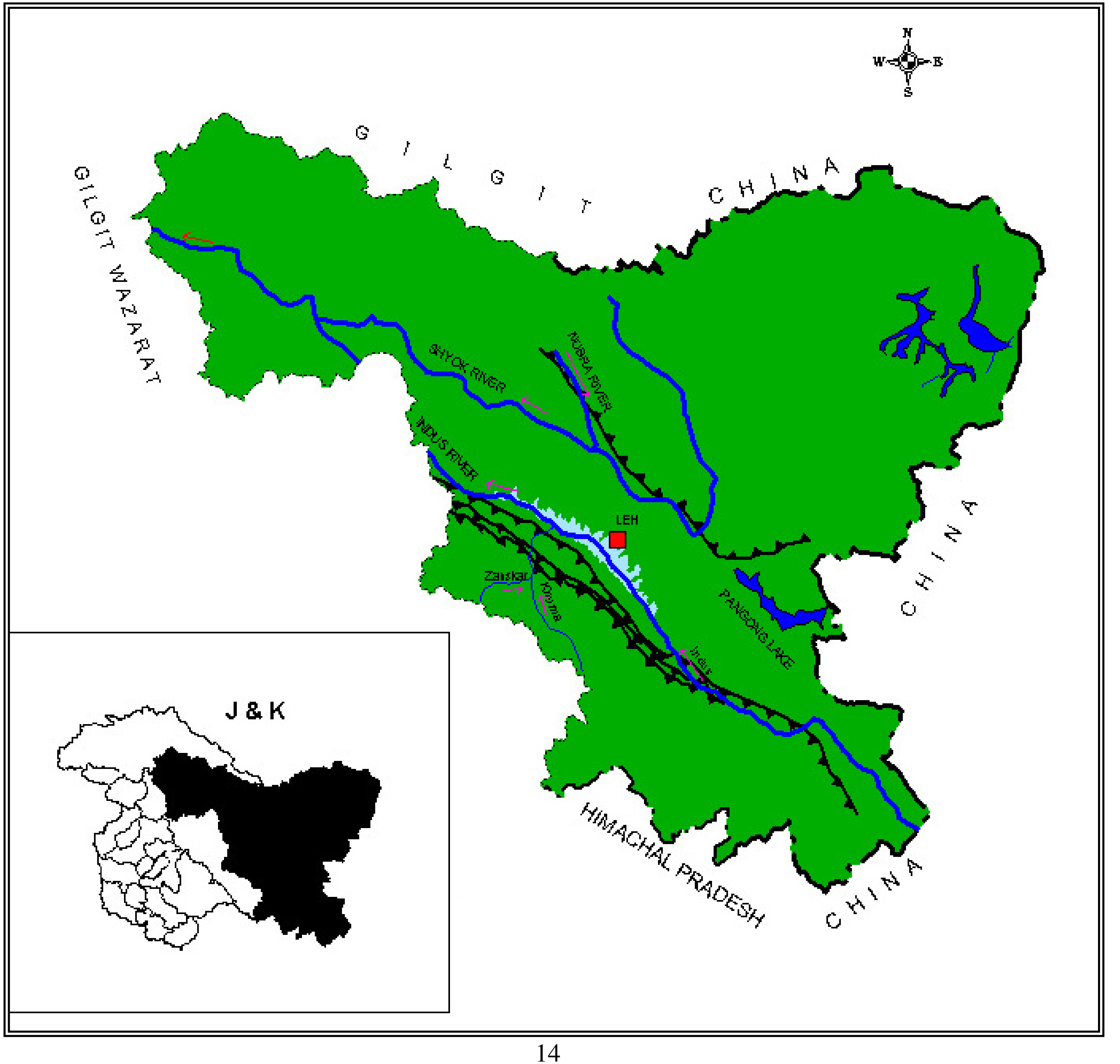

Not To Scale
JAMMU & KASHMIR
LEH DISTRICT
HYDROGEOLOGY
GILGIT
GILGIT WAZARAT
CHINA
DATA NOT AVAILABLE
DATA NOT AVAILABLE
KARGIL DISTRICT
KARGIL DISTRICT
Shyok R
Nubra R
Shyok River
LEH
Zaskar R
Indus R
HIMACHAL PRADESH
CHINA
CHINA
INDEX
District Boundary
District HQ / Town
River / Nalla
Valley Area
Hilly Area
Exploratory well

Plate IV Legend



| | Wells feasible | Rigs suitable | Depth of well (m) | Discharge (lpm) | Suitable artificial recharge structures |
|---|---|---|---|---|---|
| Soft rock aquifers | Tube well | DTH with Odex | 40 to 90* | 1000 to 2500 | Snow harvesting and Check Dam cum ground Water dam |
| Hard rock aquifers | Tube well<br>Spring Development | DTH with Odex | 40 to 90 | 300 to 750<br>30 to 1250 | |

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

Springs

Reservoir

Tehsil boundary

District boundary

Thrust

International Boundary

Tehsil HQ

District HQ

Major Drainage