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GOVERNMENT OF INDIA

**MINISTRY OF JAL SHAKTI
DEPARTMENT OF WATER RESOURCES, RIVER DEVELOPMENT AND GANGA
REJUVENATION
CENTRAL GROUND WATER BOARD**

**GROUND WATER YEAR BOOK
HIMACHAL PRADESH
(2019-2020)**

**NORTHERN HIMALAYAN REGION
DHARAMSHALA
(H.P)
February, 2021**



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(2019-2020)**

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**NORTHERN HIMALAYAN REGION
DHARAMSHALA
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FOREWARD

For an efficient management and development of ground water resources, it is imperative to have a reliable database on water level and water quality. Central Ground Water Board, in addition to various other activities on scientific studies related to groundwater, collects data from a network of National Hydrograph Network Stations also called Ground Water Monitoring Wells and prepares a scientific base for the proper planning and judicious use of available groundwater resources.

Most of the area in Himachal Pradesh is hilly, mountainous with few intermontane valleys in between them. The traditional ground water structures, which are under observation at present, are open wells mostly located in the valley area. Therefore, the ground water regime monitoring programme is concentrated mostly in valley area of the state and at some places in hard rock area. Efforts are however going on to increase the number of observation wells and include the piezometers of state government under the groundwater regime monitoring.

The measurement of these National Hydrograph Network Stations is carried out four times in a year during the month of January, May, August and November and water samples are collected during pre-monsoon period viz., May for chemical analysis. The analysis of the data indicates the changes in ground water scenario and thereby helps in adopting measures if required in the area under monitoring for the sustainable development and management of the ground water resource. The human induced problems like depletion in water level, water logging, can be identified from the maps prepared during the analysis of water level data.

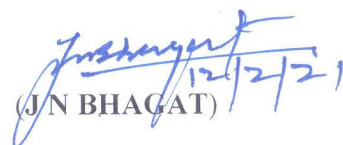
This report presents the water level data for the National Hydrograph Network Stations collected during the year 2017-2018 and its analysis and interpretations in the form of tables, maps and their descriptions to bring out the overall ground water scenario and the changes in ground water regime during the ground water year. The chemical results are awaited and will be issued separately.

The field data has been collected, processed and compiled by the scientific officers of NHR, Dharamshala. This report has been compiled by Smt. Rachna Bhatti, Scientist 'C' & Sh. Vidya Bhooshan, Senior Technical Assistant (Hg). A untiring work of map preparation was done by Ms Poonam, Draughtsman from CHQ, Faridabad. The samples were collected by Sh. Jugal Kishore Surveyor and entered in GEMS by Smt. Anju Devi draftsman. Analysis was done by C.G.W.B, NWR, Chandigarh. The efforts of Report & Processing Section in scrutiny, processing and issuance of report is also highly significant.

This ground water year book contains useful data for water year 2019-2020 for all the planners and user agencies dealing with the development of ground water resources and it is hoped that it would be utilized fully for the real time management of ground water resources in the State.

Dated: 12.02.2021

Dharamshala


(J.N. BHAGAT)

Head of Office

**GROUND WATER YEAR BOOK
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2019-2020
EXECUTIVE SUMMARY**

- ❖ Central Ground Water Board, NHR has set up a network of 128 National Hydrograph Stations in the state of Himachal Pradesh. The monitoring commenced in the year 1969 with the establishment of 3 observation wells and since, then the number of monitoring station are being increased regularly so as to get the overall picture of ground water scenario in different hydrogeological set up of the state.
- ❖ Most of the area in Himachal Pradesh is hilly enclosing few small intermontane valleys. The traditional ground water structures under observation at present are dugwells and are mostly located in the valley areas only. Therefore, the ground water regime monitoring programme is concentrated mainly in valley areas of the state and some places in hard rock areas.
- ❖ All the 128 National Hydrograph Stations are located only in 7 districts out of the 12 districts in Himachal Pradesh. The reason being hilly terrain, hard approachability and insignificant number of structures available for monitoring.
- ❖ The average annual rainfall in the state varies from 600 mm to more than 2400 mm. The rainfall increases from south to north. Dharamshala in district Kangra, receives the 2nd highest rainfall of about 3000 mm in the Country.
- ❖ Water levels are being monitored four times in a year during the month of May, August, November and January. Water samples are collected during the month of May every year for chemical analysis of ground water quality.
- ❖ The depth to water level, recorded during May 2019 (Annexure - I), ranged between 0.62m (Kangra district) and 28.72 m bgl (Una district). Out of 101 stations monitored, the majority of 80 NHS (79.20%) recorded DTWL, in the range between 2 - 20 m |bgl. 15 stations (14.85%), recorded shallow water levels, less than 2 m bgl and 6 stations (5.94%), recorded deep water levels, more than 20 m bgl in the state.
- ❖ The depth to water level recorded during August 2019 ranges between (0.08) m bgl (Una districts) to 30.31 m bgl (Solan district).
- ❖ The depth to water level recorded during November 2019 ranged between 0.38 m bgl in (Mandi district) to 30.43 m bgl in (Solan district) .
- ❖ The depth to water level recorded during January 2020 ranged between ranged between 0.34m (Mandi district) to 30.14 m bgl (Una district).
- ❖ Monsoonal fluctuation of water level was analyzed for 100 stations for the period May 2019 – November 2019. A perusal of Table-8 shows that out of the 100 stations, 96 stations (96.00%) have shown rise in water level and remaining 4 stations (4.00%) have shown fall in water level.
- ❖ Annual fluctuation data of water levels in May 2018 wrt May 2019 shows frequency distribution of rise and fall. Out of the 99 stations analysed, 85 stations (85.85%) have shown rise in water level ranging from 0.09 (kangra) to 1.61 m (kullu district), whereas 13 stations (13.13 %) have shown fall ranging from 0.06m (Kangra district) to 28.72 m (Una district).

- ❖ Annual fluctuation of water level has been worked out by comparing depth to water level of August 2018 with August 2019. Out of the 109 stations, 52 stations (47.70%) have shown rise in water level ranging from 0.01 m (Mandi District) to 8.47 m (kullu district) whereas 52 stations (47.70%) have shown fall ranging from 0.02 m (Kangra and una district) to 28.59 m (Una district).
- ❖ Annual fluctuation of water level has been worked out by comparing DTW of November 2018 with November 2019. Out of the 104 stations, 40 stations (38.46%) have shown rise in water level ranging from 0.01m (Kangra district) to 6.41 m (Una district) whereas 60 stations (57.69%) have shown fall ranging from 0.02 m (Una district) to 11.31 m (Solan district).
- ❖ Annual fluctuation of water level has been worked out by comparing depth to water level of January 2019 with January 2020 . Out of the 96 stations analyzed, 73 stations (76.04%) have shown rise in water level ranging from 0.03 (kangra and Sirmour district) to 8.47 m (kullu district) whereas 23 stations (23.95%) have shown fall ranging from 0.01 (Mandi, Sirmour and Kangra district) to 3.30 m (Kangra district).
- ❖ Decadal water level fluctuation has been worked out by comparing water level data of May 2019 with the average mean of 10 years water level data of May (2009-2018)A perusal of data shows that out of 101 stations analysed, 82 stations (81.18%) have shown rise and 19 stations (18.81%), have shown fall in water level. 68 stations (82.92%) are showing rise in water level between 0 to 2m, 9 stations (10.97%) between 2 to 4m. and 5 stations (6.09%), more than 4m.
- ❖ Decadal water level fluctuation has been worked out by comparing water level data of August 2019 with the average 10 years water level data of August (2009-2018) A perusal of data shows that that out of 109 stations analyzed, 70 stations (64.22%) have shown rise and 39 stations (35.77%), have shown fall in water level. 55 stations (78.57%) are showing rise in water level between 0 to 2m, 7 stations (10.00%) between 2 to 4m. and 8 stations (11.42%), more than 4m. Out of 39 stations, 37 stations (94.87%) show fall in water level between 0 to 2m, 1 stations (2.56%) between 2 to 4 m and 1 stations (2.56%) more than 4m.
- ❖ Decadal water level fluctuation has been worked out by comparing water level data of November 2019 with the average water level data of November for 10 years (2009-2018) A perusal of data shows that out of 105 stations analyzed, 69 stations (65.71%) have shown rise and 36 stations (34.28%), have shown fall in water level. 57 stations (82.60%) are showing rise in water level between 0 to 2m, 7stations (10.14 %) between 2 to 4m. and 5 stations (7.24%), more than 4m.
- ❖ Decadal water level fluctuation has been worked out by comparing water level data of January 2020 with the average water level data of January for 10 years (2010-2019). A perusal of data shows that out of 104 stations analysed, 84stations (80.76 %) have shown rise and 20 stations (19.23%), have shown fall in water level. 65 stations (77.38%) are showing rise in water level between 0 to 2m, 12 stations (14.28%) between 2 to 4m. and 7 stations (8.33%), more than 4m. Out of 20 stations, 17 stations (85.00%) show fall in water level between 0 to 2m, 1 stations (5.00%) between 2 to 4 m and 2 stations (10.00%) more than 4m.

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1.0 INTRODUCTION

Himachal Pradesh is located between the north latitude 30°22'40" & 33°12'40" and east longitude 75°47'55" & 79°04'20". It falls in Survey of India topographic sheets Nos. 52D, 52H, 52L, 53A, 53B, 53F, 53E and 53I and covers an area of 55,673 sq km. It is one of the predominantly hilly states in India, which lies in the western Himalayas. The length of Himachal Pradesh is about 355 km i.e. from northwestern part of Chamba to southeastern part of Kinnaur. The breadth of the state is about 270 km i.e. from western part of Una to northeast part of Lahaul and Spiti district. The state is bounded by the state of Jammu & Kashmir in north, Punjab state in west, Haryana state in south and Uttarakhand state in southeast and shares an international border with China (Tibet) in northeast.

Administratively, the state is divided in 12 districts, 76 tehsils, 34 sub-tehsils and 78 blocks. There are 20,690 villages, 3,226 Gram Panchayats, 59 towns, 28 Nagar Panchayats and 25 Nagar Parishads including Municipal Corporations. Lahaul & Spiti is the largest and Hamirpur is the smallest district of the state with geographical area of 12,835 and 1,118 sq km respectively.

The state has a population of 68,64,602 persons (Census 2011) having an average population density of 128 person per sq km. The male population in the state is 34,81,873 persons and female population is 33,82,729. The rural and urban population in the state is 61,76,050 and 6,00,552 persons respectively. The density of population in the state varies from as low as 2 persons/sq.km in Lahaul and Spiti district to 406 persons/sq km in Hamirpur district as compared to the state average of 128 persons/sq km.

Himachal region presents an intricate mosaic of mountain ranges, hills and valleys with altitude ranging from 350 m to 6500 m amsl. The Dhauladhar range looks in supreme majesty over the Kangra valley while the Pir Panjal, the Great Himalaya and the Zaskar ranges guard over Chamba, Lahaul & Spiti, Kullu and Kinnaur districts. The mountain slopes are covered with forests and meadows. The valleys below are interspersed with numerous streams, fields and quiet homesteads. There is general increase in elevation from east to west and from south to north. The physiographic divisions from south to north are the Outer Himalayas also known as Siwaliks (350 to 1500 m amsl), the Lesser Himalayan Range (1500-5000 m amsl), Great Himalayan Range (5000 – 6000 m amsl) and Zaskar Range (> 6000 m amsl)

Himachal state has a unique distinction of having drainage systems of both the Indus and the Ganga basin. The major river systems of the region are the Chandra-Bhaga or the Chenab, the Ravi, the Beas, the Satluj and the Yamuna. The catchments of these rivers are fed by snow and rainfall,

and are protected by fairly extensive cover of natural vegetation. Major rivers of the Indus river basin are the Chenab, the Ravi, the Beas and the Satluj. The Yamuna is the only river contributing water to Ganga basin.

The southwestern monsoon contributes about 70% of rainfall during monsoon period from July to September and about 30% occurs during non-monsoon period due to western disturbances and in the form of thunderstorm. Generally, rainfall increases from south to north. Western disturbances also shower rainfall in winters. Beyond Kullu towards Lahaul & Spiti and Kinnaur, rainfall decreases due to rain shadow effect. Spiti is the driest area with 50 mm rainfall because of being enclosed by High Mountain from all sides. The average annual rainfall in the districts of the state varies from about 600 mm in Lahaul & Spiti to more than 2400 mm in Kangra.

Central Ground Water Board, under part of its national ground water monitoring programme has established a network of observation stations in the state for periodic monitoring of ground water level and water quality. The ground water regime monitoring programme commenced during the year 1969 when the erstwhile groundwater wing of Geological Survey of India established 3 stations in the State. At present there are 128 Ground Water Monitoring Station (GWMS) in Himachal Pradesh. The year wise increase in GWMS in the State is given in Table-1.

Table-1: Year wise increase in GWMS, Himachal Pradesh

Year	Total Number of Ground Water Monitoring Stations
1969-73	3
1974-77	19
1978	32
1979	34
1980	35
1981	68
1982	69
1983-88	71
1989	72
1990-2000	79
2000-2010	86
2011-2013	102
2015-2016	111
2016-2017	128
2017-2018	128
2018-2019	128
2019-2020	128

The ground water monitoring is being carried out by Northern Himalayan Region, Dharamshala, since 1996. All the 128 GWMS are dug wells and are located in 7 districts of Himachal Pradesh out of the 12 districts. The reason for not monitoring other districts is being the hard approachability due to terrain conditions and non- availability of ground water monitoring structures. The district wise break up of Ground Water Monitoring Stations and their occurrence in different hydrogeological setup is given in Table-2.

Table-2: District wise GWMS & Hydrogeological setup

S. No	District	Number of GWMS			
		Total	Valley Area Porous Formation (Quaternary)	Fissured Formation (Tertiary)	Fissured Formation (Proterozoic to Mesozoic)
1.	Hamirpur	4	4	-	-
2.	Kangra	46	31	15	-
3.	Kullu	4	4	-	-
4.	Mandi	9	9	-	-
5.	Sirmaur	17	15	2	-
6.	Solan	16	16	-	-
7.	Una	31	31	-	-
8.	Chamba	1	-	1	-
TOTAL		128	110	18	-

2.0 HYDROGEOLOGY

The major part of Himachal Pradesh is hilly and mountainous with few small intermontane valleys covering about 15% of the area. These valleys comprise of alluvial deposits, which form extensive aquifers and thus represent porous formations. Major valleys in the state are Indora-Nurpur and Kangra-Palampur valleys in district Kangra, Una valley in district Una, Balh valley in district Mandi, Nalagarh valley in district Solan and Paonta valley in district Sirmaur.

The Siwalik and Sirmaur group represent the Tertiary formation in the state. These two groups occur in the western part of the state and have northwest to southeast trend. The Siwalik comprises of boulder, conglomerate, sandstone and clay while, Sirmaur group comprises of shale, sandstone and clay. The primary porosity and permeability in the Tertiary formation is low to moderate and hence, these aquifers do not form high yielding aquifers.

The older rock formations of Proterozoic to Mesozoic eras constitute of igneous and metamorphic rocks like granite, gneiss, slate, schist, phyllite, quartzite etc. Because of their consolidated nature,

these rock formations serve as poor aquifers. However, due to tectonic movements, they have been traversed by faults, thrust and joints, which have enhanced their ground water potential.

The quality of ground water in hard rocks and alluvial areas is by and large good and suitable for domestic and irrigational use. The distribution of the hydrogeological formations discussed above and their yield potential are given below in Table -3.

Table-3: Hydrogeological Formations and their Yield Potential, in Himachal Pradesh

Age	Rock Formation	Districts	Hydrogeological Characteristics
<i>POROUS FORMATIONS</i>			
Recent to sub Recent	Boulder, Cobble, Pebble, Sand, Silt, Clay,	Kangra, Una, Solan, Sirmaur, Mandi and Kullu	High Yield 30-75 m ³ /hr
<i>FISSURED FORMATIONS</i>			
Tertiary	Boulder Conglomerate Sandstone, Clay	Kangra, Solan, Sirmaur Bilaspur, Una, Mandi, and Hamirpur .	Moderate to Low Yield < 30 m ³ /hr
Proterozoic to Mesozoic	Shale, Slate, phyllite, Limestone, dolomite, Sandstone, Quartzite, Granite, Schist,	Lahaul & Spiti, Kinnaur, Chamba, Mandi, Simla, Kangra, Sirmaur, Solan, and Kullu	Moderate to Low Yield < 5 to 30 m ³ /hr

2.1 Proterozoic to Mesozoic Formations

Older formations of Proterozoic to Mesozoic age are constituted by groups like Sundernagar group, Shali-Deoban-Largi group, Vaikrita group, Jutogh group, Simla group, Krol group, Tal group, Kuling group, Lilang group, Tandi group etc. These groups comprise of granites, gneisses, slates, schists, phyllites, quartzites etc. and occur in Kangra, Chamba, Lahaul & Spiti, Kinnaur, Simla, Sirmaur, Kullu and Solan districts. These rocks are dense and consolidated in nature therefore; they bear low primary porosity and permeability, thus forming poor yielding hard rock aquifers. Secondary porosities have developed due to the tectonic movements. Weathered, fractured and contact zones however, form potential ground water zones.

Groundwater in hard rocks area is either developed through bore wells or springs at favorable locations. Springs are the major ground water sources in these formations and its yield ranges from seepages to more than 25 lps and are utilized for both domestic and irrigation purposes. Weathered mantle in low topographic areas, also forms poor aquifers. In some areas, percolation wells are also

constructed. *Bowris* are also constructed in oozing out spring zones, for collection of water to fulfill the domestic water needs. Number of hot water springs also occurs in these formations.

2.2 Tertiary Formations

The upper Tertiary formations ranging in age from Middle Miocene to Lower Pleistocene are represented by the rocks of Siwalik group and extend from northwest to southeastern part of the state. It comprises of great thickness of cobbles, pebbles, detritus rocks, clays and conglomerates. The Siwalik chain is widest in the valley of river Beas. On paleontological grounds the Siwalik are subdivided into three subgroups namely upper, middle and the lower Siwaliks.

The lower Tertiary formations ranging in age from Eocene to Lower Miocene are represented by the rocks of Sirmaur group. The Sirmaur group has also been sub-divided into three formations namely Kasauli, Dagshai and Subathu. The group comprises of shale, sandstone and clay. The Sirmaur group is separated by a fault from the Siwaliks.

Fracture zones and contact zones form important aquifers in the low topographic areas with poor to moderate yields. Yields of the tube wells are less than 30m³/hr constructed along the fault/fracture/contact zones. These fractures or faults zones form potential ground water zones for development.

2.3 Quaternary Formations

The Quaternary formations occur either as major or minor valley fills/piedmont/fluvio-glacial deposits and alluvium. The major valley fill areas are Nurpur – Jawali – Nagrota Surian, Pragpur – Dadasiba, Palampur – Kangra valley fills in Kangra district; Shathlai and Sirkhad in Hamirpur district; Balh valley in Mandi district; Una valley in Una district; Nalagarh valley in Solan district; Paonta valley in Sirmaur district; Spiti valley in Lahaul & Spiti district. Ground water occurs under phreatic to semi-confined conditions in these deposits. In some of the valleys like Indora – Nurpur valley in Kangra district and Balh valley in Mandi district, confined aquifers are encountered.

The thickness of valley fills in Paonta, Una, Nalagarh, Nurpur and Andaura are generally more than 100 m whereas, in other areas its thickness is within 100 m. Groundwater occurs under unconfined to confined conditions. In general, depth to water level varies from 5 to about 60 m bgl. Artesian conditions also exist in lower and central part of Una valley, lower part of Nurpur, Andaura and Balh valley fills.

Ground water occurs under unconfined conditions in shallow valley fills areas developed along the river/streams. Discontinuous aquifers system is observed in Kangra, Sirmaur, Solan and Una districts. Depth to water level varies from < 2 to 20 m bgl. Ground water is developed through open dug wells, shallow and deep tube wells. The discharge of the tube wells varies up to 40 lps but generally ranges between 15 to 25 lps. There are about 8000 tube wells constructed including

exploratory wells of CGWB in the valley fill deposits both for drinking and irrigation purpose. A large number of shallow boreholes fitted with hand pumps also exist in the state for developing groundwater.

3.0 GROUND WATER SCENARIO

The ground water level in the state is monitored regularly to have a review over the changes in ground water regime. The maps generated from these data help in identifying the areas, which are under water level rising and water level declining. With the help of these maps, suitable measures as per the demand of the area can be adopted for the sustainable ground water development. It also helps the planners to formulate the future strategy in various fields of ground water development.

For the purpose of presentation, the water levels and their changes are shown separately in alluvial and hard rock areas because of aquifer discontinuity. As discussed earlier, the major alluvial areas are Indura-Nurpur and Kangra-Palampur valley in district Kangra, Una valley in district Una, Balh valley in district Mandi, Nalagarh valley in district Solan and Paonta valley in district Sirmaur. In hard rock areas point values are given at places.

The water level is being monitored in the State four times in a year

1. May : 20th to 30th : represents water level of Pre-monsoon period
2. August : 20th to 30th : represents peak monsoon water level.
3. November : 1st to 10th : represents water level of Post-monsoon period.
4. January : 1st to 10th : represents the recession stage of water level

The data has been analyzed for each set of measurement and report has been prepared which include following maps to understand the groundwater regime in the area.

- A. Depth to water level maps : Water level scenario for the month in the area.
- B. Seasonal fluctuation maps : Water level fluctuation in comparison to Pre-monsoon.
- C. Annual fluctuation maps : Water level fluctuation in comparison to same month in the previous year.
- D. Decadal mean fluctuation maps : Water level fluctuation in the month of measurement with reference to the decadal average for the same month.

The depth to water level, seasonal fluctuation and annual fluctuation has been presented in Annexure-I, II and III. The decadal mean fluctuation has been tabulated in Annexure-IV. The ground water behavior in the seven districts of Himachal Pradesh has been discussed below.

3.1 Depth to Water Level

3.1.1 May 2019

The depth to water level, recorded during May 2019 (Annexure - I), ranged between 0.62m (Kangra district) and 28.72 m bgl (Una district) (Table-3). Out of 101 stations monitored, the majority of 80 NHS (79.20%) recorded DTWL, in the range between 2 - 20 m |bgl. 15 stations (14.85%), recorded shallow water levels, less than 2 m bgl and 6 stations (5.94%), recorded deep water levels, more than 20 m bgl in the state.

A perusal of the DTWL map of May 2019 shows that the shallow water level area of less than 2m bgl, occurs in eastern part of Kangra Palampur valley , northern part of kullu valley and southern part of Balh valley in Mandi district. 2-5 m bgl and 5-10 m bgl water level occupies in most of the monitoring area of all the valleys of Himachal Pradesh, mainly in Kangra-Palampur valley and Nurpur- Indora valley. Water level 10-20m bgl in shown in major part of Nallagarh and Paonta valley. Deeper water levels, between 20-40m bgl are shown in Northern part of Paonta valley, outer fringes of Nalagarh valley and at few places of Una valley.

Table-3: District wise number & % of NHS distribution, in different DWL of May 2019

2.1

Depth to Water Table
Distribution of Percentage of Observation Wells
2019/May

State : Himachal Pradesh

District	No. of Wells Analysed	Depth to Water Table (m bgl)		No. / Percentage of Wells Showing Depth to Water Table (m bgl) in the Range of					
		Min	Max	0.0 - 2.0	2.0 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	> 40.0
HAMIRPUR	4	1.96	7.39	1	1	2	0	0	0
KANGRA	34	0.62	12.48	6	21	4	3	0	0
KULLU	3	0.85	8.47	1	0	2	0	0	0
MANDI	8	0.74	8.94	3	3	2	0	0	0
SIRMAUR	12	2.11	28.52	0	1	2	8	1	0
SOLAN	10	5.41	24.61	0	0	3	5	2	0
UNA	30	1.07	28.72	4	13	6	4	3	0
Total	101	0.62	28.72	15	39	21	20	6	0

3.1.2 August 2019

The depth to water level recorded during August 2019 (Annexure - I) ranges between (0.08) m bgl (Una districts) to 30.31 m bgl (Solan district) (Table-5). Out of the 104 stations monitored the majority of 63 stations (60.57%) recorded DTW in the range between 2-20 m bgl, 38 stations (36.53%) have recorded shallow water level less than 2 m bgl, and only 3 stations (2.88%) have shown, more than 20 m bgl in the state.

A perusal of the DTW map for August 2019 indicates that the shallow water level area less than 2m bgl occurs in all the valleys of Himachal Pradesh, except Nalagarh and Paonta valley, mainly in Balh valley (Mandi district), all the valleys of Kangra district including Kangra Palampur valley and Nurpur Indaura valley and eastern & central part of Una valley. 2-5m bgl and 5-10 m bgl water level is recorded in couple of pockets in almost all the valley areas. 10 -20 m bgl water level is recorded in pockets in Una Valley, eastern part of Paonta valley and in fringes of Nalagarh valley. Deeper water levels are found at some places in Nalagarh and Una valley.

Table-5:- Depth to water level - August 2019

2.1

Depth to Water Table
Distribution of Percentage of Observation Wells
2019/Aug

State : Himachal Pradesh

District	No. of Wells Analyzed	Depth to Water Table (mbgl)		No. / Percentage of Wells Showing Depth to Water Table (mbgl) in the Range of					
		Min	Max	0.0 - 2.0	2.0 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	> 40.0
HAMIRPUR	4	1.67	5.01	2	1	1	0	0	0
KANGRA	36	0.19	7.96	18	14	4	0	0	0
KULLU	2	0.76	5.71	1	0	1	0	0	0
MANDI	8	0.21	3.47	3	5	0	0	0	0
SIRMAUR	12	1.16	19.93	1	5	3	3	0	0
SOLAN	11	2.53	30.31	0	3	0	6	2	0
UNA	31	0.08	28.59	13	10	2	5	1	0
Total	104	0.08	30.31	38	38	11	14	3	0

3.1.3 November 2019

The depth to water level recorded during November 2019 (Annexure - I) ranged between 0.38 m bgl in (Mandi district) to 30.43 m bgl in (Solan district) (Table-6). Out of 103 stations monitored, the majority of 71 NHS (68.93%) recorded DTWL, in the range between 2 - 20 m bgl. 29 stations (28.15%), recorded shallow water levels, less than 2 m bgl and 3 stations (2.91%), recorded deep water levels, more than 20 m bgl in the State.

A perusal of the DTWL map for November 2019 shows that the shallow water level areas of less than 2 m observed in eastern part of Kangra Palampur valley and in pockets of all the valleys, except Paonta valleys and Nalagarh valleys. Water level of 2-5m & 5-10 m bgl is observed in major part of Kangra Palampur valley, Indaura-Nurpur valley, Balh valley, southern part of Una Valley, Nalagarh valley Paonta valley respectively. 10-20 m bgl water level is shown in Una, Nalagah and

Paonta valley only. Deeper water level more than 20m is confined mainly in eastern part of Paonta valley in Sirmaur district, southern part of Nalagarh valley of Solan district and small part of Una valley.

Table- 6: Depth to Water Level – November 2019

2.1

Depth to Water Table
Distribution of Percentage of Observation Wells
2019/Nov

State : Himachal Pradesh

District	No. of Wells Analysed	Depth to Water Table (mbgl)		No. / Percentage of Wells Showing Depth to Water Table (mbgl) in the Range of					
		Min	Max	0.0 - 2.0	2.0 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	> 40.0
HAMIRPUR	4	1.83	5.42	1	2	1	0	0	0
				25.00%	50.00%	25.00%			
KANGRA	36	0.48	10.31	11	18	6	1	0	0
				30.56%	50.00%	16.67%	2.78 %		
KULLU	2	1.17	6.06	1	0	1	0	0	0
				50.00%		50.00%			
MANDI	8	0.38	6.44	5	4	1	0	0	0
				37.50%	50.00%	12.50%			
SIRMAUR	11	1.59	25.66	1	2	5	2	1	0
				9.09%	18.18%	45.45%	18.18 %	9.09%	
SOLAN	11	4.34	30.43	0	1	2	7	1	0
					9.09%	18.18%	63.64 %	9.09%	
UNA	31	0.85	27.22	12	8	6	4	1	0
				38.71%	25.81%	19.35%	12.90 %	3.23%	
Total	103	0.38	30.43	29	35	22	14	3	0

3.1.4 January 2020

The depth to water level recorded during January 2020 (Annexure - I) ranged between 0.34m (Mandi district) to 30.14 m bgl (Una district) (Table-7). Out of 101 stations which are monitored, the majority of 71 NHS (70.29%) recorded DTW in the range between 2 - 20 m bgl, 27 stations (26.73%) recorded shallow water levels, less than 2 m bgl and 3 stations (2.97 %) recorded deep water levels, more than 20 m bgl in the state.

A perusal of the DTW map of January 2020 shows that the shallow water level area occurs mainly in south eastern part of Kangra Palampur valley (Kangra district), southern part of Balh valley (Mandi district) and Eastern part of Una Valley . 2-5 m bgl & 5-10m bgl water level is depicted in all the valleys of Himachal Pradesh. 10-20 m bgl water level occupies Paonta valley and small parts of Nalagarh and Una valley. Deeper water level, more than 20m are confined mainly in eastern part of Paonta valley, Nalagarh and at few places of Una valley.

Table- 7: Depth to Water Level – January 2020

2.1

Depth to Water Table
Distribution of Percentage of Observation Wells
2020/Jan

State : Himachal Pradesh

District	No. of Wells Analysed	Depth to Water Table (mBGL)		No. / Percentage of Wells Showing Depth to Water Table (mBGL) in the Range of					
		Min	Max	0.0 - 2.0	2.0 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	> 40.0
HAMIRPUR	4	1.93	5.73	1	2	1	0	0	0
KANGRA	36	0.39	12.78	25.00%	50.00%	25.00%			
				11	17	7	1	0	0
KULLU	2	0.82	6.19	1	0	1	0	0	0
				50.00%		50.00%			
MANDI	8	0.34	5.69	2	5	1	0	0	0
				25.00%	62.50%	12.50%			
SIRMAUR	12	1.39	27.53	1	0	4	6	1	0
				8.33%		33.33%	50.00 %	8.33%	
SOLAN	10	4.68	30.14	0	1	2	6	1	0
					10.00%	20.00%	60.00 %	10.00%	
UNA	29	0.45	27.01	11	7	5	5	1	0
				37.93%	24.14%	17.24%	17.24 %	3.45%	
Total	101	0.34	30.14	27	32	21	18	3	0

3.2 Seasonal Water Level Fluctuation

To study the effect of monsoon and subsequent utilization for various needs like agriculture, irrigation and domestic etc, changes in water level are studied and are discussed below.

3.2.1 May 2019 to November 2019

Monsoonal fluctuation of water level was analyzed for 100 stations for the period May 2019 – November 2019. A perusal of Table-8 shows that out of the 100 stations, 96 stations (96.00%) have shown rise in water level and remaining 4 stations (4.00%) have shown fall in water level.

The minimum rise in water level of 0.01 m was observed in Una District and the maximum rise 7.17 m was noticed in Una District. Out of the 96 stations which have shown rise in water level, 69 stations (71.87%) show rise between the range of 0 to 2m, 18 stations (18.75%) between 2 to 4m and remaining 9 stations (9.37%) show rise more than 4m.

The minimum and maximum fall in water level of 0.23 m and 0.80 m was observed in Solan and Mandi District. Out of them 4 stations (1.00%) have shown fall between 0-2 m, No stations has shown fall between 2-4 m and >4m.

A perusal of map for seasonal fluctuation shows a rise in water level in major part of Paonta valley, Nalagargh valley, Una valley, Balh valley, Kullu and Kangra valley. Except a fall which is noticed in central part of Indaura valley, Una valley and northern part of Kullu valley.

Table-8: Monsoonal Fluctuation - May 2019 to November 2019

2.1

District Wise - Fluctuation and Frequency Distribution From Different Ranges from One Period to Other														
From Year: 2019/May - To Year: 2019/Nov														
State : Himachal Pradesh														
District Name	No. of Wells	Range of Fluctuation(m)				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells		
		Rise		Fall		Rise			Fall			Rise	Fall	
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4			
HAMIRPUR	4	0.13	1.97	-	-	4 100.00%	0	0	0	0	0	0	4	0
KANGRA	34	0.09	3.06	0.57	0.57	28 82.35%	5 14.71 %	0	1 2.94%	0	0	0	33	1
KULLU	3	0.43	8.47	0.32	0.32	1 33.33%	0	1 33.33%	1 33.33%	0	0	0	2	1
MANDI	8	0.11	2.50	0.80	0.80	6 75.00%	1 12.50 %	0	1 12.50%	0	0	0	7	1
SIRMAUR	11	0.49	4.87	-	-	4 36.36%	3 27.27 %	4 36.36%	0	0	0	0	11	0
SOLAN	10	0.29	5.80	0.23	0.23	3 30.00%	4 40.00 %	2 20.00%	1 10.00%	0	0	0	9	1
UNA	30	0.01	7.17	-	-	23 76.67%	5 16.67 %	2 6.67%	0	0	0	0	30	0
Total	100	0.49	1.97			69	18	9	4	0	0	0	96	4

3.3 Annual Water Level Fluctuation

Annual fluctuation in water level of GWMS during different monitoring periods were analysed and discussed below.

3.3.1 May 2018 to May 2019

Annual fluctuation of water level, has been worked out by comparing depth to water level of May 2018, with May 2019 and the data is presented in Annexure – III and its frequency distribution in various rise and fall ranges is given in Table-9.

Out of the 99 stations analysed, 85 stations (85.85%) have shown rise in water level ranging from 0.09 (kangra) to 1.61 m (kullu district), whereas 13 stations (13.13 %) have shown fall ranging from 0.06m (Kangra district) to 28.72 m (Una district).

Out of stations which have shown rise in water level, 67 stations (78.82%) show rise between the range of 0 to 2m, 12 station (14.11%) has shown rise between 2 to 4m and only 6 stations (7.05%) shown rise more than 4m.

Similarly, for the stations which have shown fall in water level, 13 stations (46.15%) show fall between the range of 0 to 2m, No stations has shown fall between 2 to 4m and 7 stations (53.84%) has shown fall more than 4m.

A perusal of map of Annual Water Level Fluctuation for May 2018 to May 2019 shows fall in water level in majority of monitoring areas. Fall of 0-2m in shown in Kangra-Palampur valley of Kangra district, and major part of Nalagarh valley of Solan district, Paonta valley of Sirmour district. Fall >4 m is noticed in small pockets of Balh valley and Nallagah valley. Rise in water level is noticed in Kangra Palampur valley, southern part of Una valley, kullu valley and at some places in Paonta valley and Balh valley.

Table-9: District wise number & % of NHS distribution in different Annual W/L Fluctuation Range (May 2018 - May 2019)

2.1

<u>District Wise - Fluctuation and Frequency Distribution From Different Ranges from One Period to Other</u>													
From Year: 2018/May - To Year: 2019/May													
State : Himachal Pradesh													
District Name	No. of Wells	Range of Fluctuation(m)				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
HAMIRPUR	4	0.22	4.12	-	-	2 50.00%	1 25.00 %	1 25.00%	0	0	0	4	0
KANGRA	34	0.09	3.72	0.06	0.78	27 79.41%	5 14.71 %	0	2 5.88%	0	0	32	2
KULLU	3	0.69	1.61	-	-	2 66.67%	0	0	0	0	0	2	0
MANDI	8	0.44	1.68	0.17	8.94	6 75.00%	0	0	1 12.50%	0	1 12.5%	6	2
SIRMAUR	10	0.12	2.59	0.25	0.73	6 60.00%	1 10.00 %	0	3 30.00%	0	0	7	3
SOLAN	10	0.61	33.49	6.49	24.61	5 50.00%	0	2 20.00%	0	0	3 30.0%	7	3
UNA	30	0.24	4.58	20.50	28.72	19 63.33%	5 16.67 %	3 10.00%	0	0	3 10.0%	27	3
Total	99	0.69	1.61	0.00	28.72	67	12	6	6	0	7	85	13

3.3.2 August 2018 to August 2019

Annual fluctuation of water level, has been worked out by comparing depth to water level of August 2018, with August 2019 and the data is presented in Annexure – III and its frequency distribution of rise and fall is given in Table-10.

Out of the 109 stations, 52 stations (47.70%) have shown rise in water level ranging from 0.01 m (Mandi District) to 8.47 m (kullu district) whereas 52 stations (47.70%) have shown fall ranging from 0.02 m (Kangra and una district) to 28.59 m (Una district).

Out of stations which have shown rise in water level, 38 stations (73.03%) show rise between the range of 0 to 2m, 7 stations (13.46 %) between 2 to 4m and remaining 7 stations (13.46%) show rise more than 4m.

Similarly, for the stations which have shown fall in water level, 39 stations (75.00%) show fall between the range of 0 to 2m, 9 stations (17.30%) between 2 to 4m and remaining 4 stations (7.69%) show fall more than 4m.

A perusal of map of Annual Water Level Fluctuation for August 2018 to August 2019 shows fall in water level in some of monitoring areas of central part of Kangra Palampur valley, Whole of Indora-Nurpur valley, Nallagarh valley, Una valley and in small patch of Paonta valley. Areas are showing water level rise in all the valleys, under monitoring area.

Table-10: Annual Fluctuation August 2018 - August 2019

2.1

District Wise - Fluctuation and Frequency Distribution From Different Ranges from One Period to Other													
From Year: 2018/Aug - To Year: 2019/Aug													
State : Himachal Pradesh													
District Name	No. of Wells	Range of Fluctuation (m)				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
HAMIRPUR	4	0.14	1.31	0.04	0.19	2 50.00%	0	0	2 50.00%	0	0	2	2
KANGRA	37	0.03	1.25	0.02	3.66	10 27.03%	0	0	20 54.05%	5 13.51%	0	10	25
KULLU	3	0.33	8.47	-	-	2 66.67%	0	1 33.33%	0	0	0	3	0
MANDI	8	0.01	0.87	-	-	8 100.00%	0	0	0	0	0	8	0
SIRMAUR	12	0.30	1.18	0.02	3.03	4 33.33%	0	0	7 58.33%	1 8.33%	0	4	8
SOLAN	13	0.38	5.92	1.33	12.16	2 15.38%	1 7.69%	3 23.08%	2 15.38%	1 7.69%	2 15.38%	6	5
UNA	32	0.21	7.36	0.02	28.59	10 31.25%	6 18.75%	3 9.38%	8 25.00%	2 6.25%	2 6.25%	19	12
Total	109	0.38	0.87	0.00	28.59	38	7	7	39	9	4	52	52

3.3.3 November 2018 to November 2019

Annual fluctuation of water level has been worked out by comparing DTWL of November 2018 with November 2019 and data is presented in Annexure – III and its frequency distribution in various rise and fall ranges is given in Table-11.

Out of the 104 stations, 40 stations (38.46%) have shown rise in water level ranging from 0.01m (Kangra district) to 6.41 m (Una district) whereas 60 stations (57.69%) have shown fall ranging from 0.02 m (Una district) to 11.31 m (Solan district).

Out of stations which have shown rise in water level, 40 stations (95.00%) show rise between the range of 0 to 2m, 1 stations (2.50 %) between 2 to 4m and remaining 1 station(2.50%) show rise more than 4m.

Similarly, for the stations which have shown fall in water level, 60 stations (93.33%) show fall between the range of 0 to 2m, 1 stations (1.66 %) has shown fall between 2 to 4m and remaining stations (1.66%) shown fall more than 4m.

A perusal of map of annual fluctuation of November 2018 to November 2019 showing fall in water levels in majority of valley areas. Nallagarh valley of Solan district is completely under fall conditions. 0-2m fall is shown in some part of Paonta valley, more than 4m is observed in the small pocket of Una, Kangra palampur valley and Indaura Nurpur valley. Similarly rise in water level 0-2m is noticed along the fringe areas of all monitoring valleys. Rise more than 4 m is shown in northern part of Una valley .

Table-11: Annual Fluctuation -November 2018 to November 2019

2.1

District Wise - Fluctuation and Frequency Distribution From Different Ranges from One Period to Other

From Year: 2018/Nov - To Year: 2019/Nov

State : Himachal Pradesh

District Name	No. of Wells	Range of Fluctuation(m)				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
HAMIRPUR	4	0.64	0.64	0.05	0.22	1 25.00%	0	0	3 75.00%	0	0	1	3
KANGRA	36	0.01	0.32	0.02	1.54	12 33.33%	0	0	24 66.67%	0	0	12	24
KULLU	3	0.40	0.43	-	-	2 66.67%	0	0	0	0	0	2	0
MANDI	7	0.11	0.16	0.07	1.49	2 28.57%	0	0	5 71.43%	0	0	2	5
SIRMAUR	11	0.20	0.30	0.06	2.18	2 18.18%	0	0	8 72.73%	1 9.09%	0	2	9
SOLAN	11	0.14	1.15	0.20	11.31	5 45.45%	0	0	3 27.27%	0	2 18.18%	5	5
UNA	32	0.12	6.41	0.02	3.28	14 43.75%	1 3.13 %	1 3.13%	13 40.63%	1 3.13%	0	16	14
Total	104	0.64	0.16	0.00	11.31	38	1	1	56	2	2	40	60

3.3.4 January 2019 to January 2020

Annual fluctuation of water level has been worked out by comparing depth to water level of January 2019 with January 2020 and data is presented in Annexure – III and its frequency distribution in various rise and fall ranges is given in Table-12.

Out of the 96 stations analyzed, 73 stations (76.04%) have shown rise in water level ranging from 0.03 (Kangra and Sirmour district) to 8.47 m (Kullu district) whereas 23 stations (23.95%) have shown fall ranging from 0.01 (Mandi, Sirmour and Kangra district) to 3.30 m (Kangra district).

Out of stations which have shown rise in water level, 73 stations (90.41%) show rise between the range of 0 to 2m, 3 stations (4.10%) between 2 to 4m and remaining 4 stations (5.47%) show rise more than 4m.

Similarly, for the stations which have shown fall in water level, 22 stations (95.65%) show fall between the range of 0 to 2m, 1 stations (4.34%) between 2 to 4m and No stations has shown fall >4m.

A perusal of map of annual fluctuation of January 2019 to January 2020 is showing fall in water levels in majority of valley areas. The fall in water level 0-2m is shown in Indora valley, and few places of Kangra Palampur valley and a part of Paonta valley. Fall in water level, more than 4m is observed in Kangra Palampur valley only. Similarly rise in water level 0-2m is noticed in central & southern part of Kangra valley, southern part of Balh valley, southern part of Una valley and part of Paonta valley.

Table-12: Annual Fluctuation, January 2019 to January 2020

2.1

District Wise - Fluctuation and Frequency Distribution From Different Ranges from One Period to Other

From Year: 2019/Jan - To Year: 2020/Jan

State : Himachal Pradesh

District Name	No. of Wells	Range of Fluctuation(m)				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
HAMIRPUR	4	0.52	1.32	0.04	0.10	2 50.00%	0	0	2 50.00%	0	0	2	2
KANGRA	35	0.03	8.32	0.01	3.30	24 68.57%	0	1 2.86%	9 25.71%	1 2.86%	0	25	10
KULLU	3	0.17	8.47	-	-	2 66.67%	0	1 33.33%	0	0	0	3	0
MANDI	8	0.10	1.32	0.01	0.49	6 75.00%	0	0	2 25.00%	0	0	6	2
SIRMAUR	12	0.03	0.54	0.01	0.67	6 50.00%	0	0	6 50.00%	0	0	6	6
SOLAN	6	0.24	2.90	0.04	0.04	3 50.00%	2 33.33%	0	1 16.67%	0	0	5	1
UNA	28	0.05	5.86	0.09	0.25	23 82.14%	1 3.57%	2 7.14%	2 7.14%	0	0	26	2
Total	96	0.52	0.54	0.00	3.30	66	3	4	22	1	0	73	23

3.4 Decadal Fluctuations

The decadal variations were analyzed considering the decadal average of water level and the water level for the respective period.

3.4.1 Decadal average of May (2009-2018) to May 2019

Decadal water level fluctuation has been worked out by comparing water level data of May 2019 with the average mean of 10 years water level data of May (2009-2018) and is presented in Annexure-IV and frequency distribution in various ranges is presented in Table -13.

A perusal of Table-13 shows that out of 101 stations analysed, 82 stations (81.18%) have shown rise and 19 stations (18.81%), have shown fall in water level. 68 stations (82.92%) are showing rise in water level between 0 to 2m, 9 stations (10.97%) between 2 to 4m. and 5 stations (6.09%), more than 4m.

Out of 19 stations, 13 stations (68.42%) show fall in water level between 0 to 2m, 5 stations (26.31 %) between 2 to 4 m and 1stations (5.26%) more than 4m.

A minimum rise in water level of 0.01 m was noticed in Sirmour districts and the maximum rise of 7.83m is noticed in Solan district. Similarly, the minimum and maximum fall of 0.11 m is noticed in Mandi district & maximum fall of 4.08 m is noticed in Solan district.

A perusal of map of Decadal Variation - Average of May (2009 - 2018) with May 2019 reveals fall less than 2m, in all the valleys of Kullu district ,Mandi district, Sirmaur district, Solan district & Una district except at some places in Indaura valley, Balh valley and Paonta & Kangra-Palampur valley and Nurpur valley, which is showing rise. A fall is 2-4m and >4 m is shwon in Paonta valley, Kullu valley and Nallagarh valley.

Table-13: District wise number & % NHS distribution in different Decadal W/L Fluctuation Range (May (2009 - 2018) with May 2019

2.1

District Wise - Fluctuation of Water Level with Mean and Selected Period
10 Years Mean (2009 May - 2018 May) - 2019/May

State : Himachal Pradesh

District Name	No. of Wells	Range of Fluctuation				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise (m)		Fall (m)		Rise (m)			Fall (m)			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
HAMIRPUR	4	0.26	3.05	-	-	3 75.00 %	1 25.00%	0	0	0	0	4	0
KANGRA	34	0.20	4.73	0.67	0.67	27 79.41 %	4 11.76%	2 5.88%	1 2.94%	0	0	33	1
KULLU	3	0.31	0.31	0.57	3.85	1 33.33 %	0	0	1 33.33 %	1 33.33 %	0	1	2
MANDI	8	0.29	1.11	0.11	2.31	5 62.50 %	0	0	2 25.00%	1 12.50 %	0	5	3
SIRMAUR	12	0.01	6.85	0.06	0.51	6 50.00 %	0	2 16.67%	4 33.33%	0	0	8	4
SOLAN	10	0.58	7.83	0.03	4.08	3 30.00 %	1 10.00%	1 10.00%	4 40.00%	0	1 10.00%	5	5
UNA	30	0.14	2.38	0.43	3.86	23 76.67 %	3 10.00%	0	1 3.33%	3 10.00 %	0	26	4
Total	101	0.31	0.58	0.00	4.08	68	9	5	13	5	1	82	19

3.4.2 Decadal Average of August (2009 - 2018) to August 2019

Decadal water level fluctuation has been worked out by comparing water level data of August 2019 with the average 10 years water level data of August (2009-2018) and is presented in Annexure - IV and frequency distribution in various ranges is presented in Table -14.

A perusal of Table-14 shows that out of 109 stations analyzed, 70 stations (64.22%) have shown rise and 39 stations (35.77%), have shown fall in water level. 55 stations (78.57%) are showing rise in water level between 0 to 2m, 7 stations (10.00%) between 2 to 4m. and 8 stations (11.42%), more than 4m.

Out of 39 stations, 37 stations (94.87%) show fall in water level between 0 to 2m, 1 stations (2.56%) between 2 to 4 m and 1 stations (2.56%) more than 4m.

A minimum rise in water level of 0.02m was noticed in Kangra district and the maximum rise of 9.08 m is noticed in Solan district. Similarly, the minimum and maximum fall of 0.01 m is noticed in Kangra district & maximum fall of 13.08 m is also noticed in Una district.

A perusal of map Decadal Average of August (2009 - 2018) to August 2019 shows fall in water level in Paonta valley except central part of Sirmaur district complete Nalagargh valley of Solan district, central part of Una valley of Una district, some part of Balh valley of Mandi district and north central part of Kangra Palampur valley of Kangra district. Fall in water level, >4 m is shown in Una valley and couple of pockets of Kangra-Palampur valley. Similarly rise in water level is noticed in Balh valley of Mandi district, southern part of Una valley in Una district part of Kangra valley of Kangra district.

Table-14: Decadal Fluctuation August (2009-2018) to August 2019

2.1

District Wise - Fluctuation of Water Level with Mean and Selected Period
10 Years Mean (2009 Aug - 2018 Aug) - 2019/Aug

State : Himachal Pradesh

District Name	No. of Wells	Range of Fluctuation				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise (m)		Fall (m)		Rise (m)			Fall (m)			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
HAMIRPUR	4	0.64	1.35	0.10	0.34	2	0	0	2	0	0	2	2
KANGRA	37	0.02	6.90	0.01	1.93	20	0	2	15	0	0	22	15
KULLU	3	0.26	4.78	-	-	2	0	1	0	0	0	3	0
MANDI	8	0.05	1.62	0.06	0.29	6	0	0	2	0	0	6	2
SIRMAUR	12	1.45	7.46	0.02	1.68	1	0	1	10	0	0	2	10
SOLAN	13	0.11	9.08	1.07	1.93	5	2	2	4	0	0	9	4
UNA	32	0.10	4.52	0.16	13.08	19	5	2	4	1	1	26	6
Total	109	1.35	1.45	0.00	13.08	55	7	8	37	1	1	70	39

3.4.3 Decadal average of November (2009-2018) to November 2019

Decadal water level fluctuation has been worked out by comparing water level data of November 2019 with the average water level data of November for 10 years (2009-2018) and is presented in Annexure - IV and frequency distribution in various ranges in Table 15.

A perusal of Table-15 shows that out of 105 stations analyzed, 69 stations (65.71%) have shown rise and 36 stations (34.28%), have shown fall in water level. 57 stations (82.60%) are showing rise in water level between 0 to 2m, 7stations (10.14 %) between 2 to 4m. and 5 stations (7.24%), more than 4m.

Out of 36 stations, 33 stations (91.66%) show fall in water level between 0 to 2m, 2 stations (5.55%) between 2 to 4 m and 1 stations (2.77 %) more than 4m.

A minimum rise in water level of 0.02 m was noticed in Una district and the maximum rise of 5.86 m is noticed in Una district. Similarly, the minimum and maximum fall of 0.01 m is noticed in Kangra district & maximum fall of 8.96 m is also noticed in Una district.

A perusal of map of Decadal average of November (2009-2018) to November 2019 reveals fall in water level less than 2m.is shown in eastern part of Kangra - Palampur valley & Indaura valley of Kangra district, major part of Nalagarh valley, Balh valley, a couple of places in Paonta valley. The fall between 2 to 4 m was noticed in, Una and Paonta valley. Similarly, rise is noticed in all the valleys from 0-2 m and 2- 4m except in major part of Nallagah valley.

Table-15: Decadal Fluctuation November (2009-2018) to November 2019

2.1

District Wise - Fluctuation of Water Level with Mean and Selected Period

10 Years Mean (2009 Nov - 2018 Nov) - 2019/Nov

State : Himachal Pradesh

District Name	No. of Wells	Range of Fluctuation				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise (m)		Fall (m)		Rise (m)			Fall (m)			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
HAMIRPUR	4	0.16	1.45	-	-	4	0	0	0	0	0	4	0
KANGRA	36	0.11	2.70	0.01	1.12	23	1	0	12	0	0	24	12
KULLU	3	4.27	4.27	0.03	0.29	0	0	1	2	0	0	1	2
MANDI	8	0.06	1.05	0.09	0.83	4	0	0	4	0	0	4	4
SIRMAUR	11	0.20	7.03	0.05	2.80	3	0	1	5	2	0	4	7
SOLAN	11	1.30	5.19	0.00	1.99	2	1	1	7	0	0	4	7
UNA	32	0.02	5.86	0.08	8.96	21	5	2	3	0	1	28	4
Total	105	1.05	4.27	0.00	8.96	57	7	5	33	2	1	69	36

3.4.4 Decadal average of January (2010-2019) to January 2020

Decadal water level fluctuation has been worked out by comparing water level data of January 2020 with the average water level data of January for 10 years (2010-2019) and is presented in Annexure - IV and frequency distribution in various ranges is presented in Table -15.

A perusal of Table-15 shows that out of 104 stations analysed, 84stations (80.76 %) have shown rise and 20 stations (19.23%), have shown fall in water level. 65 stations (77.38%) are showing rise in water level between 0 to 2m, 12 stations (14.28%) between 2 to 4m. and 7 stations (8.33%), more than 4m. Out of 20 stations, 17 stations (85.00%) show fall in water level between 0 to 2m, 1 stations (5.00%) between 2 to 4 m and 2 stations (10.00%) more than 4m.

A minimum rise in water level of 0.01 m was noticed in Kangra district and the maximum rise of 9.08 m is noticed in Solan district. Similarly, the minimum and maximum fall of 0.03 m is noticed in Solan district & maximum fall of 5.01 m is noticed in Solan district.

A perusal of map of Decadal average of January (2010-2019) to January 2020 reveals fall in water level less than 2m.is shown in eastern part of Kangra - Palampur valley & at small areas of Nurpur-Indaura valley of Kangra district, Balh valley, Una valley, Paonta valley and major part of Nalagarh valley. The fall between 2 to 4 m and >4 m was noticed in few places of Una valley, Nalagarh valley and Paonta valley of Sirmour district. Similarly, rise is noticed in all the valleys from 0-2 m and 2- 4m except in major part of Nallagah valley and Paonta Valley.

Table –15: Decadal Fluctuation January (2010-2019) to January 2020

2.1

District Wise - Fluctuation of Water Level with Mean and Selected Period

10 Years Mean (2010 Jan - 2019 Jan) - 2020/Jan

State : Himachal Pradesh

District Name	No. of Wells	Range of Fluctuation				No. of Wells /Percentage Showing Fluctuation						Total No. of Wells		
		Rise (m)		Fall (m)		Rise (m)			Fall (m)			Rise	Fall	
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4			
HAMIRPUR	4	0.06	1.92	-	-	4 100.00 %	0	0	0	0	0	0	4	0
KANGRA	36	0.01	4.77	0.16	1.27	24 66.67 %	4 11.11%	1 2.78%	7 19.44%	0	0	0	29	7
KULLU	3	0.23	5.38	-	-	2 66.67 %	0	1 33.33%	0	0	0	0	3	0
MANDI	8	0.10	2.42	0.19	0.44	5 62.50 %	1 12.50%	0	2 25.00%	0	0	0	6	2
SIRMAUR	12	0.08	5.46	0.12	2.02	5 41.67 %	0	1 8.33%	5 41.67%	1 8.33 %	0	0	6	6
SOLAN	11	0.10	9.08	0.03	5.01	4 36.36 %	2 18.18%	2 18.18%	2 18.18%	0	1 9.09%	0	8	3
UNA	30	0.02	5.45	0.52	4.46	21 70.00 %	5 16.67%	2 6.67%	1 3.33%	0	1 3.33%	0	28	2
Total	104	1.92	0.23	0.00	5.01	65	12	7	17	1	2	0	84	20

Depth to water level of May 2019, August 2019, Nov 2019 & Jan 2020

State	Himachal Pradesh				
District	HAMIRPUR	Dtw May 2019	Dtw Aug 2019	Dtw Nov 2019	Dtw Jan 2020
1	Bagnalla	5.09	3.06	3.58	3.76
2	Bijari	1.96	1.67	1.83	1.93
3	Galore	2.70	1.76	2.22	2.31
4	Kangu	7.39	5.01	5.42	5.73
District	KANGRA				
5	Andaura	2.80	1.94	2.25	2.26
6	Bandh	1.67	0.19	1.11	0.80
7	Barota	5.74	3.05	4.39	5.37
8	Basa Bazira		7.96	8.25	8.50
9	Bhalad	1.98	0.23	0.64	0.39
10	Bhali	1.85	1.57	1.51	2.03
11	Bharmar	11.46	6.33	8.78	8.69
12	Bharoli	7.03	3.31	5.51	6.23
13	Bod	2.59	1.07	2.37	1.69
14	Chakban Ambari	4.87	3.09	4.03	3.99
15	Channaur	2.52	2.15	2.19	2.13
16	Darkati	2.07	1.18	1.02	1.56
17	Dehra Gopipur	4.32	2.27	2.78	3.66
18	Dehrian	1.56	0.93	1.33	1.39
19	Hardogri	4.33	1.32	2.85	3.64
20	Jagir	3.09	2.25	2.62	2.80
21	Jassur	3.12	2.81	2.48	1.93
22	Jwalaji	4.66	0.29	1.60	1.52
23	Kangra	10.92	6.25	8.11	8.58
24	Kathgarh	3.78	3.32	3.69	3.54
25	Kotla	2.38	0.41	1.70	1.94
26	Manjgram	0.92	0.38	1.49	0.99
27	Mao	2.23	0.66	1.01	0.91
28	Mohtli	3.56	2.36	3.16	3.26
29	Nagrota		0.00		
30	Old Kangra	3.37	1.23	2.56	3.44
31	Olherian	3.16	2.56	2.47	2.16
32	Pandtehr	0.62	0.30	0.48	0.52
33	Panjpir	4.36	1.95	3.43	2.31
34	Paprola	12.48	6.40	10.31	12.78
35	Rait	8.94	4.86	7.82	8.29
36	Raja-ka-talab	3.71	1.64	1.88	2.07
37	Rakar	2.97	0.66	2.36	2.04
38	Riali	4.09	2.58	3.84	3.97
39	Takipur	4.91	0.63	2.28	2.74
40	Thali	2.98	3.03	2.54	2.87
41	Thirtynine Mile	8.54	4.87	7.20	8.66
42	Bhatka	1.14	0.77	0.83	0.82
43	Parnalla	2.62	1.59	2.05	1.22
44	Lakhnaut	2.96	0.72	1.09	0.82

45	Ladhi	2.47	1.29	NA	NA
46	Naura	1.58	0.66	0.86	0.72
47	Changara	2.18	1.02	1.36	1.33
48	Barot	3.09	1.21	3.01	2.14
49	Kuth khana	5.74	6.18	7.57	7.73
50	Nagrota Gurudwara	8.51	NA	NA	NA
District	Kullu	Dtw May 2019	Dtw Aug 2019	Dtw Nov 2019	Dtw Jan 2020
51	Gadauri	6.49	5.71	6.06	6.19
52	Hathithan	0.00	0.00	0.00	0.00
53	Kullu	0.85	0.76	1.17	0.82
District	MANDI				
54	Bahangrotu	5.81	3.14	4.76	3.75
55	Gagal	1.98	1.71	1.85	2.41
56	GUTKAR	8.94	3.39	6.44	5.69
57	Jarl	0.74	0.30	0.38	0.34
58	Jhiri	4.17	2.84	4.03	4.00
59	Kaned	1.01	0.21	0.90	0.43
60	Lohara	3.54	2.94	3.18	3.10
61	Ratti	3.54	3.47	4.34	4.21
62	Dinak	4.50	2.19	3.09	3.94
District	SIRMAUR				
63	Ajiwala	6.02	3.32	4.74	5.34
64	Akkawala	11.26	10.27		11.19
65	Badripur	13.04	7.65	9.81	11.98
66	Dhaulakuan	8.08	3.50	3.50	5.02
67	Kala-Amb	14.81	9.50	12.69	13.32
68	Khodawala	15.86	11.31	14.55	15.59
69	Kiyarda	10.47	2.83	5.60	9.30
70	Kolar	13.21	2.31	8.38	11.04
71	Nayagaon	13.26	4.60	9.22	11.67
72	Shambuwala	10.23	6.61	9.74	9.59
73	Shibpur	28.52	19.93	25.66	27.53
74	Trilokpur	2.11	1.16	1.59	1.39
75	Miserwala	8.16	1.90	3.79	6.32
76	Sainwala I	5.54	0.88	3.17	3.44
77	Kodewala	2.70	2.36	2.53	2.53
78	Kheri	2.31	1.73	2.43	2.29
79	Sainwala II	2.24	1.45	NA	1.61
District	SOLAN				
80	Baddi	6.02	2.53	5.07	6.49
81	Barotiwala	24.61	18.64	18.81	19.69
82	Baruna		30.31	30.43	30.14
83	Bhagheri	16.80	15.95	12.31	13.70
84	BHATOLI	13.01	12.16	10.75	11.17
85	Dhabota	12.34	12.07	12.05	12.22
86	Jagatpur	15.19	11.13	12.62	13.33
87	Jharmajri	Dry	Dry	Dry	Dry
88	Khera-chak	6.49	3.62	4.34	4.68
89	Mahadev	12.80	10.73	11.31	11.49
90	Manjhauli	Dry	Dry	Dry	19.44
91	Panjahra	21.51	20.26	18.62	5.05

92	Phalahi	5.41	4.41	5.64	6.49
93	Maganpura	Dry	Dry	Dry	Dry
94	Theda	5.45	2.17	2.70	2.79
95	Nalagarh	6.52	3.14	4.19	4.34
	District Una	Dtw May 2019	Dtw Aug 2019	Dtw Nov 2019	Dtw Jan 2020
96	Amb	4.96	2.39	2.46	3.16
97	Ambota	28.72	28.59	27.22	27.01
98	Babehr	2.98	1.07	1.62	1.06
99	Bawal	1.07	0.92	1.01	1.12
100	Bhadsali	13.21	12.44	11.71	11.98
101	Bhangana	1.75	0.51	0.91	0.81
102	Daulatpur	7.76	4.56	5.19	5.29
103	Dharampur	2.54	4.71	1.96	1.85
104	Gagret	7.80	7.29	7.79	6.31
105	Ghaneri	6.08	3.16	5.87	7.39
106	Guglahar	3.08	1.41	2.52	2.29
107	Ishapur	2.10	0.81	1.42	0.93
108	Jankaur	NA	2.24	3.28	3.26
109	Jawar	1.78	0.99	1.01	1.02
110	Jhalera	4.50	2.46	1.42	3.72
111	Khanpur	4.58	3.13	3.77	3.70
112	Khwaja	2.28	0.74	1.61	1.05
113	Kuluwal		0.00	0.00	0.00
114	Kuthera Jaswala	6.36	3.99	5.43	5.43
115	Lalehri	11.46	6.57	8.36	9.75
116	Loharli	3.39	1.08	2.13	2.52
117	Mawa Kalan	21.01	15.71	16.54	15.51
118	Mubarikpur	4.03	1.94	2.59	2.72
119	Nangran	5.27	3.66	4.31	4.53
120	Panjawar	11.56	10.88	11.34	10.52
121	Panoh	2.37	0.54	1.56	0.94
122	Raipur Marwadi	16.96	11.87	9.79	10.75
123	Rajli Panjal	3.10	0.08	1.06	0.51
124	Santokhgarh	5.22	2.29	4.39	4.52
125	Singhnei	20.50	19.77	18.51	18.69
126	Tahliwala 1	1.83	0.43	0.85	0.45
127	Una	2.94	0.85	1.77	1.69
	District Chamba				
128	Upper Thulel	3.20	1.49	2.14	1.30

Annexure-II

Monsoonal Fluctuation of - Pre and post for 2019

State	Himachal Pradesh	
District	HAMIRPUR	Monsoon fl (may19- Nov19)
1	Bagnalla	1.51
2	Bijari	0.13
3	Galore	0.48
4	Kangu	1.97
District	KANGRA	
5	Andaura	0.55
6	Bandh	0.56
7	Barota	1.35
8	Basa Bazira	-
9	Bhalad	1.34
10	Bhali	0.34
11	Bharmar	2.68
12	Bharoli	1.52
13	Bod	0.22
14	Chakban Ambari	0.84
15	Channaur	0.33
16	Darkati	1.05
17	Dehra Gopipur	1.54
18	Dehrian	0.23
19	Hardogri	1.48
20	Jagir	0.47
21	Jassur	0.64
22	Jwalaji	3.06
23	Kangra	2.81
24	Kathgarh	0.09
25	Kotla	0.68
26	Manjgram	-0.57
27	Mao	1.22
28	Mohtli	0.40
29		
30	Old Kangra	0.81
31	Olherian	0.69
32	Pandtehr	0.14
33	Panjpir	0.93
34	Paprola	2.17

35	Rait	1.12
36	Raja-ka-talab	1.83
37	Rakar	0.61
38	Riali	-
39	Takipur	2.63
40	Thali	0.44
41	Thirtynine Mile	1.34
District	KULLU	
42	Gadauri	0.43
43	Hathithan	0.00
44	Kullu	-0.32
District	MANDI	
45	Bahangrotu	1.05
46	Gagal	0.13
47	GUTKAR	2.50
48	Jarl	0.36
49	Jhiri	0.14
50	Kaned	0.11
51	Lohara	0.36
52	Ratti	-0.80
District	SIRMAUR	
53	Ajiwala	1.28
54	Akkawala	-
55	Badripur	3.23
56	Dhaulakuan	4.58
57	Kala-Amb	2.12
58	Khodawala	1.31
59	Kiyarda	4.87
60	Kolar	4.83
61	Nayagaon	4.04
62	Shambuwala	0.49
63	Shibpur	2.86
64	Trilokpur	0.52
District	SOLAN	
65	Baddi	0.95
66	Barotiwala	5.80
67	Barun	-
68	Bhagheri	4.49
69	Bhatoli	2.26
70	Dhabota	0.29
71	Jagatpur	2.57
72	Jharmajri	2.15
73	Khera-chak	1.49

74	Mahadev	2.89
75	Manjhauri	-0.23
76	Panjahra	0.95
77	Phalahi	5.80
District	UNA	
78	Amb	2.50
79	Ambota	1.50
80	Babehr	1.36
81	Bawal	0.06
82	Bhadsali	1.50
83	Bhangana	0.84
84	Daulatpur	2.57
85	Dharampur	0.58
86	Gagret	0.01
87	Ghaneri	0.21
88	Guglahar	0.56
89	Ishapur	0.68
90	Jankaur	-
91	Jawar	0.77
92	Jhalera	3.08
93	Khanpur	0.81
94	Khwaja	0.67
95	Kuluwal	-
96	Kuthera Jaswala	0.93
97	Lalehri	3.10
98	Loharli	1.26
99	Mawa Kalan	4.47
100	Mubarikpur	1.44
101	Nangran	0.96
102	Panjawar	0.22
103	Panoh	0.81
104	Raipur Marwadi	7.17
105	Rajli Panjal	2.04
106	Santokhgarh	0.83
107	Singhnei	1.99
108	Tahliwala 1	0.98
109	Una	1.17

- data not available

Annexure-III

**Annual Fluctuation of May 2018- May 2019, August 2018- August 2019
November 2018- November 2019 and January 2019- January 2020**

State	Himachal Pradesh				
District	HAMIRPUR	Annual fl may (18-19)	Annual fl Aug (18-19)	Annual fl Nov (18-19)	Annual fl Jan (19-20)
1	Bagnalla	1.37	1.31	-0.22	0.52
2	Bijari	2.98	0.14	-0.05	-0.10
3	Galore	0.22	-0.19	-0.15	-0.04
4	Kangu	4.12	-0.04	0.64	1.32
District	KANGRA				
5	Andaura	0.63	-1.30	-0.39	0.06
6	Bandh	1.71	0.07	-0.20	8.32
7	Barota	2.76	-0.42	-0.33	-0.10
8	Basa Bazira		-3.42	-0.88	
9	Bhalad	1.71	-0.06	0.29	0.75
10	Bhali	1.34	-0.56	0.16	0.04
11	Bharmar	3.70	-2.32	-1.20	1.12
12	Bharoli	0.81	-0.19	-1.20	-0.12
13	Bod	3.04	0.03	0.16	0.87
14	Chakban Ambari	1.74	-0.03	0.32	0.63
15	Channaur	0.90	-0.06	0.10	0.19
16	Darkati	0.49	-0.52	0.05	-0.19
17	Dehra Gopipur	0.91	0.71	0.23	0.16
18	Dehrian	0.68	0.20	0.11	0.17
19	Hardogri	0.09	1.25	-0.04	-0.01
20	Jagir	0.25	-0.49	0.01	0.07
21	Jassur	0.97	-0.02	-0.75	0.72
22	Jwalaji	0.30	0.37	-0.02	0.47
23	Kangra	-0.78	-2.17	-1.54	1.92
24	Kathgarh	3.72	-0.76	-0.38	0.04
25	Kotla	0.60	-0.59	-0.46	0.51
26	Manjgram	0.85	0.00	-0.66	0.34
27	Mao	1.98	-0.05	0.13	0.88
28	Mohtli	1.33	0.13	-0.44	0.03
29	Nagrota		0.00		
30	Old Kangra	1.60	-0.74	-0.27	-0.41
31	Olherian	1.34	0.30	-0.15	0.40
32	Pandtehr	-0.06	0.09	-0.06	-0.06
33	Panjpir	0.50	-0.18	-0.22	1.38

34	Paprola	0.38	-3.66	-1.44	-3.30
State	Himachal Pradesh	Annual fl may (18-19)	Annual fl Aug (18-19)	Annual fl Nov (18-19)	Annual fl Jan (19-20)
35	Rait	1.59	-2.62	-0.43	0.38
36	Raja-ka-talab	0.63	-0.48	-0.64	1.38
37	Rakar	1.57	0.76	0.06	0.85
38	Riali		-0.67	-0.19	-0.17
39	Takipur	2.30	-0.46	0.03	1.22
40	Thali	1.65	-0.77	-0.09	-0.39
41	Thirtynine Mile	1.23	-1.96	-0.30	-0.56
District	KULLU				
42	Gadauri	1.61	1.35	0.43	0.37
43	Hathithan	0.00	0.00	0.00	0.00
44	Kullu	0.69	0.33	0.40	0.17
District	MANDI				
45	Bahangrotu	1.33	0.87	-0.51	1.32
46	Gagal	0.51	0.03	0.16	-0.49
47	GUTKAR	-8.94	0.79	-1.49	0.77
48	Jarl	-0.17	0.01	-0.07	-0.01
49	Jhiri	1.68	0.76	-0.08	0.29
50	Kaned	0.94	0.17		0.31
51	Lohara	0.44	0.40	0.11	0.96
52	Ratti	1.58	0.46	-0.10	0.10
District	SIRMAUR				
53	Ajiwala	0.42	-0.04	-0.26	0.21
54	Akkawala		0.65		-0.06
55	Badripur	2.59	-0.02	0.20	-0.67
56	Dhaulakuan	0.92	-0.39	-0.06	0.34
57	Kala-Amb	-0.73	1.18	0.30	0.25
58	Khodawala	0.51	-3.03	-0.44	-0.23
59	Kiyarda	-0.66	-0.02	-0.17	-0.09
60	Kolar	0.36	0.30	-2.18	0.54
61	Nayagaon	-0.25	1.14	-0.29	0.03
62	Shambuwala	1.33	-0.49	-1.15	-0.59
63	Shibpur		-1.91	-0.95	-0.01
64	Trilokpur	0.12	-0.15	-0.27	0.03
District	SOLAN				
65	Baddi	0.73	-2.53	-5.07	
66	Barotiwala	-24.61	5.29	0.73	2.43
67	Barun		-1.33	1.15	
68	Bhagheri	4.88	5.92	0.58	2.90
69	Bhatoli	1.09	-12.16	0.14	
70	Dhabota	1.95	-1.84	0.00	-0.04

71	Jagatpur	-15.19	4.40	-0.88	0.24
State	Himachal Pradesh	Annual fl may (18-19)	Annual fl Aug (18-19)	Annual fl Nov (18-19)	Annual fl Jan (19-20)
72	Jharmajri		0.00		
73	Khera-chak	-6.49	1.27	-0.20	
74	Mahadev	1.45	-10.73	-11.31	0.70
76	Panjahra	21.51	2.40	0.87	
77	Phalahi	-6.49	0.38	-0.44	0.39
District	UNA				
78	Amb	1.71	0.82	-0.19	-0.25
79	Ambota	-28.72	-28.59	1.65	1.68
80	Babehr	2.69	-0.04	0.20	0.87
81	Bawal	0.24	-0.14	-0.02	-0.09
82	Bhadsali	3.16	3.00	1.32	0.98
83	Bhangana	1.31	-0.04	-0.19	0.34
84	Daulatpur	1.77	3.50	1.68	2.04
85	Dharampur	1.58	-3.07	-0.13	0.05
86	Gagret	4.20	-0.07	-1.33	1.06
87	Ghaneri	3.88	2.41	0.42	1.17
88	Guglahar	1.98	1.61	-0.39	0.32
89	Ishapur	1.56	0.21	-0.13	0.66
90	Jankaur		-2.24	-3.28	
91	Jawar	0.50	0.48	0.00	0.14
92	Jhalera	1.61	1.42	1.83	0.34
93	Khanpur	1.10	0.86	0.36	
94	Khwaja	0.78	-0.52	-0.03	0.92
95	Kuluwal		0.00	0.00	
96	Kuthera Jaswala	1.43	2.04	0.20	0.82
97	Lalehri	1.68	4.35	0.60	0.51
98	Loharli	1.94	0.94	-0.31	0.36
99	Mawa Kalan	-21.01	7.20	3.70	5.61
100	Mubarikpur	2.66	1.83	0.35	0.26
101	Nangran	0.36	1.32	0.25	
102	Panjawar	2.66	3.19	-0.20	0.69
103	Panoh	1.37	-0.54	0.63	1.26
104	Raipur Marwadi	4.58	7.36	6.41	5.86
105	Rajli Panjal	4.39	-0.05	-0.18	1.46
106	Santokhgarh	0.65	2.03	-0.13	0.35
107	Singhnei	-20.50	-19.77	1.37	1.22
108	Tahliwala 1	1.10	-0.02	0.12	0.82
109	Una	0.73	0.91	-0.03	0.64

Annexure-IV

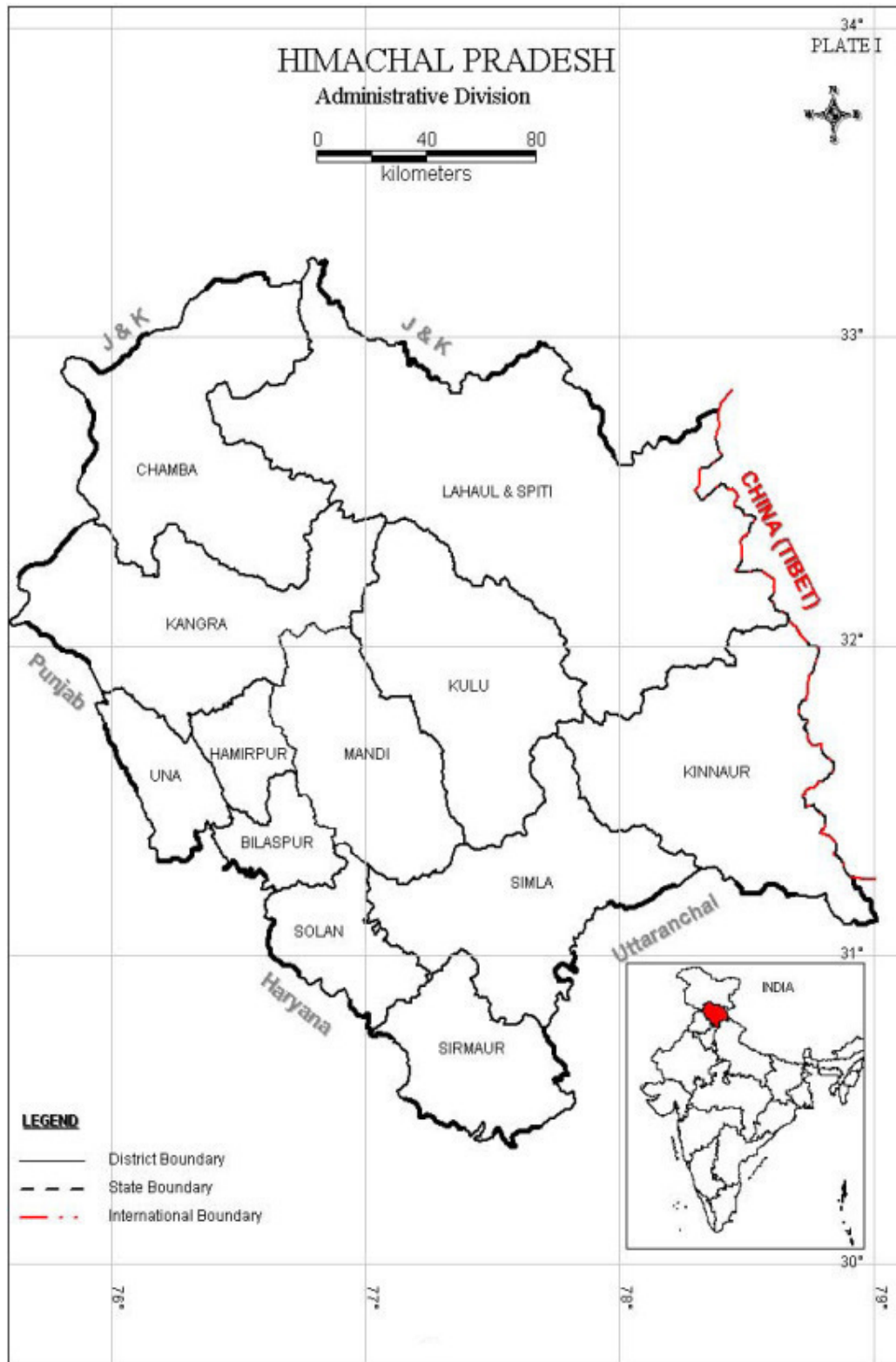
**Decadal mean Fluctuation May (2009-2018 with May 2019), August (2009-2018 with Aug 2019)
November (2009-2018 with Nov 2019) January 2010-2019 with Jan 2020)**

State	Himachal Pradesh				
District	HAMIRPUR	Decadal fl may(2009- 2018)wrt May 19	Decadal fl Aug(2009- 2018)wrt Aug19	Decadal fl Nov(2009-2018)wrt Nov19	Decadal fl Jan(2010- 2019)wrt Jan20
1	Bagnalla	1.21	1.35	1.45	1.57
2	Bijari	1.67	-0.34	0.46	0.06
3	Galore	0.26	-0.10	0.16	0.32
4	Kangu	3.05	0.64	1.18	1.92
District	KANGRA				
5	Andaura	1.70	1.03	1.29	1.60
6	Bandh	1.40	0.74	1.00	2.32
7	Barota	1.56	0.25	-0.02	-0.16
8	Basa Bazira	1.55	-1.93	-1.12	-0.16
9	Bhalad	1.97	0.10	0.70	1.21
10	Bhali	2.91	-0.45	0.21	0.14
11	Bharmar	1.62	0.05	0.59	2.25
12	Bharoli	1.11	0.59	-0.21	0.24
13	Bod	0.20	-0.01	0.26	0.97
14	Chakban Ambari	0.87	0.26	0.25	0.54
15	Channaur	0.46	0.63	1.36	1.34
16	Darkati	0.84	-0.47	0.37	0.35
17	Dehra Gopipur	0.91	0.92	1.07	0.26
18	Dehrian	0.24	0.22	0.30	0.46
19	Hardogri	0.24	1.69	0.11	-0.28
20	Jagir	1.83	-0.49	0.37	0.23
21	Jassur		0.18	1.61	3.05
22	Jwalaji	-0.67	0.37	-0.18	0.01
23	Kangra	1.43	-1.06	0.38	2.14
24	Kathgarh	0.71	-0.58	-0.21	0.07
25	Kotla	0.46	-0.44	-0.20	0.58
26	Manjgram	0.62	0.02	-0.49	0.27
27	Mao	2.37	-0.19	0.72	1.49
28	Mohtli	4.73	4.34	2.70	4.77
29	Nagrota	-	6.41	-	-
30	Old Kangra	3.00	0.91	0.41	0.24
31	Olherian	0.65	0.31	0.20	0.72

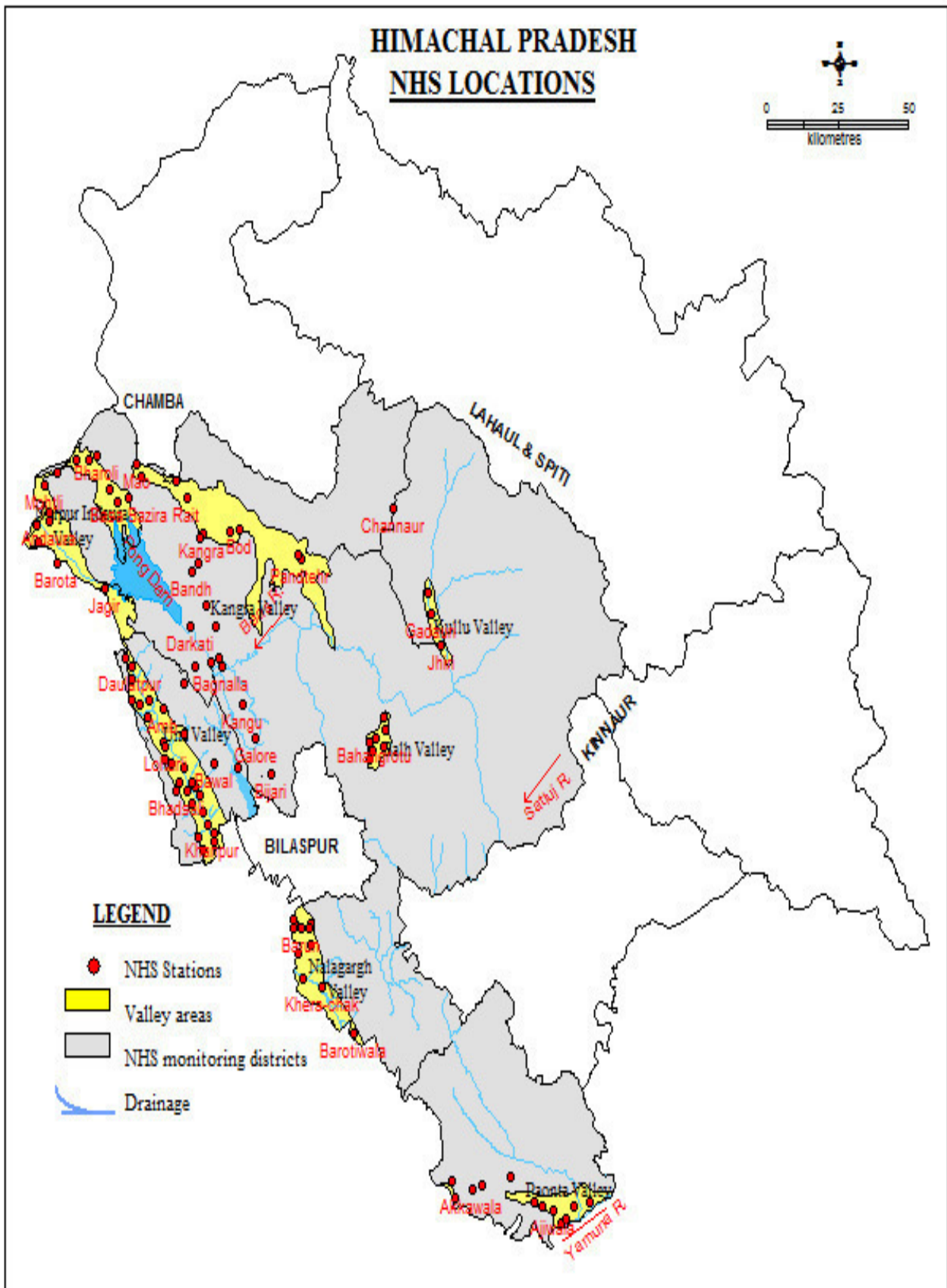
		Decadal fl may(2009- 2018)wrt May 19	Decadal fl Aug(2009- 2018)wrt Aug19	Decadal fl Nov(2009-2018)wrt Nov19	Decadal fl Jan(2010- 2019)wrt Jan20
32	Pandtehr	0.35	0.07	-0.01	0.04
33	Panjpir	0.28	-0.21	-0.01	1.57
34	Paprola	0.47	-0.95	-0.31	-1.27
35	Rait	1.10	-0.40	0.14	0.72
36	Raja-ka-talab	0.66	-0.51	0.77	1.64
37	Rakar	4.61	0.32	0.86	1.14
38	Takipur	2.04	0.20	0.65	1.80
39	Thali	1.21	-0.54	-0.03	-0.28
40	Thirtynine Mile	0.40	-0.89	0.14	-0.72
District	KULLU				
41	Gadauri	-0.57	0.26	-0.29	0.23
42	Hathithan	-3.85	4.78	4.27	5.38
43	Kullu	0.31	0.60	-0.03	0.35
District	MANDI				
44	Bahangrotu	1.11	1.62	1.05	2.42
45	Gagal	-0.11	-0.29	-0.19	-0.44
46	GUTKAR	-2.31	0.21	-0.83	1.16
47	Jarl	-0.18	0.05	0.06	0.10
48	Jhiri	0.29	0.39	-0.09	0.17
49	Kaned	0.67	0.39	0.29	0.74
50	Lohara	0.34	0.32	0.35	0.48
51	Ratti	0.60	-0.06	-0.45	-0.19
District	SIRMAUR				
52	Ajiwala	0.14	-0.41	-0.16	-0.17
53	Akkawala	0.63	-1.68	-	0.20
54	Badripur	4.23	-0.12	-2.45	1.51
55	Dhaulakuan	0.01	-0.37	0.20	1.20
56	Kala-Amb	-0.51	1.45	0.38	0.08
57	Khodawala	-0.17	-0.02	-2.80	-2.02
58	Kiyarda	-0.22	-0.27	-0.19	-0.45
59	Kolar	6.85	7.46	7.03	5.46
60	Nayagaon	0.01	-0.69	-0.52	-0.16
61	Shambuwala	0.66	0.03	-1.43	-0.43
62	Shibpur	-0.06	-0.17	-0.35	-0.12
63	Trilokpur	0.42	-0.05	-0.05	0.38
District	SOLAN				
64	Baddi	-0.95	1.97	-1.07	-1.63

		Decadal fl may(2009- 2018)wrt May 19	Decadal fl Aug(2009- 2018)wrt Aug19	Decadal fl Nov(2009-2018)wrt Nov19	Decadal fl Jan(2010- 2019)wrt Jan20
65	Barotiwala	-4.08	5.53	5.19	5.33
66	Baruna	-	-1.11	-1.99	-5.01
67	Bhagheri	1.21	0.42	2.06	3.84
68	Bhatoli	-0.51	-1.83	-0.21	-0.03
69	Dhabota	0.58	-1.93	-0.01	3.34
70	Jagatpur	2.10	3.72	1.82	9.08
71	Jharmajri	-	9.08	-	
72	Khera-chak	-1.90	0.11	-0.14	0.10
73	Mahadev	-0.03	-1.07	-1.12	0.49
74	Manjhaul	-	2.95	-	
75	Panjahra	7.83	0.92	1.22	1.41
76	Phalahi	0.87	0.84	0.00	0.17
District	UNA				
77	Amb	1.74	1.83	1.82	1.72
78	Ambota	-3.86	-13.08	-8.96	-4.46
79	Babehr	1.77	0.14	0.49	1.96
80	Bawal	0.32	0.15	0.29	0.44
81	Bhadsali	2.38	2.47	2.34	3.06
82	Bhangana	0.62	0.19	1.19	0.52
83	Daulatpur	0.63	2.47	1.65	1.97
84	Dharampur	1.18	-1.62	0.65	0.89
85	Gagret	0.79	0.21	-0.79	1.38
86	Ghaneri	2.36	2.07	0.63	0.28
87	Guglahar	1.19	1.33	0.50	1.30
88	Ishapur	1.37	1.43	1.00	1.54
88	Jankaur	-	-0.57	-1.01	-0.52
89	Jawar	-0.43	-0.16	-0.08	0.02
90	Jhalera	0.92	1.44	2.99	1.11
91	Khanpur	0.45	0.45	0.82	-
92	Khwaja	0.15	0.10	0.02	0.76
93	Kuluwal	-	2.88	2.89	3.34
94	Kuthera Jaswala	0.66	1.62	0.98	1.54
95	Lalehri	0.73	2.62	1.21	1.29
96	Loharli	1.18	0.94	3.15	1.26
97	Mawa Kalan	-3.44	4.28	4.24	5.20
98	Mubarikpur	1.92	1.89	1.07	1.36
99	Nangran	0.14	0.74	0.34	-

100	Panjawar	1.94	-0.57	1.36	2.58
101	Panoh	0.74	0.21	0.59	1.29
102	Raipur Marwadi	1.12	4.52	5.86	5.45
103	Rajli Panjal	2.21	0.83	0.66	2.43
104	Santokhgarh	0.23	1.65	0.14	0.43
105	Singhnei	-2.50	-3.18	2.19	2.35
106	Tahliwala 1	0.66	1.64	0.47	1.17
107	Una	0.56	0.84	0.48	0.99

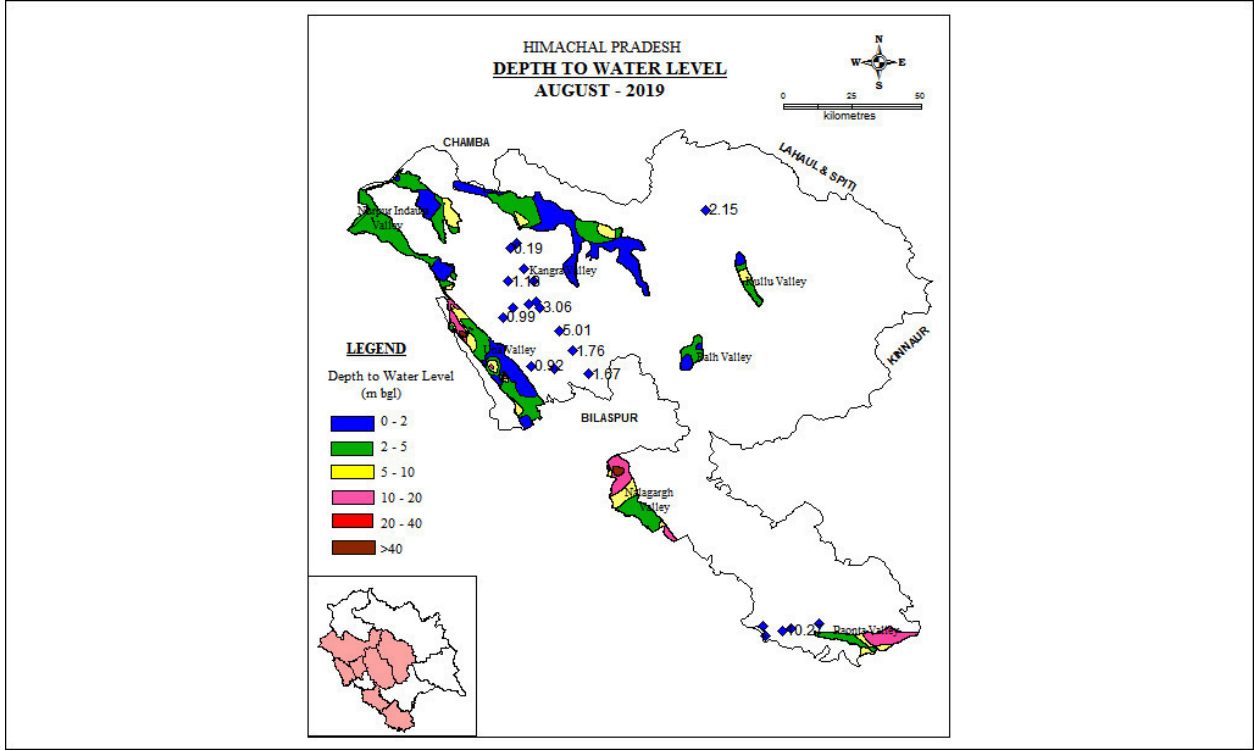
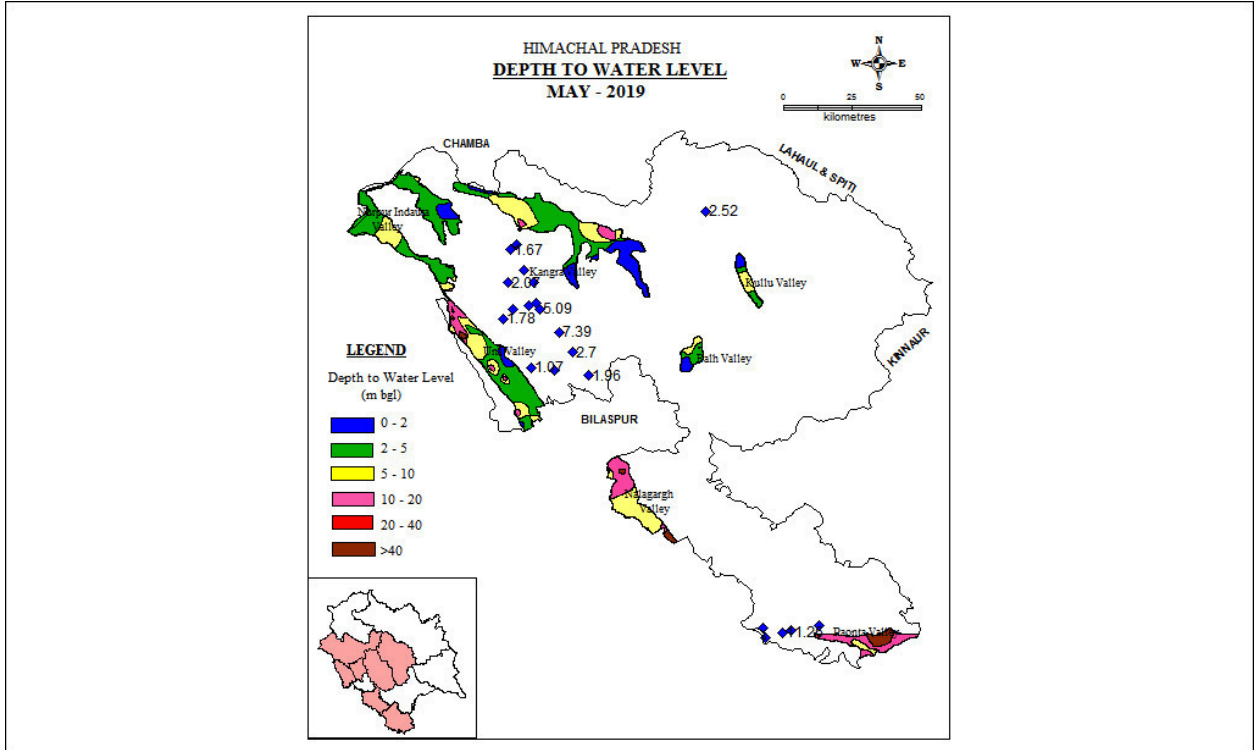


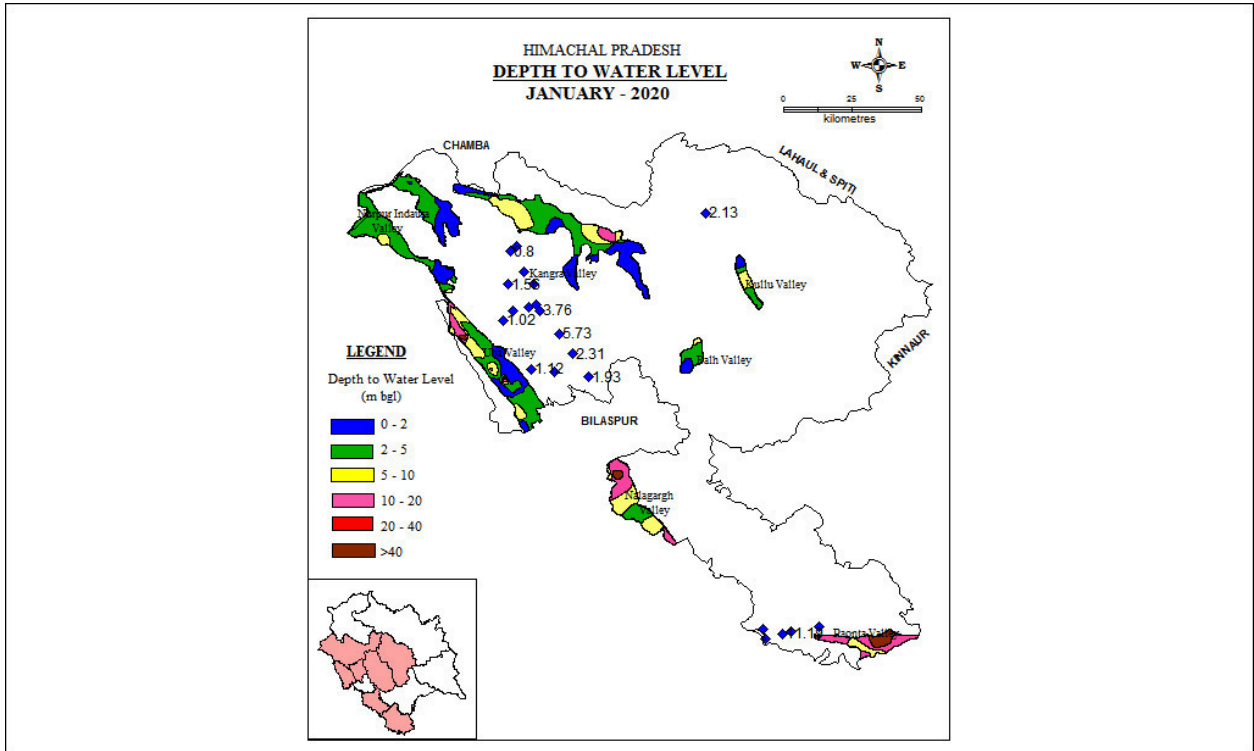
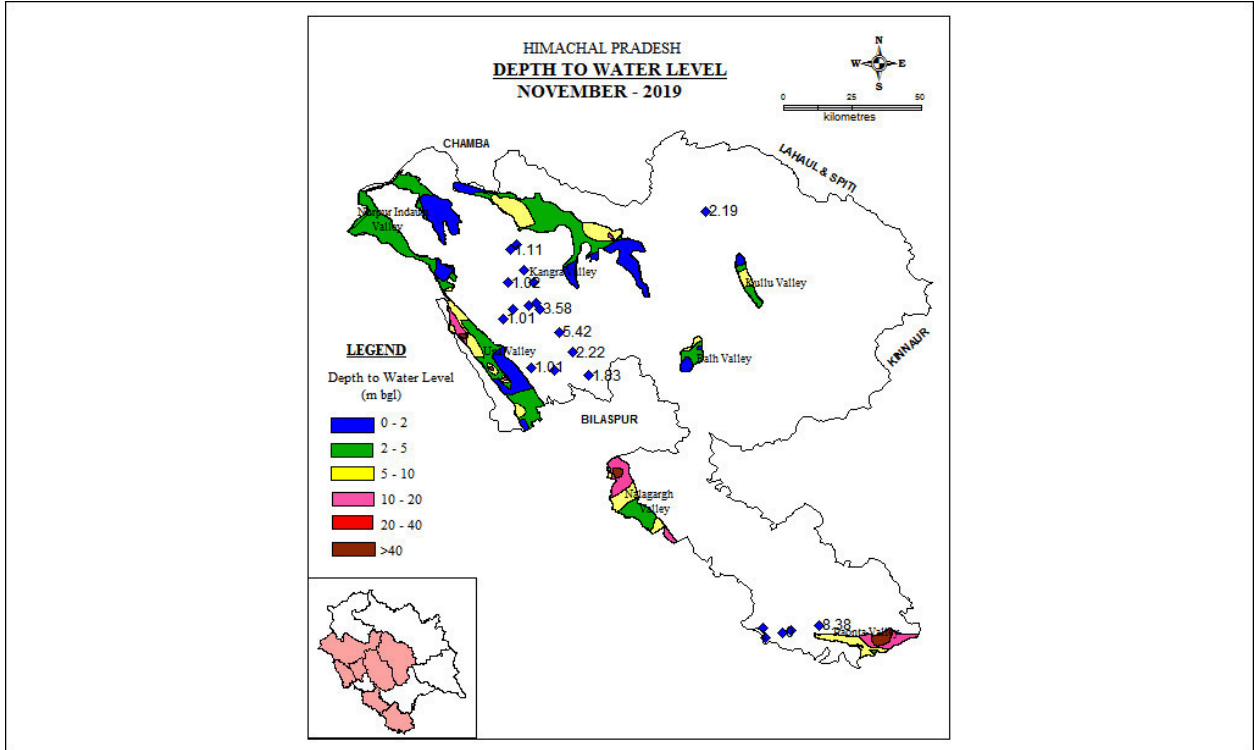
HIMACHAL PRADESH NHS LOCATIONS

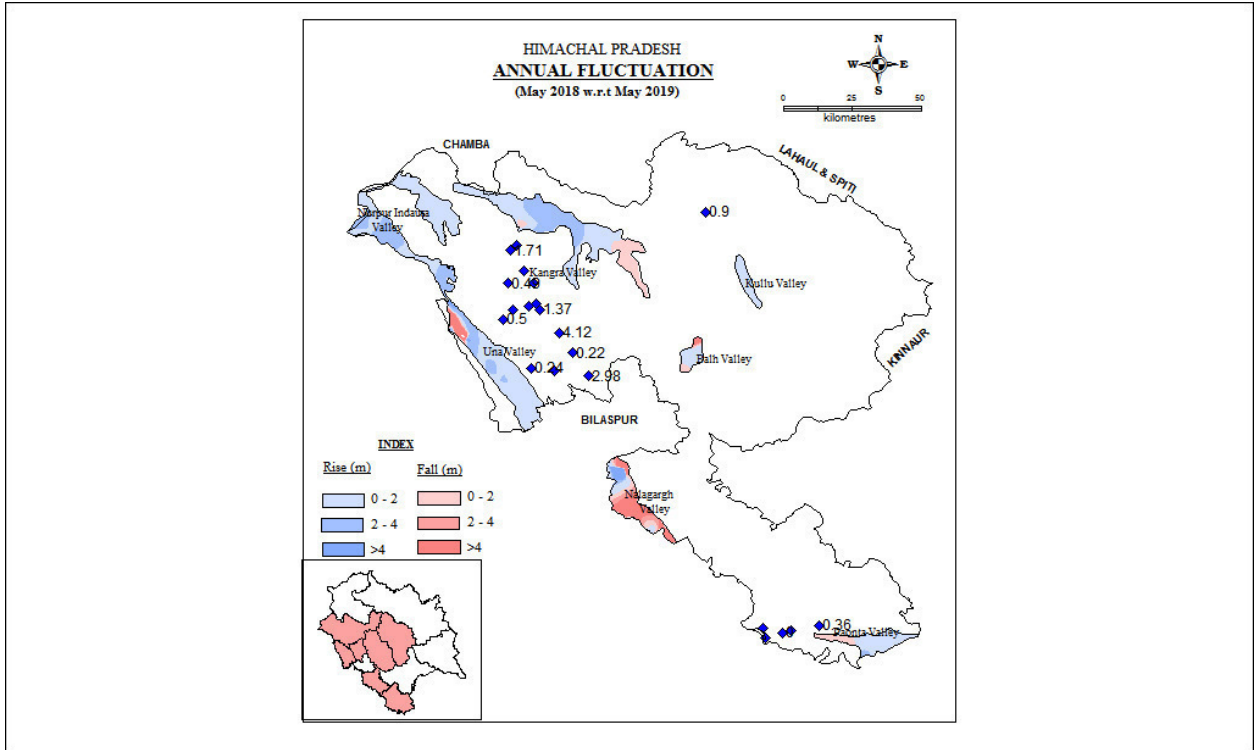
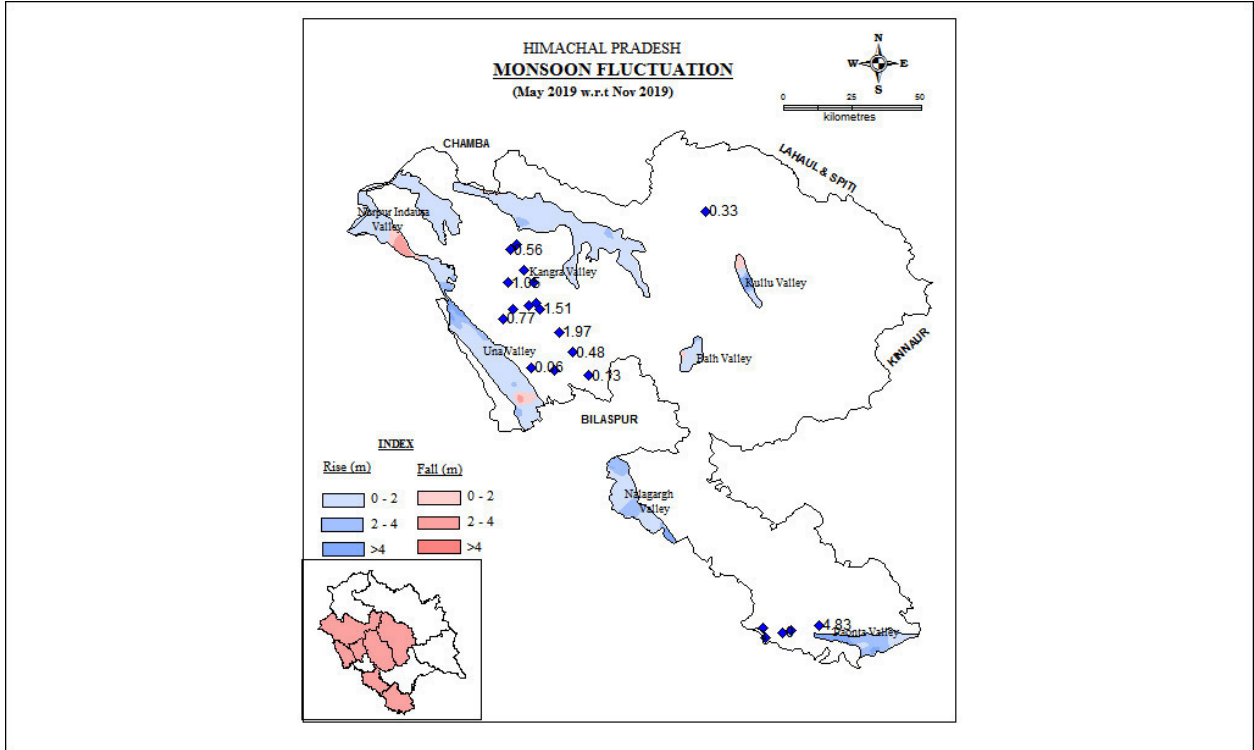


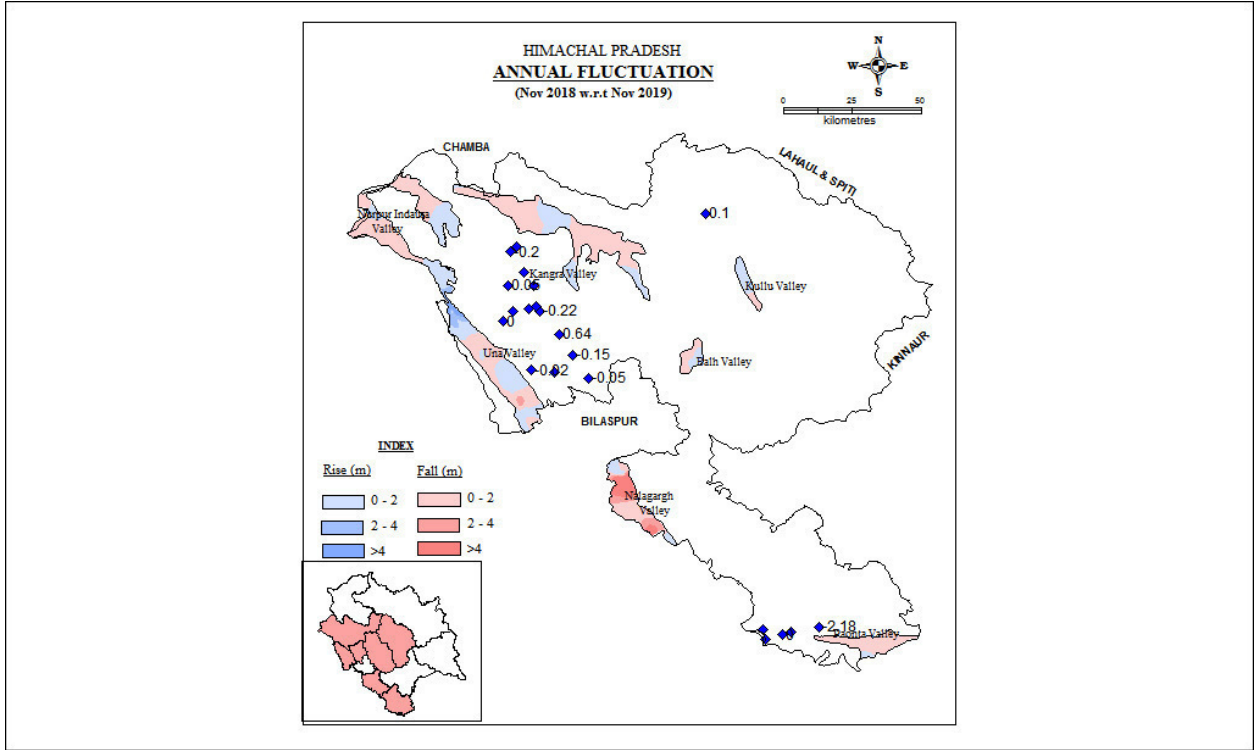
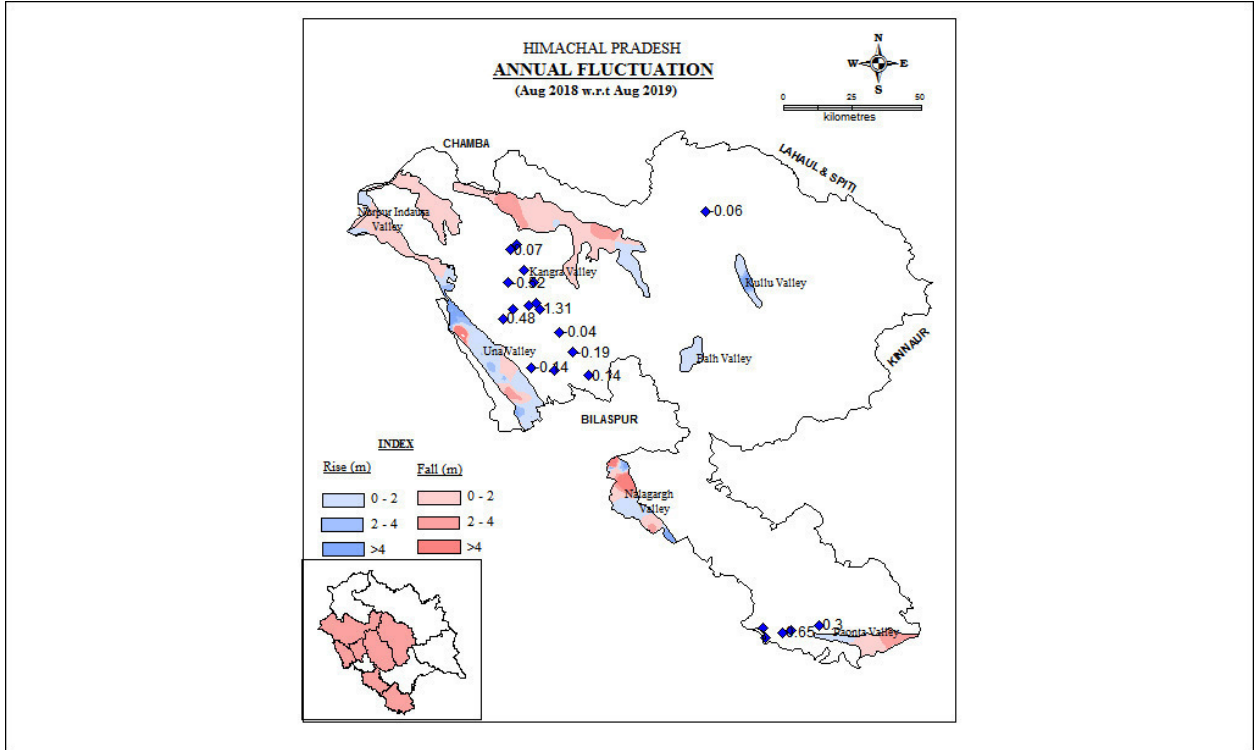
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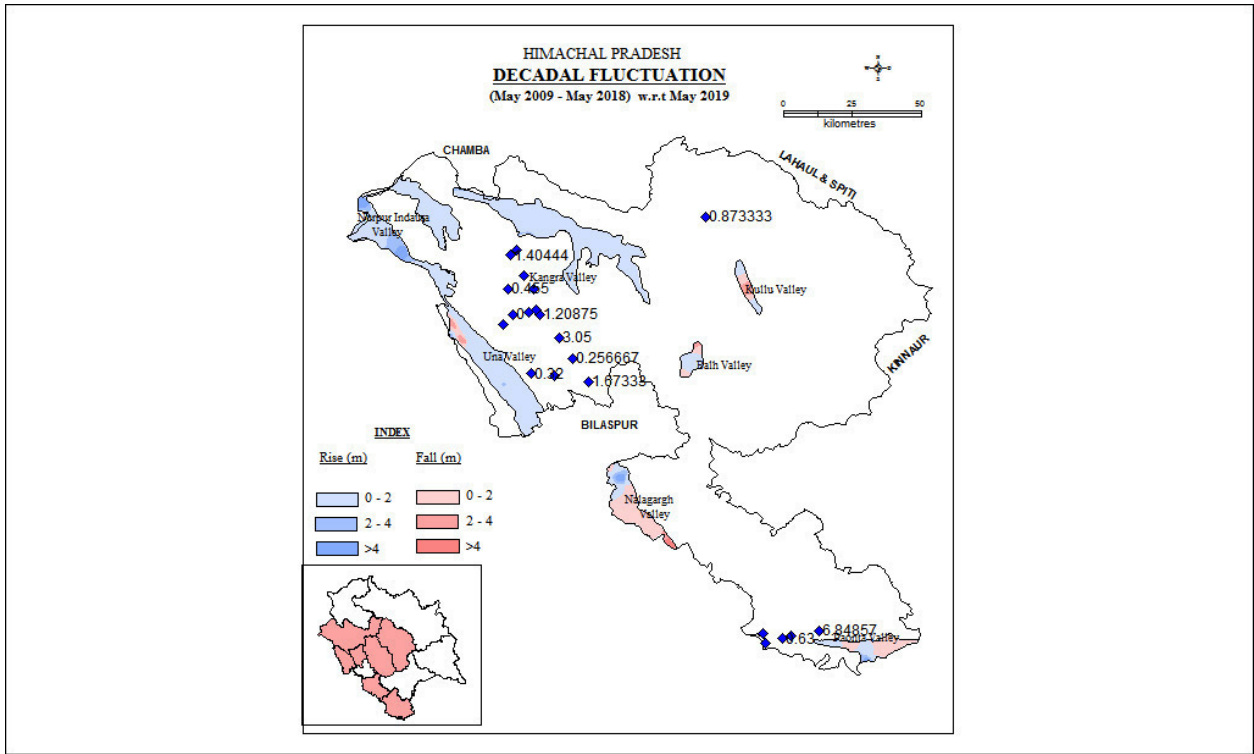
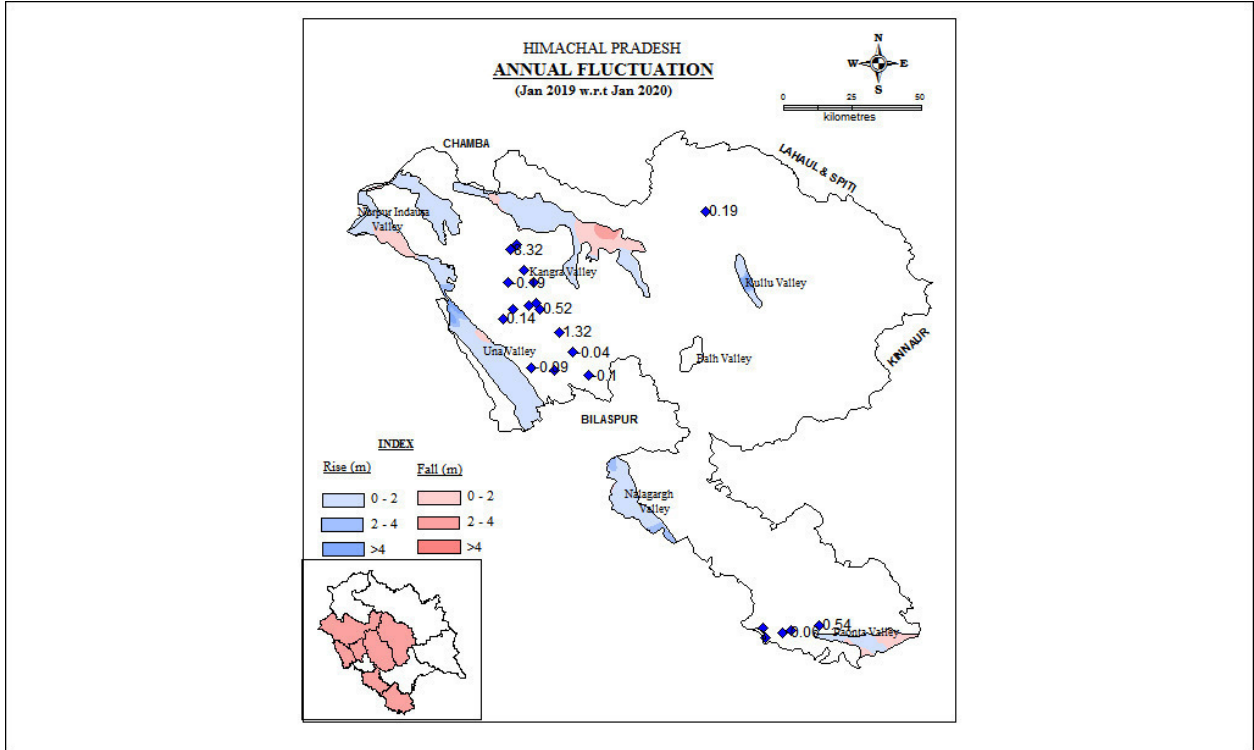
- NHS Stations
- Valley areas
- NHS monitoring districts
- Drainage

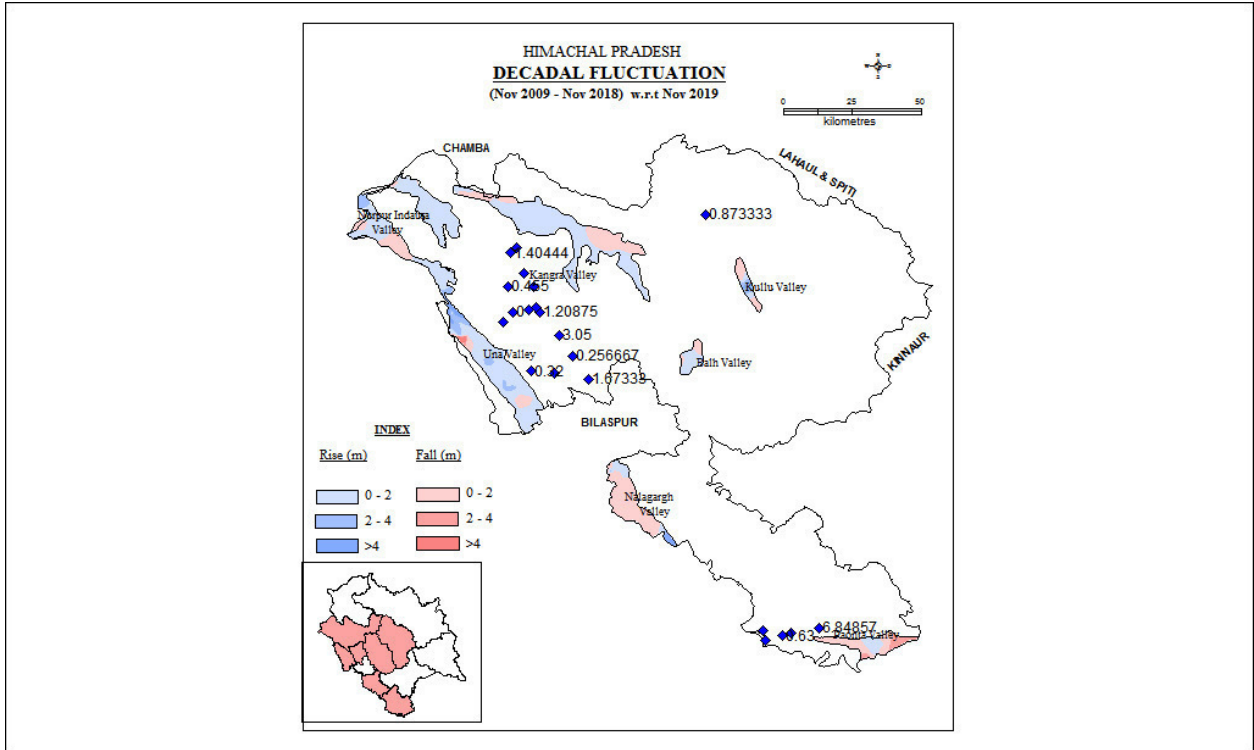
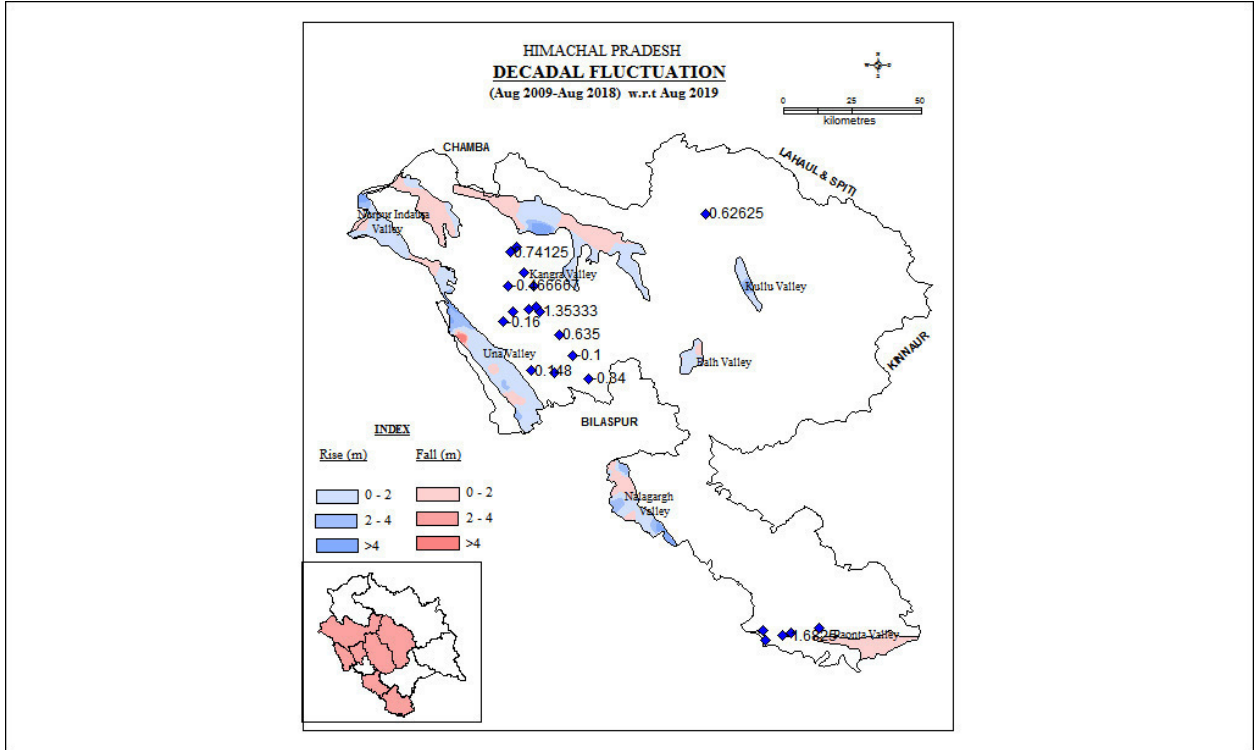




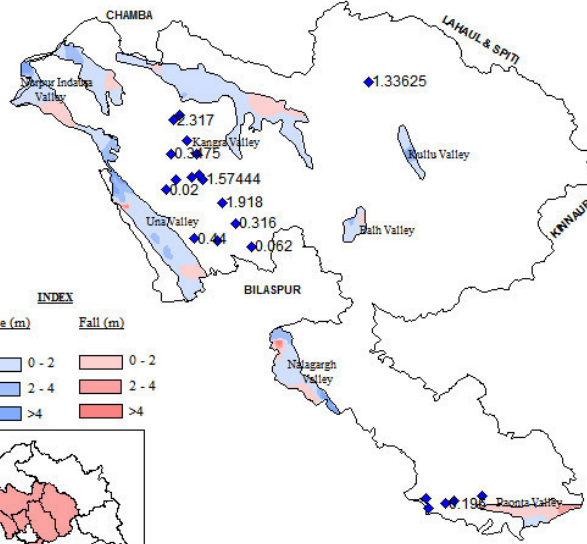
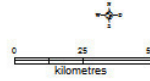






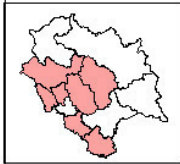


HIMACHAL PRADESH
DECADAL FLUCTUATION
 (Jan 2010 - Jan 2009) w.r.t Jan 2020



INDEX

Rise (m)	Fall (m)
0 - 2	0 - 2
2 - 4	2 - 4
>4	>4



S. No	District	Block	Location	Source	Longitude	Latitude	Aquifer	Depth(m)	Date of sampling	Date of Analysis	pH*	EC* in $\mu\text{S/cm}$ at 25 ^o C	CO ₃	HCO ₃	Cl [*]	SO ₄	NO ₃ *	F*	PO ₄	Ca*	Mg*	Na	K	SiO ₂	TH* as CaCO ₃	
													mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
1	Kangra		Bod								8.60	795	60	232	57	BDL	58	0.30	<0.1	56	36	48	20	22	290	
2	Kangra		Panjpir								8.12	277	Nil	171	14	BDL	10	0.22	<0.1	28	9.7	26	2.01	30	110	
3	Kangra		Jassur								8.45	330	24	122	21	BDL	21	0.16	<0.1	24	19	23	1.99	14	140	
4	Kangra		Mohtli								8.18	377	Nil	146	42	BDL	23	0.15	<0.1	32	9.7	35	4.9	17	120	
5	Kangra		Channur								8.70	540	60	195	21	BDL	20	0.30	<0.1	12	22	86	1.5	21	120	
6	Kangra		Raja Ka Talab								8.25	215	Nil	134	21	BDL	9.5	0.14	<0.1	36	<5	22	<1	21	100	
7	Kangra		Bharmar								8.38	315	24	146	11	BDL	10	0.15	<0.1	44	<5	18	2.6	15	130	
8	Kangra		Manjgram								8.40	300	24	98	32	6	8.9	0.14	<0.1	20	19	22	2.9	15	130	
9	Kangra		Rait								8.25	225	Nil	134	14	BDL	14	0.40	<0.1	28	<5	22	1.8	22	90	
10	Kangra		Bandh								8.45	310	12	159	28	BDL	7.2	0.30	<0.1	32	7.30	24	<1	23	110	
11	Kangra		Kangra								8.47	275	12	110	21	BDL	20	0.15	<0.1	28	<5	22	2.2	23	110	
12	Kangra		Takipur								8.25	307	Nil	134	21	BDL	23	0.12	<0.1	28	15	16	<1	10	130	
13	Kangra		Paprola								7.72	200	Nil	85	21	BDL	15	0.32	<0.1	24	<5	20	3.9	6	70	
14	Kangra		Dehra Gopipur								8.35	520	24	134	49	BDL	40	0.27	<0.1	20	27	45	1	25	160	
15	Kangra		Jawalamukhi								8.42	550	24	171	56	10	17	0.25	<0.1	24	17	70	1.5	19	130	
16	Kangra		Bharoli								8.32	630	12	159	83	10	32	0.15	<0.1	36	22	57	1.9	9.8	180	
17	Kangra		Dehrian								8.05	300	Nil	171	21	18	16	0.18	<0.1	40	<5	27	<1	13	110	
18	Kangra		Mao								8.40	312	12	171	21	BDL	1.6	0.17	<0.1	40	7.3	28	1	14	130	
19	Kangra		Bhalad								8.50	415	36	122	35	10	11	0.22	<0.1	20	17	50	2.3	5.5	120	
20	Kangra		Andaura								8.50	400	48	171	21	5	7.7	0.25	<0.1	28	17	55	2.3	19	140	
21	Kangra		Olehrian								8.45	800	24	146	97	98	3.5	0.25	<0.1	28	29	58	75	16	190	
22	Kangra		Barota								8.32	415	12	171	28	BDL	36	0.10	<0.1	32	17	26	19	15	150	
23	Kangra		Pandtehr								7.98	175	Nil	85	7.1	15	5.3	0.20	<0.1	20	<5	20	1.7	12	60	
24	Kangra		Hardogri								8.30	385	24	159	35	BDL	3.3	0.15	<0.1	44	9.7	32	1.5	15	150	
25	Kangra		Rakkar								8.32	360	12	134	27	22	<0.20	0.28	<0.1	20	19	30	<1	13	130	
26	Kangra		Kathgarh								8.80	830	96	268	53	BDL	22	0.48	<0.1	20	58	60	47	30	290	
27	Kangra		Chakban Ambari								8.00	150	Nil	61	20	BDL	7.3	0.10	<0.1	16	<5	16	<1	13	50	
28	Kangra		39 Miles (Shahpur)								7.90	335	Nil	244	13	BDL	1.0	0.15	<0.1	36	22	17.0	3.2	12	180	
29	Kangra		Bhali								8.50	505	24	134	46	BDL	12	0.12	<0.1	24	9.7	54	7.9	15	100	
30	Kangra		Kotla								8.48	300	24	159	13	BDL	9.1	0.14	<0.1	12	27	26	2	23	140	
31	Kangra		Darkati								8.35	345	12	146	27	BDL	24	0.12	<0.1	24	15	28	14	15	120	
32	Kangra		Thali								7.90	195	Nil	146	6.7	BDL	5.2	0.15	<0.1	24	9.7	17	<1	22	100	
33	Kangra		Basa-Bazira								8.50	340	48	98	27	BDL	27	0.12	<0.1	16	29	27	1	27	160	
34	Kangra		Old Kangra								8.47	362	48	110	13	12	16	0.14	<0.1	40	15	25	1.5	29	160	

35	Kangra	Bhatka								8.45	275	36	85	13	BDL	2.7	0.16	<0.1	20	7.3	33	2.3	16	80
36	Kangra	Parnalla								8.32	200	24	85	6.7	BDL	1.7	0.22	<0.1	24	9.7	12	<1	12	100
37	Kangra	Lakhnaut								8.50	235	24	61	21	BDL	5.7	0.15	0.9	24	<5	22	<1	18	80
38	Kangra	Ladhi								8.20	255	Nil	134	21	20	1.0	0.14	<0.1	28	19	17	8.9	3.9	120
39	Kangra	Naura								8.35	270	12	134	21	BDL	1.8	0.14	<0.1	44	<5	20	1.7	11	120
40	Kangra	Riyali								8.32	255	12	122	21	BDL	7.6	0.14	<0.1	20	15	20	5	11	110
41	Kangra	Changrara								8.40	255	24	110	14	BDL	4.1	0.18	<0.1	12	19	21	1.3	22	110
42	Kangra	Jagir								8.40	480	24	134	42	24	22	0.16	<0.1	24	29	30	8	6.7	180
43	Kangra	Barot								8.45	319	24	134	21	BDL	6.3	0.14	<0.1	44	<5	29	5.5	17	120
44	Kangra	Kuthkhana								8.18	225	Nil	134	14	BDL	12	0.12	<0.1	28	<5	19	1	11	100
45	Kangra	Nagrot Gurudwara								8.10	190	Nil	98	21	BDL	8.1	0.11	<0.1	20	<5	16	1.4	24	80
46	Una	Daulatpur								8.35	805	36	122	92	135	24	0.15	<0.1	28	29	120	2.2	25	190
47	Una	Amb								8.70	490	60	183	21	BDL	0.6	0.22	<0.1	12	34	48	7.5	15	170
48	Una	Gagret								8.10	400	Nil	110	42	35	23	0.07	<0.1	56	15	12	1.2	23	180
49	Una	Panoh								7.48	445	Nil	232	28	BDL	9.9	0.14	<0.1	8	7.3	69	1.3	16	90
50	Una	Khawaja								8.25	695	Nil	134	85	65	23	0.15	<0.1	32	24	58	11	20	180
51	Una	Kuthera Jaswan								8.14	425	Nil	122	28	65	23	0.12	<0.1	36	12	40	1.2	30	140
52	Una	Ganehri								8.10	320	Nil	134	21	30	20	0.12	<0.1	32	15	22	1.2	28	140
53	Una	Mubarikpur								8.25	410	Nil	159	28	35	23	0.14	<0.1	24	27	26	1.3	20	170
54	Una	Guglehar								8.18	362	Nil	146	42	30	0.3	0.15	<0.1	28	15	36	1.1	23	130
55	Una	Jalehra								8.32	370	12	159	21	BDL	19	0.38	<0.1	44	<5	36	1.2	22	120
56	Una	Ishpur								8.52	1100	24	232	120	BDL	23	0.32	<0.1	40	<5	175	8	20	30
57	Una	Lalehri								8.50	472	36	183	28	BDL	18	0.23	<0.1	28	27	40	2.7	27	180
58	Una	Una								8.40	790	24	134	106	88	23	0.23	<0.1	20	34	102	1.5	25	190
59	Una	Jawar								8.24	280	Nil	134	21	25	16	0.20	<0.1	32	12	22	2.7	21	130
60	Una	Rajli Panjal								8.38	705	36	146	35	18	<0.2 0	0.16	<0.1	16	46	70	1.8	18	230
61	Una	Bhangana								8.40	427	24	110	50	5	18	0.15	<0.1	20	15	52	<1	13	110
62	Una	Bawal								8.79	640	71	247	43	BDL	2.8	0.45	<0.1	20	32	86	4	12	180
63	Una	Dharampur								8.42	401	57	58	21	BDL	39	0.24	<0.1	32	17	26	<1	25	150
64	Una	Badsali								8.18	851	Nil	102	28	159	155	0.08	<0.1	48	32	80	2	15	250
65	Una	Panjawar								8.38	329	29	73	21	BDL	51	0.13	<0.1	20	22	15	1.3	14	140
66	Una	Ambota								8.12	523	Nil	102	21	57	115	0.07	<0.1	56	19	19	1	15	220
67	Una	Singhnei								8.47	265	43	87	28	BDL	12	0.14	<0.1	24	12	35	1.5	16	110
68	Una	Mawa Kalan								8.26	220	Nil	145	14	BDL	12	0.30	<0.1	17	15	18	<1	11	105
69	Una	Babehr								8.06	353	Nil	203	21	BDL	12	0.24	<0.1	25	18	28	2	20	137
70	Una	Raipur Marwadi								8.10	325	Nil	102	43	BDL	25	0.16	<0.1	29	18	10	1	21	147
71	Una	Nangran								8.37	260	29	116	14	BDL	5.8	0.18	<0.1	17	18	21	2	14	116
72	Una	Khanpur								8.04	642	Nil	363	43	BDL	8.9	0.23	<0.1	42	41	37	2.1	16	273
73	Una	Santokhgarh								8.38	523	43	102	64	BDL	19	0.18	<0.1	21	38	26	2.5	17	210
74	Una	Loharli								8.12	385	Nil	102	57	BDL	21	0.11	<0.1	31	10	24	3.1	19	126

75	Una		Tahliwal							8.22	635	Nil	218	106	BDL	6.7	0.14	<0.1	29	31	46	20	21	200
76	Hamirpur		Bhagnallah							8.18	367	Nil	145	50	BDL	16	0.14	<0.1	38	13	22	2	22	147
77	Hamirpur		Kangu							8.04	361	Nil	218	28	BDL	1.7	0.18	<0.1	55	13	11	1.6	14	189
78	Hamirpur		Galore							8.46	350	57	87	21	BDL	6.9	0.13	0.20	51	10	10	6.1	14	168
79	Hamirpur		Bijhri							8.27	312	Nil	131	35	BDL	8.5	0.09	<0.1	34	10	16	<1	10	126
80	Solan		Kherachak							8.58	1010	29	131	156	141	16	0.18	0.5	86	14	101	23	15	273
81	Solan		Jagatpur							8.44	299	43	87	21	BDL	2.7	0.20	<0.1	17	10	39	2.4	11	84
82	Solan		Bagheri							8.49	348	43	102	24	BDL	11	0.16	<0.1	13	18	40	1	9	105
83	Solan		Bhatoli							8.40	318	43	87	21	BDL	13	0.15	<0.1	10	18	28	2.5	13	116
84	Solan		Baruna							8.40	270	43	87	14	BDL	10	0.12	<0.1	10	18	23	1	12	116
85	Solan		Palahi							8.27	507	Nil	145	50	50	14	0.10	<0.1	29	23	35	2.2	15	168
86	Solan		Mahadeva							8.48	1145	43	145	248	34	8.9	0.14	0.1	59	38	118	4.2	11	305
87	Solan		Panjiara							8.21	288	Nil	160	14	BDL	10	0.17	<0.1	25	7.7	27	1.4	13	95
88	Solan		Dabota							8.40	612	14	160	64	40	31	0.26	<0.1	34	23	57	6.3	10	179
89	Solan		Baddi							8.60	750	71	116	113	BDL	5.7	0.21	<0.1	38	26	71	16	10	200
90	Solan		Brotiwala							7.69	742	Nil	243	64	83	5.3	0.14	<0.1	76	28	38	2	15	305
91	Solan		Nalagarh							8.2	864	Nil	160	121	128	13	0.25	<0.1	34	31	114	<1	13	210
92	Solan		Maganpura							8.12	715	Nil	131	134	21	52	0.14	<0.1	38	26	68	4	16	200
93	Solan		Theda							8.17	579	Nil	87	106	45	28	0.15	<0.1	42	18	47	<1	18	179
94	Sirmour		Tirlokpur							8.81	933	71	305	92	BDL	26	2.20	<0.1	13	<5	214	1.8	17	42
95	Sirmour		Kala Amb							8.07	718	Nil	87	85	155	<0.20	0.25	<0.1	42	28	58	4.9	15	221
96	Sirmour		Shambhu-wala							8.41	250	29	102	14	BDL	30	0.15	<0.1	34	7.7	25	1.1	11	116
97	Sirmour		Kiyarda							8.00	142	Nil	103	14	BDL	5.7	0.07	<0.1	13	7.7	18	2.5	10	63
98	Sirmour		Kolar							7.93	413	Nil	145	21	43	27	0.08	<0.1	46	15	13	2.6	15	179
99	Sirmour		Nayagaon							8.22	205	Nil	145	7	BDL	18	0.08	<0.1	25	10	16	<1	15	105
100	Sirmour		Shibpur							8.45	284	14	102	7	BDL	90	0.12	<0.1	38	13	16	1	11	147
101	Sirmour		Dhaulakuan							8.22	345	Nil	116	21	BDL	55	0.09	<0.1	38	13	12	1.6	10	147
102	Sirmour		Badripur							8.21	431	Nil	130	35	35	33	0.07	<0.1	34	20	19	3.7	15	168
103	Sirmour		Ajiwala							8.46	492	57	116	28	BDL	25	0.13	<0.1	34	18	19.0	42	17	158
104	Sirmour		Khodawala							8.38	488	57	160	21	BDL	4.5	0.10	<0.1	25	46	7	1.3	14	252
105	Sirmour		Akkwala							8.13	290	Nil	145	14	BDL	56	0.07	<0.1	21	15	30	4.5	17	116
106	Sirmour		Miserwala							8.55	492	71	131	28	BDL	10	0.10	<0.1	63	20	13	2.4	14	242
107	Sirmour		Sainwalai							8.23	278	Nil	131	21	BDL	0.5	0.06	<0.1	29	15	2.2	<1	15	137
108	Sirmour		Kodewala							8.43	344	29	145	21	BDL	1.1	0.33	<0.1	13	15	43.0	2.7	17	95
109	Sirmour		Kheri							8.37	320	29	102	21	BDL	17	0.22	<0.1	51	<5	13	4.2	15	137
110	Sirmour		Sainwala II							8.36	481	29	102	43	BDL	51	0.18	<0.1	21	33	24	1	19	189
111	Sirmour		Nariwala							8.34	280	14	145	14	BDL	0.7	0.15	<0.1	25	15	16	1.3	17	126
112	Mandi		Gutkar							8.18	244	Nil	102	28	BDL	14	0.48	<0.1	29	<5	18	6	14	84
113	Mandi		Bangrotu							8.33	929	29	102	128	115	61	0.17	<0.1	34	31	107	18	18	210
114	Mandi		Kaned							8.15	522	Nil	189	50	29	11	0.17	<0.1	29	20	37	14	19	158

115	Mandi	Lohara								8.04	1052	Nil	102	156	167	72	0.10	<0.1	76	38	75	6.8	22	347
116	Mandi	Jarl								8.45	396	43	116	35	BDL	8.7	0.14	<0.1	42	15	21	2.3	14	168
117	Mandi	Gaagal								8.39	234	29	87	21	BDL	0.5	0.16	<0.1	29	5.1	20	5.5	18	95
118	Mandi	Rati								8.12	423	Nil	115	35	47	38	0.08	<0.1	34	13	33	5.7	16	137
119	Mandi	Jhiri								8.09	367	Nil	116	35	BDL	42	0.17	<0.1	38	13	13	3.9	21	147
120	Mandi	Dinak								8.42	445	43	102	43	BDL	22	0.13	<0.1	29	26	25	1.7	11	179
121	Kullu	Gadauri								8.18	378	Nil	102	35	BDL	61	0.07	<0.1	38	15	11	5	16	158
122	Kullu	Kullu								8.53	470	29	175	35	BDL	48	0.12	<0.1	63	8.4	36	12	11	177
123	Chamba	Upper Thulel								8.36	215	14	87	14	BDL	2.8	0.10	<0.1	21	13	7	<1	15	105