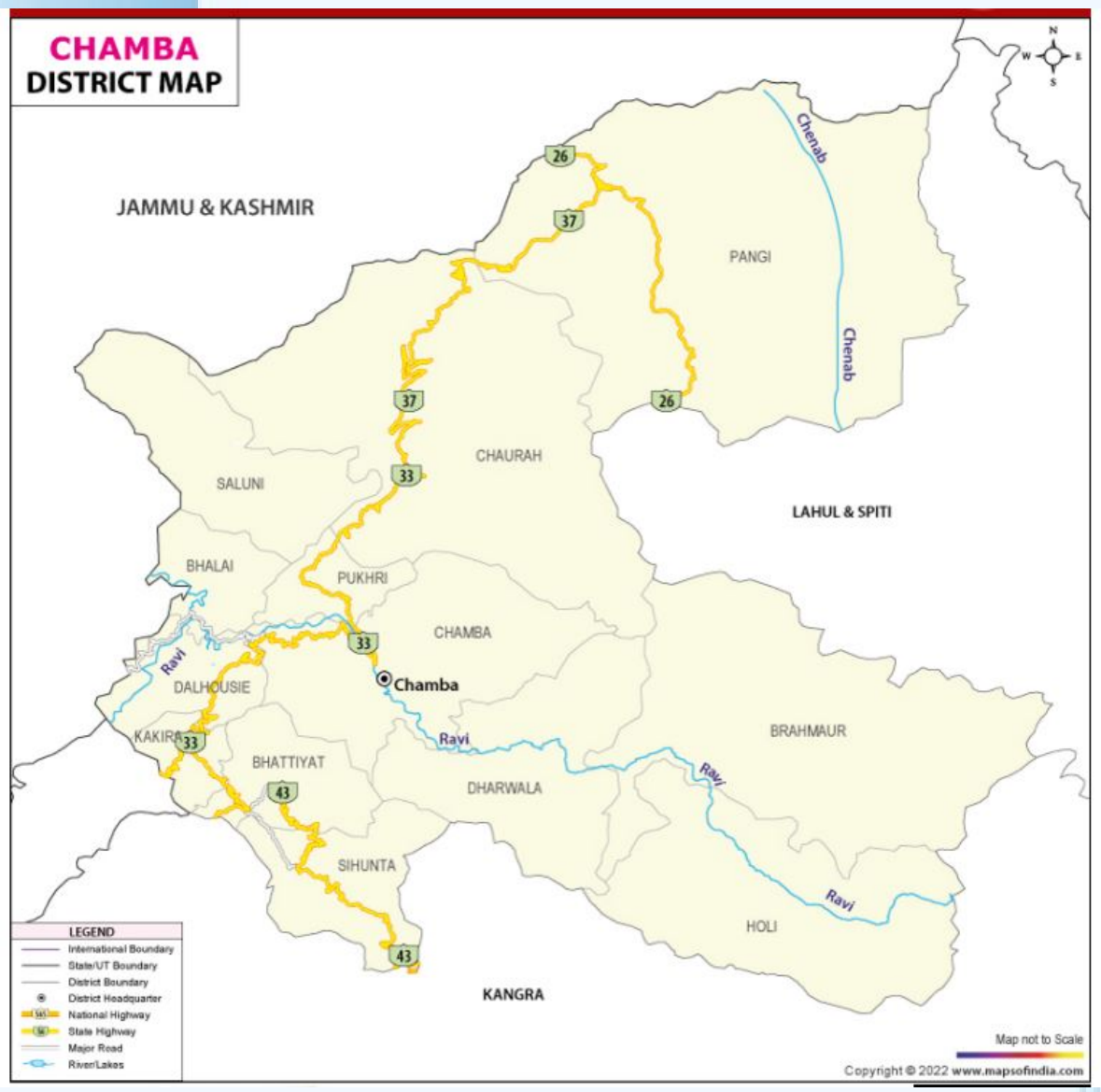
DISTRICT SURVEY REPORT-2024
District- Chamba Himachal Pradesh



DISTRICT SURVEY REPORT FOR SAND

MINING OR RIVER BED MINING *AND OF MINOR MINERALS OTHER THAN SAND MINING OR RIVER BED MINING*

Executive Summary DSR

District Survey Report (DSR) is a comprehensive document prepared to regulate riverbed and hill slope mining activities within the district. This report is essential for sustainable management of riverbed mining, ensuring that the extraction of minerals is conducted in an environmentally sound and socially responsible manner. The preparation of DSRs is mandated under the Sustainable Sand Mining Management Guidelines, 2016.

District Survey Report of riverbed mining are indispensable tools for the sustainable management of riverine mineral resources. They offer a structured approach to resource assessment, environmental protection, regulatory compliance, and stakeholder engagement. By fostering sustainable mining practices, DSRs contribute significantly to environmental conservation, socio-economic development, and the overall well-being of communities dependent on river ecosystems.

As per the EIA Notification, 2006 and its subsequent amendment vide S.O. 3611(E) dated 25th July, 2018 issued by MoEF&CC, GoI, the main objective of the preparation of District Survey Report (as per the Sustainable Sand Mining Guideline) is to ensure the identification of areas of aggradations or deposition where mining can be allowed; and identification of areas of erosion and proximity to infrastructural structures and installations where mining should be prohibited and calculation of annual rate of replenishment and allowing time for replenishment after mining in that area.

- **Key Aspects of District Survey Report**

1. **Assessment of Resources**: DSR provide a detailed assessment of available mineral resources in the riverbeds within the district. This includes data on the quantity, quality, and distribution of sand and other minor minerals. By accurately estimating these resources, the report aids in preventing over-extraction and depletion of minerals.
2. **Environmental Impact Analysis**: The report include an analysis of the environmental impact of riverbed mining. This encompasses the effects on river morphology, hydrology, aquatic ecosystems, and biodiversity. Understanding these impacts is crucial for mitigating adverse environmental effects and preserving riverine ecosystems.
3. **Regulation and Compliance**: DSR serve as a regulatory framework for riverbed mining operations. They outline guidelines and standards for mining practices, ensuring compliance with national and state environmental laws. This helps in curbing illegal mining activities and promoting legal and regulated mining.
4. **Sustainable Mining Practices**: By recommending sustainable mining practices, DSR help in minimizing environmental degradation. These practices may include controlled mining depths, restricted extraction zones, and periodic replenishment studies to maintain the ecological balance of river systems.
5. **Socio-Economic Considerations**: The report also takes into account the socio-economic aspects of riverbed mining, including the impact on local communities. This includes evaluating benefits such as employment generation and revenue for local governments, as well as addressing negative consequences like displacement and loss of livelihoods.
6. **Data-Driven Decision Making**: DSR provide a scientific basis for decision-making regarding riverbed mining. The inclusion of geospatial data, remote sensing images, and field surveys enhances the accuracy and reliability of information. This data-driven approach supports informed policy-making and resource management.
7. **Stakeholder Involvement**: The preparation of DSR involves consultation with various stakeholders, including government agencies, local communities, environmentalists, and industry representatives. This inclusive process ensures that multiple perspectives are considered, leading to balanced and equitable mining practices.

- **Benefits of District Survey Report**

1. **Environmental Protection**: By identifying and mitigating the environmental impacts of riverbed mining, DSR play a crucial role in protecting river ecosystems, reducing erosion, and maintaining water quality.
2. **Resource Management**: Effective management of mineral resources is achieved through regulated extraction, preventing over-exploitation and ensuring the longevity of resources for future use.
3. **Legal Compliance**: DSR help in ensuring that mining activities adhere to legal requirements, reducing the incidence of illegal mining and associated environmental damage.
4. **Community Welfare**: By considering the socio-economic impacts, DSR help in safeguarding the interests of local communities, ensuring that they benefit from mining activities without suffering undue harm.
5. **Sustainable Development**: The integration of sustainable practices in mining operations contributes to the broader goals of sustainable development, balancing economic growth with environmental stewardship.

- While issuing any fresh permission for mining activity in the district the same is permissible only when the identified stretch is reflected in the DSR with its geo coordinates, quantity and geological profiling.
- The SEIAA/ SEAC while considering the cases for grant of EC need to assess with the help of DSR the proposed mining activity is within the identified stretches of river/ streams/ khads, matching the geo coordinates of proposed site and river stretch where the mineral is available by using ***kml*** files.
- In the DSR '**No Mining Zones**' are also listed which clearly give a view of stretches where no mining activity will be allowed and remain restricted.

"*No Mining Zones*" (NMZs) are critical areas identified within riverbeds where mining activities are strictly prohibited. These zones are delineated based on various environmental, ecological, and social criteria to ensure the protection of sensitive areas. The identification of NMZs is a key component of District Survey Report (DSR) for riverbed mining in India, aimed at promoting sustainable and responsible mining practices.

Criteria for Identifying No Mining Zones in DSR

1. **Ecological Sensitivity**: Areas with high ecological value, such as habitats for endangered species, breeding grounds for aquatic life, and regions with significant biodiversity, are designated as NMZs. Protecting these areas is crucial for maintaining ecological balance and biodiversity.
2. **Hydrological Importance**: Zones critical for maintaining river flow and groundwater recharge are marked as NMZs. This includes regions near riverbanks, floodplains, and areas prone to erosion. Preserving these areas helps in sustaining water quality and quantity.
3. **Proximity to Infrastructure**: Areas close to infrastructure such as bridges, roads, dams, and human settlements are identified as NMZs to prevent structural damage and ensure the safety of human life and property.
4. **Cultural and Archaeological Significance**: Regions with cultural, historical, or archaeological importance are protected as NMZs to preserve heritage sites and prevent any damage due to mining activities.
5. **Community Dependence**: Areas that are vital for the livelihood of local communities, such as regions used for fishing, agriculture, and other traditional activities, are designated as NMZs. This ensures the sustenance of community livelihoods and social well-being.

Sl. No.	PP Details	Location with khasra Nos.	River/ Stream location	Coordinates (Lat Long)	Area of Mining lease (ha)	Period of Mining lease (Initial)		Period of Mining lease	
						From	To	Form	To
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Details of River/ Stream

S. No.	Name of the River or Stream	Total Length in the District (in Km)	Place of origin	Altitude at Origin
(1)				
(2)				

Portion of the River or Stream Recommended for Mineral Concession	Length of area recommended for mineral concession (in kilometer)	Average width of area recommended for mineral concession (in meters)	Area recommended for mineral concession (in square meter)	Mineable mineral potential (in metric tonne) (60% of total mineral potential)

Mineral Potential

Boulder (MT)	Bajari (MT)	Sand (MT)	Total Mineable Mineral Potential (MT)

S. No.	River or Stream	Portion of the river or stream recommended for mineral concession	Length of area recommended for mineral concession (in kilometer)	Average width of area recommended for mineral concession (in meters)	Area recommended for mineral concession (in square meter)	Mineable mineral potential (in metric tonne) (60% of total mineral potential)
(1)						
(2)						
Total for the District						

Contents

PART I

DISTRICT SURVEY REPORT OF DISTRICT CHAMBA H.P

(River Bed Sand Mining and Other Minor Minerals)

1. Introduction

Minerals are valuable natural resources being finite and non-renewable. They constitute the vital raw materials for many basic industries and are a major resource for development. The history of mineral extraction in India dates back to the days of the Harappan civilization. The wide availability of minerals in the form of abundant rich reserves made it very conducive for the growth and development of the mining sector in India. The country is endowed with huge resources of many metallic and non-metallic minerals. The mining sector is an important segment of the Indian economy. Since independence, there has been a pronounced growth in mineral production both in terms of quantity and value. India produces as many as 87 minerals, which include 4 fuel, 10 metallic, 47 non-metallic, 3 atomic and 23 minor minerals (including building and other materials).

Minerals are classified into two groups, namely (i) Major minerals and (ii) Minor minerals. Amongst these two groups, minor minerals have been defined under section 3(e) of the Mines and Minerals (Regulation and development) Act, 1957. The minor minerals are further governed by "The Himachal Pradesh Minor Minerals (concession) and Minerals (Prevention of Illegal Mining, Transportation and Storage) Rules, 2015". The Minor minerals include building stones, gravel, ordinary clay, ordinary sand, limestone used for lime burning, boulders, kankar, murum, brick earth, bentonite, road metal, slate, marble, stones used for making household utensils etc. and other minerals not defined as minor minerals in the said Act are treated as major minerals. They include coal, kyanite, sillimanite, barites, chromite, fluorite, quartz, sand used for stowing purposes in coal mines and many other minerals used for industrial purposes.

The mining activities in the state of Himachal Pradesh can basically be categorized as in the large sector and in the small sector. The large sector comprises of limestone projects for manufacturing cement and other lime products while the small mining sector comprises the mining of minor minerals like sand, stone, bajri, slate, shale and clay etc. which are basically building materials to meet up the demand for infrastructure development of the state.

In pursuance to the orders of the Hon'ble Supreme Court dated 27.02.2012 in the matter of Deepak Kumar etc. vs State of Haryana and Others, prior environment clearance has

now become mandatory for mining of minor minerals irrespective of the area of mining lease. In order to comply with the judgment of the Hon'ble Supreme Court, the Ministry issued S.O.141 (E) dated 15.01.2016 vide which the District Level Environment Assessment Committee (DEAC) and District level Environment Impact Assessment Authority (DEIAA) were constituted. In the said Notification at point No.7 (iii) the procedure to prepare the District Survey Report (DSR) was laid down providing that a survey shall be carried out by the DEIAA with the assistance of Geology/Irrigation/Forest/PWD etc. departments. As, per the aforesaid, Notification dated 15.01.2016 the Geological Wing, assisted the DEIAA in the preparation of the District Survey Report during the year 2016 and the said District Survey Report prepared for District Shimla was approved by the DEIAA, after following the procedure laid down in the aforesaid Notification. It is also provided in the Notification No. S.O. 141 (E) dated 15th January 2016 that the District Survey Report (DSR) shall form the basis for the application for environmental clearance, preparation of reports and appraisal of Projects. The report shall be updated once every 5 years.

In the aforesaid notification dated 15.01.16, the Hon'ble High Court of Jharkhand at Ranchi in its orders dated the 11th April 2018 and 19th June 2018 in W.P. (PIL) No. 1806 of 2015, in the matter of Court on its Own Motion Versus the State of Jharkhand & Others with W.P. (PIL) No. 290 of 2013, in the matter of Hemant Kumar Shilkarwar Versus the State of Jharkhand & Others, has inter-alia directed the preparation of District Survey Report for the Sand mining or riverbed mining and for minor minerals other than Sand and bajri or delegation of the powers for preparation of format of District Survey Report of minor minerals other than sand and bajri to the State Government and/or District Environment Impact Assessment Authority and District Expert Appraisal. Thereafter, the Ministry of Environment, Forests and Climate Change (MoEF & CC) vide notification dated 25.07.2018 provided the procedure for the preparation of the District Survey Document. Accordingly, the survey report for district Shimla has been updated. This District Survey Report has been updated by covering the mineral-bearing areas and overviews of mining activities in the district with all the relevant features pertaining to geology and mineral wealth in replenish-able and non-replenish-able areas of rivers, streams and other sources. The mineral potential has been calculated based on field investigations taking into consideration the geology of the catchment area of the river/streams and other sources.

The District Survey Report (DSR) of District Chamba comprises secondary data on geology, mineral resources, climate, topography, landform, forest, rivers, soil, agriculture, road, transportation, irrigation etc of the district collected from various published and

unpublished literature and reports as well as various websites. The data of deposition or replenishment, the distance of deposits from the river banks, chances of erosion and other geomorphological features of rivers may vary due to floods, heavy rains and other natural calamities.

2. Overview Of Mining Activity In The District

Himachal Pradesh is situated in the western Himalayas covering an area of 55,673 kilometres (34,594 mi). Himachal Pradesh is almost wholly mountainous with altitudes ranging from 350 meters to 6,975 meters above the mean sea level. It is located between Latitude 30º22'40"N to 33º12'20"N and Longitude 75º45'55" E to 79º04'20" E. It has a deeply dissected topography, complex geological structure and a rich temperate flora in the sub-tropical latitudes. The drainage system of Himachal is composed both of rivers and glaciers. Himalayan rivers criss cross the entire mountain chain. Himachal Pradesh provides water to both the Indus and Ganges basins. The drainage systems of the region are the Chandra Bhaga or the Chenab, the Ravi, the Beas, the Sutlej and the Yamuna. These rivers are perennial and are fed by snow and rainfall. They are protected by an extensive cover of natural vegetation. Due to extreme variation in elevation, there is great variation in the climatic conditions of Himachal. The climate varies from hot and sub-humid tropical in the southern tracts to, with more elevation, cold, alpine and glacial in the northern and eastern mountain ranges. The state has areas like Dharamsala that receive very heavy rainfall, as well as those like Lahaul and Spiti that are cold and almost rainless.

Chamba district in the state of Himachal Pradesh, in northern India. According to the 2001 Indian census the town is situated on the banks of the Ravi River (a major tributary of the Trans-Himalayan Indus River), at its confluence with the Sal River. Chambial were the Rulers of Chamba State Chambials use suffix Varmans.

Though historical records date the history of the Chamba region to the Kolian tribes in the 2nd century BC, the area was formally ruled by the Maru dynasty, starting with the Raju Maru from around 500 AD, ruling from the ancient capital of Bharmour, which is located 75 kilometres (47 mi) from the town of Chamba. In 920, Raja Sahil Varman (or Raja Sahil Verma) shifted the capital of the kingdom to Chamba, following the specific request of his daughter Champavati (Chamba was named after her). From the time of Raju Maru, 67 Rajas of this dynasty have ruled over Chamba until it finally merged with the Indian Union in April 1948..

Mainly three types of minor mineral constituents such as sand, stone and bajri are required for any type of construction apart from other materials like cement and steel. In earlier times, the houses/ buildings were constructed in the form of small dwellings with walls made

up of mud plaster, stone and interlocking provided with wooden frames and there were negligible commercial as well as developmental activities resulting in less demand for building materials. However, with time, new vistas of developmental activities were started. In district Shimla, there is a boom in construction activities especially in roads and Hotel industries, as such the demand for minor minerals in the District started to increase trend.

The minor minerals available in the district are Boulder, Bajri (Gravels), Sand, Clay etc. from the river bed as well as Slate and Rough Stone, Project Stone, and Terrace mineral deposits from the hill slope. However, there are no major mineral industrial enterprises that can be set up in the district. Other minerals like semi-precious stones, Beryl-bearing pegmatites, China clay, Garnet crystals, Bands of haematite-quartzite etc. are also present in very small quantities which are not of much economic value.

The Shimla district does not have any large mines. At present, the Collection of in-situ stone from the hilly terrain is the main minor mineral source. These materials are primarily utilized for construction purposes. In order to meet the requirement of raw construction materials, the extraction of stone is being carried out exclusively from the Hill slopes. The demand for sand and grit is mainly met by the broken rock material from the hill slope which is manufactured by stone crushers. The local residents used to lift gravel etc. from the river beds to meet their bonafide requirement, however after coming into the Himachal Pradesh Minor Minerals (Concession) Rules 1971 Repealed as Himachal Pradesh Minor Minerals (Concession) and Minerals (Prevention of illegal Mining, Storage and Transportation) Rules 2015, the mining is regulated.

The minor mineral from the Riverbed and its tributaries as well as from the Hill slope are also granted through the concessions for the exploitation of minor minerals by tender cum e-auction method for specific quantities and periods in the district. The contract period of auction/tender is up to 15 years in the case of forest land and the auctioned land is granted for extraction of minor minerals only after completing all the codal formalities.

3. List Of Granted Mining Leases/Auctioned Areas In The District With Location, Area And Period Of Validity

At present about 11 Nos of mining leases (Pvt./Govt. Land) have been granted/executed and are under operation and the demand for furnished material is still high.

Table: The details of the Mining lease are as follows:

DETAILS OF LEASES DISTRICT CHAMBA

Sr. no.	Name & Address of the Mining Lease	Khasra No. Mauza /Mohal	Area	River Bed/Hill Slope	Period of mining lease with date	Purpose of Lease	Lease area Co-Ordinates	Status (working/non-working), if non-working reason
Division Chamba								
1.	Sh. Prakash Chand S/o Sh. Soorma Ram, Vill. & P.O. Kunr, Tehsil & Distt. Chamba (H.P.)	3026/2939/1Kunr	0.4087 Hect.	Hill Slope	14-01-2011 to 13-01-2021	Open Sale	32°24'35.9"N 76°23'17.7"E	Non-Working
2.	Sh. Yogesh Kumar S/o Sh. Jarmo Ram, Vill. Batti-Hatti, P.O. Gehra, Tehsil & Distt. Chamba (H.P.)	1265/544/1, 1244/598 Piura	0.3318 Hects	Hill Slope	19-08-2023 to 18-08-2033	Open Sale	32°26'04.32"N 76°20'10.35"E 32°26'03.15"N 76°20'10.38"E	Working
3.	Sh. Dhiraj Mahajan S/o Sh. Madan Lal, Vill. & P.O. Rajpura, Tehsil & Distt. Chamba (H.P.)	600/1,602to613,613/1,614,615,1314/616,1316/617,617/1,621,1318/622,623,624,1320/625,1277/1208,1278/1208,1279/1208,1275/1208,1276/1208,1206/988& 1207/988 Rajpura	46-16-18 Bighas	River Bed	23-09-2022 to 22-09-2027	Open Sale	32°36'17.9"N 76°05'44.68"E 32°36'15.33"N 76°05'48.53"E	Working
4.	GPA holder Sh. Shailender Thakur S/o Sh. Gian Chand, Village Lech, P.O. Gehra, Tehsil & Distt. Chamba, H.P.	1823/1704/36/1 Bhadour	2-00 Bighas	Hill Slope	30-05-2018 to 29-05-2023	Open Sale	32°26'35.5"N 76°20'11"E 32°26'33"N 76°20'10"E	Non-Working
5.	Sh. Neeraj Nayar S/o Sh. S. C. Nayar, Mohalla Bangotu, Tehsil & Chamba, H.P.	1883/1579/1 Gehra	17-05-00 Bighas	Hill Slope	31-08-2020 to 30-08-2025	Open Sale	32°26'23.72"N 76°20'05.37"E 32°26'17.98"N 76°20'02.43"E	Working
6.	Smt. Rachya Devi w/o Sh. Roshan Lal VPO Kunr Tehsil & Chamba, H.P.	3026/2939/2 Kunr	0.2186 Hect.	Hill Slope	20-02-2020 to 19-01-2030	Open Sale	32°24'28.9"N 76°22'13.2"E 32°26'27.8"N 76°22'14.7"E	Working
7.	Sh. D.S. Thakur, S/o Sh. Kirpa Ram, Prop:- M/s Thakur Stone Crusher Village & P.O. Kandla, Tehsil & Distt. Chamba, H.P.	4,10,11,12,530/22,531/22 & 24 Kandla	23-13-11 Bighas	River Bed	26-02-2021 to 25-02-2031	Stone Crusher	76°04'07.31"E 32°41'40.55"N 76°03'54.65"E 32°41'44.69"N	Working
8.	Sh. D.S. Thakur, S/o Sh. Kirpa Ram, Prop:- M/s Thakur Stone Crusher Village & P.O. Kandla, Tehsil & Distt. Chamba, H.P.	647/640/1 & 173 Mohadi	12-09-00 Bighas	River Bed	07-12-2018 to 06-12-2023	Stone Crusher	76°03'09.93"E 32°4049.29"N 76°03'08.68"E 32°4041.19"N	Non-Working under renewal
Division Churah								

9.	Sh. Chatter Singh S/o Sh. Lehnu Ram, Vill. Jawari, P.O. Thani-kothi, Tehsil Churah, Distt. Chamba (H.P.)	85/1,92 Jawari	0.4896 Hect.	Hill Slope	29-03-2018 to 28-03-2023	Open Sale	76°07'35.70"E 32°50'16.95"N	Non-Working
10	Smt. Hamiru Devi S/o Sh. Hans Raj Village Dayas P.O. Tarela, Tehsil Curah Distt. Chamba	882 Bounderi	08-00-00 Bighas	Hill Slope	14-12-2022 to 13-12-2032	Stone Crusher	32°52'38.40"N 76°8'47.77"E 32°52'37.53"N 76°8'51.93"E	Not working due to non-installation of Stone Crusher
Division Dalhousie								
11.	Sh. Sunil Kumar S/o Sh. Anirudh Prop:- M/s Sunil Stone Crusher, Village & P.O. Samleu, Tehsil Dalhousie, Distt. Chamba H.P.	374/153,375/153 & 376/153, 154,155,160,161,162,163,164,165,166 & 167 Samleu	10-02-00 Bighas	River Bed	13-10-2017 to 12-10-2022	Stone Crusher	32°36'05.65"N 75°54'22.55"E 32°36'02.44"N 75°54'21.02"E	Non-Working under renewal

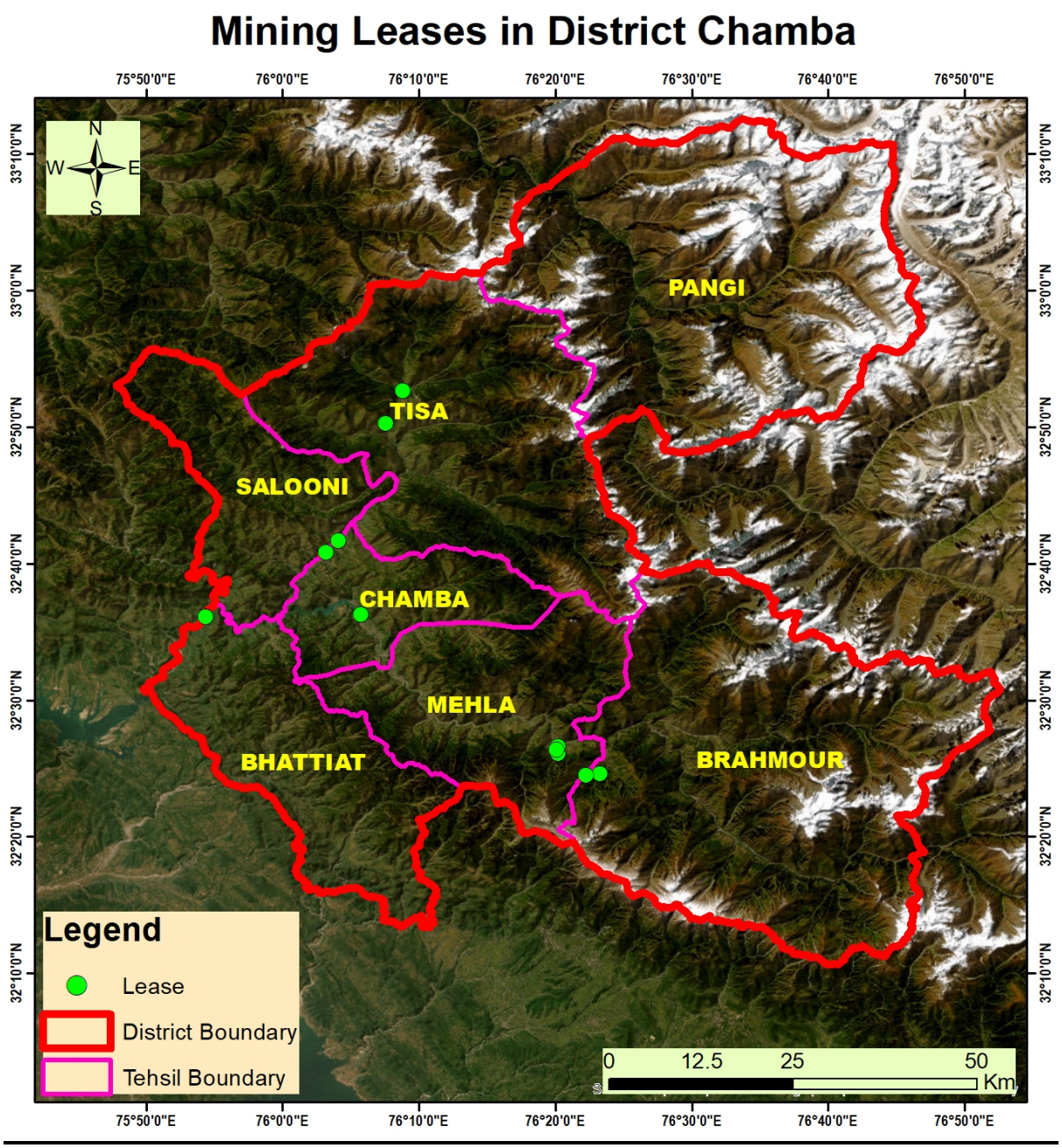


Image showing the location of the mining leases

4. Details Of Royalty Or Revenue Received In The Last Four Years

Table: Detail of Revenue Collected by Mining Office Shimla H.P. in Last 03 Years

Sr. No.	Financial Year	Production of minor minerals (in tonns)	Royalty received (in lacs
2	2021-22	126591 MT	8186880/-
3	2022-23	48984 MT	4134520/-
4	2023-24	138496 MT	11149880/-

5. Detail Of Production Of Minor Mineral In Last Three Years:

Table: Production of Minor Mineral in Metric Tonnes

FY	2021-22	2022-23	2023-24
Sand	61971	6320	15399
Stone/Bajri	63381	41834	122827
Slate	1239	830	270

6. Detail Of Letter of Intent

It is submitted that the department grant's mineral concessions by two modes, one through auction and another through mining leases. In both cases, as per the provisions contained in the Himachal Pradesh Minor Minerals (Concession) and Minerals (Prevention of Illegal Mining, Transportation and Storage) Rules, 2015, the areas are inspected by the Joint Inspection Committee under the Chairmanship of SDO (Civil) concerned comprising members from other department like Irrigation & Public health, State Pollution Control Board, Forest Department, HP Public Works Department, Geologist or Mining Officer and as such, the letter of intents are issued only after recommendations of the Joint Inspection Committee which is continuous process.

The applicant has to complete the codal formalities like preparation of mining plan and has to obtain environment clearance before the grant of mineral concession. As such, it is an ongoing process and as soon as the clearances are obtained, the letters of intents are converted into mining lease. Also, if the letter of intent holder is unable to obtain the required statutory clearances within the validity period of letter of intent, the period is accordingly extended so as to enable the letter of intent holder to obtain the required clearances. Hence, as such it shall not be possible to provide the exact details of the letter of intents in this survey document as these keeps on changing on day to day basis.

7. Process Of Deposition Of Sediments In The Rivers Of The District

Many rivers originate from the Himalayan and Shivalik regions which supply water in down streams. The greatest sediment yields are generally associated with rivers draining areas of intensive tectonic activity therefore, Himalayan rivers cause tremendous erosion and carry large amounts of sediment. The sediment load of a river is commonly considered to be a pollutant that is aesthetically displeasing and environmentally degrading. Sediment load can be divided into bed load and suspended load based on the mode of transport. Bed load is transported close to the bed where particles move by rolling, sliding, or jumping transport in natural rivers is a complicated phenomenon. Its movement is quite uneven in both the transverse and longitudinal directions, which varies considerably. Some sediment particles roll

or slide along the bed intermittently and some others saltate (hopping or bouncing along the bed).

The material transported in one or both of these modes is called 'bed load'. Finer particles (with low fall velocities) are entrained in suspension by the fluid turbulence and transported along the channel in suspension. This mode of transport is called 'suspended load'. Sometimes finer particles from upland catchment (sizes which are not present in the bed material), called 'wash load', are also transported in suspension. The combined bed material and wash .load is called 'total load'. Bed load ranges from a few percent of the total load in lowland rivers to perhaps 15% in Mountain Rivers to over 60% in some arid catchments. Although a relatively small part of the total sediment load, the arrangement of bed load sediment constitutes the architecture of sand bed and gravel-bed channels. The rate of sediment transport typically increases as a power function of flow; that is, a doubling of flow typically produces more than a doubling in sediment transport and most sediment transport occur during floods.

Rivers can be called open as well as underground circulatory systems of a continent and in the case of the Chmaba district of Himachal Pradesh River Ravi and River Chandrabhaga are the main aortae which are the main conduits for carrying water, minerals and load to nurture and to shape the life and the land. History has shown us that rivers have provided us with drinking water, agricultural lands, building materials, means of transportation and a habitable ecosystem. In northern India, the main drinking water source direct or indirect comes from rivers only but as human activities are profoundly increased a systematic and scientific utilization of the system is very important.

Natural processes shape the land by various means i.e. fluvial, erosional and Aeolian are slow and steady but any slight change to these processes can imbalance the process and resultant is the catastrophe. Deforestation, industrialization, urbanization, floodplain cultivation, dam and levee construction, and channelization have altered dramatically natural flow regimes. These changes have contributed to flooding, erosion, channel incision, contamination, non-native species introductions, and loss in ecological diversity. Although well-organised techniques to harvest natural resources can sustain the changes still slow and steady.

The multiple and sometimes incompatible services we demand from rivers often lead to social conflicts. The policy and management decisions that surround these conflicts increasingly require the integration of science-based information that crosses traditional disciplines. Unfortunately, gaps in our understanding of river processes often limit our ability to manage rivers optimally.

7.1 River Science

River Science is the study of processes affecting the river system. River science integrates multiple disciplines; it includes the study of how hydrological, geological, chemical, and ecological processes interact to influence the form and dynamics of riverine ecosystems and how riverine ecosystems in turn influence these processes across multiple spatial and temporal scales.

River science seeks to understand the linkages between river-related processes and patterns at multiple scales, from small streams to large rivers, from pristine to heavily urbanized watersheds, and from daily- to century-scale dynamics. Watersheds range in size from under one to thousands of square kilometres, and a river's physical and biological environment changes as water moves downstream. Small-scale or short-term physical processes may influence reach-scale habitat features that in turn influence ecological processes at broader scales and over longer periods. River science includes the study of relationships between watersheds, riparian zones, floodplains, groundwater, headwaters and downstream Rivers. Thus, river science is not constrained by any arbitrary spatial scale or physical boundaries defined by the morphology of channels, floodplains, or terraces. Rather, its domain and bounds are defined by the scales necessary to understand and predict river processes.

7.2 Major Rivers of Chamba District

The Ravi, Chenab and Beas rivers form the major drainage system in the district. The river Ravi and its tributaries, drain about 63% of the district area. The northern part of the district, is drained by the Chenab River, the river and its distributaries drain about 23% of the area. The southern part of the district is drained by Beas river and the river drains 10% of the total area of the district.

7.2.1 Ravi River

The Ravi River, one of the five rivers that give the Punjab region its name, is an important tributary of the Indus River system. It originates in the Bara Bhangal region of the Kangra district in the Indian state of Himachal Pradesh, at an altitude of approximately 4,421 meters (14,505 feet) in the Himalayas. From its source, the river flows westward through the picturesque Chamba Valley, meandering through deep gorges, lush forests, and scenic landscapes, before entering the plains of Punjab near Madhopur. The river then crosses the international border into Pakistan, flowing past the city of Lahore and eventually merging with the Chenab River. Spanning approximately 720 kilometers (447 miles) in length, the Ravi plays a crucial role in the agriculture of the region, supporting extensive irrigation networks,

including the historically significant Upper Bari Doab Canal. The Ravi River holds historical and cultural significance, having been mentioned in ancient texts as the Parushani River during the Vedic period. It has witnessed the rise and fall of numerous civilizations along its banks, from ancient settlements to the bustling cities of today. In addition to its historical importance, the river has also been a subject of international treaties, such as the Indus Waters Treaty of 1960 between India and Pakistan, which regulates the sharing of its waters. Despite its beauty and utility, the Ravi faces several environmental challenges, including pollution from industrial discharge, untreated sewage, and the over-extraction of water for agriculture, which have significantly reduced its flow and quality. Efforts are being made to rejuvenate and protect the river, recognizing its critical role in the ecology and economy of the region. The Ravi River, thus, is not just a geographical feature but a lifeline that has shaped the lives and cultures of the people it touches.

Ravi river forms the biggest sub-micro region of Chamba district. From Bara Bangal of Kangra district, it flows through Bara Bansu, Tretha, Chanota and Ulhansa. The Ravi river merges with the Chenab in Pakistan. The well known human settlement along the river are Barmaur, Madhopur and Chamba town. Its total length is 720 km.

Important Tributaries of river Ravi in District Chamba:

Table: Catchment area of the Ravi River and its tributaries as given below

Catchment area of the Ravi River				
Sr. No	**Name of the Khad**	**Area in Sq Km**	**Length in Km**	**%age of Total**
1	Suil Nala (Right Bank Tribuatry of Ravi River)	200	40	12.4
2	Salandari Nala (Right Bank Tribuatry of Ravi River)	50	6	5.1
3	Kiyani Nala (Right Bank Tribuatry of Ravi River)	59	5	6.7
4	Saho Nala (Right Bank Tribuatry of Ravi River	159	16	7.5
5	Sach Nala (left Bank Tributary of Ravi River)	40	7	6.3

6	Mehla Nala (left Bank Tributary of Ravi River)	24	4	6.3
7	Bakani Nala (left Bank Tributary of Ravi River)	12	3	4.1
8	Gehra Nala (left Bank Tributary of Ravi River)	12	5	3.3
9	Kurn Nala (left Bank Tributary of Ravi River)	12	6	2.9
10	Budal Nala (left Bank Tributary of Ravi River)	172	30	9.9
Total Ravi River Catchment		**730**	**122**	**64.5**

Table: The key characteristic of the Ravi River are described below

Name of the River	**Length(in km)**	**CatchmentArea (in Sq.km)**	**Average Width(in mtrs.)**
Ravi River	125 Km.	4955 Sq. Kmtrs.	50 mtrs.
Origin of Ravi River	Bara Bhangal region of the Kangra district in the Indian state of Himachal Pradesh, at an altitude of approximately 4,421 meters (14,505 feet) in the Himalayas.		
Important tributaries of the catchment.	Suil Nala (Right Bank Tribuatry of Ravi River), Salandari Nala (Right Bank Tribuatry of Ravi River), Kiyani Nala (Right Bank Tribuatry of Ravi River), Saho Nala (Right Bank Tribuatry of Ravi River, Sach Nala (left Bank Tributary of Ravi River), Mehla Nala (left Bank Tributary of Ravi River), Bakani Nala (left Bank Tributary of Ravi River), Gehra Nala (left Bank Tributary of Ravi River), Kurn Nala (left Bank Tributary of Ravi River), Budal Nala (left Bank Tributary of Ravi River).		

Geological Conditions:

The geomorphological characteristics of the Ravi River reflect its journey from the high-altitude Himalayas through narrow gorges, wide valleys, and plains before it eventually merges with other rivers in the Punjab plains. The river receives significant inputs from glacial and snowmelt waters, contributing to its flow, especially during the summer when melting is at its peak. In its upper reaches, the Ravi carves through narrow, V-shaped gorges and steep-sided valleys, particularly in the Chamba district. This region is marked by rapid gradients, creating a fast-flowing river with numerous rapids and waterfalls. As the Ravi descends from

the mountains, it transitions into wider valleys with more gentle slopes. The river starts meandering slightly, depositing sediments and forming alluvial fans, especially where tributaries join from side valleys. This section is characterized by a combination of erosional and depositional features. The river carries a heavy sediment load, eroding its banks in some sections while depositing silt in others, forming point bars and small islands. The middle course of the Ravi has well-defined river terraces, indicating past levels of the river during different climatic and geological periods. The floodplain widens as the river exits the hilly terrain, supporting agricultural activities.

Total Potential of Ravi River:

On the basis of drainage analysis, No. of tributaries, average erosion in the river bed, the annual deposition of minor mineral in the river bed has been calculated by taking into consideration the annual deposition of about 6 Cms.

Table: The total potential of the Ravi River is given below

Name of River	Boulder (in Metric Tonnes)	Bajri (in Metric Tonnes)	Sand (in Metric Tonnes)	Total (in Metric Tonnes)
Ravi River	45,50,000	55,00,500	40,12,000	1,40,62,500
Annual Replenishment				
	2,07130	3,42,840	2,07130	7,57,100

Recommendations:

It is evident from the above table and photographs that about 1,40,62,500 metric tones of different sizes of minor minerals are available upto depth of one meter in the river bed of Ravi river in Chamba District. Similarly, the annual deposition of minor mineral in the river bed is calculated approximately to the tune of 7,57,100 metric tones. It is, therefore recommended that mineral concession can be granted in the river bed of Ravi River , From Holi up to boarder of Chamba district near Khairi.

7.2.1.1 Suil Nala:

Located in the Chamba Valley of Himachal Pradesh, the Suil is a perennial tributary of the Ravi river originating from the Padri gali. The key characteristic of the river and its major tributaries are described below:

Table: The key characteristic of the Stream are described below

Name of the Stream	Length(in km)	CatchmentArea (in Sq.km)	Average Width (inmtrs.)
Suil Nala	40 Km.	200 Sq Km.	50 mtr
Origin	From Padri Gali,3125 Meter above Mean Sea Level.		
Important tributaries of the catchment.	Sach Nala and Malen Nala		

Geological Conditions:

The deposit is of small little length and is mainly consist of river-borne deposit & also materials derived from uphill side of nallah. The deposit comprises of sand, stone & bajri. However the proportion of stone & sand is maximum and during monsoon season the stream carries heavy sediment load and deposit it annually on the river bed. Hence the site is recommended to put for auction

Total Potential of Suil Nala.

On the basis of drainage analysis, No. of tributaries, average erosion in the river bed, the annual deposition of minor mineral in the river bed has been calculated by taking into consideration the annual deposition of about 4 Cms.The total potential of the Binnu Khad is given below in the table

Table: The total potential of the Stream is given below

Name of Stream	Boulder (in Metric Tonnes)	Bajri (in Metric Tonnes)	Sand (in Metric Tonnes)	Total (in Metric Tonnes)
Suil Nalla	15,44,400	12,01200	6,86,400	34,32,000
Annual Replenishment				
	77,220	600,60	34,3,20	1,71,600

Recommendations:

It is evident from the above table that about 34,32,000 metric tones of different sizes of minor minerals are available upto depth of one meter in the river bed of Suil Nala in Chamba District. Similarly the annual deposition of minor mineral in the river bed is calculated approximately to the tune of 1,71,600 metric tones. It is therefore recommended that mineral concession can be granted in the river bed of Suil Nala from Salooni up to Chakloo (Confluence point).

7.2.1.2 Salandari Nala:

Located in the Chamba Valley of Himachal Pradesh, the Salandari Nala is a perennial right bank tributary of the Ravi River. Originating from the Raja ka Dera, 2800 Meter above Mean Sea Level. The key characteristic of the river and its major tributaries are described below:

Table: The key characteristic of the Stream are described below

Name of the Stream	Length(in km)	CatchmentArea (in Sq.km)	Average Width (inmtrs.)
Salandari Nala	6 Km.	50 Sq Km.	30 mtr
Origin	From Raja ka Dera, 2800 Meter above Mean Sea Level.		
Important tributaries of the catchment.	Garanda Nala (Right bank tributary), Salar Nala (Left bank tributary), Paprud Nala (Right bank tributary), Patech Nala (Left bank tributary),Dholera Nala (Right bank tributary), Chanden Nala(Left bank tributary), and Kohar Nala(Right bank tributary).		

Geological Conditions:

This deposit is located both upstream and downstream of Lachori bridge on both banks of Salandari nala . It is a part of reservoir area acquired by N.H.P.C. It comprises of rock fragment of small size mainly of slate, phyllite & sand and stone etc. This deposit is considerable for lifting of materials. There will be no possibility of degradation of environment in case this material is lifted from this site and pit out area after excavation will be replenished in rainy seasons for considerable thickness both by Suil river and as The boulder beds are considered the prominent source of river borne deposits and during monsoon season the stream carries heavy sediment load and deposit it annually on the river bed on the confluence with Ravi.

Total Potential of Salandari Nala.

The following quantity of mineral potential has been calculated based on the percentage of each mineral constituent like boulder, river borne bazri and sand upto a depth of one metre.

Table: The total potential of the Stream is given below

Name of Stream	Boulder (in Metric Tonnes)	Bajri (in Metric Tonnes)	Sand (in Metric Tonnes)	Total (in Metric Tonnes)
Salandari Nalla	1,00,000	1,50,000	1,50,000	4,00,000
Annual Replenishment				
	7,000	8,000	9,000	24,000

Recommendations:

It is evident from the above table that about 4,00,000 metric tones of different sizes of minor minerals are available upto depth of one meter in the river bed of Salandari Nala in Chamba District. Similarly the annual deposition of minor mineral in the river bed is calculated approximately to the tune of 2400 metric tones. It is therefore recommended that 2400 metric tones of mineral can safely be allowed to lift up to Confluence with Ravi River.

7.2.1.3 Kiyani Nala:

Located in the Chamba Valley of Himachal Pradesh, the Kiyani Nala is a perennial tributary of the Ravi River originating from the Dawat Ki Dhar. The key characteristic of the river and its major tributaries are described below

Table: The key characteristic of the Stream are described below

Name of the Stream	Length(in km)	CatchmentArea (in Sq.km)	Average Width (inmtrs.)
Kiyani Nala	5 Km.	59 Sq Km.	30 mtr
Origin	From 2345 Meter above Mean Sea Level near Dawat Ki Dhar		
Important tributaries of the catchment	Kuledh Nala		

Geological Conditions:

This deposit is located on Kuledh nala on both banks of Kuledh nala especially near the confluences point of this nal with Ravi River at Kiyani and having bulk or potentials of river-borne materials which can be utilized for construction purpose. These materials varying in shape from sand to stone & bajri etc. Materials are deposited in form of river bed in right bank of river Ravi on kuledh nala upstream. Since this deposit is extended for approximately 500 metrs upstream and is replenish able. Hence this area is also recommended for purpose of mining lease as it will not cause any adverse effect in terms of erosion when materials will be lifted from this area.

Total Potential of Kiyani **Nala.**

On the basis of drainage analysis, No. of tributaries, average erosion in the river bed, the annual deposition of minor mineral in the river bed has been calculated by taking into consideration the annual deposition of about 2 Cms.

Table: The total potential of the Stream is given below

Name of Stream	Boulder (in Metric Tonnes)	Bajri (in Metric Tonnes)	Sand (in Metric Tonnes)	Total (in Metric Tonnes)
Kiyani Nalla	75,000	75,000	1,00,000	2,50,000
Annual Replenishment				
	13,000	7,000	15,000	35,000

Recommendations:

Since a no. of water supply as well as irrigation schemes exist along the bed of Kiyani Nala and adequate accumulation of minor minerals and is recommended for mineral concession.

7.2.1.4 Saho Nala:

Located in the Chamba Valley of Himachal Pradesh, the Saho Nala is a perenial tributary of the Ravi river originating from the Dalpa. The main characteristic of the river and its major tributaries are described below:

Table: The key characteristic of the Stream are described below

Name of the Stream	Length(in km)	CatchmentArea (in Sq.km)	Average Width (inmtrs.)
Saho Nala	16 Km.	159 Sq Km.	25 mtr
Origin	From north –South trending ridge near Saho, 3500 Meter above Sea Level		
Important tributaries of the catchment	Saho Nala, Meradi Nala & Chaminu Nala		

Geological Conditions:

The Saho Nala deposits are seen covered with overburden materials which is mainly consist of river-borne deposit mixed with materials derived from uphill side. The boulder beds are considered the prominent source of river borne deposits and during monsoon season the stream carries heavy sediment load and deposit it annually on the river bed.

Total Potential of Saho Nala.

On the basis of drainage analysis, No. of tributaries, and average erosion in the river bed, the annual deposition of minor mineral in the river bed has been calculated by taking into consideration the annual deposition of about 4 Cms.

Table: The total potential of the Stream is given below

Name of Stream	Boulder (in Metric Tonnes)	Bajri (in Metric Tonnes)	Sand (in Metric Tonnes)	Total (in Metric Tonnes)
Saho Nalla	1,50,000	1,50,000	1,00,000	4,00,000
Annual Replenishment				
	15,000	15,000	10,000	40,000

Recommendations:

This deposit is located along Saho nala from Maredi upstream. The mineral deposit is deposited inform of river bed and this area was also being auctioned in the past. The deposit is approached through road at Maredi. Deposits are seen covered with overburden materials which is mainly consist of river-borne deposit mixed with materials derived from uphill side. Slope angle is varies from gentle to moderate and banks are seems to stable. Similarly, the annual deposition of minor mineral in the river bed is calculated approximately to the tune of 40,000 metric tonnes. It is therefore recommended that 40,000 metric tonnes of mineral can safely be allowed to lift up to Confluence with Ravi River. This deposit about 100-250 metres in length and consist of sand, stone & bajri and sandy materials can be extracted only through screening the suitability of materials, the area is recommended for auction.

7.2.1.5 Sach Nala:

Located in the Chamba Valley of Himachal Pradesh, Sach Nala is a right bank tributary of the Ravi river originating from the Dalpa. The key characteristic of the river are described below:

Table: The key characteristic of the Stream are described below

Name of the Stream	Length(in km)	CatchmentArea (in Sq.km)	Average Width (inmtrs.)
Sach Nala	7 Km.	40 Sq Km.	20 mtr
Origin	From, 2431 Meter above Mean Sea Level Dalpa		
Important tributaries of the catchment	Saho Nala, Meradi Nala & Chaminu Nala		

Geological Conditions:

The Sach Nala deposits are seen covered with overburden materials which is mainly consist of river-borne deposit mixed with materials derived from uphill side. The boulder beds are considered the prominent source of river borne deposits and during monsoon season the stream carries heavy sediment load and deposit it annually on the river bed.

Total Potential of Sach Nala.

The following quantity of mineral potential has been calculated based on the percentage of each mineral constituent like boulder, river borne bazri and sand upto a depth of one metre.

Table: The total potential of the Stream is given below

Name of Stream	Boulder (in Metric Tonnes)	Bajri (in Metric Tonnes)	Sand (in Metric Tonnes)	Total (in Metric Tonnes)
Sach Nalla	55000	35000	20000	1,10,000
Annual Replenishment				
	6,200	3,800	2,000	12,000

Recommendations:

It is evident from the above table that about 110000 metric tones of different sizes of minor minerals are available upto depth of one meter in the river bed of Sach Nala in hamba District. Similarly the annual deposition of minor mineral in the river bed is calculated approximately to the tune of 12000 metric tones. The stream width is narrow in major portion. The mineral deposit is located on the right bank of Sach nala near upstream of Baloo and accumulated bulk of river-borne materials which can be best utilized for construction purpose by lifting from it manually. These materials varying in shape from sand to stone & bajri etc. Since area being replenishable to sufficient extent, hence recommended for purpose of mining lease.

7.2.1.6 Chakki Khad:

Located in the Chamba Valley of Himachal Pradesh, the Chakki Khad is a tributary of the Beas river, It flows through Bhatiyat Chamba and part in kangra district and Punjab and joins Beas near Pathankot. It is fed by snow and rain stream from the Southern slopes of the Dhauladhar range .The key characteristic of the river and its major tributaries are described below:

Table: The key characteristic of the Stream are described below

Name of the Stream	Length(in km)	CatchmentArea (in Sq.km)	Average Width (inmtrs.)
Chakki Khad	8 Km.	55 Sq Km.	50 mtr
Origin	From, Southern slopes of the Dhauladhar range		
Important tributaries of the catchment	Kalam trimath (Right bank tributary of Nakki Khad),Kalam Khad – II(Right bank tributary of Nakki Khad),Chakki-Siyan Khad (Right bank tributary of Nakki Khad) Hawar Khad (Right bank tributary of Nakki Khad(Right bank tributary of Nakki Khad)		

Geological Conditions:

The Chakki Khad passes through rocks of upper Siwaliks containing boulder beds, and small lenses of clay and sand stone. This formation is considered the potential source of river borne deposites in the stream bed. The stream bed is occupied with huge deposits of gravel and sand. Near the confluence with Beas river this stream has developed a vast flood plain as the velocity of water of this stream during monsoon is checked at the confluence and sediment load is deposited at this place forming vast flood plain.

Total Potential of Chakki Khad

The following quantity of mineral potential has been calculated based on the percentage of each mineral constituent like boulder, river borne bazri and sand upto a depth of one metre.The total potential is given below

Table: The total potential of the Stream is given below

Name of Stream	Boulder (in Metric Tonnes)	Bajri (in Metric Tonnes)	Sand (in Metric Tonnes)	Total (in Metric Tonnes)
Chakki Khad	2,00,000	4,00,000	4,00,000	8,00,000
Annual Replenishment				
	25,000	20,000	30,000	75,000

Recommendations:

It is evident from the above table that about 8,00,000 metric tones of different sizes of minor minerals are available upto depth of one meter in the river bed of Chakki Khad. in hamba District.Similarly the annual deposition of minor mineral in the river bed is calculated approximately to the tune of 75,000 metric tones. Keeping in view the significant amount of

minor mineral lying in the river bed, it is recommended that minor mineral such as sand stone and bajri can be allowed to be lifted from this river bed.

7.2.1.7 Dehar Khad:

Located in the Chamba Valley of Himachal Pradesh, the Dehar Khad is a perenial tributary of the Beas river originating from near Pirigarh in Chamba district and entered the Kangra district at Kotla. The key characteristic of the river and its major tributaries are described below:

Table: The key characteristic of the Stream are described below

Name of the Stream	Length(in km)	CatchmentArea (in Sq.km)	Average Width (inmtrs.)
Chakki Khad	10 Km.	85 Sq Km.	100 mtr
Origin	From, 1324 Meter above Mean Sea Level near Pirigarh		
Important tributaries of the catchment	Bhed Khad(Left bank tributary), Brahi Khad (Left bank tributary), Dhramman Khad (Left bank tributary of Brahi Khad), Chho Khad (Right bank tributary) and Kibber Khad (Left bank tributary)		

Geological Conditions:

The Dehar Khad cut its course all along its length through the rocks of Siwalik formation. The Siwalik Group comprises of sandstone, siltstone and clay/claystone alternations in the lower part, whereas the upper part is represented by conglomerates, pebbly bands and sandstone lenses, ranging in age from Middle Miocene to Lower Pleistocene.The river bed is occupied with recent deposits of minor minerals comprising sand, silt, gravel and pebbles of Newer Alluvium belonging to Quaternary age. These sediments are deposited in the shape of channel bars, piedmont bars, flood plains and alluvial fan deposits.The Alluvium consists of loose sand, silt, clay, pebble, gravel, boulder and kankar. It unconformably overlies different formations in different areas. During monsoon season the stream carries heavy sediment load and deposit it annually on the river bed.

Total Potential of Chakki Khad

The following mineral potentials have been calculated based on the %age of each mineral constituent like boulder, river borne bajri, sand upto a depth of one metre. The annual deposition of minor mineral in the river bed has been calculated by taking into consideration the annual deposition of about 5 Cms. As seen in photographs the banks comprise of boulder beds are steep and stable in nature. The total potential is given below

Table: The total potential of the Stream is given below

Name of Stream	Boulder (in Metric Tonnes)	Bajri (in Metric Tonnes)	Sand (in Metric Tonnes)	Total (in Metric Tonnes)
Chakki Khad	3,02,000	4,36,000	3,02,000	10,40,000
Annual Replenishment				
	30,000	25,000	35,000	90,000

Recommendations:

It is evident from the above table that about 10,40,000 metric tones of different sizes of minor minerals are available upto depth of one meter in the river bed of Dehar Khad in Chamba District.Similarly the annual deposition of minor mineral in the river bed is calculated approximately to the tune of 90,000 metric tones. It is therefore recommended that mineral concession can be granted in the river bed of Dehar Khad.

7.2.1.8 Deposits

Following sites have been identified right from Holi to Rajpura area by keeping in view the potential and feasibility of sites after going through all parameters of environment safety and erosion etc.

(1) Holi Deposit:-

This deposit is located about 300-400 metres downstream from Holi station on left bank. It comprises of rock fragment of small size mainly of slate, phyllite & sand and stone etc. This deposit is considerable for lifting of materials. There will be no possibility of degradation of environment in case this material is lifted from this site and pit out area after excavation will be replenished in rainy seasons for considerable thickness. Hence the site is recommended to put for auction.

(2) **Bagga-River deposit:-**

This deposit is located downstream Bagga on both bank of river and is accessible from main road. The deposit mainly comprises of sand and stone with negligible proportion of bajri. The deposit is deposited in form of river bed. In case of lifting of materials from this site, there will be no side effect on environment in term of erosion and also the site being is term river bed will also be replenished during rainy season and flood time with in short spell of time. Hence the site is recommended to pout for auction on following condition:-

The collection of materials should be allowed from the side of water flow towards the banks of nalla.

(3) Bakanipul to Kalsuin:-

This deposit is located in downstream Rakh up to Kalsuin and having bulk or potentials of river-borne materials which can be utilized for construction purpose. These materials varying in shape from sand to stone & bajri etc. Materials are deposited in form of river bed in right bank of river Ravi. Since this deposit is extended for few kilometres and is replenish able. Hence this area is also recommended for auction as it will not cause any adverse effect in terms of erosion when materials will be lifted from this area.

(4) Sach Nala deposit:-

The mineral deposit is located on the right bank of Sach nala near upstream of Baloo and accumulated bulk of river-borne materials which can be best utilized for construction purpose by lifting from it manually. These materials varying in shape from sand to stone & bajri etc. Since area being replenishable to sufficient extent, hence recommended for purpose of mining lease.

(5) Kuledh or Pukhri nala deposit:-

This deposit is located on Kuledh nala on both banks of Kuledh nala especially near the confluences point of this nal with Ravi River at Kiyani and having bulk or potentials of river-borne materials which can be utilized for construction purpose. These materials varying in shape from sand to stone & bajri etc. Materials are deposited in form of river bed in right bank of river Ravi on kuledh nala upstream. Since this deposit is extended for approximately 500 metrs upstream and is replenish able. Hence this area is also recommended for purpose of mining lease as it will not cause any adverse effect in terms of erosion when materials will be lifted from this area.

(6) Balu to Parel and Tadoli to Udaipur, Salimar & Rajpura. Deposit:-

The mineral deposit is located on the both side of river Ravi between area from balu downstream top Parel and also from Tadoli upto Rajpura. This deposit also is apart of previously auctioned area although it has been now segmented into two fraction like Balu to Parel and further 7.Tadoli to Rajpura. However earlier it was a continuous single path for great extent before the construction of bridge near Parel downstream. This river bed deposit comprises of mine-borne deposit which is of different dimension varying from sand to boulder

type. Here deposit is encounted in form of flood plain & channel bar. The proportion of boulder is maximum in comparison to sand and whole area is accessible through road and this entire pocket extends about 3-4 km I length and having width varying from 20-130 metres. Since the deposit is located on the both bank of Ravi river and also at some place the flow of river on the both banks is higher than flood plain and hence there is chance of overflowing of river flows towards the both banks during high/floods seasons which can cause the damage to surroundings area in terms of property as well as life. So keeping in view the above narrated facts, the site is recommended for grant of mining lease subject to following terms & condition:-

No mining be carried out at the place along the river where the river bed is seen to be higher than river bed.

(7) Sherpur Deposit:-

This deposit is located in both down and upstream of Sherpur on left bank of Ravi River and having bulk of river-borne materials which can be best utilized for construction purpose. These materials varying in shape from sand to stone & bajri etc. Materials are deposited in form of river bed in left bank of river Ravi. Since this deposit is extended for considerable (nearly about 500 meters) distances and is replenishable. Hence this area is also recommended for grant of mining lease as it will not cause any adverse effect in terms of erosion when materials will be lifted from this area manually.

(8) Khairi Deposit:-

This deposit is located downstream near village khairi on right bank of Ravi River. The deposit is spread over sufficient length and is mainly consist of river-borne deposit & also materials derived from uphill side of surrounding nalla apart from Ravi River. The deposit comprises of sand, stone & bajri. However the proportion of stone & sand is maximum. Hence the site is recommended grant of mining lease.

(9) Kalam Trimth deposit:-

This deposit is located near Chowari bridge upstream and deposit is mainly comprises of sand, stone , bajri & clay matrix on both side of banks and of small areal extent maximum width showing tapering towards upstream & downstream side. This is also a part of previously auctioned area. If materials are lifted from banks, it will not cause any adverse impact. Moreover it will shift the flow of water toward centre causing less erosion of materials from banks. Hence site is recommended for auction.

(10) Kalam Khad-II deposit:-

This deposit is situated both upstream & downstream of Kalam Khad near Parchhar and sand; stone is deposited during flood seasons. Here there is possibility of replenishment of the mineral/ materials annually during flood seasons. Therefore, the site is recommended to put auction subject to the condition that the spot where there is apprehension of bank-cutting may not be put to auction.

(11) Chakki-Siyun Khad:-

The deposit lies both side of Chakki-Siyun Khad downstream the bridge. The minerals deposit ate in form of floods plain and main constituents are varying from sand to small/big boulder. There is no adverse impact on the area if the river-borne materials will be lifted from river bed with out any impact in form of bank cutting and also there would be maximum chance of replenishment during the flood seasons. Hence site is recommended to put for auction.

(12) Hawar Khad:-

This deposit is located on the downstream of Hawar Khad near Taragargh. The minerals are deposited along the bed of the khad in form of floods plain and comprises of big boulder and matrix of fine assorted materials. The bank seen to be quite stable. If any case minor minerals are extracted from the bed, there is no possibility of any damage/ erosion of the bank. In view of above the site is recommended to put for auction.

(13) **Dudaman Khad deposit:-**

This minor minerals deposit extends both upstream & downstream near Hatli industrial area. The whole of bed of this khad is minerals bearing containing big boulder, sand matrix & other rock fragments. The banks do not expose any bed rocks. There is also great possibility of replenishment of materials. Hence lifting/ collection of materials will not cause any adverse impact on environment & damage to bank erosion. Hence site is recommended to put for auction.

(14) Patka Khad deposit:-

This deposit is located upstream of Patka Khad near village Panjla. The minor minerals are deposited in form of flood plain and consist of mostly sand. There is no apprehension of further bank cutting due to mining. The site is recommended to put for auction.

(15) Channal Khad:-

This deposit is located on channel Khad upstream near Sihunta and having sufficient quantity of river borne materials in form of sand, stone and bajri. Here the stone are available in maximum proportion. Since the area is of sufficient aerial extents and is replenishable in month of monsoon/flood seasons. Therefore it is recommended to put for auction.

(16) Sarahal Khad, Brahal, Thulel & Balana deposit:-

These deposit is located on Thulel khad near Sarahal, Brahal, Balana and lies in upstream side of main road(Sihunta-Dramman road). The deposit consist of sand, stone, bajri (little proportion) and whole are is replenishable during flood season. These deposit also contains assorted materials admixed with clay matrix. Here the deposit is in form of flood plain and there will be no adverse impart on banks of Khad if the materials is lifted from these spot/area.

7.2.2 ChandraBhaga River

The Chandra River originates from Baralacha La at an elevation of about 4950 m above sea level and is augmented by Chandra Tal. The Bhaga rises in the north-western slopes of Baralacha pass and is further joined by Jhankar and Millang nalas in the head reach. The Chandra comes forming a loop changing the course from southerly to westerly and then to the north westerly direction and the Bhaga comes descending in the direct westerly course. The important places in this reach are Koksar on the Chandra River and Keylong on the Bhaga River. The Chandra and Bhaga join each other at Tandi (EL 2820 m) south of Keylong, the district headquarters of Lahaul and Spiti in Himachal Pradesh. These two streams, after meeting at Tandi in Lahaul Valley, form the Chandra-Bhaga which flows forward through the Pangi valley towards Kashmir. The key characteristic of the river and its major tributaries are described below:

Table: The key characteristic of the River are described below

Name of the Stream	Length(in km)	CatchmentArea (in Sq.km)	Average Width (inmtrs.)
Chandra-Bhaga River	45 Km.	1575 Sq Km.	50 mtr
Origin	From, north-western slopes of Baralacha pass		
Important tributaries of the catchment	Mulkila Nallah, Sura Tal Nala, Tindi Nala, Thirot Nalla and Miyar Nallah		

Geological Conditions:

The terrain in the upper reaches of tributaries shows a typical glacial landscape characterized by rugged towering peaks, cirque glaciers and morainic deposits. There are also thick and extensive alluvial fans. At the higher reaches of the valley, the thickness of colluvium cover varies from a few meters to 10 meters but in the lower portions, it could be even up to ±20 to 30m in a few stretches. These tributaries show a sub-dendritic to trellis pattern of drainage.

Total Potential of Chndra-Bhaga River

The following quantity of mineral potential has been calculated based on the percentage of each mineral constituent like boulder, river borne bazri and sand upto a depth of one metre.The total potential is given below

Table: The total potential of the River is given below

Name of Stream	Boulder (in Metric Tonnes)	Bajri (in Metric Tonnes)	Sand (in Metric Tonnes)	Total (in Metric Tonnes)
Chnadra-Bhaga River	9,45,000	18,90,000	18,90,000	47,25,000
Annual Replenishment				
	47,250	94,500	94,500	2,36,250

Recommendations:

It is evident from the above table that about 47,25,000 metric tones of different sizes of minor minerals are available upto depth of one meter in the river bed of Chnadra-Bhaga River. in Chamba District.Similarly the annual deposition of minor mineral in the river bed is calculated approximately to the tune of 2,36,250 metric tones. Keeping in view the significant amount of minor mineral lying in the river bed, it is recommended that minor mineral such as sand stone and bajri can be allowed to be lifted from this river bed.

7.3 Drainage Pattern

The Ravi, Chenab and Beas rivers form the major drainage system in the district. The river Ravi and its tributaries, drain about 67% of the district area. The northern part of the district, is drained by the Chenab River, the river and its distributaries drain about 23% of the area. The southern part of the district is drained by Beas river and the river drains 10% of the total area of the district.

Table: Catchment Charecterstics of the District Chamba

S.No.	Basin	Area (Sq. Km)	Percentage Area
1	**Beas Watershed**	675	10%
2	**Chandra Bhaga Watershed**	1525	23%
3	**Ravi Watershed**	4322	67%
Total		**6522**	**100%**

The drainage pattern is mostly dendritic to sub-dendritic i.e. the tributaries meet at low angles and branch at random, like a tree pattern. A dendritic drainage pattern indicates comparatively low permeable rocks which allow high drainage density in the district.

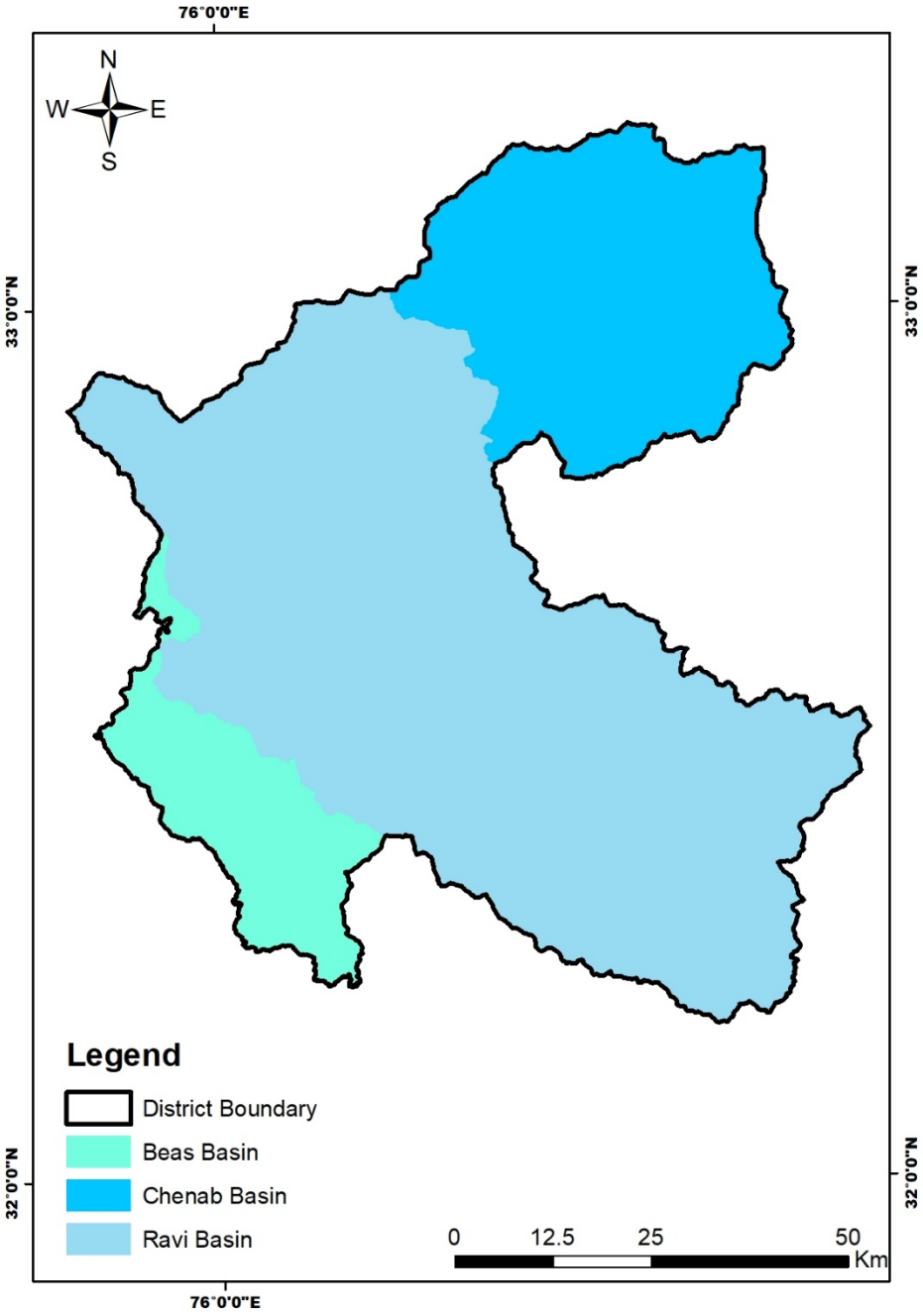


Image Showing Catchments of the District

7.4 Stream ordering

The stream order hierarchy was officially proposed in 1952 by Arthur Newell Strahler, a geoscience professor at Columbia University in New York City, in his article “Hypsometric (Area Altitude) Analysis of Erosional Topology.” The article, which appeared in the Geological Society of America Bulletin outlined the order of streams as a way to define the size of perennial (a stream with water in its bed continuously throughout the year) and recurring (a stream with water in its bed only part of the year) streams.

When using stream order to classify a stream, the sizes range from a first-order stream all the way to the largest, a 12th-order stream. A first-order stream is the smallest of the world's streams and consists of small tributaries. These are the streams that flow into and "feed" larger streams but do not normally have any water flowing into them. In addition, first and second-order streams generally form on steep slopes and flow quickly until they slow down and meet the next-order waterway.

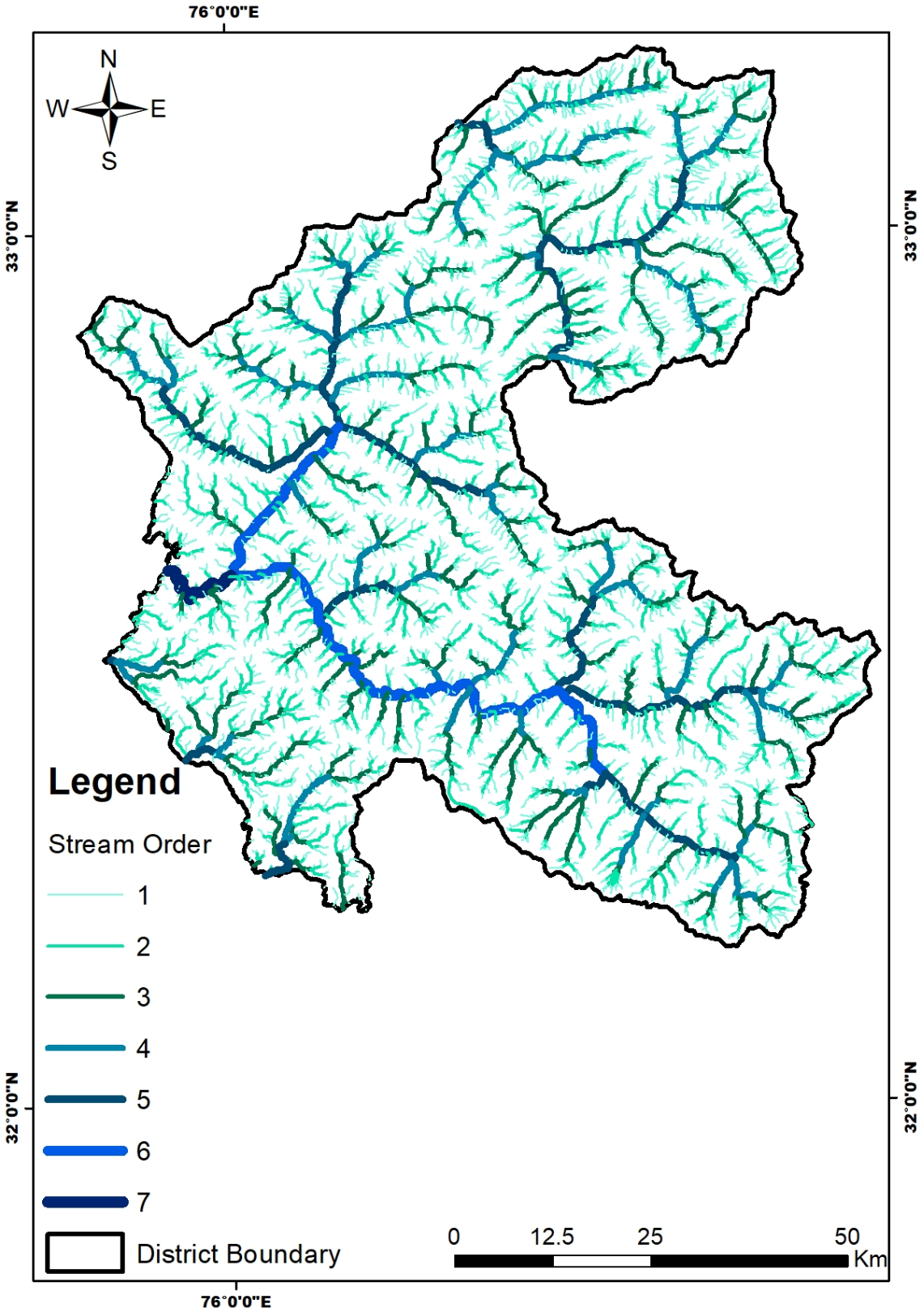


Fig showing Stream Order of Chamba District

First through third-order streams are also called headwater streams and constitute any waterways in the upper reaches of the watershed. It is estimated that over 80% of the world's waterways are these first through third-order, or headwater streams.

Going up in size and strength, streams that are classified as fourth through sixth order are medium streams while anything larger (up to 12th order) is considered a river. For example, to compare the relative size of these different streams, the Satluj River in the Shimla district is a 5th-order stream. The world's largest river, the Amazon in South America, is considered a 12th-order stream.

Unlike the smaller order streams, these medium and large rivers are usually less steep and flow slower. They do however tend to have larger volumes of runoff and debris as it collects in them from the smaller waterways flowing into them.

7.4.1 Going Up in Order

When studying stream order, it is important to recognize the pattern associated with the movement of streams up the hierarchy of strength. Because the smallest tributaries are classified as first order, they are often given a value of one by scientists It then takes a joining of two first-order streams to form a second-order stream. When two second-order streams combine, they form a third-order stream, and when two third-order streams join, they form a fourth and so on.

If however, two streams of different order join, neither increases in order. For example, if a second-order stream joins a third-order stream, the second-order stream simply ends by flowing its contents into the third-order stream, which then maintains its place in the hierarchy.

7.4.2 The Importance of Stream Order

This method of classifying stream size is important to geographers, geologists, hydrologists and other scientists because it gives them an idea of the size and strength of specific waterways within stream networks- an important component of water management. In addition, classifying stream order allows scientists to more easily study the amount of sediment in an area and more effectively use waterways as natural resources. Stream order also helps people like biogeographers and biologists in determining what types of life might be present in the waterway. This is the idea behind the River Continuum Concept, a model used to determine the number and types of organisms present in a stream of a given size. Different types of plants for example can live in sediment-filled, slower-flowing rivers like the lower Ganges than can live in a fast-flowing tributary of the same river

Whether it is used by a GIS, a biogeographer, or a hydrologist, stream order is an effective way to classify the world's waterways and is a crucial step in understanding and managing the many differences between streams of different sizes.

7.6 Relief

Terrain, or land relief, is the vertical and horizontal dimension of the land surface. When relief is described underwater, the term bathymetry is used. Terrain is used as a general term in physical geography, referring to the lay of the land. This is usually expressed in terms of the elevation, slope, and orientation of terrain features. Terrain affects surface water flow and distribution. Over a large area, it can affect weather and climate patterns.In terms of environmental quality, agriculture, and hydrology, understanding the terrain of an area enables the understanding of watershed boundaries, drainage characteristics, water movement, and impacts on water quality. Complex arrays of relief data are used as input parameters for hydrology transport models (such as the SWMM or DSSAM Models) to allow the prediction of river water quality.

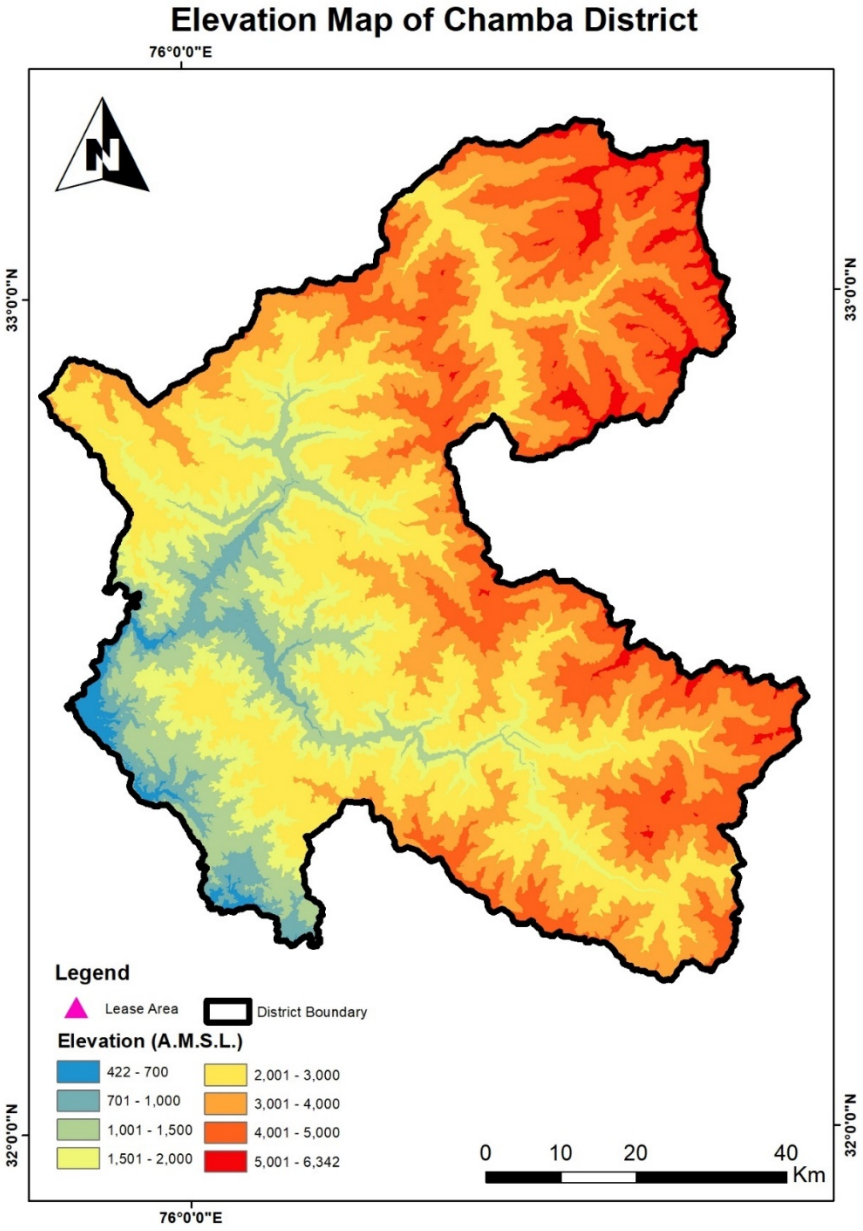


Figure Showing Elevation Map Of The District

7.7 Reserve Calculation

The reserve calculations are based on the following expression:

Total reserve = Volume X Tonnage Factor

Where the volume of the deposit is approximated by Length, Breadth and height parameters.

7.7.1. Tonnage Factor

Method For Calculation of Reserves:-
METHODOLOGY:

On an average the competency of stream at the point of mining site is 10 to 15 cm x 4 to 6 cm but it is also important to mention here that there is a provision in the river/strem bed mining policy guidelines where collection of material upto a depth of 1 metre is allowed in a single season where mineral concessions have been granted, and it is noticed that during flood season whole of the pit so excavated is completely filled up and as such the excavated area is replenished with new harvest of mineral. However vide notification dated 29.02.2024 **Himachal Pradesh Mineral Policy, 2024 for regulation of mines and minerals in Himachal Pradesh came to existence and thus allowing 2m depth instead of 1m , but during the preparation of this report calculations are done with 1 m depth.**

In order to calculate the mineral deposits in the stream beds, the mineral constituents have been categorized as clay, silt, sand, bajri and boulder and there average %age is taken into account. It is observed in different rivers/streams that % age of boulders varies from 30% to 70%, bajri 15 % to40%, sand from 15% to 30% and silt .Only boulder bajri and sand is the resource mineral i.e. usable mineral and rest is taken as the waste. Further the Survey of India Topo-Sheets were used as base map to know the extent of river course. The mineral reserves have been calculated only upto 1.00 metre depth although there are some portions in the river beds such as channel bars, point bars and central islands where the annual deposition is raising the level of river bed thus causing shifting of the rivers towards banks and causing cutting cosequently of banks and at such locations, removal of this material upto the bed level is essential to control the river flow in its central part and to check the bank cutting. While calculating the mineral potentials, the mineral deposits lying in the sub-tributaries of that particular stream/river has not been taken into consideration. Since these mineral deposits are adding annually to the main river, the mineral deposits will be much more.

(Length x Width x Depth x Specific Gravity x 0.6)= X

Annual Replishment

The annual replishment of the material depends up on the discharge, grade of river and geology of catchment area. Based on the studies it is inferred/concluded that excavated area will fully

be replenished during single monsson. The replishment factor is taken to be 3-7 % of annual production.

The tonnage factor is the parameter that directly converts the volume of the mineral to the weight of the mineral. In the metric system, the tonnage factor is the specific gravity of the ore and the specific gravity is a function of the mineral composition of the ore. The most accurate method of determination of the specific gravity of the ore is to determine the average specific gravity of the individual mineral of the ore provided with the accurate relative percentages.

The relative percentage of minerals in the River System in the Chamba district is as below

Granite = 35 %

Quartzite = 20 %

Phyllite = 15 %

Limestone = 7 %

Dolomite = 10 %

Slate = 3 %

Therefore the total specific gravity of the mineral in the Chamba district is calculated by

Granite => 2.7 ×0.35 = 0.945

Quartzite => 2.8 × 0.20 = 0.560

Phyllite => 2.6 × 0.15 = 0.390

Limestone => 2.7 × 0.07 = 0.189

Dolomite => 2.7 × 0.10 = 0.270

Slate => 1.8 × 0.03 = 0.054

Total Specific Gravity = 2.4

The average height of the deposit in any mining spot is taken (i.e. 1 meter) by considering the annual replenishment factor.

7.7.2 Annual Replenishment Factor

Replenishment of river bed material takes place is the deposition of the sediments of different sizes carried by the stream. Many factors such as topography, soil type, bedrock type, climate and vegetation cover influence the input, output and transport of sediment and water in a drainage basin (Charlton; 2008). Sediment transport knowledge is important in river

restoration, ecosystem protection, navigation, watershed studies and reservoir management. These factors also influence the natural pattern and carrying capacity of water bodies (Twidale, 2004). Di-siltation (removal of .excess sand and stone from river bed) of the river helps to maintain the carrying capacity and provides protection from flooding during monsoon season. However, in the subsequent rainy season grain/particle size distribution analysis of bed load samples must be done to define the size composition of the material in transit.

The elevation of Shimla district ranges from 422 m to 6342 m above mean sea level with varied agro-climatic conditions. Geomorphologically the Shimla district can be broadly divided into two regions i.e. the Ravi Catchment area and the Chandra-Bhaga Catchment area which plays an important role in deciphering the sub-surface and surface hydrogeological conditions. On the basis of hydro-geomorphological and geological set-up, the study area can be divided into the following geomorphic units.

Chamba District in Himachal Pradesh, India, is characterized by diverse geomorphological features, shaped by its location in the north-western Himalayas. The landscape is rugged, marked by high mountain ranges, deep valleys, and various geomorphic processes. Here are the key geomorphological features of Chamba District:

1. Mountain Ranges

Dhauladhar Range: Forms the southern boundary of Chamba and acts as a prominent divide between the Chamba and Kangra districts. It rises steeply with peaks over 5,000 meters in height.

Pir Panjal Range: Another significant range, forming the northern boundary of Chamba, extends from the Ravi River basin to the Pangi Valley.

2. Valleys

Chamba Valley: A fertile, wide valley through which the Ravi River flows. It is known for its scenic beauty and agricultural activities.

Pangi Valley: A remote and rugged valley, located beyond the Pir Panjal range. It is a cold desert-like valley with difficult terrain and limited access.

Saach Pass and Other High Passes: The Saach Pass connects Chamba to the Pangi Valley and is located at an elevation of about 4,420 meters.

3. Rivers and Drainage Systems

Ravi River: The Ravi is the main river in Chamba, flowing through the district and creating a broad, well-defined valley. It originates from the Bara Bhangal region in the Himalayas.

Chandrabhaga (Chenab) River: Flows through the northern part of the district, contributing to the region's geomorphic development.

Other Streams: Numerous tributaries and streams like the Sal River, Saho River, and Tundah Nallah contribute to the area's drainage network.

4. Glaciers and Glaciated Landforms

Glacial Landscapes: The higher altitudes of Chamba experience significant glaciation, with glaciers like Chobia, Bhaga, and Miyar contributing to river systems.

Glacial Lakes: Lakes like Manimahesh Lake are prominent glacial features in the district, located in high-altitude areas.

Moraines: Deposits of glacial debris (moraines) can be found in the upper reaches of the valleys, indicating past glaciation.

5. Karst Topography

Limestone and Karst Features: Some areas of Chamba exhibit karst landscapes due to the presence of limestone, leading to features like caves and sinkholes.

6. Hanging Valleys and Steep Cliffs

Hanging Valleys: These are valleys that end abruptly and are often marked by waterfalls, common in glaciated regions of Chamba.

Steep Cliffs: The steep terrain creates numerous cliffs and escarpments, contributing to the dramatic landscape.

7. Landslide-Prone Zones

Chamba is prone to landslides due to the steep slopes, heavy monsoonal rainfall, and tectonic activity. These landslides shape the landscape by creating terraces and disrupting drainage patterns.

8. Tectonic Features

The district lies in a tectonically active region of the Himalayas, with fault lines and zones of crustal deformation contributing to frequent earthquakes. This tectonic activity influences the rugged topography and seismic hazards in the area.

9. Fluvial Landforms

River Terraces: Along the rivers, especially the Ravi, one can find river terraces formed by the downcutting of the rivers over time.

Alluvial Plains: Limited in extent, alluvial plains occur in lower valleys where river sediments are deposited.

10. Forests and Vegetation

The geomorphology influences the vegetation patterns, with dense forests covering much of the lower and middle ranges, and alpine meadows occurring at higher elevations.

These features combine to make Chamba District a region of significant geomorphological interest, shaped by both natural forces like rivers, glaciers, and tectonic movements, as well as human activities.

Sedimentation in any river is dependent on sediment yield which depends on erosional factors in the river's catchment area. Annual replenishment is based on the location of the depositional spot in the river bed, meandering of the river, geology, weathering conditions and height of the rainfall in the area. The annual replenishment is determined here by the average of the various heights of deposition per year in a specific location.

The Sediment load deposition in a river is dependent on the catchment area, weathering index of the various rock types of the catchment area, land-use pattern of the area, rainfall data and grain size distribution of the sediments. Again, the sediment load estimation is not a dependent variable of the district boundary, but it largely depends upon the aerial extents of the catchment areas, which cross the district and state boundaries.

7.8 Mineral Deposits due to heavy floods in the Rivers

Himachal Pradesh witnessed severe monsoon seasons every year characterized by massive landslides, slope failures, rockfalls, cloudbursts, and flash floods. This monsoon has been unusually intense, with most areas experiencing significantly higher rainfall than the average. The continuous heavy rainfall reduced the land's moisture retention capacity to its minimum level, while the water levels of the rivers reached all-time high flood levels in the various rivers like Ravi, Chandra-Bhaga and its tributaries. The river beds of the various rivers are very wide and change in river course is a natural phenomenon during floods. The formation of islands due to heavy deposition which is up to 3-4 meters in height, has been a dominant factor for river course changes. In many places, the river course change has been seen at the point of confluence too wherein the primary factor is the deposit of huge debris and boulders by the tributary stream.

8.0 General Profile Of The District

8.1 Introduction

Chamba is one of the northernmost districts of Himachal Pradesh, India, known for its rich cultural heritage, scenic landscapes, and rugged terrain. District Chamba lies between 32° 11' and 33° 13' North latitude, and 75° 49' and 77° 03' East longitude. It is bounded by Jammu and Kashmir to the north-west, Lahaul and Spiti to the east, Kangra and Mandi to the south-east, and the Dhauladhar and Pir Panjal mountain ranges forming its natural boundaries. Area

of district is approximately 6,522 square kilometers, making it one of the larger districts in Himachal Pradesh.

The district is predominantly mountainous, with elevations ranging from about 2,000 meters to over 6,000 meters above sea level. Major mountain ranges include the Dhauladhar Range and Pir Panjal Range. The district is crisscrossed by several rivers, most notably the Ravi, Chenab (Chandrabhaga), and Sal rivers. Due to its altitude range, Chamba experiences a variety of climatic conditions. Lower areas have a sub-tropical climate with warm summers and mild winters. In contrast, higher Altitudes experience a temperate to alpine climate, with heavy snowfall in the winter months. In monsoon season, the district receives moderate to heavy rainfall during the monsoon (June to September), contributing to the region's agriculture and natural beauty.

As per the 2011 Census of India, Chamba had a population of approximately 519,080. The population density is around 79 persons per square kilometer, making it a sparsely populated region. Most of the population resides in rural areas, with agriculture being a dominant livelihood. The official language is Hindi, though Chambeali (a dialect of Dogri), Gaddi, and Pangwali are widely spoken in different parts of the district. The population consists of a blend of Hindus, Muslims, Sikhs, and Buddhists. Tribes like Gaddis and Pangwals dominate the upper mountain areas.

The majority of the population is engaged in agriculture and horticulture, growing crops like maize, wheat, barley, pulses, and rice. Apple and other fruits are grown in higher altitudes. Sheep and goats are commonly reared, particularly by the Gaddi tribe in the upper areas. Tourism is a major contributor to the local economy, thanks to scenic spots, religious pilgrimage sites, and adventure activities. Chamba is also famous for its unique handicrafts like Chamba Rumals (embroidered handkerchiefs), Chamba Chappals (leather sandals), and metal crafts.

The district has significant potential for hydropower generation, with several operational and under-construction projects on its rivers. The town of Chamba serves as the administrative capital of the district. The district is divided into seven sub-divisions — Chamba, Bharmour, Pangi, Salooni, Tissa, Dalhousie, and Bhalai. The district has several tehsils, each with smaller administrative units (villages and panchayats) under them.

Chamba is known for its ancient temples, especially dedicated to Lord Shiva and Vishnu. The Lakshmi Narayan Temple, Manimahesh Lake, and Bhuri Singh Museum are notable attractions. The Minjar Fair, held annually, is one of the most significant festivals in Chamba. The Manimahesh Yatra is a pilgrimage trek to the sacred Manimahesh Lake, attracting devotees from all over India.

District Profile

Table: Demographic Profile-table

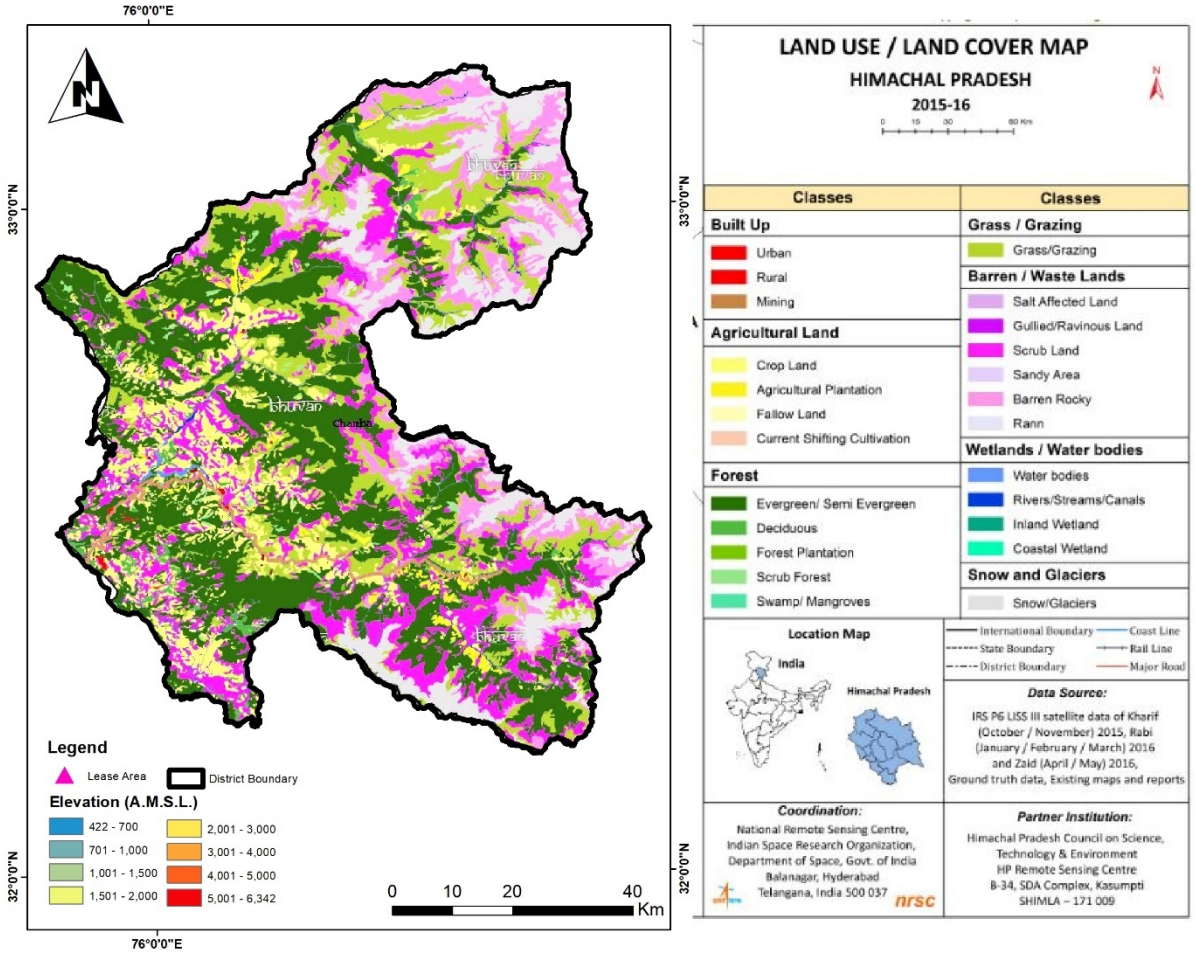
Area	6522 sq,kms
Area (out of total area) of H.P.	11.71 %
Sub-Divisions	Total = 7 Chamba, Bharmour, Pangi, Salooni, Tissa, Dalhousie & Bhalai.
Tehsils	Total = 10 Chamba, Bharmour, Pangi, Salooni, Dalhousie, Bhalai, Churah, Sihunta, Bhattiyat & Holi
Population (Census 2011)	5,19,080
No. of Male	2,61,320
No. of Female	2,57,760
No. S.C. Population	144,043
No. S.T. Population	130,549
Population density	80
Population growth	12.58%
Literacy Rate	73.19%
Male literacy	83.03%
Female literacy	62.14%

b. Administrative Profile-table-

No. of Sub-division	6
No. of Development Blocks	7
No. of Tehsil	10
No. of Sub- Tehsil	7
No. Zila Parishad	01
No. of Panchayats Samities	8
No. of Panchayat	270
No. of Villages	1591

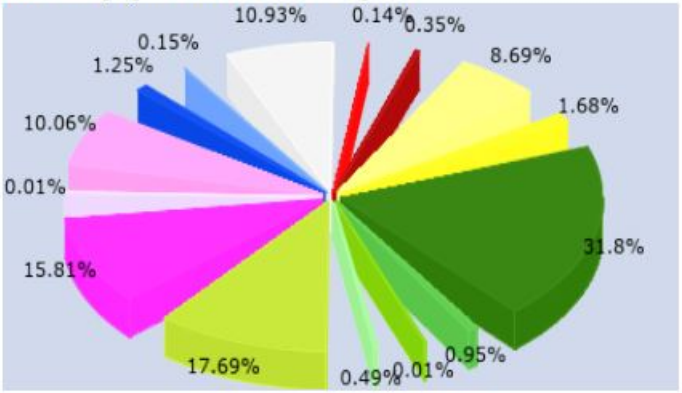
9. Land Utilization Pattern In The District: Forest, Agriculture, Horticulture, Mining Etc.

The economy of Chamba district is predominately agrarian as most of the population is dependent on agriculture and activities allied to it for earning their livelihood. The moisture retention capacity of the area is poor due mainly to the fact the bedrock are argillaceous and the land the uneven. The crops usually face moisture stress during the remaining period of the year due to inadequate and irregular rainfall. The irrigation facilities are provided by lifting water from streams, shallow dug wells and medium to deep tube wells in the valley area.



Land Use Land Cover Map of Chamba District

LULC Information (2015-16) for Chamba
Total Geographical Area : 6528 Sq. Km



LULC Class	Area (Sq.Km)	LULC Class	Area (Sq.Km)
Builtup,Urban	9.18	Builtup,Rural	22.57
Agriculture,Crop land	567.25	Agriculture,Plantation	109.45
Forest,Evergreen/ Semi evergreen	2075.82	Forest,Deciduous	62.06
Forest,Forest Plantation	0.77	Forest,Scrub Forest	31.89
Grass/Grazing	1154.91	Barren/unculturable/ Wastelands, Scrub land	1032.35
Barren/unculturable/ Wastelands, Sandy area	0.77	Barren/unculturable/ Wastelands, Barren rocky	656.85
Wetlands/Water Bodies, River/Stream/canals	81.3	Wetlands/Water Bodies, Reservoir/Lakes/Ponds	9.55
Snow and Glacier	713.26		

Land Use Land Cover Statistics of District Chamba

9.1 Agriculture

Being a hilly district, there is more pressure on land than in plains as most of the geographical area forms snow-clad mountain ranges, passes, river gorges terrains that can be judged from the per cent changes in the land use pattern over the years. It can be visualized that most of the geographical area of the district (around 80 per cent) is under forests and pastures. The cultivated area accounted for about 14 per cent of the reported area and about 11 per cent of the total geographical area (District Abstract, Government of Himachal Pradesh 1998-2007). There has been an increase in the area under forests in the Chamba district due to recent reporting of more geographical areas. There is an increase in the land put under non-agricultural uses like roads, buildings, water reservoirs, etc, due to the burgeoning need for infrastructure and overhead facilities for economic development in the state. The limited availability of cultivable land is the basic feature of hill geography. The proportion of cultivable areas declines drastically from low hills Shivalik range to high mountain alpine range. There has also been a decrease in the culturable wasteland that might be due to allotment to landless farmers at the state level, maize and wheat are the two predominant crops accounting for 29

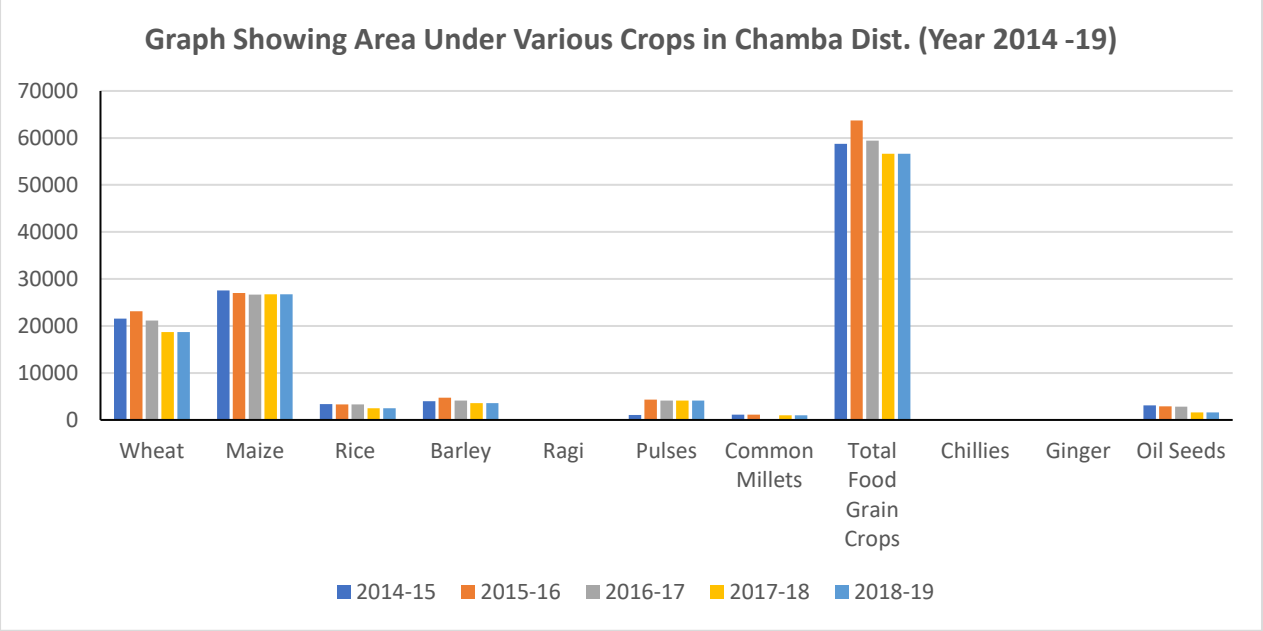
per cent and 36 per cent of the cropped area The area under maize and wheat increased over the years in the Chamba district. The area under paddy decreased in the Chamba district due to the allocation of more irrigated areas to vegetable crops, The area under barley also has declined considerably, showing the marginalization of these crops in hill farming.

The scenario of crop production in the Chamba district revealed that like area, the production of maize and wheat was recorded ups and down. The production of barley and pulses declined considerably in the district showing that these crops were fast losing relevance in hill farming though these crops were important from point of view of consumption and demand which presently is met mostly through imports from other states. The yields of maize and paddy increased but showed unpredictable and uncertain changes over the years in the district. Contrary to this, the yields of barley and pulses did not reveal any breakthrough. The combined yield of all food grains showed a marked increase during these two triennium periods.

Table: Showing Agriculture Area Under Major Crops, District, Chamba (2014-19)

Area in Hectares											
Year	**Wheat**	**Maize**	**Rice**	**Barley**	**Ragi**	**Pulses**	**Common Millets**	**Total Food Grain Crops**	**Chillies**	**Ginger**	**Oil Seeds**
2014-15	21589	27580	3355	3978	19	1082	1151	58754	31	4	3068
2015-16	23139	27040	3325	4734	16	4318	1119	63691	37	2	2922
2016-17	21155	26648	3310	4106	16	4118	101	59454	45	4	2831
2017-18	18678	26750	2491	3591	5	4105	987	56607	50	5	1614
2018-19	18678	26750	2491	3591	5	4105	987	56607	50	5	1614

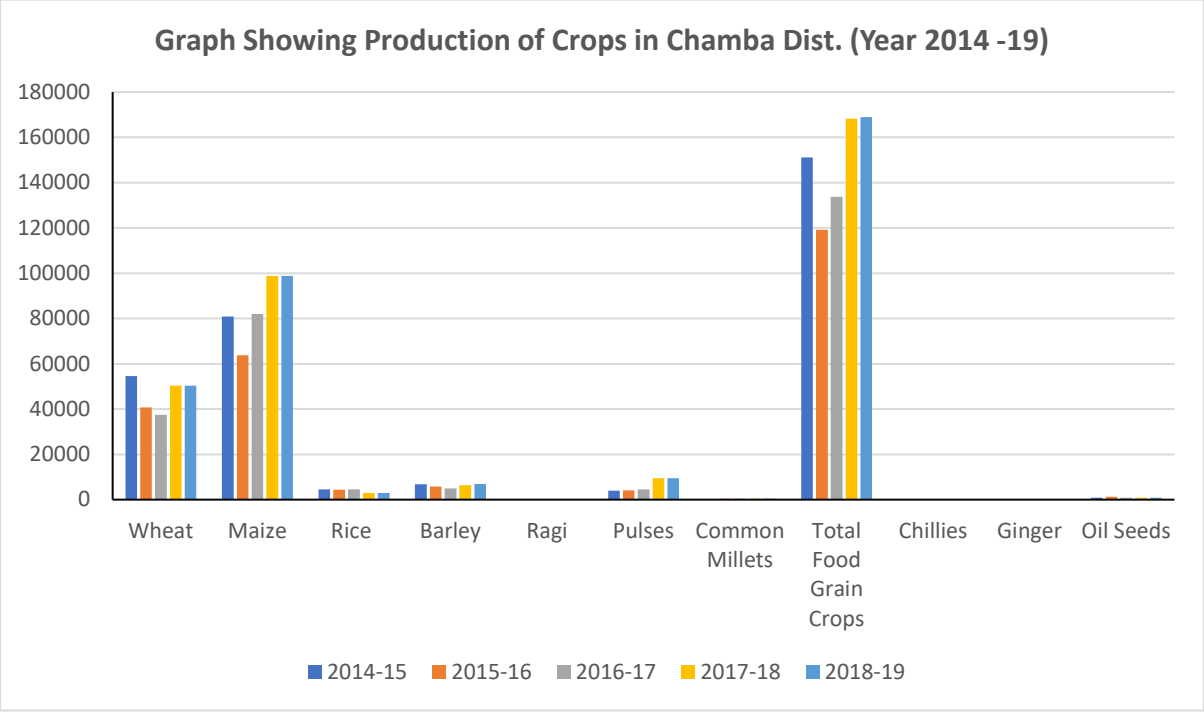
Source: Directorate of Land Records, HP



Graph Showing area under Major Crops in Chamba District (2014-19)

Table: Showing Production of Major Crops, District, Chamba (2014-19)

Production in Tonnes											
Year	Wheat	Maize	Rice	Barley	Ragi	Pulses	Common Millets	Total Food Grain Crops	Chillies	Ginger	Oil Seeds
2014-15	54512	80945	4540	6774	13	3966	347	151097	8	28	907
2015-16	40781	63811	4340	5765	11	4137	367	119212	10	14	1251
2016-17	37468	81969	4470	4956	11	4537	367	133778	13	28	877
2017-18	50277	98789	2999	6339	4	9485	421	168314	21	31	797
2018-19	50277	98789	2999	6939	4	9487	421	168916	21	31	797

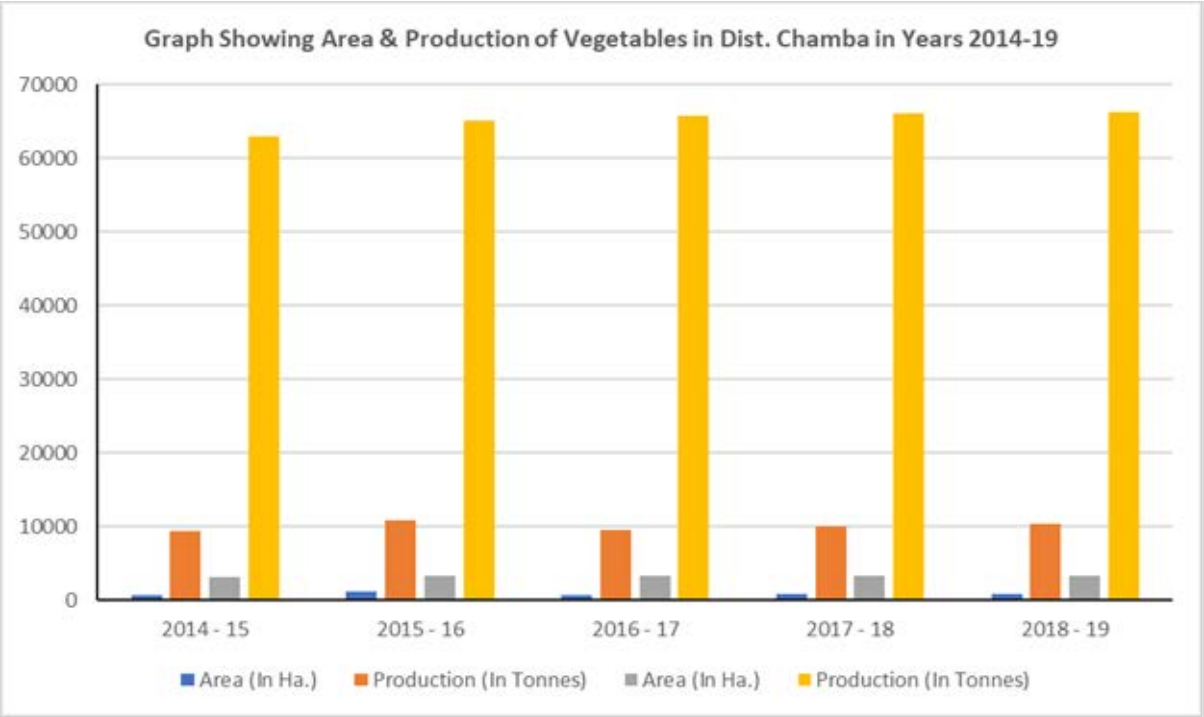


Graph Showing production of Major crops in Chamba District (2014-19)

Table: Showing Area in Hects Under & Production In Tonnes of Vegetables

Area & Production of Vegetables in tonnes				
	Potato		Other Vagetables	
Year	Area (In Ha.)	Production (In Tonnes)	Area (In Ha.)	Production (In Tonnes)
2014 - 15	650	9340	3161	63086
2015 - 16	1100	10880	3225	65086
2016 - 17	750	9460	3346	65794
2017 - 18	800	10000	3375	66199
2018 - 19	806	10412	3384	66332

Source: Directorate of Land Records, HP



Graph Showing Area in Ha & Production in Tonnes Of Vegetables in District Chamba (2014-19)

9.2 Horticulture

The topography and agro-climatic conditions of the district are quite suitable for the productions of various fruits. The topography of the district can be grouped into three categories namely High hill areas located at the higher elevation mid hill areas and low-lying valley areas Fruits of various kinds depending upon the terrain climatic condition and soil are grown in the district. The Main horticulture produce of the area can be classified into four categories

1 Citrus Fruits

2 Sub-tropical Fruits

3 Nuts and dry fruits

4 Other temperate fruits

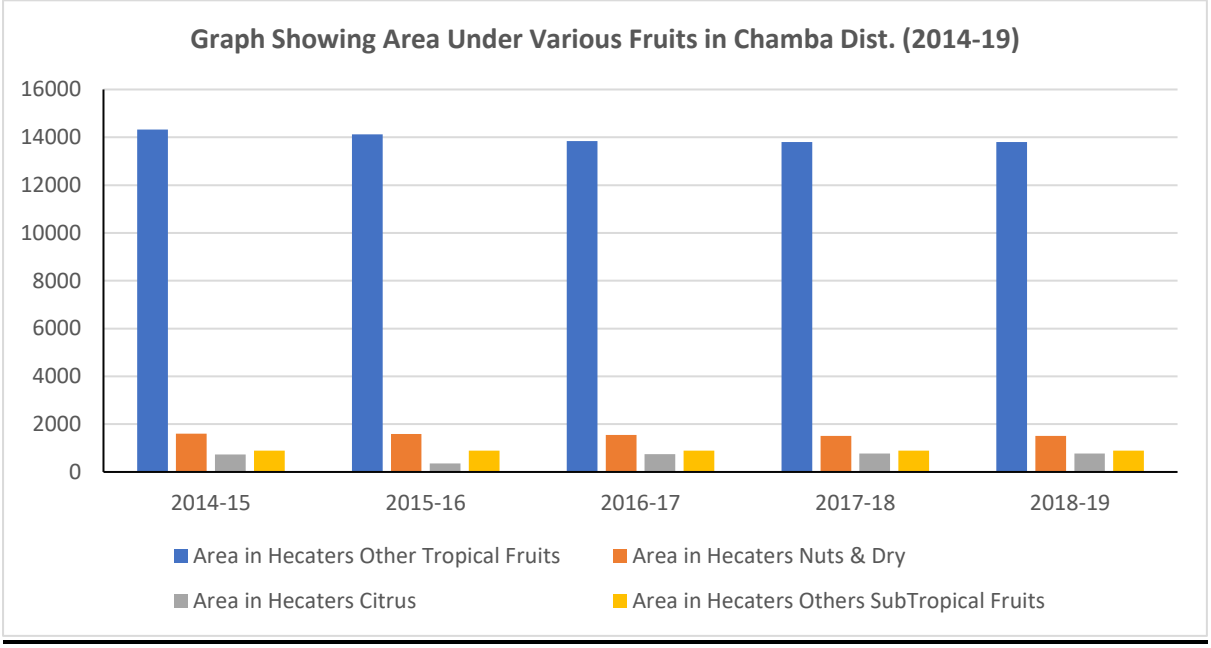
The following table shows the area under cultivations of each fruit in district Kangra.

The area under each fruit and percentage area to total district area as well as the percentage of the area under fruit in each category is given in the table below. The table also shows the production of each fruit in district Solan. Also, the tables below show the area covered under each category and the total production as per survey.

Table: Showing Area under each fruit In Distt Chamba (2014-2019)

Area in Heaters					
Year	Other Tropical Fruits	Nuts & Dry	Citrus	Others Sub-Tropical Fruits	Total Area
2014-15	14322	1606	732	889	17549
2015-16	14129	1583	360	896	16968
2016-17	13844	1553	742	896	17035
2017-18	13803	1513	766	892	16974
2018-19	13803	1513	766	892	16974

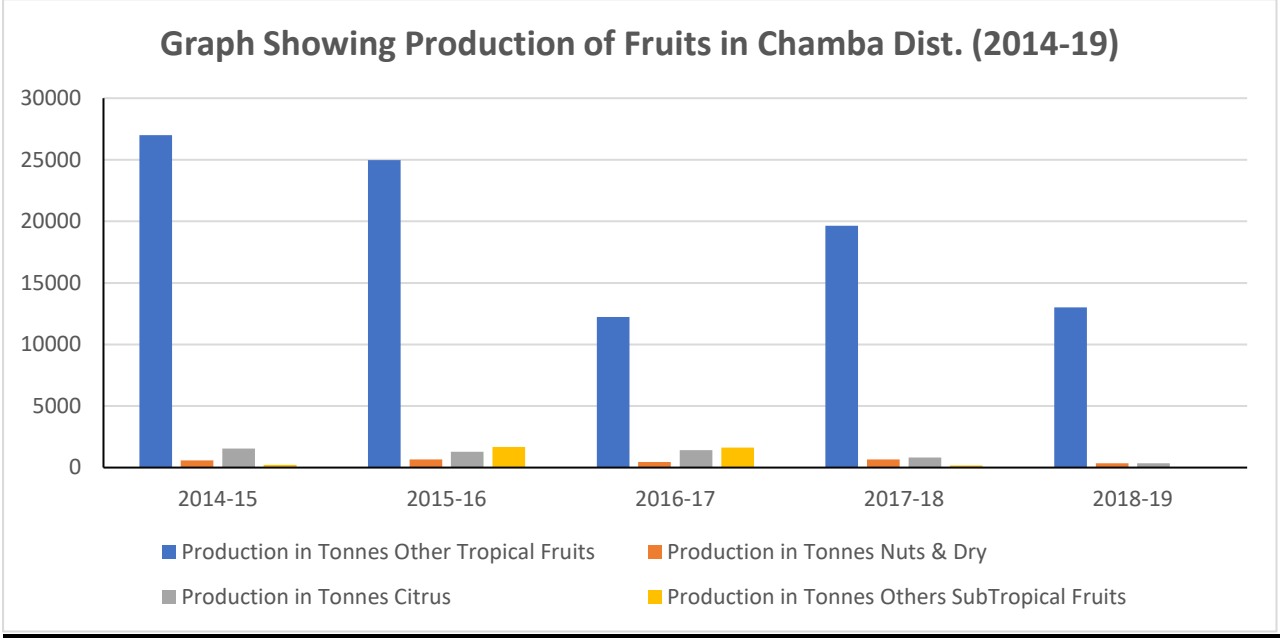
Source: Directorate of Horticulture, HP



Graph Showing Area Under Various Fruits in Chamba Dist. (2014-19)

Table Showing Production of each fruit In Distt Chamba (2014-2019)

Production in Tonnes					
Year	Other Tropical Fruits	Nuts & Dry	Citrus	Others Sub-Tropical Fruits	Total Area
2014-15	27007	577	1535	219	29338
2015-16	24981	668	1290	1670	28609
2016-17	12239	457	1424	1623	15743
2017-18	19647	653	811	174	21285
2018-19	13018	361	338	48	13765



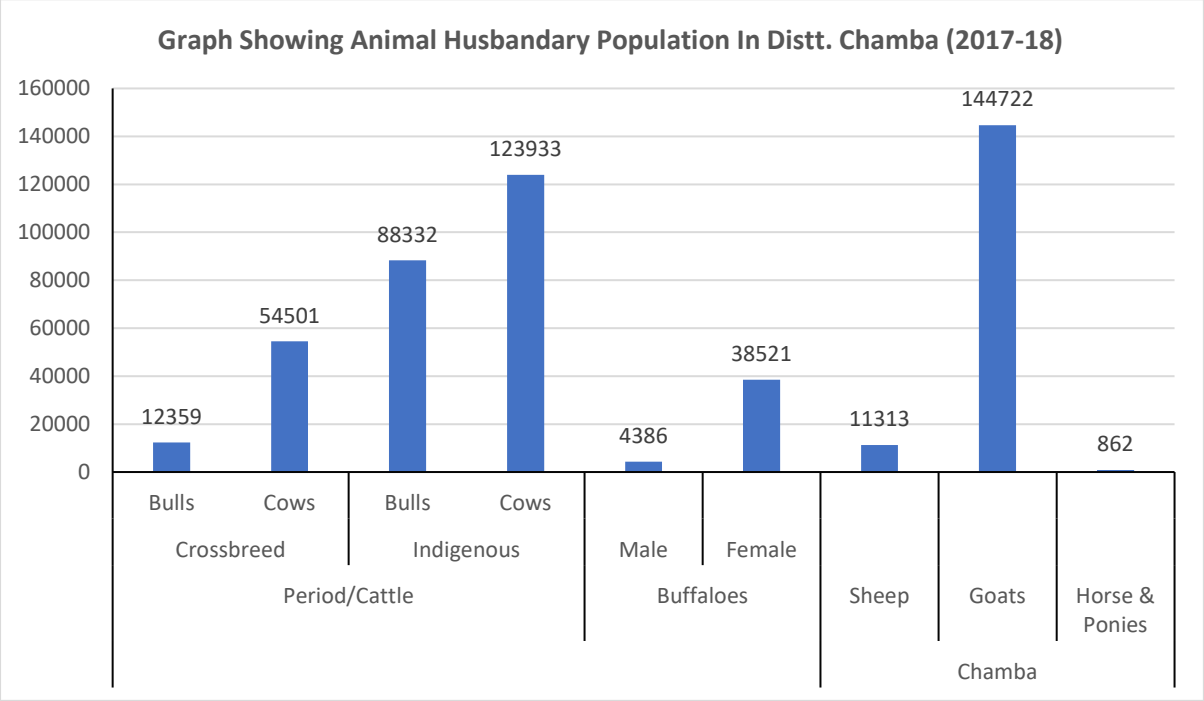
Graph Showing Production of Various Fruits in Chamba Dist. (2014-19)

9.3 Animal Husbandry

Animal husbandry plays a very important role in the lives of farmers. They depend upon animals to sustain their day-to-day lives. Large numbers of farmers have adopted animal husbandry as a livelihood activity along with agriculture and horticulture. The animals reared by the farmers are mainly for milk, farm yard manure, and meat purposes. Most of the farmers rear animals for milk production which is mainly used for self-consumption. The livestock kept by the farmers includes cows (local and Jersey) buffaloes, goats and bullocks, etc. Most of the animals are indigenous (local breed) having very low milking capacity.

Table Showing Animal Husbandry Population Chamba District-2017-18

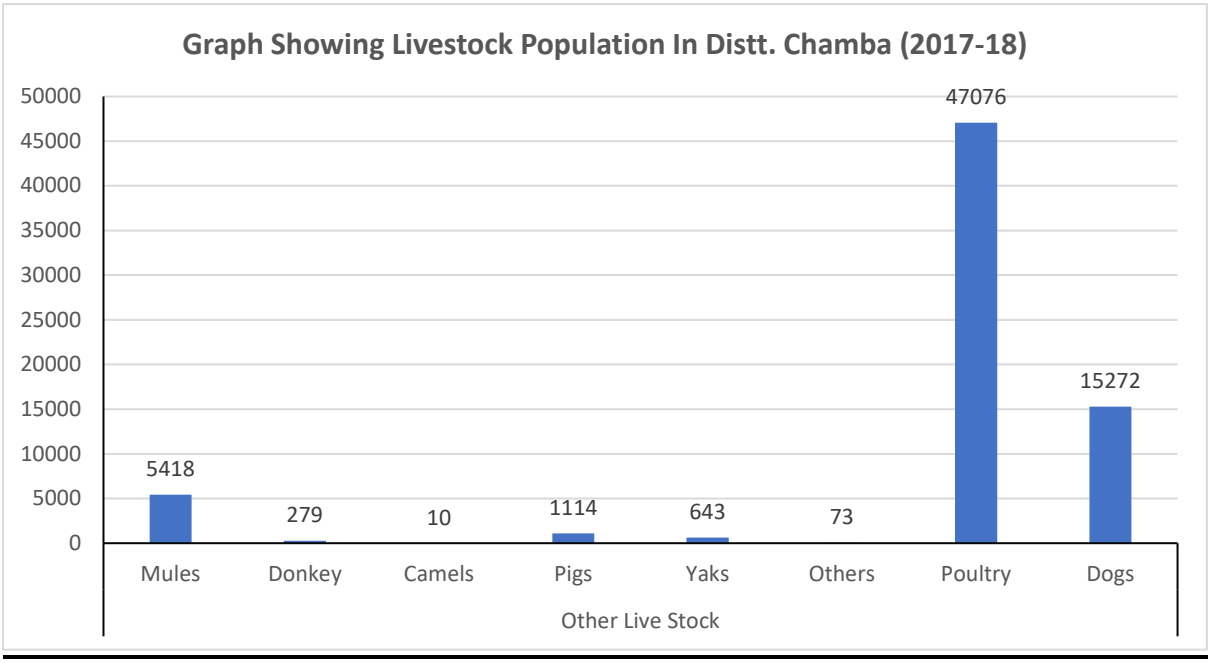
Animal Husbandry Population in District							Chamba		
Year	Period/Cattle				Buffaloes		Sheep	Goats	Horse & Ponies
	Crossbreed		Indigenous		Male	Female			
	Bulls	Cows	Bulls	Cows					
2012	12359	54501	88332	123933	4386	38521	11313	144722	862



Graph Showing Animal Husbandry Population Kangra District-2017-18

Table Showing Livestock Population in Chamba District

Other Live Stock							
Mules	**Donkey**	**Camels**	**Pigs**	**Yaks**	**Others**	**Poultry**	**Dogs**
5418	279	10	1114	643	73	47076	15272



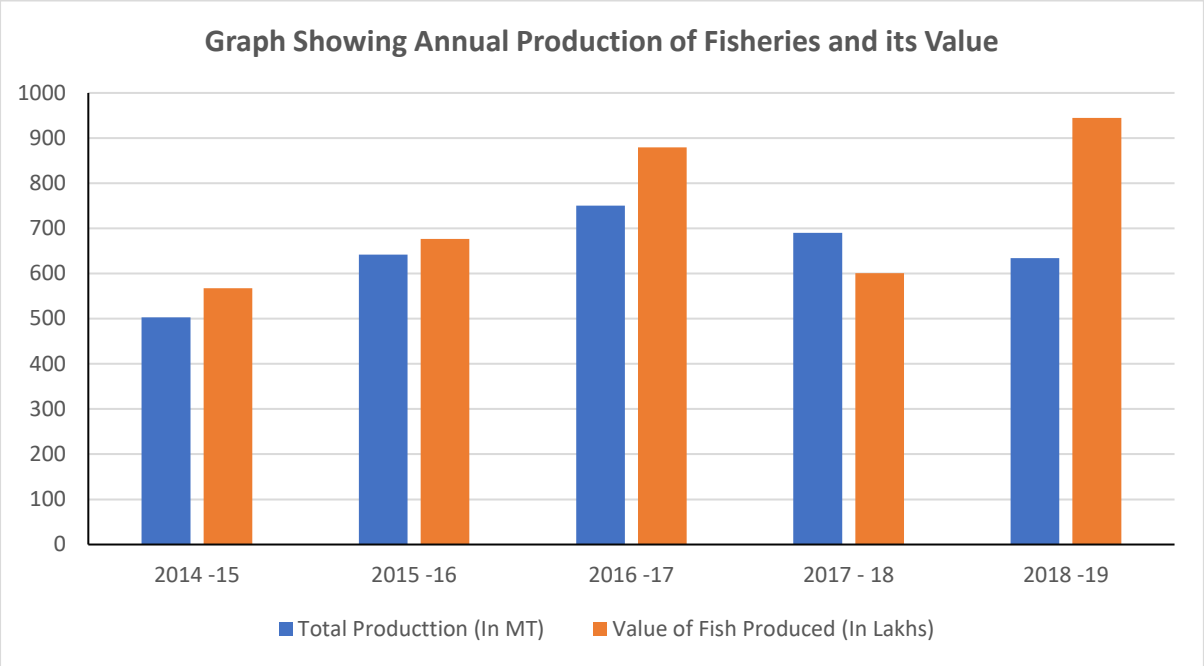
Graph Showing Livestock Population, Chamba District-2017-18

9.4 Fisheries

Fisheries play an important role in the rural economy by augmenting food supply, generating employment and raising the nutritional contents of food. Fish are abundant in rivers and perennial streams. Riverine are the main source of fish production and constitute 93.2 per cent of the total fish production. Since 1995 fisheries production in Chamba increased at the rate of 0.43 per cent per year. The production from reservoirs, riverine and ponds increased at the rate of 0.09, 17.38 and 7.91 per cent per annum respectively. There is scope to introduce the cold-water fish culture at certain places where river Ravi flow is mild in the valley area. There is also scope for rearing trout that can be sold at a premium price. The production of trout was 0.200 M.T. in the year 2001 which increased to 1.20 M.T. in the year 2007 showing an increasing rate of growth of 24.20 per cent per annum. Although pisciculture is a non-traditional activity, yet depletion of fish in rivers and increasing market demands have forced the Government as well as farmers to think along these lines. There is a vast scope of fishery development in the district.

Table Showing Years Wise Production of fish and its Value in Lakhs

Year	Total Production (In MT)	Value of Fish Produced (In Lakhs)
2014 -15	502.73	567.26
2015 -16	641.83	676.8
2016 -17	750.26	879.72
2017 - 18	690.24	600.74
2018 -19	634.49	944.34



Graph Showing Years Wise Production of fish and its Value in Lakhs

9.5 ***Forest***

Because of its complex geography and its great variations in altitude, Chamba is home to an enormous range of species, which span the subtropical to the alpine. The common trees in the Chamba hills belong to the conifer species (deodar, pine, spruce, fir). Several species of medicinal plants like Hath Panja (Dactylorhizahatageria) and Brahma Kamal (Saussureaobvallata) grow luxuriously in the valley. The valley is known for the presence of the majestic snow leopard, the Himalayan brown bear and the Himalayan Tahr. The Western Tragopan (the state bird of Himachal Pradesh) and the Monal pheasant are the prominent bird species found in the region.

Flora

Species/ Botanical Name	Common Name	Elevation Range (m)
Abies spectabilis (D.Don.) Mirbel	Himalayan high-altitude fir	3,000-4,000
Abies pindrowRoyle	Silver fir/ Tosh	2,500-3,200
Acer acuminatum Wall. ex D.Don.	Maple	2,500-3,200
Acer caesium Wall. ex Brandis	Maple	2,200-3,000
Aesculus indica Kk. f. & Th.	Horse chestnut/ Khnor	1,800-3,000
Alnus nepalensis D. Don.	Alder	1,500-2,000
Betula utilis D. Don.	Birch/ Bhojpatra	3,000-4,000
Buxus wallichianaBaillon	Boxwood/ Shamshad	2,500-3,000
Cedrus deodara G. Don.	Deodar/ Cedar	2,000-3,000
Cornus capitata Wall.	Dogwood	1,800-2,800
Corylus jacquemontiiDecne.	Hazelnut/ Bhutibadam	2,500-3,200
Cupressus torulosaD.Don.	Pencil cedar	1,800-3,000
Ilex dipyrena Wall.	Holly/ Kaluchha	2,000-2,800

Shrubs

Species	Altitude (m)
Aconitum heterophyllum Wall. ex Royle	3,300-4,200
Atropa acuminata Royle	1,500-3,000
Dactylorhizahatageria (D. Don.) Soo	2,800-4,000
Jurineamacrocephala (DC.) Benth.	3,000-4,300
Meconopsis aculeata Royle	3000-4,300
PicrorhizakurroaRoyle ex Benth.	3,200-4,200

SaussureagossipiphoraD.Don	3,800-4,500
Angelica glauca Edgew.	2,000-2,800
Arnebiabenthami (Wall. ex G. Don) I. M. Johnston	3,300-4,000
Arnebiaeuchroma (Royle) Johnston	3,500-4,400
Berberis aristata DC.	1,200-1,500
Betula utilis D.Don.	3,300-4,000
Dioscoreadeltoidea Wall.	2,000-3,000
Fritillaria roylei Hook.	2,800-4,000
Malaxismuscifera Lind.	2,000-3,000
Nardostachys grandiflora DC.	3,600-4,300
Paris polyphylla Smith	2,000-3,000
Podophyllum hexandrumRoyle	2,400-4,000
PolygonatumcirrhifoliumRoyle	1,500-3,000
Polygonatummultiflorum (L.) All	2,500-3,500
Polygonatumverticillatum (L.) All.	1,500-3,300
Saussureaobvallata (DC.) Edgew.	3,600-4,500
Taxus wallichianaZucc.	2,100-3,300
Zanthoxylum armatum DC.	1,200-1,800
Aconitum violaceum Jacq. ex Stapf	3,300-4,200
Ephedra gerardiana Wall. ex Stapf.	3,300-4,500
Hypericum perforatum L.	2,000-3,000
Juniperus communis L.	2,800-4,000
Rheum australe D. Don	3,000-4,200
Rheum webbianumRoyle	3,000-4,000
Roscoea alpine Royle	2,400-3,500
Roscoeaprocera Wall. ex Bak.	2,000-3,000
Selinumconnifolium	2,500-3,500
Selinumvaginatum Clarke	2,500-3,500
SkimmialaureolaSieb. &Zucc.	2,200-3,200
Symplocospaniculata (Thumb.) Miq.	1,500-2,500

Fauna

Common Name	Scientific Name
Asiatic Black Bear	*Ursus thibetanus*
Blue Sheep	*Pseudoisnayaur*
Common Leopard	*Panthera pardus*
Himalayan Brown Bear	*Ursus arctos*
Himalayan Ghoral	*Naemorhedus goral*
Himalayan Musk Deer	*Moschus chrysogaster*
Himalayan Tahr	*Hemitragusjemlahicus*
Red Fox	*Vulpes vulpes*
Serow	*Nemorhaedussumtraensis*
Snow Leopard	*Uncia uncia*

Birds

Little Forktail,

Crested Kingfisher, m)

Blue Whistling Thrush,

Western Tragopan Male

Monal Male

Koklash Pheasant (Male)

White-crested Kaleej

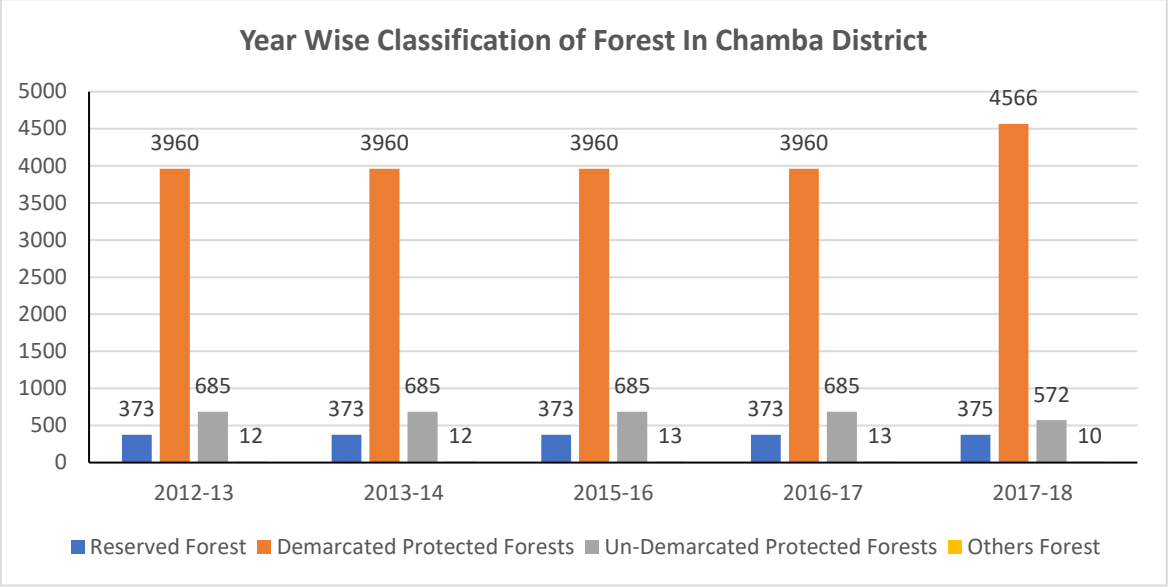
Insects

Blue Pansy, Junoniaoenone

The Paris Peacock, Papilioparis

Table Year Wise Classification of Forest in Chamba District

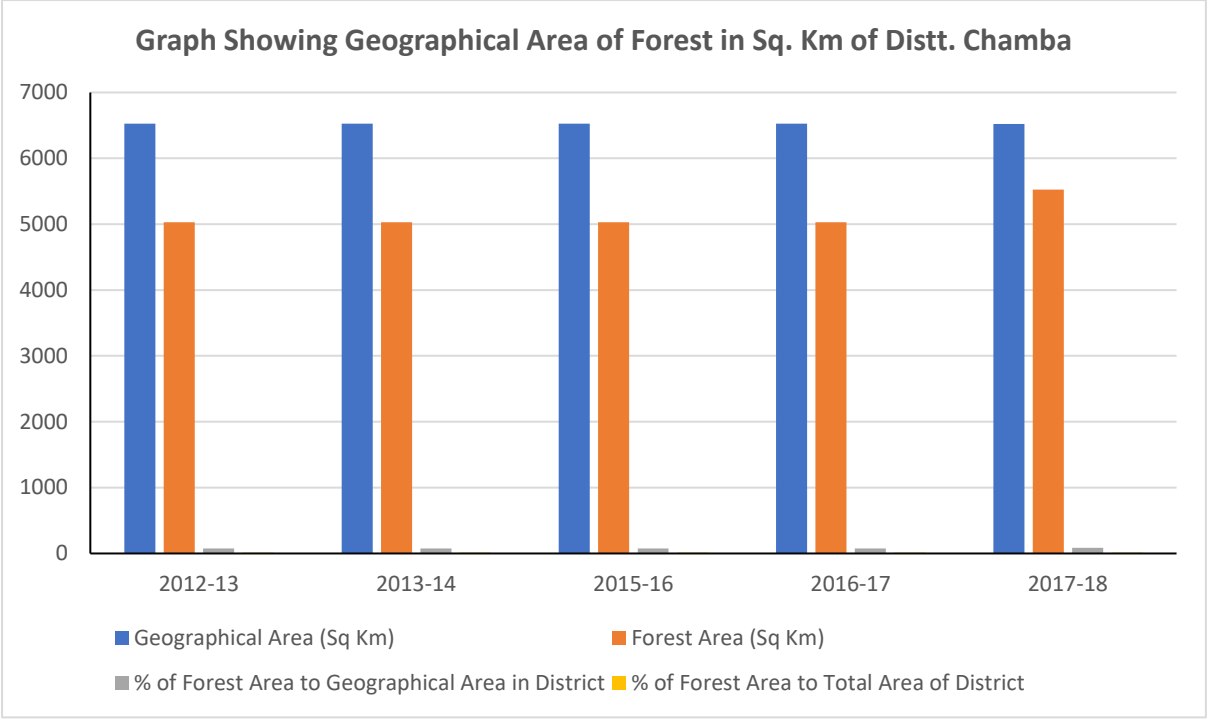
Year	Reserved Forest	Demarcated Protected Forests	Un-Demarcated Protected Forests	Others Forest	Total
2012-13	373	3960	685	12	5030
2013-14	373	3960	685	12	5030
2015-16	373	3960	685	13	5031
2016-17	373	3960	685	13	5031
2017-18	375	4566	572	10	5523



Graph Showing Year Wise Classification of Forest in Chamba District

Table Showing Geographical Area of Forest in Sq. Km of Distt. Chamba

Year	Geographical Area (Sq Km)	Forest Area (Sq Km)	% of Forest Area to Geographical Area in District	% of Forest Area to Total Area of District
2012-13	6528	5030	77.05	13.6
2013-14	6528	5030	77.05	13.6
2015-16	6528	5031	77.07	13.6
2016-17	6528	5031	77.07	13.6
2017-18	6522	5523	84.68	14.55



Graph Showing Geographical Area of Forest in Sq. Km of Distt. Chamba

10. Physiography Of The District

Physiographically, the entire Chamba District is mountainous with altitude ranging from 422 meters to 6342 meters above mean sea level. However, the habitation is found only up to 3000 meters. The district is part of the Northern Himachal Pradesh Himalaya. It lies between latitudes ranging from 32º10'N to 33º12'N and longitudes ranging from 75º47'E to 76º52'E. The district is bounded by Punjab state in the south-west, on the south and south-east by Kangra district and Lahul-Spiti encloses it from north-east to east. According to the Surveyor General of India, the total area of the district is 6,522 Sq. Km and ranks 2nd in terms of the area, occupying 11.7 percent of the total area of the state. There are tree big valleys i.e., i) Beas Valley ii) Ravi Valley iii) Chenab Valley. The valleys in the south-west of the district are fertile. The Ravi of the Chamba valley, as a whole is tolerably open and presents many delightful contrasts. In the lower areas of the valley, the vegetation is semi-tropical and at the higher elevation the tree belonging Pinus longfila, Oak and Chest nut are found and above these there are brich and Juniper. In this valley the villages are diminutive. In the villages up to an altitude of 2100 meters two crops are grown whereas, in the higher reaches only one crop is grown all-round the year. The main rivers of the district are Ravi, Budhil, Siul, and Tundah and the main glacier of the district is Tantgari glacier. The southern part of Chamba district is dominated by the Dhauladhar Range, which forms a natural boundary with the Kangra district. These snow-capped peaks rise to considerable heights and provide a stunning backdrop to the landscape of Chamba. The northern part of the district is flanked by the Zanskar Range, adding to the rugged beauty of the region. The Pangi Valley, located to the northwest of Chamba, is another prominent valley known for its remoteness and natural beauty. Plateaus like the Sach Pass region are part of the district's terrain. The higher altitudes of Chamba district are adorned with glaciers and high-altitude lakes. These glaciers feed the rivers and maintain the ecological balance of the region. Some of the notable lakes include the Manimahesh Lake, Khajjiar Lake, and the Suraj Tal, which add to the serene landscape and attract tourists and pilgrims alike. In conclusion, Chamba district, Himachal Pradesh, is a land of immense natural beauty and geographical diversity. Its snow-capped mountains, lush valleys, gushing rivers, and serene lakes make it a paradise for nature lovers and adventure enthusiasts. The region's physiography plays a vital role in shaping its unique cultural heritage and contributes to its importance as a popular tourist destination in Himachal Pradesh.

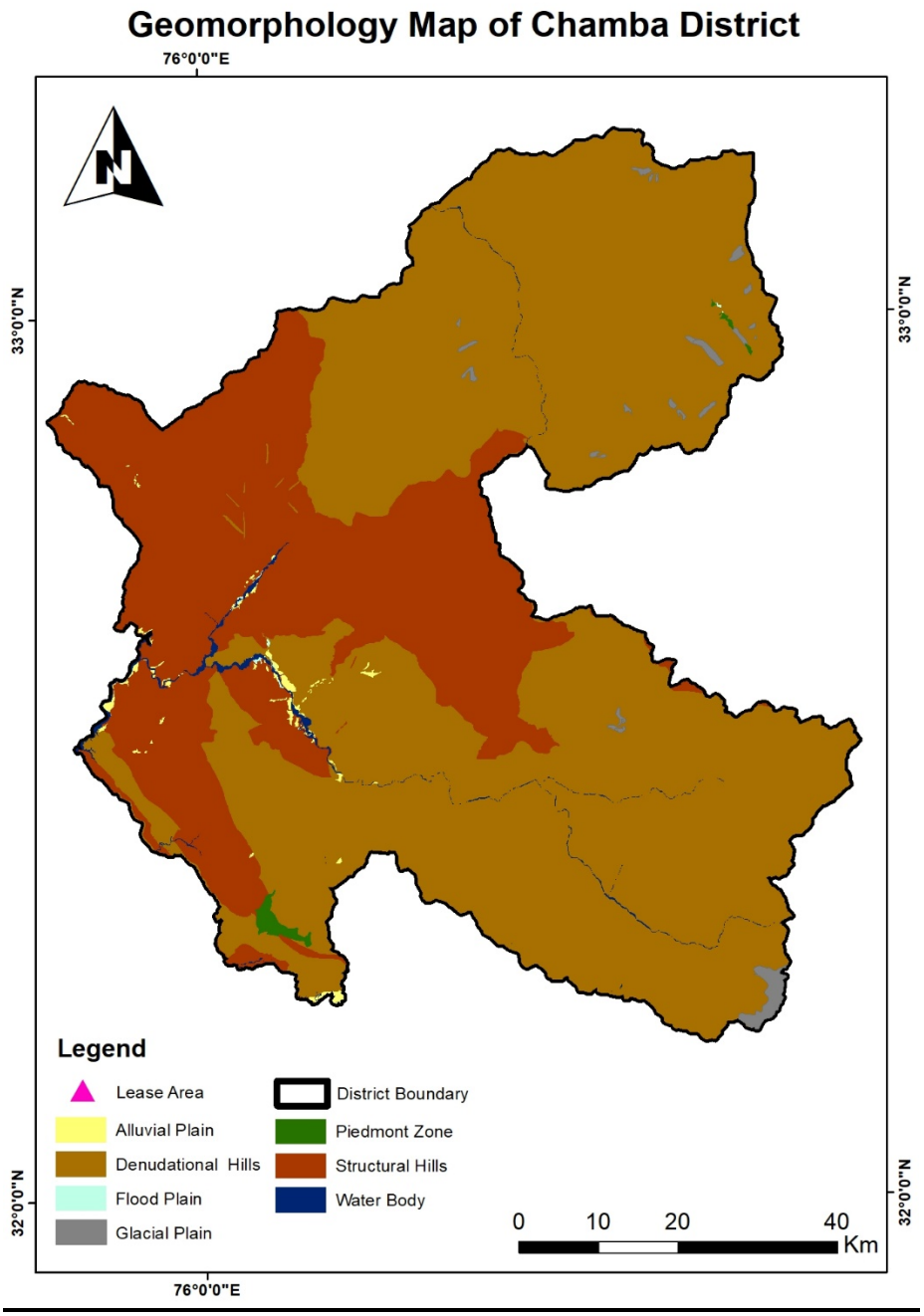


Image Showing Physiography of the District

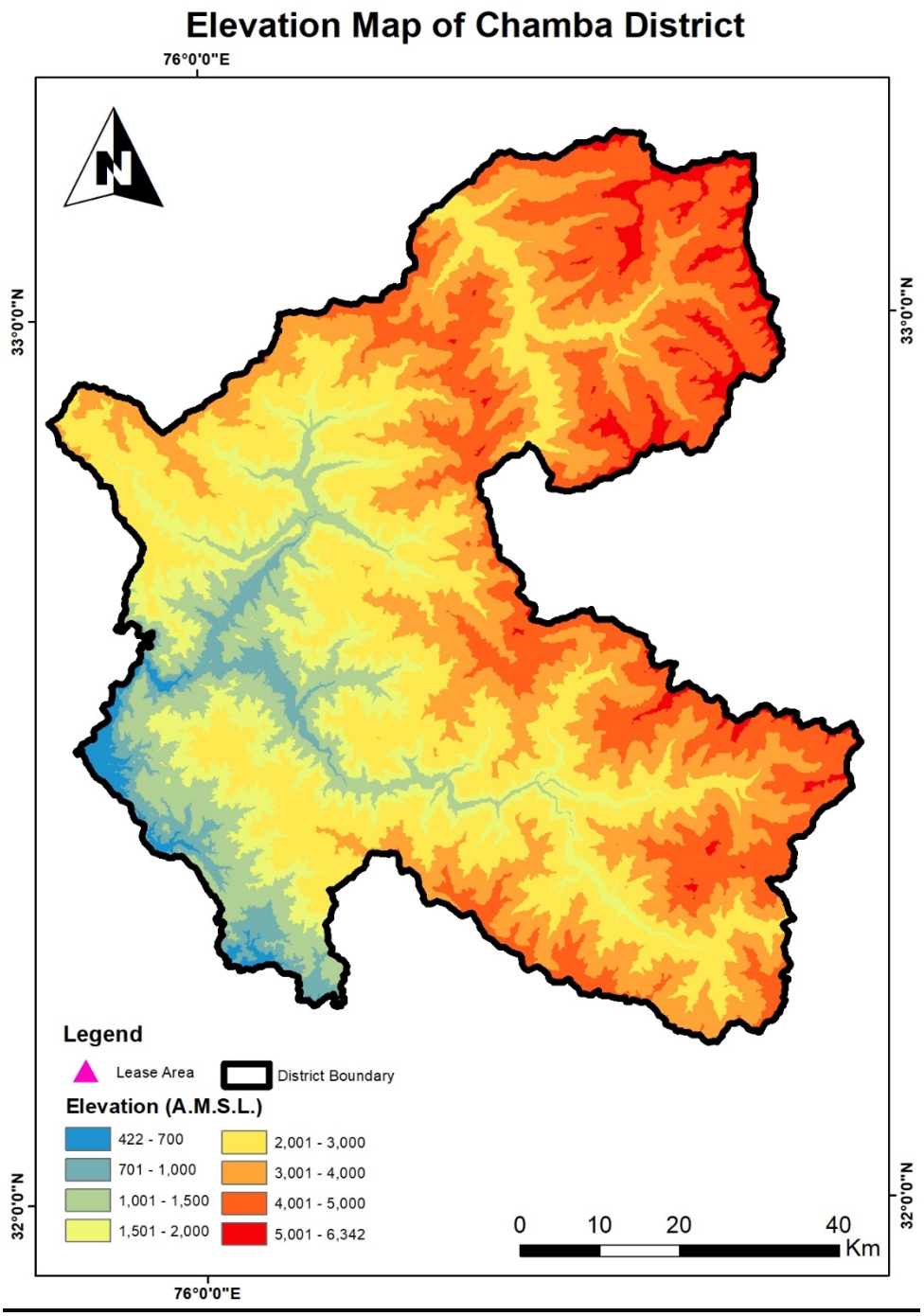


Image showing elevation profile of District

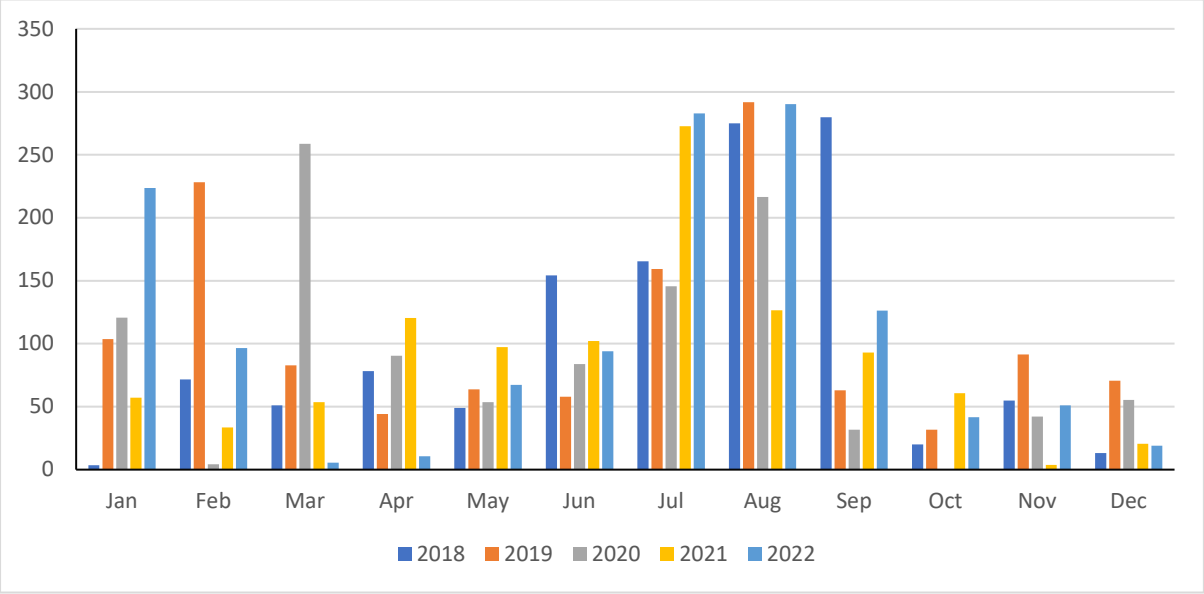
11. Rainfall

Rainfall varies significantly with the altitude of the area. The catchment area receives rainfall due to western disturbances that pass over the northwestern part of the country during the winter months. Significant precipitation in the form of snow is received at higher altitudes and rainfall in valleys is received during the winter month. The rainy season generally starts in mid-July and extends up to mid-September. During winter the rains are scarce and extend from 15th December to 15th February. The following Table shows the quantum of rainfall from the year 2018 to 2022 in the district as per IMD.

Table Showing Rainfall Data In Millimetres Of District Chamba

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018	3.6	71.7	51.1	78.1	48.9	154.3	165.4	275	279.8	19.9	54.8	13.1
2019	103.6	228.2	82.8	44.2	63.8	58	159.2	291.7	62.9	31.8	91.4	70.7
2020	120.6	4.2	258.7	90.4	53.5	83.8	145.7	216.4	31.6	0.3	42.1	55.3
2021	57.1	33.6	53.5	120.5	97.2	102	272.6	126.5	92.9	60.6	3.7	20.6
2022	223.5	96.6	5.5	10.6	67.4	94	282.8	290.2	126.3	41.6	51	19

Source: Meteorological Department, Govt. of India



Graph Showing Annual Rainfall Data of District Chamba from the Year 2018 To 2022

12. Geology And Mineral Wealth

The first authoritative geological work in the Himachal Himalayas was carried out by the Medlicot in 1864 who described the Geology of nearly 18000 km^2 area between the Ravi and the Ganga. His description of the Tertiary and pre Tertiary rocks provides the basic of all future work in the part of Himalayas. Thereafter belt wise mapping covering the major Tectono-stratigraphic belts of Himachal Himalayas was initiated. This enabled extensive coverage of Shali-Shimla, Largi-Rampur, Deoban-Jaunsar-Krol-Tal belt (Srikantia and Sharma, 1976, Bhargava, 1976, Sharma 1977).

Broadly, Himachal Pradesh can be divided in to two major geo-tectonic zones Viz Lesser Himalayan Tectogen in the South and the Tethys Himalayan Tectogen in the North (Srikantia, 1987).These two tectonic zones are juxtaposed with each other along a major tectonic break collectively designed as the Main Central Thrust (MCT).The Lesser Himalayan Tectogen and Tethys Himalayan Tectogen are characterized by diverse stratigraphical,

sedimentological, faunal, igneous and tectonic elements so as to imply two alien blocks which are now juxtaposed.

In Himachal Pradesh Geological history goes back to the archaean proterozoic transition although the actual Himalayan Mountain building took place only during Cenozoic era. The Himalayas is a classic example of continent and continent collision due to the convergent movement of the Indian plate toward the Eurasian plate. It comprises two contrasting tectogens with their distinctive geological history. The dividing line between these two tectogens represents amajor tectonic discontinuity and is designated by several local names. However, it can be collectively referred to as a Main Central trust and on either side of this thrust the tectogens display contrasting stratigraphic and tectonics features indicating convergence of two alien blocks These are the lesser Himalayan tectogens and the Tethys Himalayan tectogen.

Chamba Basin

In the Chamba area, falling between the Pir Panjal and the Dholadhar Ranges of NW Himachal Pradesh, a thick sequence of Proterozoic and Upper Palaeozoic-Mesozoic formation is exposed. These formations link up with similar rock types of Bhadarwah in Jammu and Kashmir in the NW and the Proterozoic rocks are the continuation of similar rocks of south western Lahaul.

The Chamba formation, which forms the upper part of the Proterozoic Salkhala Group, appears prominently in the core of an anticline in the NW comer of Chamba and also as a long and narrow band along the SW part The Chamba formation comprises a thick sequence of metagreywacke, slate and phyllite with slrong flyschoid characteristics It is rimmed by the Manjir Formation which succeeds it along an unconformity followed by a broad belt of the Satal Formation, also called the Katari Gali Formation in Bhadarwah-Bhallesh.

A study by the Geological Survey of India has brought out that much of what was eariier identified as the Salooni Formation in Chamba is the extension of the Terminal Proterozoic Batai Formation of the Lahaul area and the Manjir is its basal unit.

Table Showing Geological sequence of Chamba area

Kalhel Fm (Triassic)	Greyish blue, grey and yellow limestone and dolomite with interbedded grey orthoquartzite in the upper part. Grey calcareous shale with inter beds of limestone in the basal part.

Salooni Fm. (Permian)	Dark grey or black carbonaceous pyritous slates with thin lenticles of limestone at placees. There are discon-tinuous bands of varying thickness of amygdaloidal and massive lava flow of basaltic to andesitic composition.
----------	---unconformity----------
Batal Fm (also called KatariGali Fm.) (Terminal Proterozoic)	Black carbonaceous phyllite with inter beds of quartzite. Local limestone bed at the base with magnesite and scale of gypsum.
Manjir Fm. (Neoproterozoic)	Polymictic diamictite-poorly sorted, lithologically heterogeneous, laminated or banded.
----------	---unconformity----------
Chamba Fm.(Salkhala Group) (Mesoproterozoic)	Dark Grey, thinly bedded laminated slates with subordinate bands

Manjir Formation

The Manjir formation overlies the Chamba formation of the Salkhala group with conformity. It borders the Chamba Formation in NW, W&SW part and continues SE towards K og and turns around and extends into the Kullu area. The Manjir Formation comprises chiefly lenti thick-bedded or massive diamictite together with subordinate sand stone and intercalated argillite The matrix of the diamictite shows variation from sand silt to clay. There are several units of diamictite within the Manjir with thicknesses ranging from a few meters to several hundred meters. Clasts comprise dominantly quartzite. Limestone, volcanic rocks and at places phyllitic clasts. Faceting and flat iron shape are rarely noticed. The cfasts are poorly sorted ranging from grit to boulders in size and sub-angular to sub rounded in shape. The clasts matrix ratio is highly variable and some phyllite magic lasts have slaty cleavage, the orientation of which discordant implies an earlier phase of deformation (Rattan-1973, Thakur & Pande-1972) possibly in Mesoproterozoic. The overall characteristics of the diamictite point to glaciomarine origin (Tandon & Thakur-1976) This may coincide with the global proterozoic glacial phenomenon witnessed in all the continents other than Antarctica.

Batal Formation

Manjir is succeeded by the Batal Formation without any perceptible break. It is also infolded with the Batal and even occurs as imbricates. The Batal Formation is described in the Tethyan belt of the Lahaul-Spiti-KJnnaur basin, comprises dark grey carbonaceous slate and phyllite

with interbeds of quartzite. At places, lenticular bands of dolomite are seen inihe basal "part of the Batal Formation closer to its contact with the Manjir Formation These dolomite bonds are also associated with magnesite.

Salooni Formation

The Salooni Formation is infolded within the Batal Formation and it comprises black shales, slates, calcareous slates and lenticels of limestone. Modiolalidarensis, spiriferalla rajah, and Products sp. are some of the fossils found in Salooni{Datta and Bhatiacharyya-1975). This assigns Permian age to the Salooni. Associated with its rocks there are basic lava flows correctable with the Panja volcanic of Jammu-Kashmir. However, the lithostratigraphic position of various litho units with regard to the lava flows has not been worked out. The exact correlation of permo-Trias units of Chamba with those of the main Kashmir basin has to await a more detailed classification of Chamba Rocks and also the discovery of additional fossil beds. From the locality Swanthith, plant remains have been recovered (Srivastva & Kumar-1992). These are variously compared with the Glossopterid leaves which point to a Lower Permian age. The plant bearing beds may correspond to the Nishatbagh Formation and the Spiriferalla rajah bearing beds are equivalent to the Zewan Formation of Kashmir. The Salooni Formation of Chamba needs more detailed study and classification.

Kalhel Formation

The Kalhel Formation normally overlies the Salooni. It comprises mainly greyish blue, grey and yellow limestone and dolomites with inter bedded grey quartzite in the upper part. Limestone contains fossils of cnnoids in the lower part. A teleostean fish saurichthys Agassiz 1834 has been reported from the topmost bed of Kalhel (Dalmon Formation, Mishra et al 1990) The Salooni and Kalhel represent the major Permo-Trias marine transgressive event in the Himalayas, which is common to the Bhadrwah area of Jammu (Sharma, 1977) and the Tandi Belt of SW Lahaul. The Chamba basin is the extension of the Bhadarwah basin and these two together constitute a larger Permo-Trias basin in NW Himalaya.

Siwalik Group

The Siwalik Group in the Himachal Himalaya forms a parallel foot – hill belt in the Sub- Himalayan zone, extending along the southern margin of the Palaeogene Sirmur Group belt from the Ravi to the Yamuna and forms part of the larger Sub-Himalayan mega belt

extending from Potwar basin in NW to the Arunachal foot-hill in SE. In the Himachal Himalaya it has maximum width between Hoshiarpur and Jogindernagar.

The Siwalik sediments,though occurring as a independent structural belt, are also seen to overlie the Muree in the Jammu.sector of the Kashmir Himalaya and the Kasauli in the Himachal Himalaya. Pilgrim (1910) recorded a gradual transition from Muree beds to Lower Siwalik in rhe Rawalpindi and Jhelum districts of Pakistan and from Kasauli to Lower siwalik (Nahan) in the Himachal Himalaya. This fact assumes importance because there is a tendency to ignore this normal relationship between the Siwalik and Sirmour Groups at Dharamsala, Sarkaghat and Nalagarh.

At Haritalyangar near Bilaspur, the Lower Siwalik is seen resting on the Dagshai with an unconformity, which is described as the most striking discordance in the whole sequence of freshwater deposits and evidently representing a period of considerable earth movements (Pascoe, 1964).

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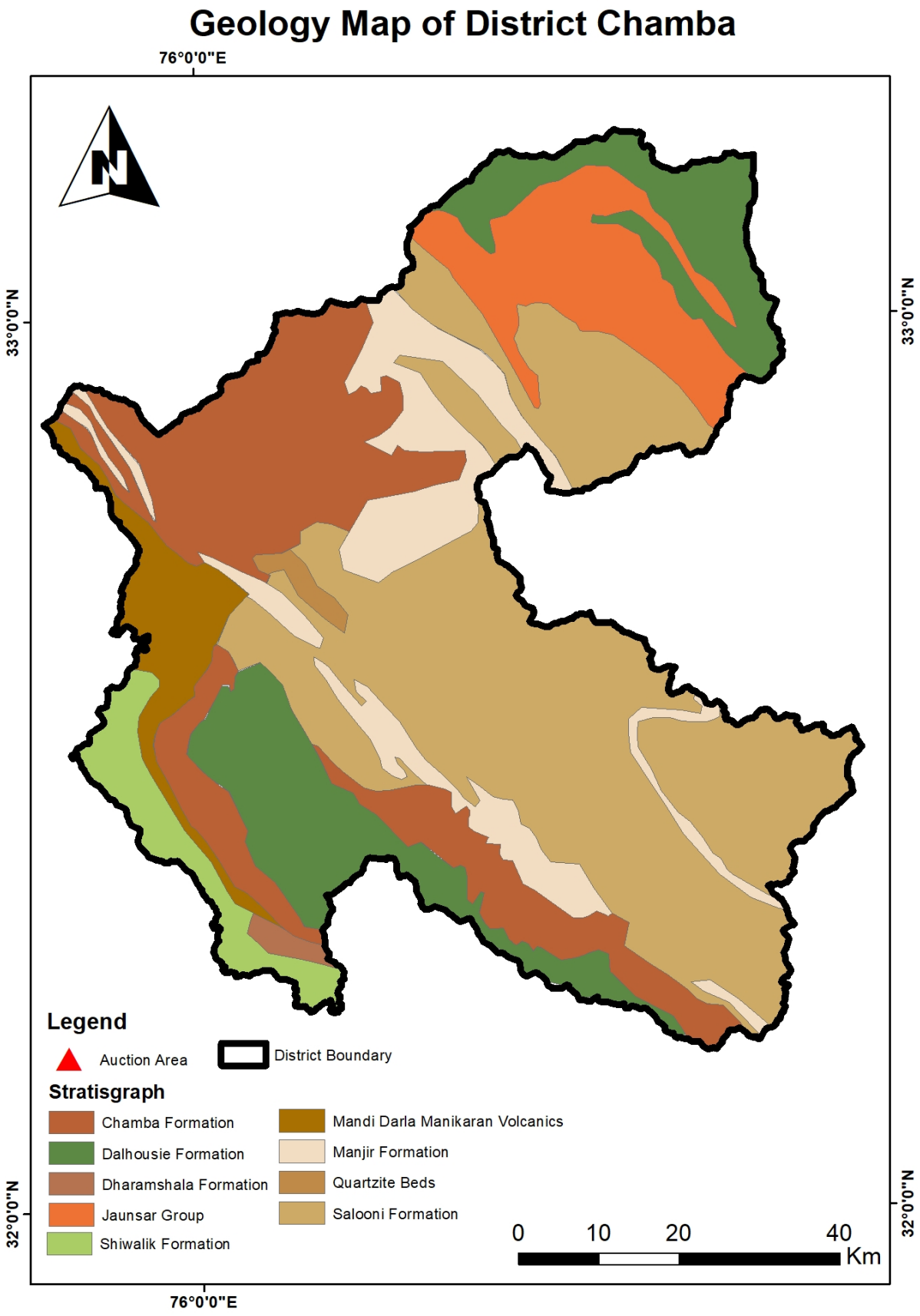

Image Showing Geology of District Chamba

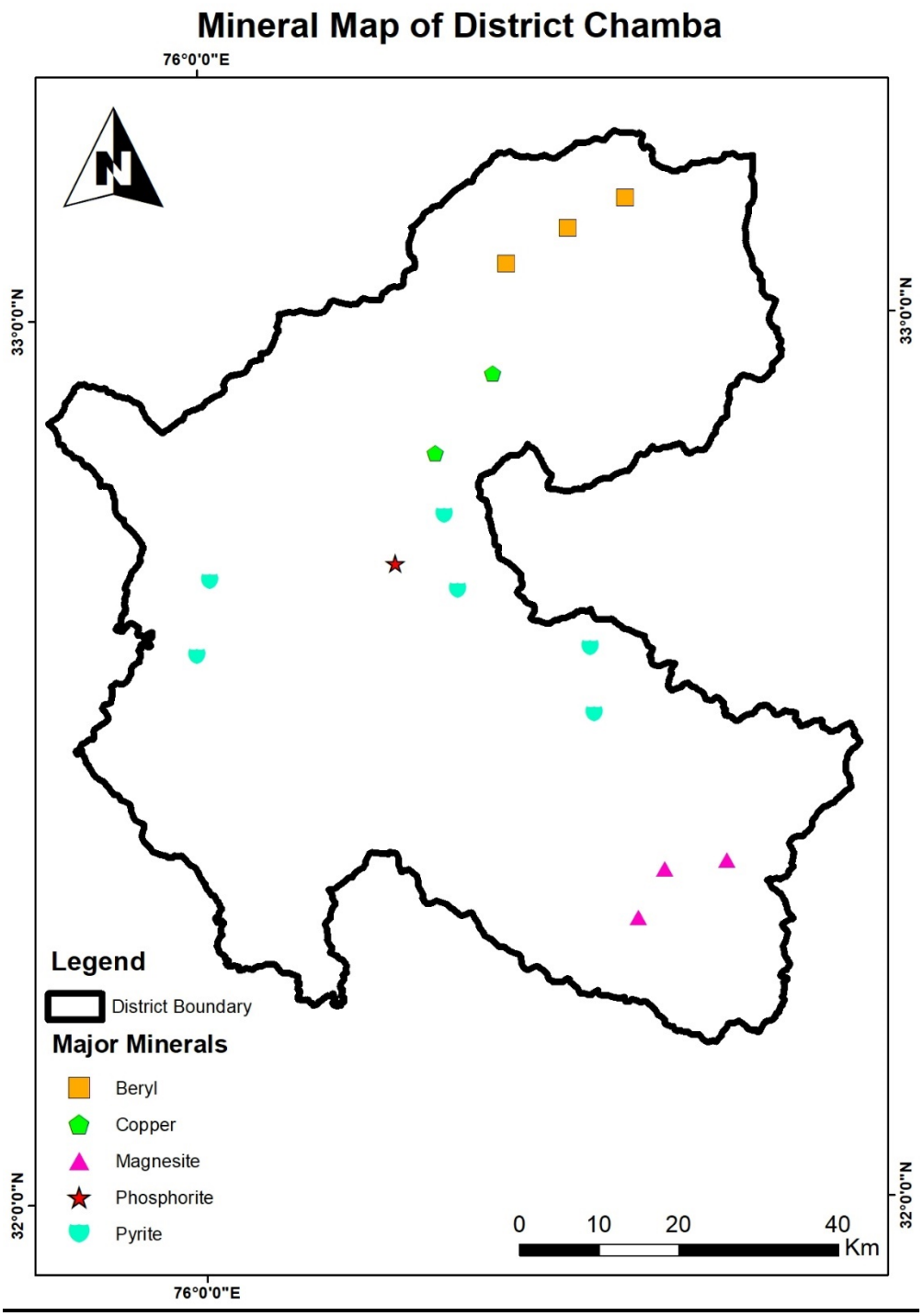

Image Showing Mineral Wealth of District Chamba

Beryl

(i) Beryl bearing pegmatites have been located in Kilar gneiss around Haksu bridge (33° 05': 76°23'0.

(ii) Pegmatite bodies with beryl have been found within gneisses of Kilar Formation. The pale yellow to light bluish-green beryl occurs at about one kilometres east of Dehda nala bridge (33°05'10" : 76°22'30") and about 1.5 kmsouth of Jules (33°05' 35" : 76° 23'15". The visual estimate of beryl in pegmatite is less than 0.5%.

Copper

It is believed by the inhabitants of Chamba District that a large quantity of copper ore had been mined from the Silagharat in the old times. Historically the mining in the area is said to have been carried out in 1559 A. D. It is said that in the times of Raja Partap Singh Verman, the ruler was in need of source of revenue for repair of Laxmi Narayan Temple. A farmer from the Hul area presented to the Raja a piece of copper and informed him of the existence of a large deposit. Thus a rich deposit of copper is said to have been found and worked. The rock types in the vicinity of old workings comprise dense black carbonaceous slates and dark grey slates with occasional lenses of the limestone. The working are situated about a km east of Banja (32° 41': 76° 13') on a steep terrain. Mineralization in the slates in the adit as well as around it is predominantly of Pyrite. Only occasional chalcopyrite grains are noticed. In the old audit somewhat graphitic slates, shows only few signs of Malachite.

Magnesite

Magnesite is reported only in District Chamba . Magnesite occures in grey phyllite of Salooni Formation in lenselike irregular shape and a few deposits are large in size. Invariably the dolomite limestone is found associated with magnesite. At places carbonaceous phyllite are seen coming in contact with magnesite deposit. Magnesite is medium to very coarse grained and crystalline in nature. Granular and bladed texture is commonly developed.

(i) Lenses of magnesite occur in the Katarigali Formation near the confluence of Muchetar nala and the Ravi river (32° 23' 00" : 76° 39'10"). The main magnesite band is exposed in a vertical cliff face on the left side of Muchetar nala and extends towards WNW to the ridge top. It is a lensoid band varying in size between 30 x 3m and 350 x 10m. On an average, its thickness varies between four and nine metres. The estimated reseves, calculated upto five metres depth, are of the order of 55,620 tonnes.

Phosphorite

Salooni Formation

Phosphatic nodules varying from 1.5 cm to 7 cm, in diameter and analysing 20 to 30 % P_2O_5 , were recovered from the black slates. A few sporadically distributed nodules were also seen in the grey slate and phyllites. The phosphatic nodules have been recorded from a number of localities in district Chamba such as Tarota (32º42' : 76º 05'), Dhaneli nala(32º45':76º 00'), Chikoli bridge, Dhamot (32º43': 76º05') and from Tiloga, Thamiru (32º48': 76º 57'), Deutal (32º 45': 76º 00'), Bhatinund (32º43' : 76º 04') of Chamba District.

Pyrite

Chamba district : Sporadic cubes of pyrite occur in Kamli Got area along joint planes in slates and phyllites in two to five metres thick zone traceable for a length of 150 cm, about 800m southwest of Mawa (32° 46': 76° 18'). Such mineralisation was also seen two kilometres east of Kamli Got (32° 461: 78° 20'). in the debris of quartzitic slates on the right bank of Lanj nala. The pyrite associated with pyrrhotite is of no economic significance.

Pyrite has been recorded in highly crushed carbonaceous slates of Katarigali Formation near the Chakoli bridge (32° 45' 30" : 76° 00' 00'), Bharaura (32° 46':75°58'),Kanthili (32° 47': 75° 57') and Sumu Kuthi (32° 48': 75° 56'). as disseminated cubes, veins, stringers and fine grained impregnation. Near Chakoli bridge, pyrite veins vary in thickness from a millimeter to 4.5 cm.

PART II

DISTRICT SURVEY REPORT FOR MINOR MINERALS OTHER THAN SAND MINING OR RIVER BED MINING

(Hill Slope Mining)

1. Introduction:

Minor Minerals (Hill Slopes or riverbeds) are valuable natural resources being the vital raw material for infrastructure, capital goods and basic industries. As a major resource for development, the extraction and management of minerals have to be integrated into the overall strategy of the country's economic development. The exploitation of minerals has to be guided by long-term state goals and perspectives. Just as these goals and perspectives are dynamic and responsive to the changing global economic scenario so also the state minor mineral protection policy has to be dynamic taking into consideration the changing needs of industry in the context of the domestic and global economic environment. To exploit the country's geological potential it is important that scientific and detailed prospecting is carried out in search of its mineral resources.

Mineral deposits in the Chmaba District occur largely in the form of rocks (Hill Slope) or River bed material such as Granite, Gneiss, Quartzite, Phyllite, Slate, Schist, pegmatite etc. They constitute the vital raw materials for many construction activities (roads and building projects) and hence are a major source for the development of infrastructure in the District and in the nearby towns and villages of the neighbouring State. The Government of India through the Ministry of Environment, Forest & Climate Change (MoEF& CC) has brought out a Notification on 25" July 2018, further amending the Erstwhile Environment Impact Assessment Notification 2006. Based on the amendment introduced by the Ministry, a District Survey Report for minor minerals available in the District is to be prepared separately which shall form the basis for application of environmental clearance and appraisal of projects. Such a Report shall be updated once every five years.

The need for a District Survey Report (DSR) has been necessitated by the Ministry of Environment, Forest and Climate Change (MoEF& CC) vide there Notification No. 125 (Extraordinary, Part II Section 3, Sub-section ii), S.O. 141 (E), dated 15th January 2016. The notification was addressed to bring certain amendments with respect to the EIA notification 2006 and in order to have better control over the legislation. As a part of this notification, the preparation of District Survey Reports has been introduced. Subsequently, MOEF& CC has published Notification No. 3611 (E), dt. 25th July 2018 regarding the inclusion of the ***"Minerals Other than Sand"*** and the format for preparation of the DSR has been specified. Enforcement & Monitoring Guidelines for Sand Mining (EMGSM) January 2020, Issued by MoEF& CC is prepared in consideration of various orders/directions issued by Hon'ble NGT in matters pertaining to illegal sand mining and also based on the reports submitted by expert committees and investigation teams. This DSR has been prepared in conformity with the S O 141 (E), S O 3611 (E) and other sand mining guidelines published by MOEF& CC from time

to time as well as the requirement specified in Himachal Pradesh Minor Mineral Concession Rule, 2015.

The purpose of the District Survey Report (DSR) is to identify the mining potential areas where mining can be allowed; and also to distinguish areas where mining will not be allowed due to proximity to infrastructural structures and installations, areas of erosion. The Preparation of this District Survey Report (DSR) involved both primary and secondary data generation. The primary data generation involved the site inspection, survey, ground truthing etc. while secondary data has been acquired through various authenticated sources and satellite imagery studies. The district survey report of Chamba district also describes the general geographical profile of the district, distribution of natural resources, livelihood, climatic condition and sources of revenue generation.

To ensure systematic mining by way of proper planning, replenishment and reclamation of the area, the period of lease shall be 5 years. Extension can be considered only after Joint Inspection by Sub-Divisional Committee and keeping in view its recommendations, depending upon the availability of raw material and requirement of mineral based industry under Himachal Pradesh Minor Minerals (Concession) and Minerals (Prevention of Illegal. Mining, Transportation and Storage) Rules, 2015.

2. Overview Of Mining Activity In The District

Hillslopes are one of the dominant landform features on Earth. Many types of processes act to create, modify, and attenuate slopes. Most of the districts of Himachal Pradesh have the mightiest mountain ranges having the Highest elevation of 6,813 m (22,352 ft) and the Lowest elevation of 232 m (761 ft). Physiographically, the entire Chamba District is mountainous with altitude ranging from 422 meters to 6342 meters above mean sea level. However, the habitation is found only up to 3000 meters. The district is part of the Northern Himachal Pradesh Himalaya. It lies between latitudes ranging from 32º10'N to 33º12'N and longitudes ranging from 75º47'E to 76º52'E. The district is bounded on the north and west by Jammu & Kashmir state, on the south-west by Punjab state, on the south and south-east by Kangra district whereas Lahul & Spiti district encloses it from east. According to Surveyor General of India, the total area of the district is 6,522 Sq. Kms. and ranks 2nd in terms of area occupying 11.7 per cent area of the state.

The minor minerals available in the district are sand, clay, slate and Rough Stone/Project Stone. Hence on the basis of available minerals no major industrial enterprises can be set up in the district.

Hill slope mining and terrace mining are two methods employed in the extraction of minerals and resources from sloped or hilly terrain. Here's a brief note on each:

Hill Slope Mining:

Hill slope mining involves the extraction of minerals or resources from the sides of hills. This method is commonly used when the mineral deposit extends horizontally along the slope.

The process usually includes the following steps:

1. **Exploration:** Identifying the location and extent of the mineral deposit.
2. **Excavation:** Breaking the rock into manageable fragments. Mining activities are carried out after the formation of benches of usually 6mX6m, with an angle of repose of 45º.
3. **Transportation:** Moving the extracted material down the slope, often using conveyors or trucks.
4. **Processing:** Refining and processing the raw material to extract the desired minerals. The extracted raw material i.e., stone can be directly sold in the open market or can be used as a captive use for stone crusher units which are crushed in the form of angular grit.

Hill slope mining can be challenging due to issues such as soil erosion, landslide risks, and environmental concerns. Proper planning and environmental safeguards are essential to mitigate the negative impacts on the ecosystem.

Terrace deposits, in a geological context, refer to accumulations of sediments, minerals, or other materials that have been deposited on flat, elevated surfaces known as terraces. Terraces are often formed by the erosion and weathering of landscapes over time, and they can be found along river valleys, coastal areas, or on the slopes of hills and mountains. These deposits can be of various types, including sediments, alluvium, or even mineral deposits, depending on the geological processes that led to their formation. Here are a few examples:

Fluvial Terraces:

These terraces form along river valleys and are the result of river downcutting and lateral erosion over time. The sediments deposited on these terraces can include gravel, sand, and silt. Fluvial terraces are often indicative of changes in the river's course or base level.

Alluvial Terraces:

Alluvial terraces are associated with the floodplains of rivers. As rivers meander and change their course, they leave behind elevated terraces with deposits of alluvial materials. These terraces can contain valuable minerals and are often targeted in mining operations.

Mineral Deposits on Terraces:

In a mining context, terrace deposits specifically refer to mineral accumulations found

on terraced slopes or elevated flat surfaces. These deposits can include valuable minerals like gold, silver, copper, or others. Terrace mining may be employed to extract these minerals from the flat benches or terraces created on the slopes.

Understanding terrace deposits is crucial in geological and mining studies, as they provide insights into past environmental conditions, sedimentation processes, and the history of the landscape. Geologists and mining professionals analyse terrace deposits to determine the potential for valuable resources and to plan appropriate extraction methods while considering environmental and safety factors.

Terrace Mining:

Terrace mining, also known as bench mining, is a method of extracting minerals from a series of flat benches or terraces created on the sides of a hill or mountain. This technique is employed when the mineral deposit is found in layers parallel to the surface. The process typically involves the following stages:

Cutting Benches:

Creating a series of flat, horizontal steps or benches on the slope. Mining activities are carried out after the formation of benches of usually 6mX6m, with an angle of repose of 45º.

Excavation: The excavation process is done manually or semi-mechanical methods may be applied such as poclain or JCB after taking permission from the competent authorities.

Hauling: Transporting the mined material from each terrace to a collection point.

Processing: Refining and processing the extracted material to obtain the desired minerals.

Terrace mining helps minimize the environmental impact compared to some other methods as it reduces the risk of soil erosion and landslide occurrences. However, proper land reclamation measures must be implemented to restore the landscape post-mining.

Both hill slope mining and terrace mining have environmental and safety considerations. Sustainable practices and adherence to regulations are crucial to minimize the ecological footprint and ensure the safety of workers and surrounding communities. Additionally, community engagement and consultation are essential to address concerns and incorporate local perspectives into the mining operations.

3. General Profile Of The District

Physiographically, the entire Chamba District is mountainous with altitude ranging from 422 meters to 6342 meters above mean sea level. However, the habitation is found only up to 3000 meters. The district is part of the Northern Himachal Pradesh Himalaya. It lies between latitudes ranging from 32º10’N to 33º12’N and longitudes ranging from 75º47’E to

76º52'E. The district is bounded by Punjab state in the south-west, on the south and south-east by Kangra district and Lahul-Spiti encloses it from north-east to east. According to the Surveyor General of India, the total area of the district is 6,522 Sq. Km and ranks 2nd in terms of the area, occupying 11.7 percent of the total area of the state. There are tree big valleys i.e., i) Beas Valley ii) Ravi Valley iii) Chenab Valley. The valleys in the south-west of the district are fertile. In the lower areas of the valley, the vegetation is semi-tropical and at the higher elevation the tree belonging Pinus longfila, Oak and Chest nut are found and above these there are brich and Juniper. In this valley the villages are diminutive. In the villages up to an altitude of 2100 meters two crops are grown whereas, in the higher reaches only one crop is grown all-round the year. The main rivers of the district are Ravi, Budhil, Siul, and Tundah and the main glacier of the district is Tantgari glacier. The southern part of Chamba district is dominated by the Dhauladhar Range, which forms a natural boundary with the Kangra district. These snow-capped peaks rise to considerable heights and provide a stunning backdrop to the landscape of Chamba. The northern part of the district is flanked by the Zanskar Range, adding to the rugged beauty of the region. The Pangi Valley, located to the northwest of Chamba, is another prominent valley known for its remoteness and natural beauty. Plateaus like the Sach Pass region are part of the district's terrain. The higher altitudes of Chamba district are adorned with glaciers and high-altitude lakes. These glaciers feed the rivers and maintain the ecological balance of the region. Some of the notable lakes include the Manimahesh Lake, Khajjiar Lake, and the Suraj Tal, which add to the serene landscape and attract tourists and pilgrims alike. In conclusion, Chamba district, Himachal Pradesh, is a land of immense natural beauty and geographical diversity. Its snow-capped mountains, lush valleys, gushing rivers, and serene lakes make it a paradise for nature lovers and adventure enthusiasts. The region's physiography plays a vital role in shaping its unique cultural heritage and contributes to its importance as a popular tourist destination in Himachal Pradesh.

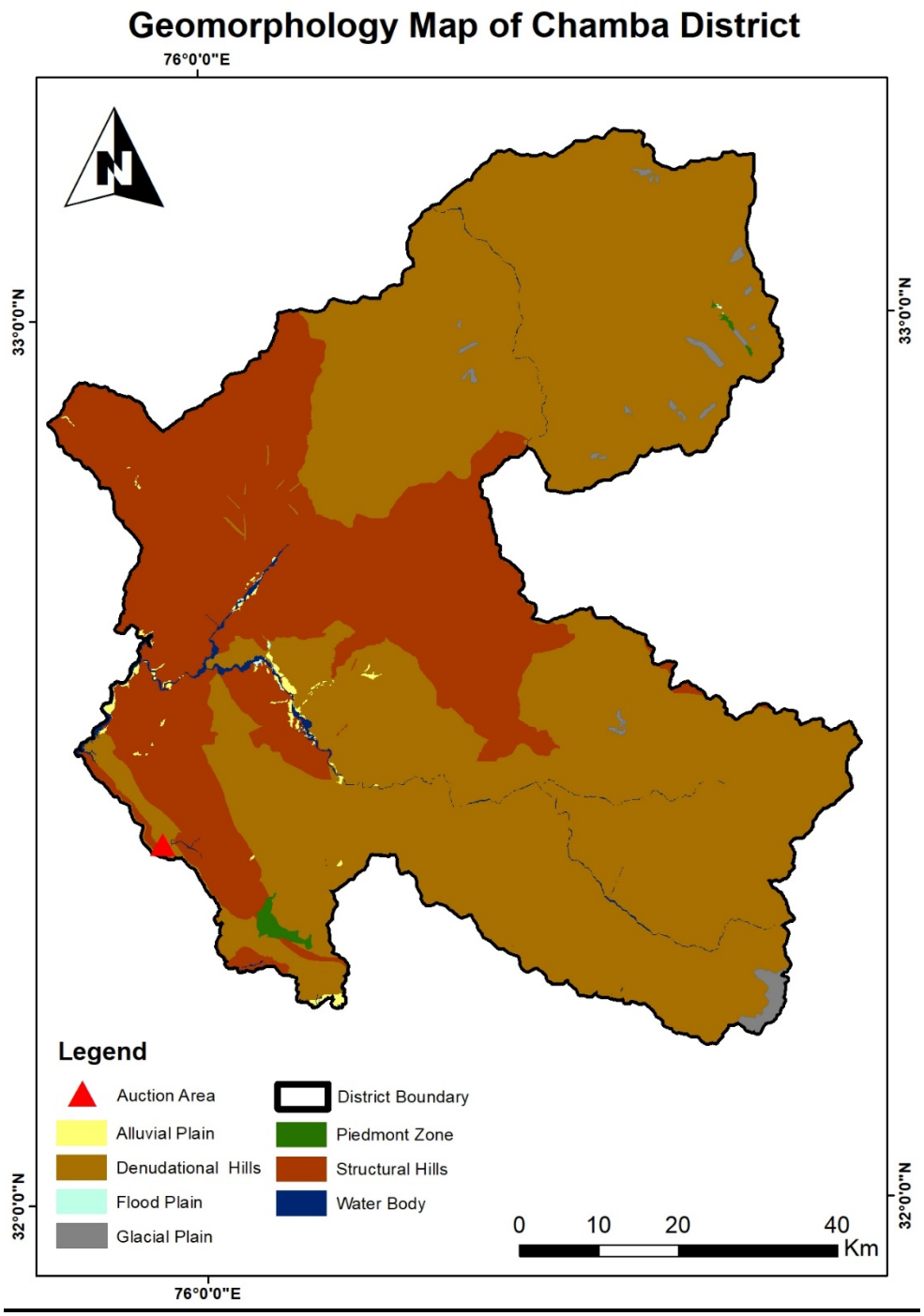

Image Showing Physiography of the District

4. Geology Of The District

Himachal Pradesh, as part of the erstwhile Panjab State by virtue of having Shimla as the summer capital of British India, received considerable attention of the Geologists from earliest times. The first authoritative geological work in the Himachal Himalayas was carried out by the Medlicot in 1864 who described the Geology of nearly 18000 km^2 area between the Ravi and the Ganga. His description of the Tertiary and pre Tertiary rocks provides the basic

of all future work in the part of Himalayas. Thereafter belt wise mapping covering the major Tectono-stratigraphic belts of Himachal Himalayas was initiated. This enabled extensive coverage of Shali-Shimla, Largi-Rampur, Deoban-Jaunsar-Krol-Tal belt (Srikantia and Sharma, 1976, Bhargava, 1976, Sharma 1977).

Broadly, Himachal Pradesh can be divided in to two major geo-tectonic zones Viz Lesser Himalayan Tectogen in the South and the Tethys Himalayan Tectogen in the North (Srikantia, 1987).These two tectonic zones are juxtaposed with each other along a major tectonic break collectively designed as the Main Central Thrust (MCT).The Lesser Himalayan Tectogen and Tethys Himalayan Tectogen are characterized by diverse stratigraphical, sedimentological, faunal, igneous and tectonic elements so as to imply two alien blocks which are now juxtaposed.

In Himachal Pradesh Geological history goes back to the archaean proterozoic transition although the actual Himalayan Mountain building took place only during Cenozoic era. The Himalayas is a classic example of continent and continent collision due to the convergent movement of the Indian plate toward the Eurasian plate. It comprises two contrasting tectogens with their distinctive geological history. The dividing line between these two tectogens represents amajor tectonic discontinuity and is designated by several local names. However, it can be collectively referred to as a Main Central trust and on either side of this thrust the tectogens display contrasting stratigraphic and tectonics features indicating convergence of two alien blocks These are the lesser Himalayan tectogens and the Tethys Himalayan tectogen.

Chamba Basin

In the Chamba area, falling between the Pir Panjal and the Dholadhar Ranges of NW Himachal Pradesh, a thick sequence of Proterozoic and Upper Palaeozoic-Mesozoic formation is exposed. These formations link up with similar rock types of Bhadarwah in Jammu and Kashmir in the NW and the Proterozoic rocks are the continuation of similar rocks of south western Lahaul.

The Chamba formation, which forms the upper part of the Proterozoic Salkhala Group, appears prominently in the core of an anticline in the NW comer of Chamba and also as a long and narrow band along the SW part The Chamba formation comprises a thick sequence of metagreywacke, slate and phyllite with slrong flyschoid characteristics It is rimmed by the Manjir Formation which succeeds it along an unconformity followed by a broad belt of the Satal Formation, also called the Katari Gali Formation in Bhadarwah-Bhallesh.

A study by the Geological Survey of India has brought out that much of what was eariier identified as the Salooni Formation in Chamba is the extension of the Terminal Proterozoic Batai Formation of the Lahaul area and the Manjir is its basal unit.

Table Showing Geological sequence of Chamba area

Kalhel Fm (Triassic)	Greyish blue, grey and yellow limestone and dolomite with interbedded grey orthoquartzite in the upper part. Grey calcareous shale with inter beds of limestone in the basal part.
Salooni Fm. (Permian)	Dark grey or black carbonaceous pyritous slates with thin lenticles of limestone at placees. There are discon-tinuous bands of varying thickness of amygdaloidal and massive lava flow of basaltic to andesitic composition.
----------	---unconformity----------
Batal Fm (also called KatariGali Fm.) (Terminal Proterozoic)	Black carbonaceous phyllite with inter beds of quartzite. Local limestone bed at the base with magnesite and scale of gypsum.
Manjir Fm. (Neoproterozoic)	Polymictic diamictite-poorly sorted, lithologically heterogeneous, laminated or banded.
----------	---unconformity----------
Chamba Fm.(Salkhala Group) (Mesoproterozoic)	Dark Grey, thinly bedded laminated slates with subordinate bands

Manjir Formation

The Manjir formation overlies the Chamba formation of the Salkhala group with conformity. It borders the Chamba Formation in NW, W&SW part and continues SE towards K og and turns around and extends into the Kullu area. The Manjir Formation comprises chiefly lenti thick-bedded or massive diamictite together with subordinate sand stone and intercalated argillite The matrix of the diamictite shows variation from sand silt to clay. There are several units of diamictite within the Manjir with thicknesses ranging from a few meters to several hundred meters. Clasts comprise dominantly quartzite. Limestone, volcanic rocks and at places phyllitic clasts. Faceting and flat iron shape are rarely noticed. The cfasts are poorly sorted ranging from grit to boulders in size and sub-angular to sub rounded in shape. The clasts matrix ratio is highly variable and some phyllite magic lasts have slaty cleavage, the orientation of which discordant implies an earlier phase of deformation (Rattan-1973, Thakur & Pande-1972) possibly in Mesoproterozoic. The overall characteristics of the diamictite point to glaciomarine

origin (Tandon & Thakur-1976) This may coincide with the global proterozoic glacial phenomenon witnessed in all the continents other than Antarctica.

Batal Formation

Manjir is succeeded by the Batal Formation without any perceptible break. It is also infolded with the Batal and even occurs as imbricates. The Batal Formation is described in the Tethyan belt of the Lahaul-Spiti-KJnnaur basin, comprises dark grey carbonaceous slate and phyllite with interbeds of quartzite. At places, lenticular bands of dolomite are seen inihe basal "part of the Batal Formation closer to its contact with the Manjir Formation These dolomite bonds are also associated with magnesite.

Salooni Formation

The Salooni Formation is infolded within the Batal Formation and it comprises black shales, slates, calcareous slates and lenticels of limestone. Modiolalidarensis, spiriferalla rajah, and Products sp. are some of the fossils found in Salooni{Datta and Bhatiacharyya-1975). This assigns Permian age to the Salooni. Associated with its rocks there are basic lava flows correctable with the Panja volcanic of Jammu-Kashmir. However, the lithostratigraphic position of various litho units with regard to the lava flows has not been worked out. The exact correlation of permo-Trias units of Chamba with those of the main Kashmir basin has to await a more detailed classification of Chamba Rocks and also the discovery of additional fossil beds. From the locality Swanthith, plant remains have been recovered (Srivastva & Kumar-1992). These are variously compared with the Glossopterid leaves which point to a Lower Permian age. The plant bearing beds may correspond to the Nishatbagh Formation and the Spiriferalla rajah bearing beds are equivalent to the Zewan Formation of Kashmir. The Salooni Formation of Chamba needs more detailed study and classification.

Kalhel Formation

The Kalhel Formation normally overlies the Salooni. It comprises mainly greyish blue, grey and yellow limestone and dolomites with inter bedded grey quartzite in the upper part. Limestone contains fossils of cnnoids in the lower part. A teleostean fish saurichthys Agassiz 1834 has been reported from the topmost bed of Kalhel (Dalmon Formation, Mishra et al 1990) The Salooni and Kalhel represent the major Permo-Trias marine transgressive event in the Himalayas, which is common to the Bhadrwah area of Jammu (Sharma, 1977) and the Tandi Belt of SW Lahaul. The Chamba basin is the extension of the Bhadarwah basin and these two together constitute a larger Permo-Trias basin in NW Himalaya.

Siwalik Group

The Siwalik Group in the Himachal Himalaya forms a parallel foot – hill belt in the Sub- Himalayan zone, extending along the southern margin of the Palaeogene Sirmur Group belt from the Ravi to the Yamuna and forms part of the larger Sub-Himalayan mega belt extending from Potwar basin in NW to the Arunachal foot-hill in SE. In the Himachal Himalaya it has maximum width between Hoshiarpur and Jogindernagar.

The Siwalik sediments,though occurring as a independent structural belt, are also seen to overlie the Muree in the Jammu.sector of the Kashmir Himalaya and the Kasauli in the Himachal Himalaya. Pilgrim (1910) recorded a gradual transition from Muree beds to Lower Siwalik in rhe Rawalpindi and Jhelum districts of Pakistan and from Kasauli to Lower siwalik (Nahan) in the Himachal Himalaya. This fact assumes importance because there is a tendency to ignore this normal relationship between the Siwalik and Sirmour Groups at Dharamsala, Sarkaghat and Nalagarh.

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The Siwalik Group is divisible into three subgroups respectively the Lower, Middle and Upper on the basis of lithostratigraphy (Table—Karunakaran and Ranga Rao,1979).

Lower Siwalik Subgroup

The Lower Siwalik subgroup consists essentially of sandstone-clay alternation. The lower boundary of the Lower Siwalik does not crop out at surface in the Jawalamukhi sector. In a deep well drilled in the over thrust block of the Jawalamukhi Thrust, however, the Lower Siwalik is found conformably is also marked by an increase in the percentage of heavy minerals giving a dark appearance to the rock and incoming of less rounded heavy minerals like staurolite and unstable types like zosite and epidote.

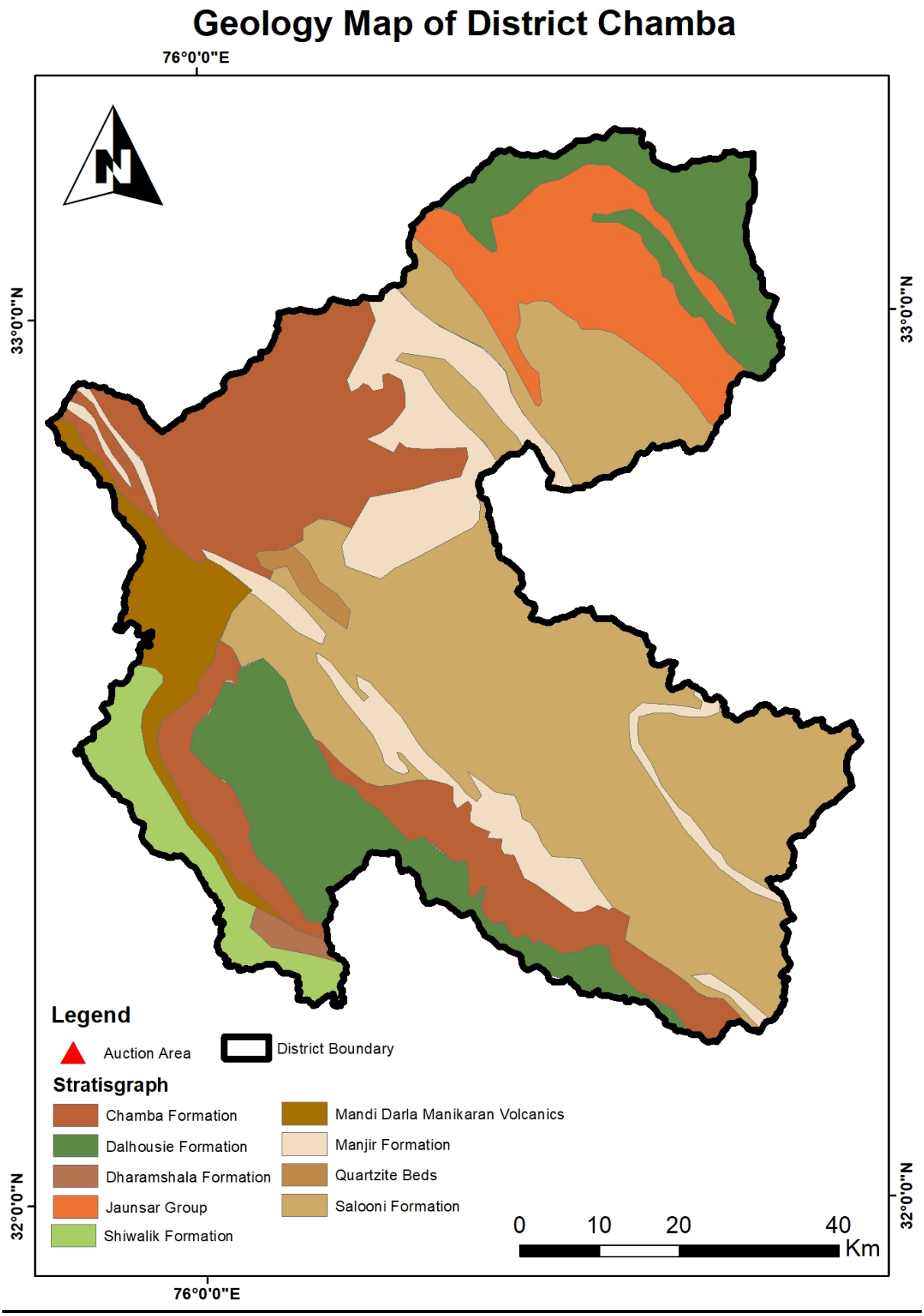


Image Showing Geology of District Chamba

5. Drainage of Irrigation Pattern

Irrigation Overview:

Cultivated area includes irrigated as well as un-irrigated area. It further elaborates the proportion of cultivable area under irrigation. There are total 1,110 inhabited villages in the district having a total area of 272,494.50 hectares. Of this, 15.49 per cent is cultivable and 10.49 per cent of total cultivable area has got the irrigation facility. The area figures have been collected from the revenue records maintained by the concerned sub-district offices for each village in the State. A look at the land use pattern at block level shows that Pangi block with 60 villages have a total area of 31,080.22 hectares, of this, 6.75 per cent of land is cultivable and of the afor esaid area, 46.03per cent is irrigated. In Tisa block, all the 158 villages have a total land area of 36,218.74 hectares, of this, 15.10 per cent of land is cultivable and of the afor esaid area, 3.38 per cent is irrigated. In Saluni block, all the 223 villages have a total area of 44,856.82 hectares, of this, cultivable area is 15.25 percent and 0.79 per cent is irrigated. In Chamba block, all the 111 villages have a total area of 30,457.67 hectares. Of this, cultivable area is 22.03 per cent. Of cultivable area, 2.24 per cent is irrigated. Bhattiyat block with 322 villages have a total land area of 57,043.54 hectares, of this, 16.18 per cent is cultivable area and out of this cultivable area, 27.04 per cent is irrigated. Mehla block with 130 villages has a total land area of 37,824.21 hectares. Of this, 19.24 per cent is cultivated area, out of which 5.85 per cent is irrigated. Brahmaur block with a total 96 villages have an area of 35,013.30 hectares. Of this, 13.10 per cent is cultivable area of which 3.33 per cent is irrigated.

Agricultural Context:

- **Dependence on Rainfall:** Agriculture largely relies on timely rainfall due to insufficient irrigation infrastructure.
- **Rainfall and Irrigation:** The state has four seasons, with 50-70% of rainfall occurring during the monsoon (June to September). Currently, 78% of the cropped area depends on rainfall, with only 22% having assured irrigation.
- **Recent Initiatives:** New schemes like the “Flow Irrigation Scheme” and “Solar Irrigation Scheme” have been introduced, alongside the Pradhan Mantri Krishi Sinchai Yojana (PMKSY) to enhance water usage. The state is also promoting rainwater harvesting and efficient irrigation technologies.

Regulatory Measures:

- **Water Regulation:** The Himachal Pradesh Water Regulatory Authority Act, 2011, aims to manage water resources sustainably, involving communities and local bodies in water management and infrastructure maintenance.

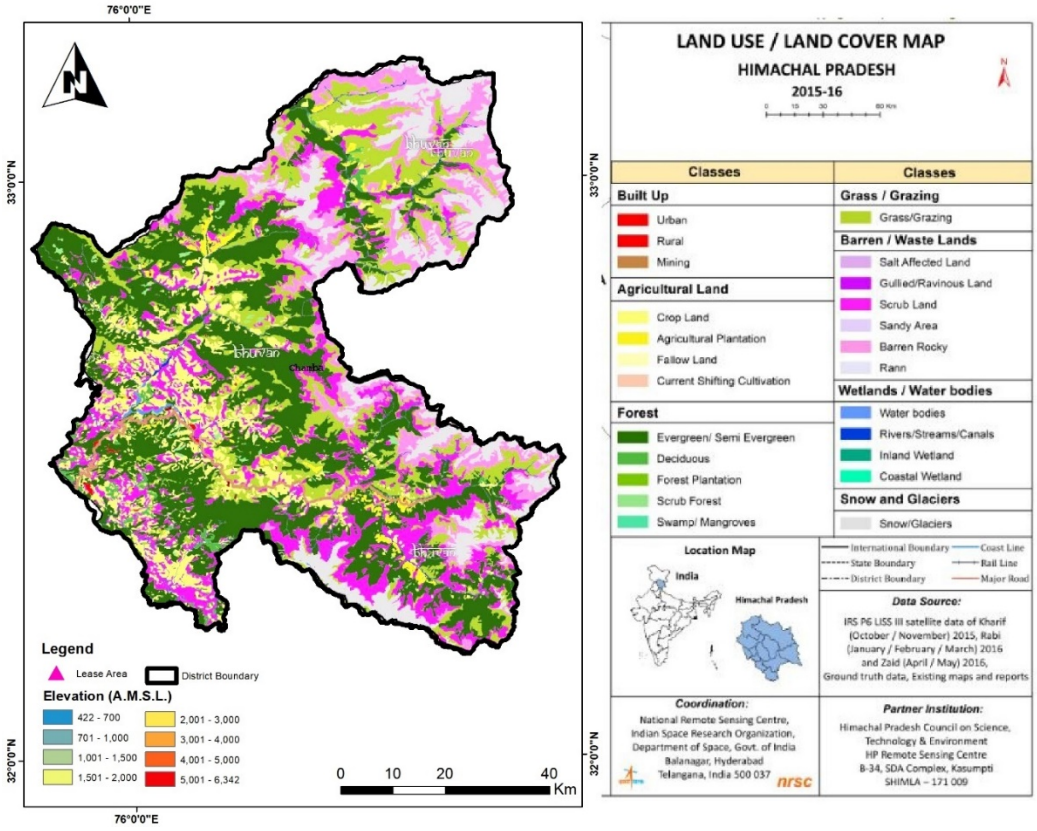
Rainfall Statistics:

- **Average Rainfall:** The average rainfall is 1418.1 mm, slightly above the normal of 1378.1 mm. Current rainy days average 63.3, compared to the normal 71.1.
- **Rainfall Variability:** Rainfall is categorized as normal, excess, deficient, or scanty based on deviations from the average.

Overall, while the state has low irrigation coverage and heavy dependence on rainfall, new schemes and regulatory measures are being implemented to improve water management and agricultural productivity.

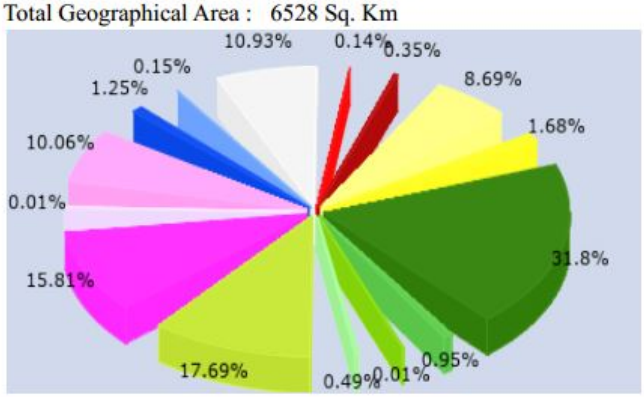
6. Land Utilization Pattern In The District

The economy of Chamba district is predominately agrarian as most of the population is dependent on agriculture and activities allied to it for earning their livelihood. The moisture retention capacity of the area is poor due mainly to the fact the bedrock are argillaceous and the land the uneven. The crops usually face moisture stress during the remaining period of the year due to inadequate and irregular rainfall. The irrigation facilities are provided by lifting water from streams, shallow dug wells and medium to deep tube wells in the valley area.



Land Use Land Cover Map of Chamba District

LULC Information (2015-16) for Chamba
Total Geographical Area : 6528 Sq. Km



LULC Class	Area (Sq.Km)	LULC Class	Area (Sq.Km)
Builtup,Urban	9.18	Builtup,Rural	22.57
Agriculture,Crop land	567.25	Agriculture,Plantation	109.45
Forest,Evergreen/ Semi evergreen	2075.82	Forest,Deciduous	62.06
Forest,Forest Plantation	0.77	Forest,Scrub Forest	31.89
Grass/Grazing	1154.91	Barren/unculturable/ Wastelands, Scrub land	1032.35
Barren/unculturable/ Wastelands, Sandy area	0.77	Barren/unculturable/ Wastelands, Barren rocky	656.85
Wetlands/Water Bodies, River/Stream/canals	81.3	Wetlands/Water Bodies, Reservoir/Lakes/Ponds	9.55
Snow and Glacier	713.26		

Land Use Land Cover Statistics of District Chamba

7.1 Agriculture

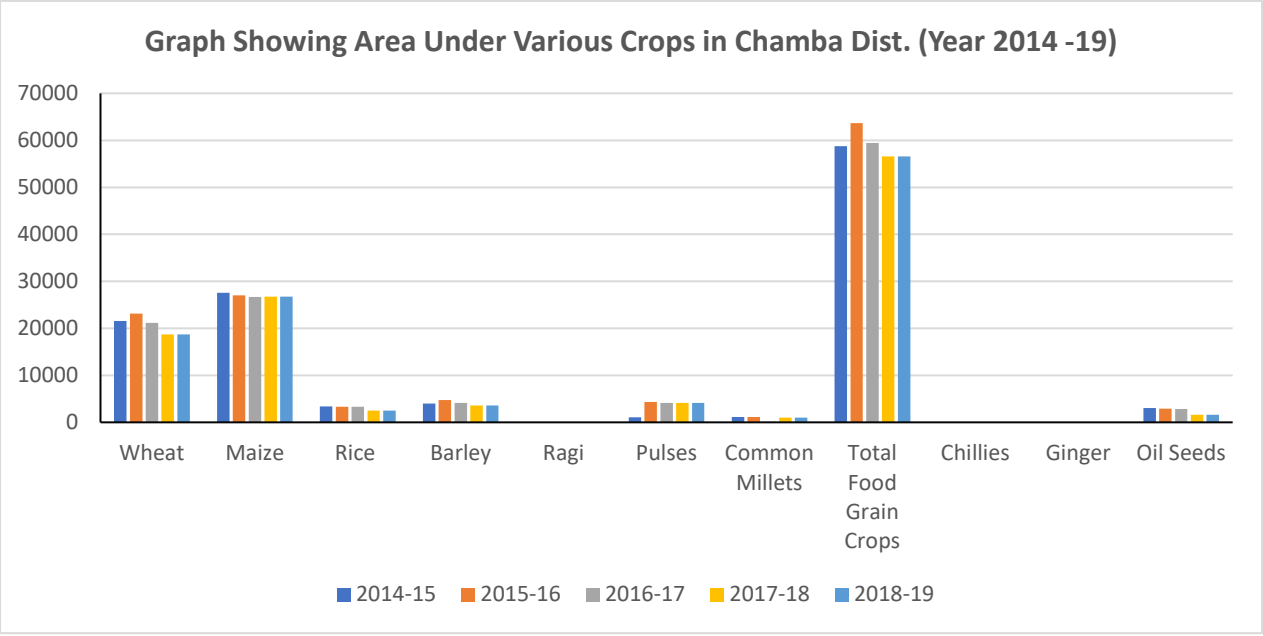
Being a hilly district, there is more pressure on land than in plains as most of the geographical area forms snow-clad mountain ranges, passes, river gorges terrains that can be judged from the per cent changes in the land use pattern over the years. It can be visualized that most of the geographical area of the district (around 80 per cent) is under forests and pastures. The cultivated area accounted for about 14 per cent of the reported area and about 11 per cent of the total geographical area (District Abstract, Government of Himachal Pradesh 1998-2007). There has been an increase in the area under forests in the Chamba district due to recent reporting of more geographical areas. There is an increase in the land put under non-agricultural uses like roads, buildings, water reservoirs, etc, due to the burgeoning need for infrastructure and overhead facilities for economic development in the state. The limited availability of cultivable land is the basic feature of hill geography. The proportion of cultivable areas declines drastically from low hills Shivalik range to high mountain alpine range. There has also been a decrease in the culturable wasteland that might be due to allotment to landless farmers at the state level, maize and wheat are the two predominant crops accounting for 29 per cent and 36 per cent of the cropped area The area under maize and wheat increased over the years in the Chamba district. The area under paddy decreased in the Chamba district due to the allocation of more irrigated areas to vegetable crops, The area under barley also has declined considerably, showing the marginalization of these crops in hill farming.

The scenario of crop production in the Chamba district revealed that like area, the production of maize and wheat was recorded ups and down. The production of barley and pulses declined considerably in the district showing that these crops were fast losing relevance in hill farming though these crops were important from point of view of consumption and demand which presently is met mostly through imports from other states. The yields of maize and paddy increased but showed unpredictable and uncertain changes over the years in the district. Contrary to this, the yields of barley and pulses did not reveal any breakthrough. The combined yield of all food grains showed a marked increase during these two triennium periods.

Table: Showing Agriculture Area Under Major Crops, District, Chamba (2014-19)

Area in Hectares											
Year	Wheat	Maize	Rice	Barley	Ragi	Pulses	Common Millets	Total Food Grain Crops	Chillies	Ginger	Oil Seeds
2014-15	21589	27580	3355	3978	19	1082	1151	58754	31	4	3068
2015-16	23139	27040	3325	4734	16	4318	1119	63691	37	2	2922
2016-17	21155	26648	3310	4106	16	4118	101	59454	45	4	2831
2017-18	18678	26750	2491	3591	5	4105	987	56607	50	5	1614
2018-19	18678	26750	2491	3591	5	4105	987	56607	50	5	1614

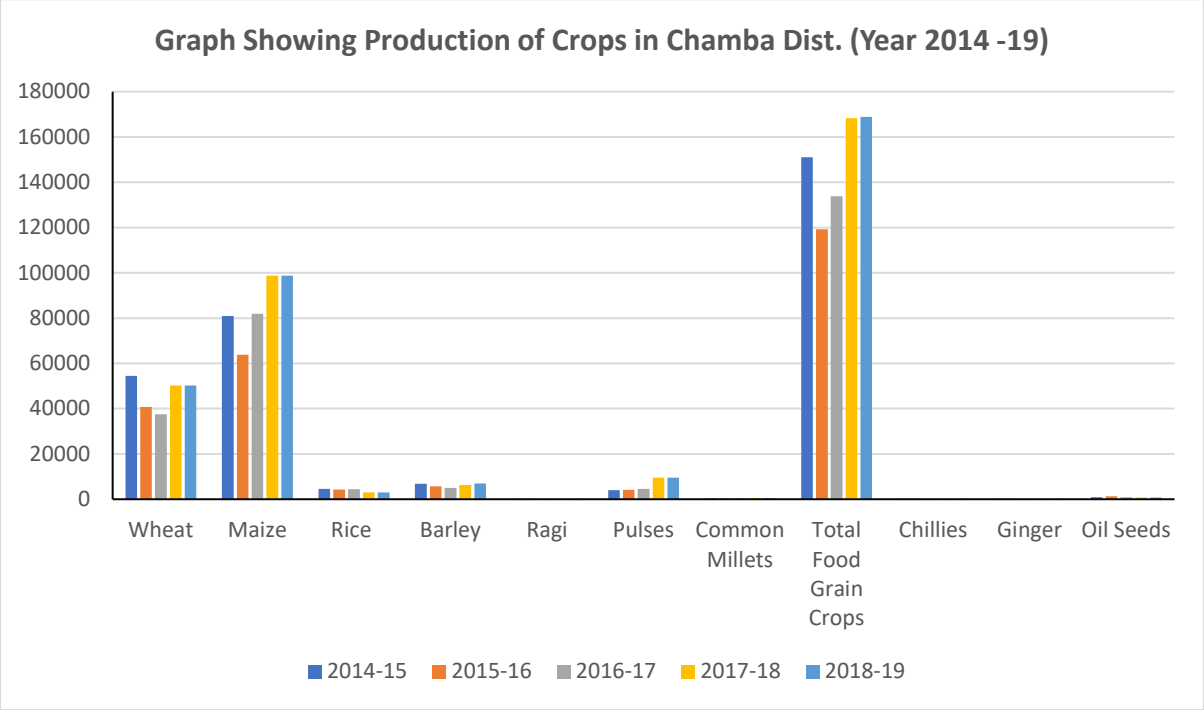
Source: Directorate of Land Records, HP



Graph Showing area under Major Crops in Chamba District (2014-19)

Table Showing Production of Major Crops, District, Chamba (2014-19)

Production in Tonnes											
Year	Wheat	Maize	Rice	Barley	Ragi	Pulses	Common Millets	Total Food Grain Crops	Chillies	Ginger	Oil Seeds
2014-15	54512	80945	4540	6774	13	3966	347	151097	8	28	907
2015-16	40781	63811	4340	5765	11	4137	367	119212	10	14	1251
2016-17	37468	81969	4470	4956	11	4537	367	133778	13	28	877
2017-18	50277	98789	2999	6339	4	9485	421	168314	21	31	797
2018-19	50277	98789	2999	6939	4	9487	421	168916	21	31	797

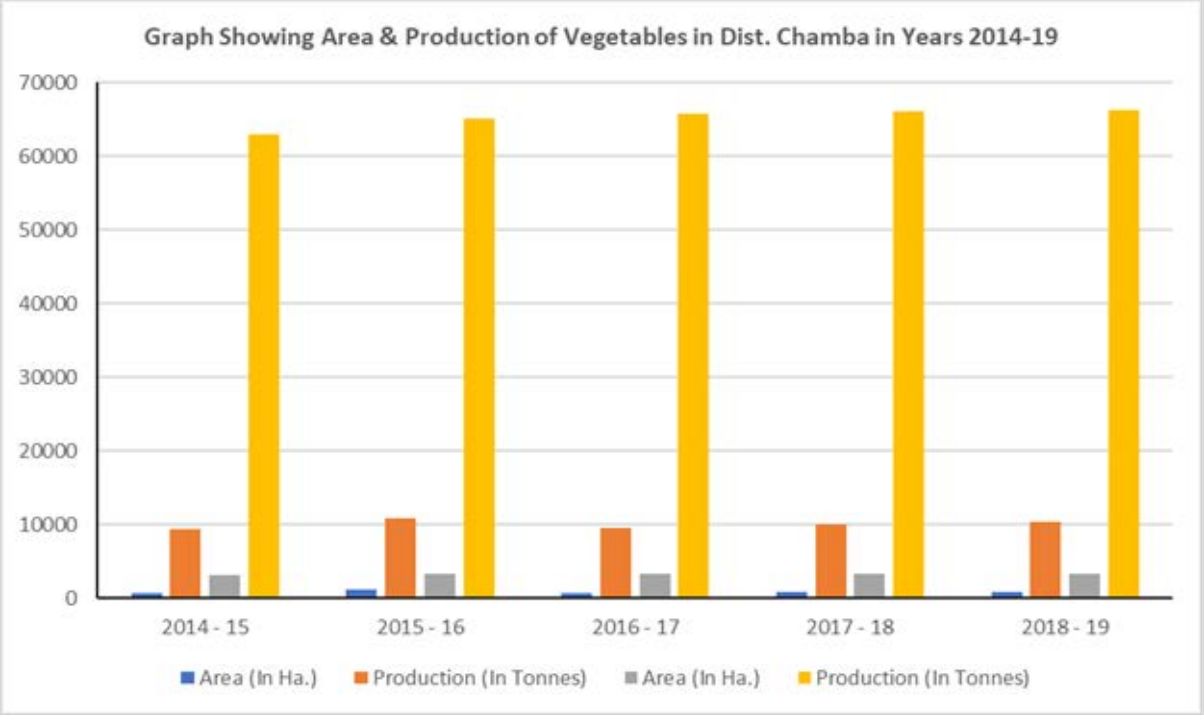


Graph Showing production of Major crops in Chamba District (2014-19)

Table Showing Area in Hects Under & Production In Tonnes Of Vegetables

Area & Production of Vegetables in tonnes				
	Potato		Other Vagetables	
Year	Area (In Ha.)	Production (In Tonnes)	Area (In Ha.)	Production (In Tonnes)
2014 - 15	650	9340	3161	63086
2015 - 16	1100	10880	3225	65086
2016 - 17	750	9460	3346	65794
2017 - 18	800	10000	3375	66199
2018 - 19	806	10412	3384	66332

Source: Directorate of Land Records, HP



Graph Showing Area in Ha & Production in Tonnes Of Vegetables in District Chamba (2014-19)

7.2 Horticulture

The topography and agro-climatic conditions of the district are quite suitable for the productions of various fruits. The topography of the district can be grouped into three categories namely High hill areas located at the higher elevation mid hill areas and low-lying valley areas Fruits of various kinds depending upon the terrain climatic condition and soil are grown in the district. The Main horticulture produce of the area can be classified into four categories

1 Citrus Fruits

2 Sub-tropical Fruits

3 Nuts and dry fruits

4 Other temperate fruits

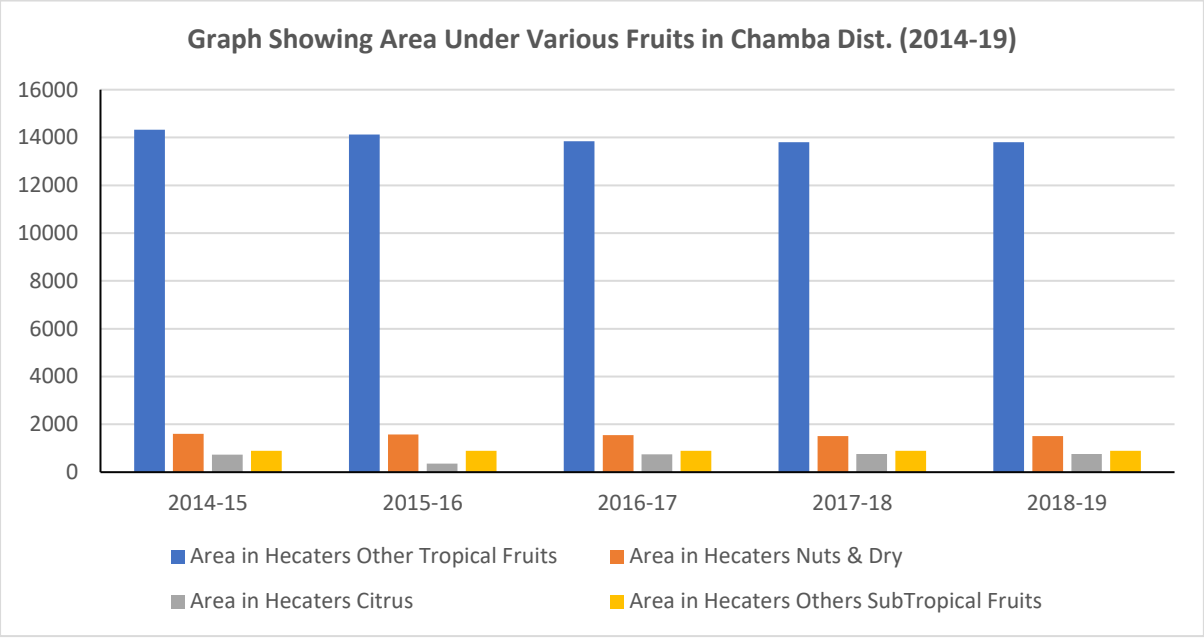
The following table shows the area under cultivations of each fruit in district Kangra.

The area under each fruit and percentage area to total district area as well as the percentage of the area under fruit in each category is given in the table below. The table also shows the production of each fruit in district Solan. Also, the tables below show the area covered under each category and the total production as per survey.

Table Showing Area under each fruit In Distt Chamba (2014-2019)

Area in Heaters					
Year	Other Tropical Fruits	Nuts & Dry	Citrus	Others Sub-Tropical Fruits	Total Area
2014-15	14322	1606	732	889	17549
2015-16	14129	1583	360	896	16968
2016-17	13844	1553	742	896	17035
2017-18	13803	1513	766	892	16974
2018-19	13803	1513	766	892	16974

Source: Directorate of Horticulture, HP

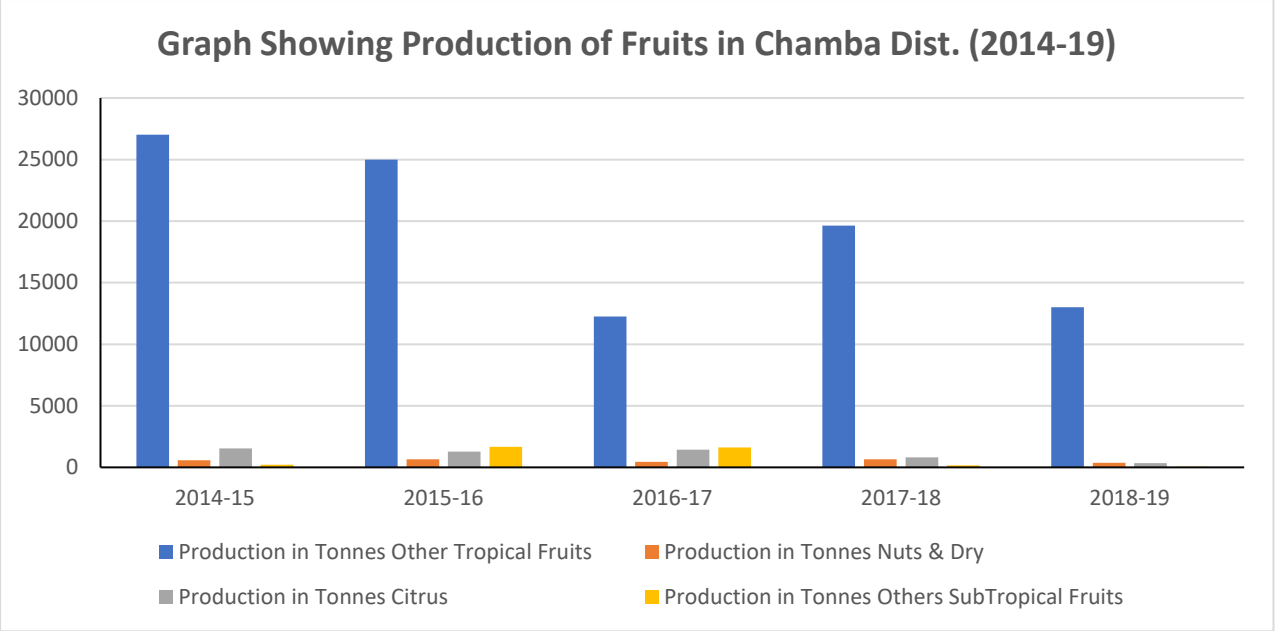


Graph Showing Area Under Various Fruits in Chamba Dist. (2014-19)

Table Showing Production of each fruit In Distt Chamba (2014-2019)

Production in Tonnes					
Year	Other Tropical Fruits	Nuts & Dry	Citrus	Others Sub-Tropical Fruits	Total Area
2014-15	27007	577	1535	219	29338

2015-16	**24981**	**668**	**1290**	**1670**	**28609**
2016-17	**12239**	**457**	**1424**	**1623**	**15743**
2017-18	**19647**	**653**	**811**	**174**	**21285**
2018-19	**13018**	**361**	**338**	**48**	**13765**



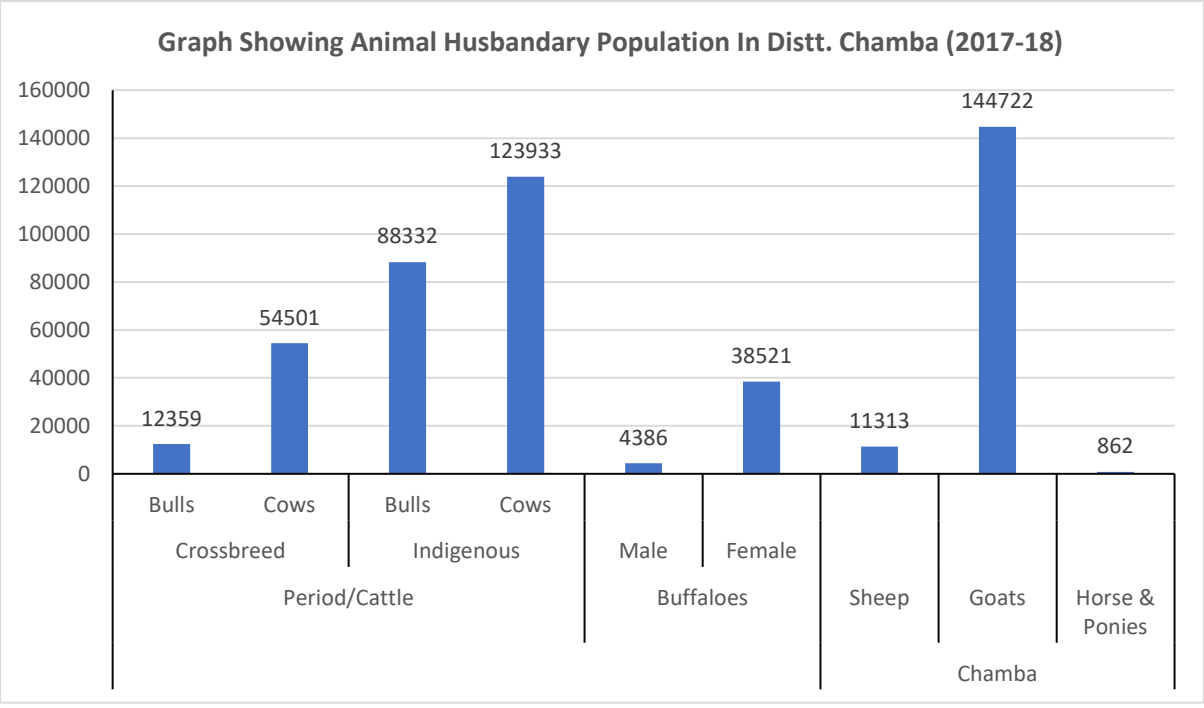
Graph Showing Production of Various Fruits in Chamba Dist. (2014-19)

7.3 Animal Husbandry

Animal husbandry plays a very important role in the lives of farmers. They depend upon animals to sustain their day-to-day lives. Large numbers of farmers have adopted animal husbandry as a livelihood activity along with agriculture and horticulture. The animals reared by the farmers are mainly for milk, farm yard manure, and meat purposes. Most of the farmers rear animals for milk production which is mainly used for self-consumption. The livestock kept by the farmers includes cows (local and Jersey) buffaloes, goats and bullocks, etc. Most of the animals are indigenous (local breed) having very low milking capacity.

Table Showing Animal Husbandry Population Chamba District-2017-18

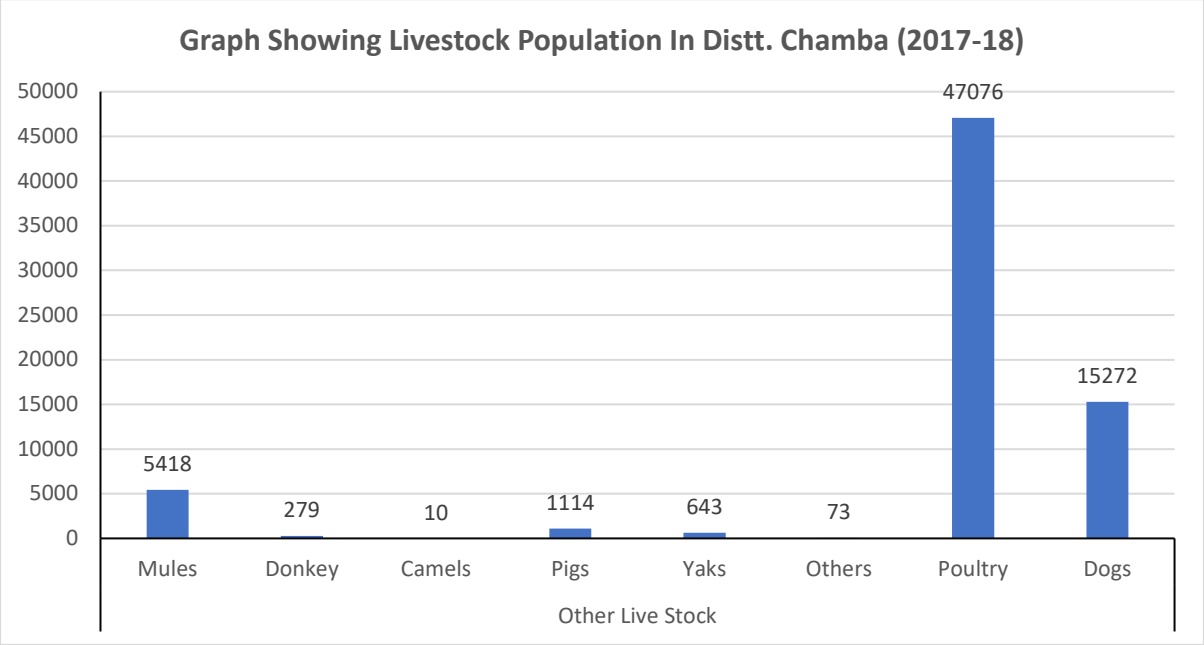
Animal Husbandry Population in District							Chamba		-
Year	Period/Cattle				Buffaloes		Sheep	Goats	Horse & Ponies
	Crossbreed		Indigenous		Male	Female			
	Bulls	Cows	Bulls	Cows					
2012	12359	54501	88332	123933	4386	38521	11313	144722	862



Graph Showing Animal Husbandry Population Kangra District-2017-18

Table Showing Livestock Population in Chamba District

Other Live Stock							
Mules	Donkey	Camels	Pigs	Yaks	Others	Poultry	Dogs
5418	279	10	1114	643	73	47076	15272



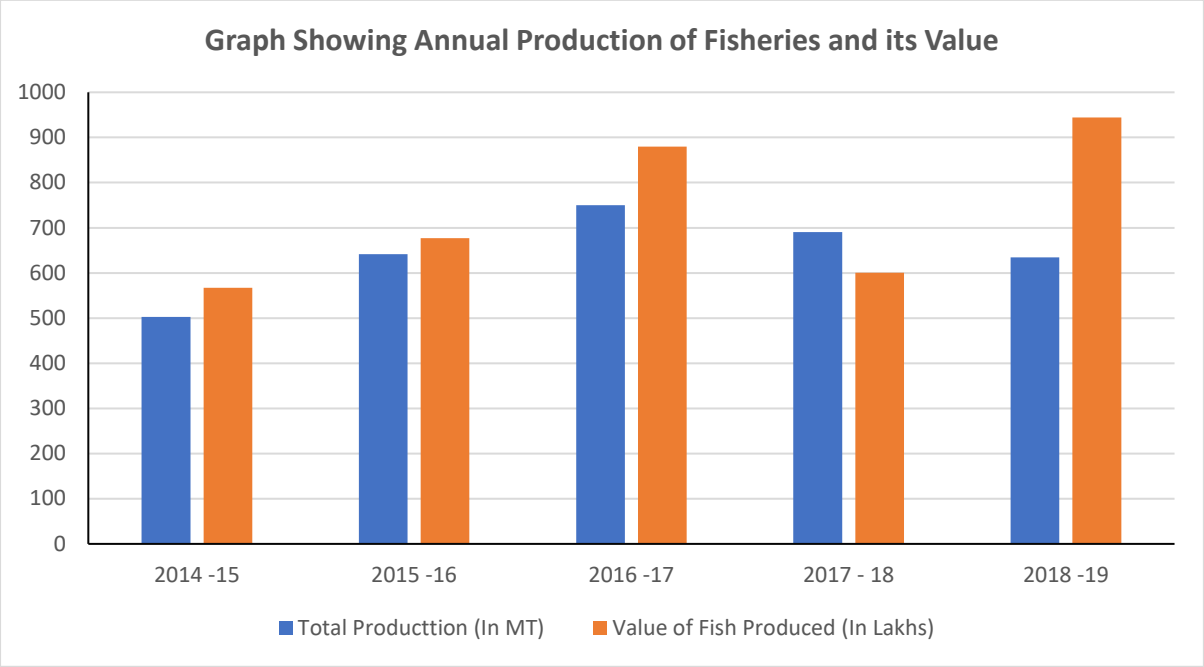
Graph Showing Livestock Population, Chamba District-2017-18

7.4 Fisheries

Fisheries play an important role in the rural economy by augmenting food supply, generating employment and raising the nutritional contents of food. Fish are abundant in rivers and perennial streams. Riverine are the main source of fish production and constitute 93.2 per cent of the total fish production. Since 1995 fisheries production in Chamba increased at the rate of 0.43 per cent per year. The production from reservoirs, riverine and ponds increased at the rate of 0.09, 17.38 and 7.91 per cent per annum respectively. There is scope to introduce the cold-water fish culture at certain places where river Ravi flow is mild in the valley area. There is also scope for rearing trout that can be sold at a premium price. The production of trout was 0.200 M.T. in the year 2001 which increased to 1.20 M.T. in the year 2007 showing an increasing rate of growth of 24.20 per cent per annum. Although pisciculture is a non-traditional activity, yet depletion of fish in rivers and increasing market demands have forced the Government as well as farmers to think along these lines. There is a vast scope of fishery development in the district.

Table Showing Years Wise Production of fish and its Value in Lakhs

Year	Total Production (In MT)	Value of Fish Produced (In Lakhs)
2014 -15	502.73	567.26
2015 -16	641.83	676.8
2016 -17	750.26	879.72
2017 - 18	690.24	600.74
2018 -19	634.49	944.34



Graph Showing Years Wise Production of fish and its Value in Lakhs

7.5 ***Forest***

Because of its complex geography and its great variations in altitude, Chamba is home to an enormous range of species, which span the subtropical to the alpine. The common trees in the Chamba belong to the conifer species (deodar, pine, spruce, fir). Several species of medicinal plants like Hath Panja (Dactylorhizahatageria) and Brahma Kamal (Saussureaobvallata) grow luxuriously in the valley. The valley is known for the presence of the majestic snow leopard, the Himalayan brown bear and the Himalayan Tahr. The Western Tragopan (the state bird of Himachal Pradesh) and the Monal pheasant are the prominent bird species found in the region.

Flora

Species/ Botanical Name	Common Name	Elevation Range (m)
Abies spectabilis (D.Don.) Mirbel	Himalayan high-altitude fir	3,000-4,000
Abies pindrowRoyle	Silver fir/ Tosh	2,500-3,200
Acer acuminatum Wall. ex D.Don.	Maple	2,500-3,200
Acer caesium Wall. ex Brandis	Maple	2,200-3,000
Aesculus indica Kk. f. & Th.	Horse chestnut/ Khnor	1,800-3,000
Alnus nepalensis D. Don.	Alder	1,500-2,000
Betula utilis D. Don.	Birch/ Bhojpatra	3,000-4,000
Buxus wallichianaBaillon	Boxwood/ Shamshad	2,500-3,000

Cedrus deodara G. Don.	Deodar/ Cedar	2,000-3,000
Cornus capitata Wall.	Dogwood	1,800-2,800
Corylus jacquemontiiDecne.	Hazelnut/ Bhutibadam	2,500-3,200
Cupressus torulosaD.Don.	Pencil cedar	1,800-3,000
Ilex dipyrena Wall.	Holly/ Kaluchha	2,000-2,800

Shrubs

Species	Altitude (m)
Aconitum heterophyllum Wall. ex Royle	3,300-4,200
Atropa acuminata Royle	1,500-3,000
Dactylorhizahatageria (D. Don.) Soo	2,800-4,000
Jurineamacrocephala (DC.) Benth.	3,000-4,300
Meconopsis aculeata Royle	3000-4,300
PicrorhizakurroaRoyle ex Benth.	3,200-4,200
SaussureagossipiphoraD.Don	3,800-4,500
Angelica glauca Edgew.	2,000-2,800
Arnebiabenthami (Wall. ex G. Don) I. M. Johnston	3,300-4,000
Arnebiaeuchroma (Royle) Johnston	3,500-4,400
Berberis aristata DC.	1,200-1,500
Betula utilis D.Don.	3,300-4,000
Dioscoreadeltoidea Wall.	2,000-3,000
Fritillaria roylei Hook.	2,800-4,000
Malaxismuscifera Lind.	2,000-3,000
Nardostachys grandiflora DC.	3,600-4,300
Paris polyphylla Smith	2,000-3,000
Podophyllum hexandrumRoyle	2,400-4,000
PolygonatumcirrhifoliumRoyle	1,500-3,000
Polygonatummultiflorum (L.) All	2,500-3,500
Polygonatumverticillatum (L.) All.	1,500-3,300
Saussureaobvallata (DC.) Edgew.	3,600-4,500
Taxus wallichianaZucc.	2,100-3,300
Zanthoxylum armatum DC.	1,200-1,800

Aconitum violaceum Jacq. ex Stapf	3,300-4,200
Ephedra gerardiana Wall. ex Stapf.	3,300-4,500
Hypericum perforatum L.	2,000-3,000
Juniperus communis L.	2,800-4,000
Rheum australe D. Don	3,000-4,200
Rheum webbianumRoyle	3,000-4,000
Roscoea alpine Royle	2,400-3,500
Roscoeaprocera Wall. ex Bak.	2,000-3,000
Selinumconnifolium	2,500-3,500
Selinumvaginatum Clarke	2,500-3,500
SkimmialaureolaSieb. &Zucc.	2,200-3,200
Symplocospaniculata (Thumb.) Miq.	1,500-2,500

Fauna

Common Name	Scientific Name
Asiatic Black Bear	*Ursus thibetanus*
Blue Sheep	*Pseudoisnayaur*
Common Leopard	*Panthera pardus*
Himalayan Brown Bear	*Ursus arctos*
Himalayan Ghoral	*Naemorhedus goral*
Himalayan Musk Deer	*Moschus chrysogaster*
Himalayan Tahr	*Hemitragusjemlahicus*
Red Fox	*Vulpes vulpes*
Serow	*Nemorhaedussumtraensis*
Snow Leopard	*Uncia uncia*

Birds

Little Forktail,

Crested Kingfisher,

Blue Whistling Thrush

Western Tragopan Male

Monal Male

Koklash Pheasant (Male)

White-crested Kaleej

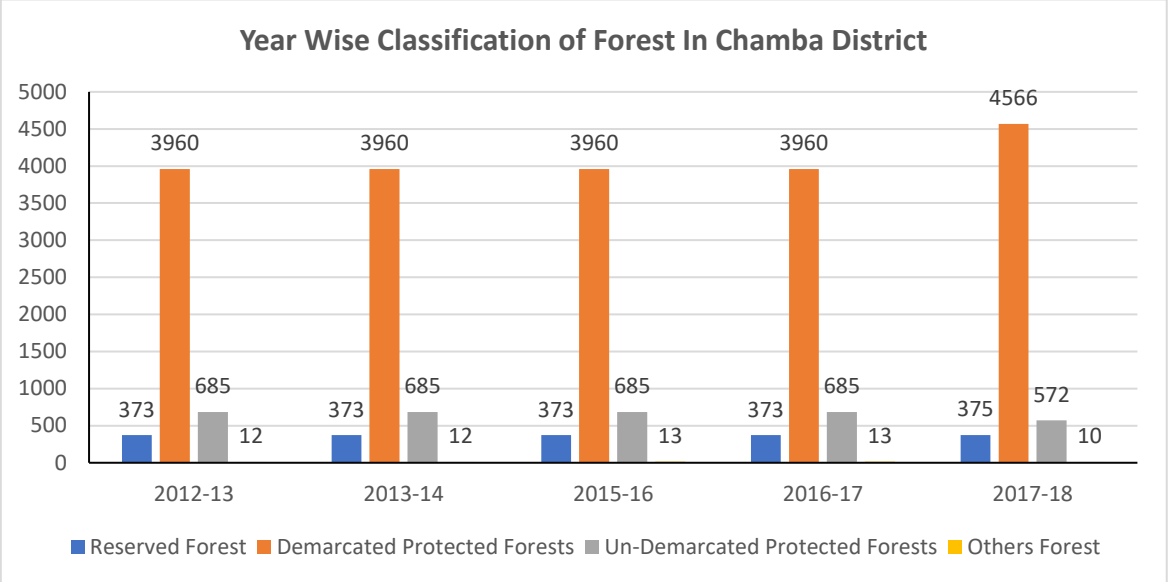
Insects

Blue Pansy, Junoniaoenone

The Paris Peacock, Papilioparis

Table Year Wise Classification of Forest in Chamba District

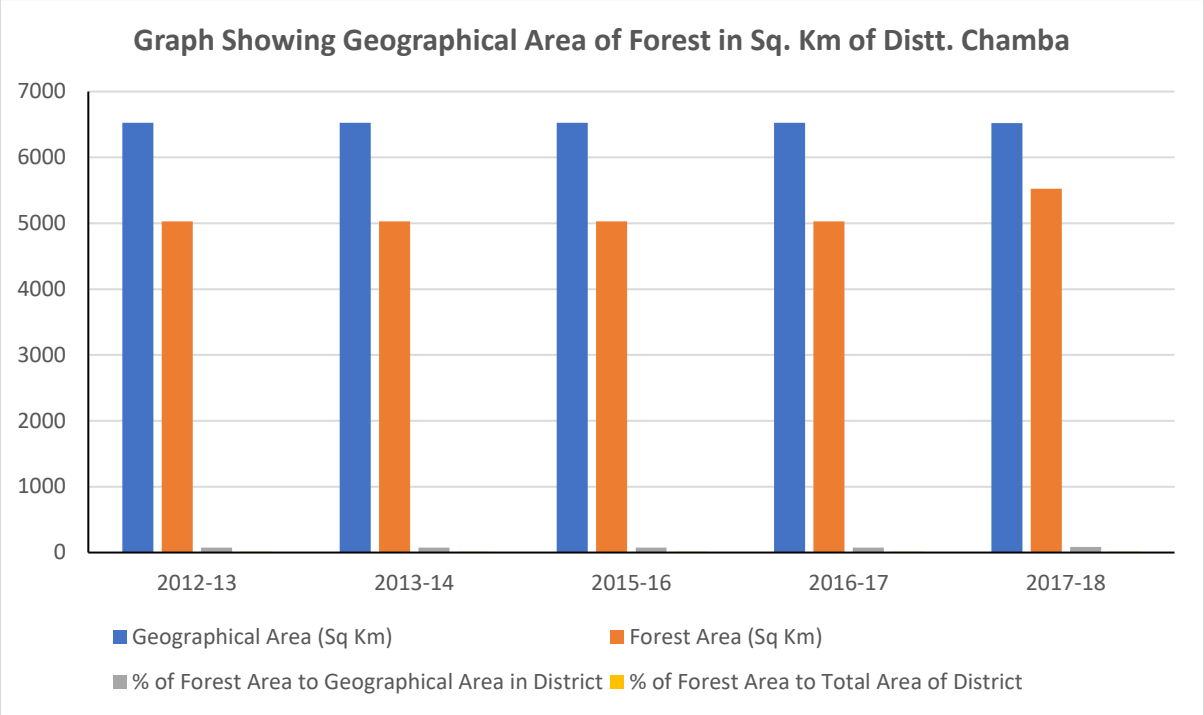
Year	Reserved Forest	Demarcated Protected Forests	Un-Demarcated Protected Forests	Others Forest	Total
2012-13	373	3960	685	12	5030
2013-14	373	3960	685	12	5030
2015-16	373	3960	685	13	5031
2016-17	373	3960	685	13	5031
2017-18	375	4566	572	10	5523



Graph Showing Year Wise Classification of Forest in Chamba District

Table Showing Geographical Area of Forest in Sq. Km of Distt. Chamba

Year	Geographical Area (Sq Km)	Forest Area (Sq Km)	% of Forest Area to Geographical Area in District	% of Forest Area to Total Area of District
2012-13	6528	5030	77.05	13.6
2013-14	6528	5030	77.05	13.6
2015-16	6528	5031	77.07	13.6
2016-17	6528	5031	77.07	13.6
2017-18	6522	5523	84.68	14.55



Graph Showing Geographical Area of Forest in Sq. Km of Distt. Chamba

8 Surface Water And Ground Water Scenario Of The District

8.1 Surface Water

The Ravi, Chenab and Beas rivers form the major drainage system in the district. The river Ravi and its tributaries, drain about 67% of the district area. The northern part of the district, is drained by the Chenab River, the river and its distributaries drain about 23% of the area. The southern part of the district is drained by Beas river and the river drains 10% of the total area of the district.

S.No.	Basin	Area (Sq. Km)	Percentage Area
1	**Beas Watershed**	675	10%
2	**Chandra Bhaga Watershed**	1525	23%
3	**Ravi Watershed**	4322	67%
Total		**6522**	**100%**

The drainage pattern is mostly dendritic to sub-dendritic i.e. the tributaries meet at low angles and branch at random, like a tree pattern. A dendritic drainage pattern indicates comparatively low permeable rocks which allow high drainage density in the district.

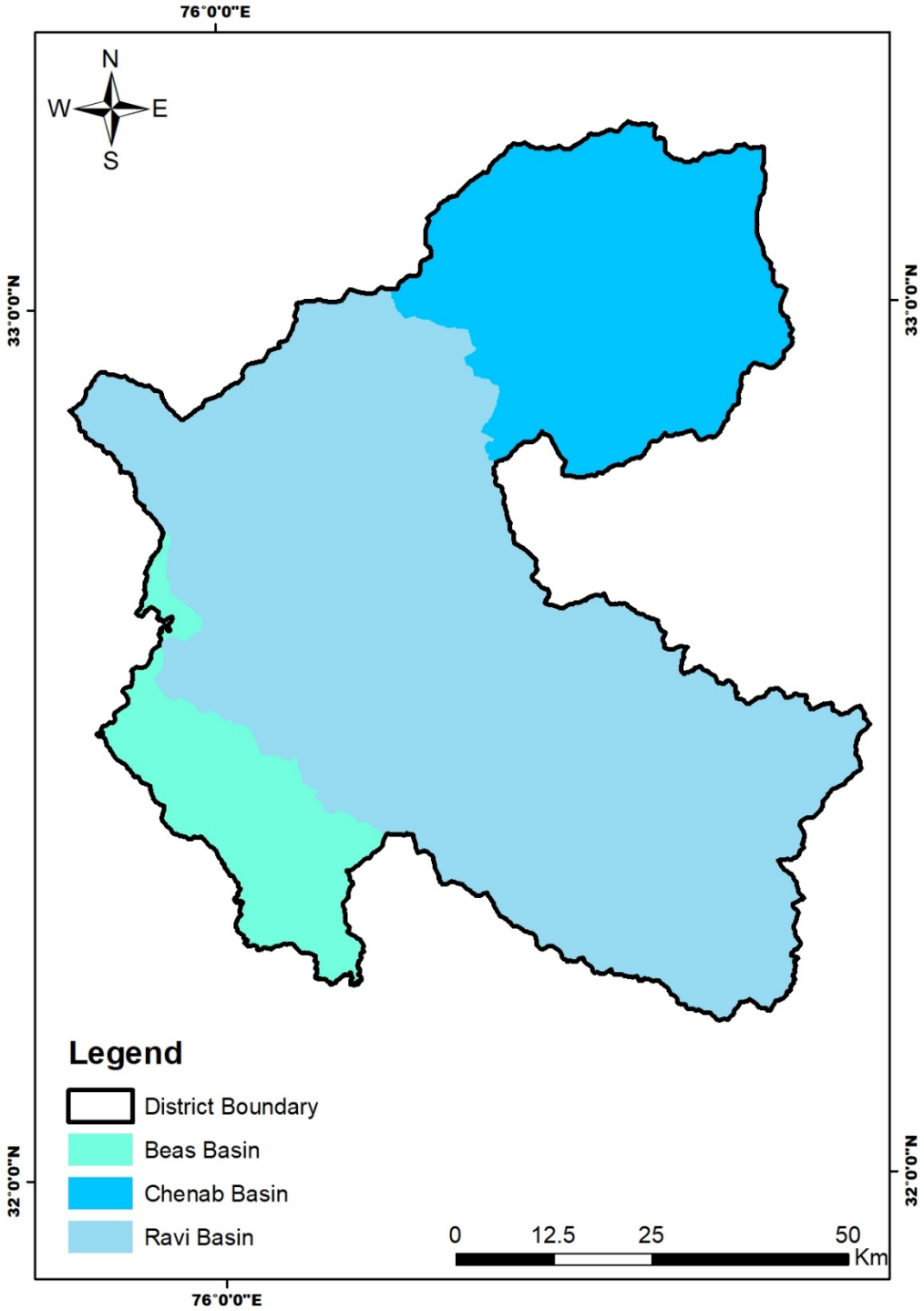


Fig showing Watershed Map of Chamba District

Further, the dendritic pattern in the Chamba district i.e., in the Himalayas System is mainly controlled by the structural influences which further limit the percolation of rainwater to groundwater reserve at the structural contacts.

Drainage density can affect the shape of a river's hydrograph during a rain storm. Rivers that have a high drainage density will often have a 'flashier' hydrograph with a steep falling limb. High densities can also indicate a greater flood risk which leads to damage of roads and habitats. In the Chamba district, the drainage density ranges from 0.004 to 1.705 KM/KM2. The areas with high drainage density lead to flooding in the lower areas and deposit the RBM (River Borne Material) when the hydrograph limb falls steeply.

8.2 Groundwater

The district being hilly & mountainous, traditional sources of ground water mainly springs have played a major role in past in providing assured irrigation and water supply. These include the nallas, springs, Chasmas, khatis. In some of the areas, at present too, these are the only sources of water for the settlements. However, modern means for tapping the groundwater have been employed in recent years.

Hydrogeological, the district is divided into two distinct and well-defined units viz. porous formations constituted by unconsolidated sediments and the fissured formations or hard rock formations constituted mainly by semi-consolidated to consolidated rock.

The fissured formations include the semi-consolidated to consolidated (hard) rocks exposed in the district and are of sedimentary, metamorphic and igneous origin. These form low and high hill ranges throughout the district. Fractured and jointed sandstone, and siltstone forms low-potential aquifers in the area. In general weathered and fractured hard rocks are favorable for groundwater aquifers. Fracture zones and contact zones form the important aquifers in the topographic low areas, with poor to moderate yields. These fracture or fault zones form potential groundwater zones. Groundwater in these hilly areas oozes in the form of seepages, and springs and is utilized for domestic and other uses. At places, shallow boreholes fitted with hand pumps have been constructed to develop groundwater.

The unconsolidated sediments comprising fluvial, channel deposits, valley fills and terrace deposits and alluvial fans constitute the porous aquifers in the district. These sediments consist of sand, gravel, cobbles, pebbles and boulders interlayered with clay beds. These sediments form prolific aquifers.

Rainfall is the major source of groundwater recharge, apart from the influent seepage from the rivers, irrigated fields and inflow from upland areas, whereas discharge from groundwater mainly takes place through wells and tube wells; effluent seepages of groundwater in the form of springs and base flow in streams etc.

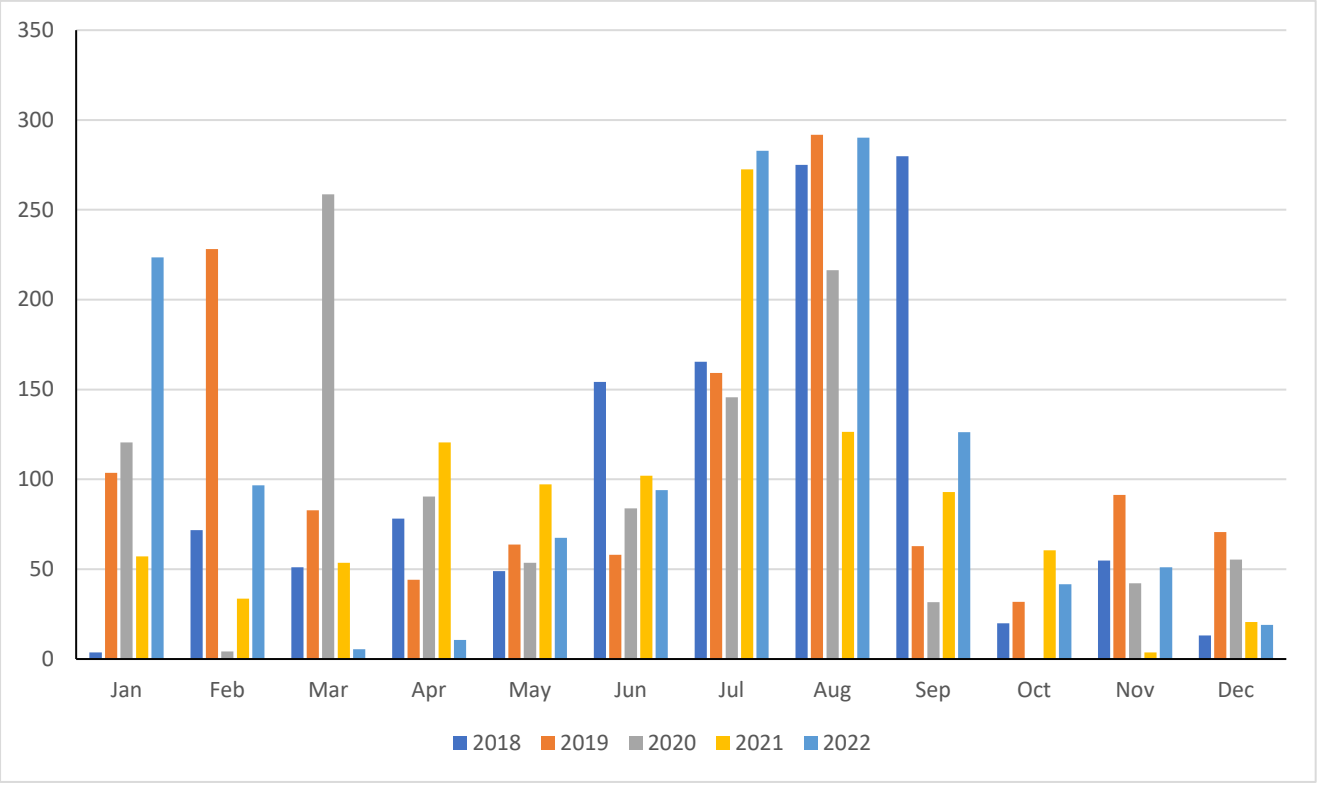
9 Rainfall Of The District And Climatic Condition

Rainfall varies significantly with the altitude of the area. The catchment area receives rainfall due to western disturbances that pass over the northwestern part of the country during the winter months. Significant precipitation in the form of snow is received at higher altitudes and rainfall in valleys is received during the winter month. The rainy season generally starts in mid-July and extends up to mid-September. During winter the rains are scarce and extend from 15th December to 15th February. The following Table shows the quantum of rainfall from the year 2018 to 2022 in the district as per IMD.

Table Showing Rainfall Data In Millimetres Of District Chamba

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018	3.6	71.7	51.1	78.1	48.9	154.3	165.4	275	279.8	19.9	54.8	13.1
2019	103.6	228.2	82.8	44.2	63.8	58	159.2	291.7	62.9	31.8	91.4	70.7
2020	120.6	4.2	258.7	90.4	53.5	83.8	145.7	216.4	31.6	0.3	42.1	55.3
2021	57.1	33.6	53.5	120.5	97.2	102	272.6	126.5	92.9	60.6	3.7	20.6
2022	223.5	96.6	5.5	10.6	67.4	94	282.8	290.2	126.3	41.6	51	19

Source: Meteorological Department, Govt. of India



Graph Showing Annual Rainfall Data of District Chamba from the Year 2018 To 2022

10 Details Of The Mining Leases In The District

DETAILS OF LEASES DISTRICT CHAMBA

Sr. no.	Name & Address of the Mining Lease	Khasra No. Mauza /Mohal	Area	River Bed/Hill Slope	Period of mining lease with date	Purpose of Lease	Lease area Co-Ordinates	Status (working /non-working), if non-working reason
Division Chamba								
1.	Sh. Prakash Chand S/o Sh. Soorma Ram, Vill. & P.O. Kunr, Tehsil & Distt. Chamba (H.P.)	3026/2939/1Kunr	0.4087 Hect.	Hill Slope	14-01-2011 to 13-01-2021	Open Sale	32°24'35.9"N 76°23'17.7"E	Non-Working
2.	Sh. Yogesh Kumar S/o Sh. Jarmo Ram, Vill. Batti-Hatti, P.O. Gehra, Tehsil & Distt. Chamba (H.P.)	1265/544/1, 1244/598 Piura	0.3318 Hects	Hill Slope	19-08-2023 to 18-08-2033	Open Sale	32°26'04.32"N 76°20'10.35"E 32°26'03.15"N 76°20'10.38"E	Working
3.	Sh. Dhiraj Mahajan S/o Sh. Madan Lal, Vill. & P.O. Rajpura, Tehsil & Distt. Chamba (H.P.)	600/1,602to613,613/1,614,615,1314/616,1316/617,617/1,621,1318/622,623,624,1320/625,1277/1208,1278/1208,1279/1208,1275/1208,1276/1208,1206/988 &1207/988 Rajpura	46-16-18 Bighas	River Bed	23-09-2022 to 22-09-2027	Open Sale	32°36'17.9"N 76°05'44.68"E 32°36'15.33"N 76°05'48.53"E	Working
4.	GPA holder Sh. Shailender Thakur S/o Sh. Gian Chand, Village Lech, P.O. Gehra, Tehsil & Distt. Chamba, H.P.	1823/1704/36/1 Bhadour	2-00 Bighas	Hill Slope	30-05-2018 to 29-05-2023	Open Sale	32°26'35.5"N 76°20'11"E 32°26'33"N 76°20'10"E	Non-Working
5.	Sh. Neeraj Nayar S/o Sh. S. C. Nayar, Mohalla Bangotu, Tehsil & Chamba, H.P.	1883/1579/1 Gehra	17-05-00 Bighas	Hill Slope	31-08-2020 to 30-08-2025	Open Sale	32°26'23.72"N 76°20'05.37"E 32°26'17.98"N 76°20'02.43"E	Working
6.	Smt. Rachya Devi w/o Sh. Roshan Lal VPO Kunr Tehsil & Chamba, H.P.	3026/2939/2 Kunr	0.2186 Hect.	Hill Slope	20-02-2020 to 19-01-2030	Open Sale	32°24'28.9"N 76°22'13.2"E 32°26'27.8"N 76°22'14.7"E	Working
7.	Sh. D.S. Thakur, S/o Sh. Kirpa Ram, Prop:- M/s Thakur Stone Crusher Village & P.O. Kandla, Tehsil & Distt. Chamba, H.P.	4,10,11,12,530/22,531/22 & 24 Kandla	23-13-11 Bighas	River Bed	26-02-2021 to 25-02-2031	Stone Crusher	76°04'07.31"E 32°41'40.55"N 76°03'54.65"E 32°41'44.69"N	Working

8.	Sh. D.S. Thakur, S/o Sh. Kirpa Ram, Prop:- M/s Thakur Stone Crusher Village & P.O. Kandla, Tehsil & Distt. Chamba, H.P.	647/640/1 & 173 Mohadi	12-09-00 Bighas	River Bed	07-12-2018 to 06-12-2023	Stone Crusher	76°03'09.93"E 32°4049.29"N 76°03'08.68"E 32°4041.19"N	Non-Working under renewal
Division Churah								
9.	Sh. Chatter Singh S/o Sh. Lehnu Ram, Vill. Jawari, P.O. Thani-kothi, Tehsil Churah, Distt. Chamba (H.P.)	85/1,92 Jawari	0.4896 Hect.	Hill Slope	29-03-2018 to 28-03-2023	Open Sale	76°07'35.70"E 32°50'16.95"N	Non-Working
10	Smt. Hamiru Devi S/o Sh. Hans Raj Village Dayas P.O. Tarela, Tehsil Curah Distt. Chamba	882 Bounderi	08-00-00 Bighas	Hill Slope	14-12-2022 to 13-12-2032	Stone Crusher	32°52'38.40"N 76°8'47.77"E 32°52'37.53"N 76°8'51.93"E	Not working due to non-installation of Stone Crusher
Division Dalhousie								
11.	Sh. Sunil Kumar S/o Sh. Anirudh Prop:- M/s Sunil Stone Crusher, Village & P.O. Samleu, Tehsil Dalhousie, Distt. Chamba H.P.	374/153,375/153 & 376/153, 154,155,160,161,162,163,164,165,166 & 167 Samleu	10-02-00 Bighas	River Bed	13-10-2017 to 12-10-2022	Stone Crusher	32°36'05.65"N 75°54'22.55"E 32°36'02.44"N 75°54'21.02"E	Non-Working under renewal

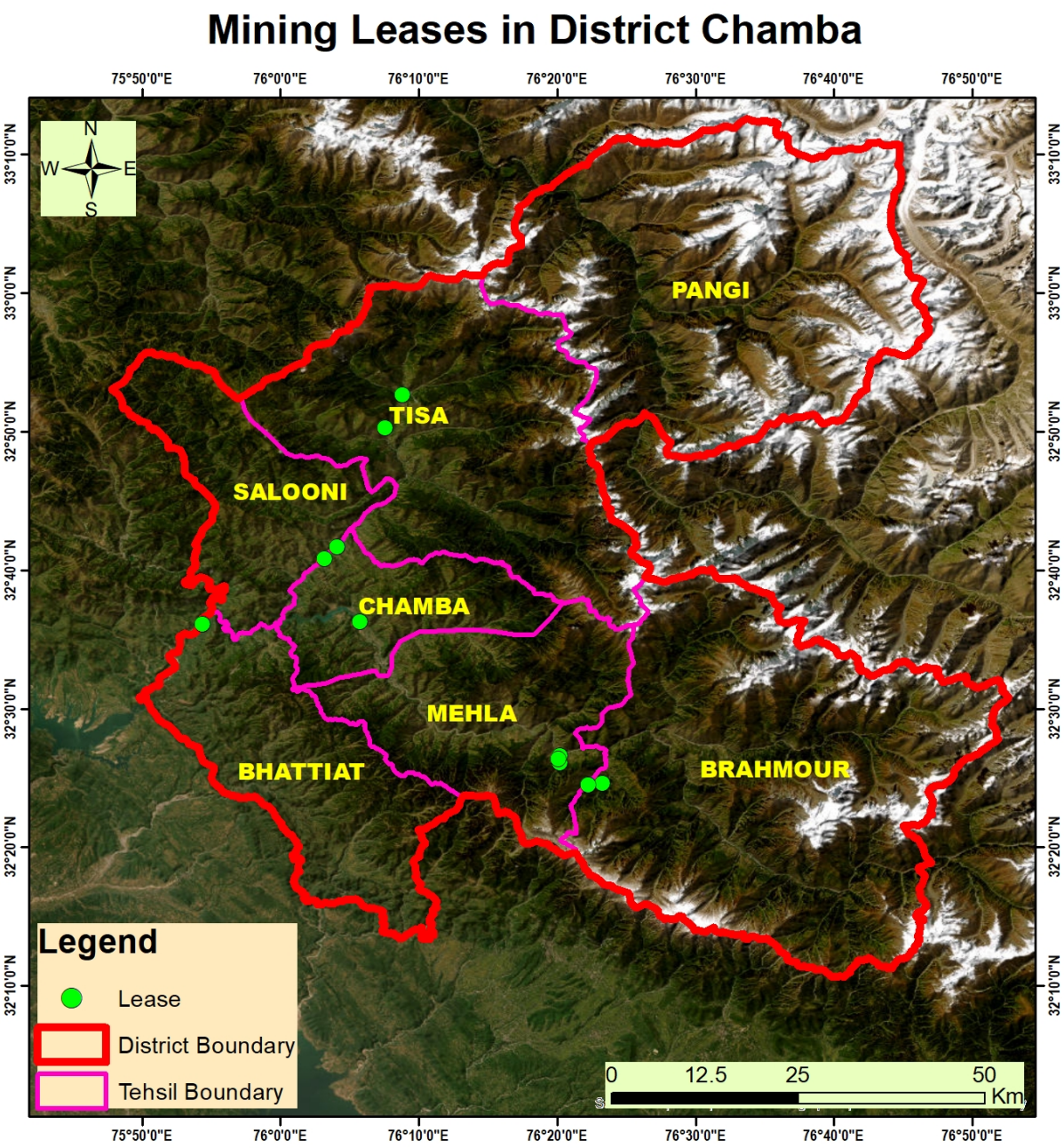


Image showing the location of the mining leases

11 Details Of Royalty Or Revenue Received In Last three Years

Sr. No.	Financial Year	Production of minor minerals (in tonns)	Royalty received (in lacs
2	2021-22	126591 MT	8186880/-
3	2022-23	48984 MT	4134520/-
4	2023-24	138496 MT	11149880/-

12 Details Of Production Of Minor Mineral In Last Four Years

Table 1: Production of Minor Mineral in Metric Tonnes

FY	2021-22	2022-23	2023-24
Sand	61971	6320	15399
Stone/Bajri	63381	41834	122827
Slate	1239	830	270

13 Mineral Map Of The District:

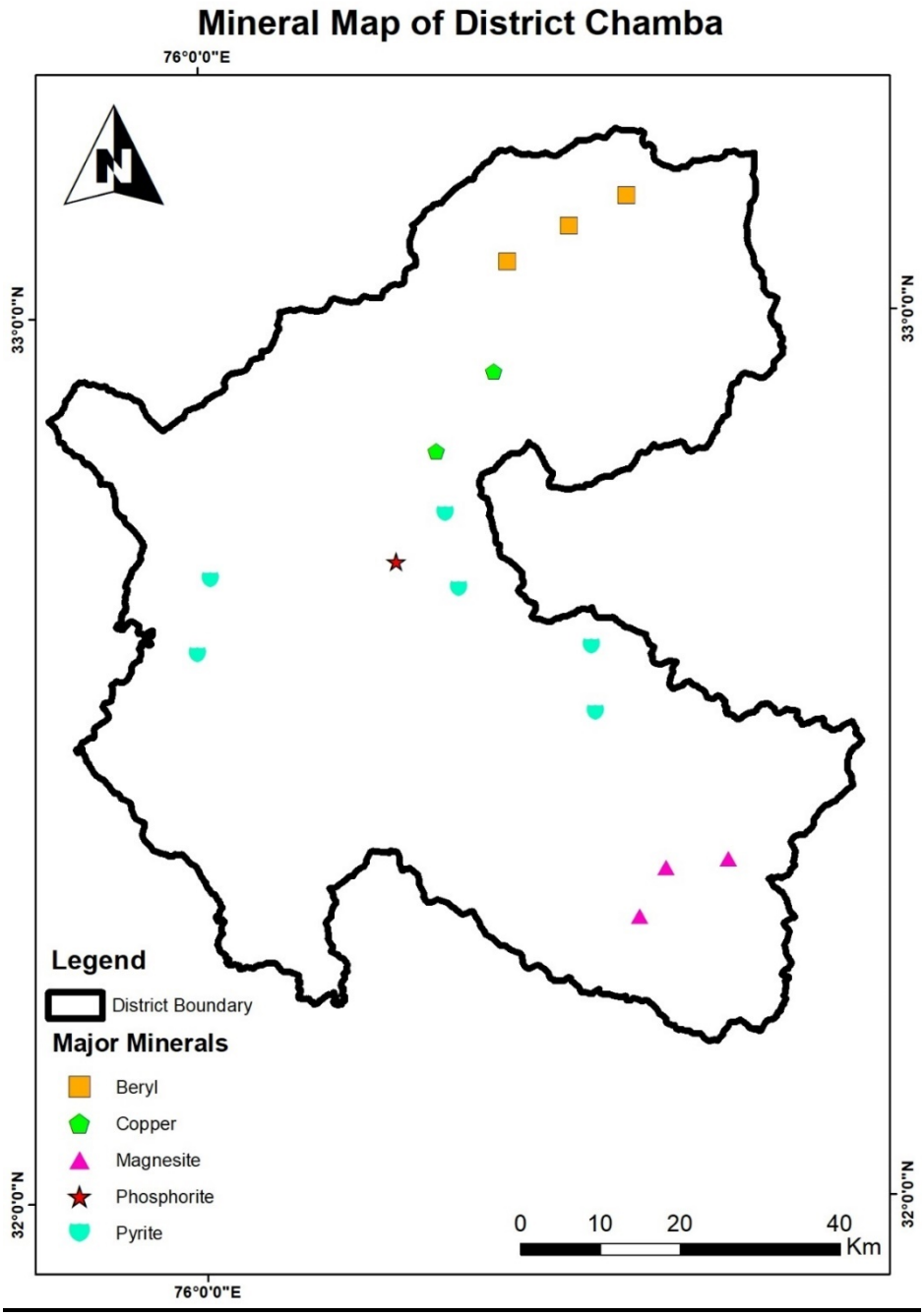


Image Showing Mineral Wealth of District Chamba

Beryl

(i) Beryl bearing pegmatites have been located in Kilar gneiss around Haksu bridge (33° 05': 76°23'0.

(ii) Pegmatite bodies with beryl have been found within gneisses of Kilar Formation. The pale yellow to light bluish-green beryl occurs at about one kilometres east of Dehda nala bridge (33°05'10" : 76°22'30") and about 1.5 kmsouth of Jules (33°05' 35" : 76° 23'15". The visual estimate of beryl in pegmatite is less than 0.5%.

Copper

It is believed by the inhabitants of Chamba District that a large quantity of copper ore had been mined from the Silagharat in the old times. Historically the mining in the area is said to have been carried out in 1559 A. D. It is said that in the times of Raja Partap Singh Verman, the ruler was in need of source of revenue for repair of Laxmi Narayan Temple. A farmer from the Hul area presented to the Raja a piece of copper and informed him of the existence of a large deposit. Thus a rich deposit of copper is said to have been found and worked. The rock types in the vicinity of old workings comprise dense black carbonaceous slates and dark grey slates with occasional lenses of the limestone. The working are situated about a km east of Banja (32° 41': 76° 13') on a steep terrain. Mineralization in the slates in the adit as well as around it is predominantly of Pyrite. Only occasional chalcopyrite grains are noticed. In the old audit somewhat graphitic slates, shows only few signs of Malachite.

Magnesite

Magnesite is reported only in District Chamba . Magnesite occures in grey phyllite of Salooni Formation in lenselike irregular shape and a few deposits are large in size. Invariably the dolomite limestone is found associated with magnesite. At places carbonaceous phyllite are seen coming in contact with magnesite deposit. Magnesite is medium to very coarse grained and crystalline in nature. Granular and bladed texture is commonly developed.

(i) Lenses of magnesite occur in the Katarigali Formation near the confluence of Muchetar nala and the Ravi river (32° 23' 00" : 76° 39'10"). The main magnesite band is exposed in a vertical cliff face on the left side of Muchetar nala and extends towards WNW to the ridge top. It is a lensoid band varying in size between 30 x 3m and 350 x 10m. On an average, its thickness varies between four and nine metres. The estimated reseves, calculated upto five metres depth, are of the order of 55,620 tonnes.

Phosphorite

Salooni Formation

Phosphatic nodules varying from 1.5 cm to 7 cm, in diameter and analysing 20 to 30 % P_2O_5 , were recovered from the black slates. A few sporadically distributed nodules were also seen in the grey slate and phyllites. The phosphatic nodules have been recorded from a number of localities in district Chamba such as Tarota (32º42' : 76º 05'), Dhaneli nala(32º45':76º 00'), Chikoli bridge, Dhamot (32º43': 76º05') and from Tiloga, Thamiru (32º48': 76º 57'), Deutal (32º 45': 76º 00'), Bhatinund (32º43' : 76º 04') of Chamba District.

Pyrite

Chamba district : Sporadic cubes of pyrite occur in Kamli Got area along joint planes in slates and phyllites in two to five metres thick zone traceable for a length of 150 cm, about 800m southwest of Mawa (32° 46': 76° 18'). Such mineralisation was also seen two kilometres east of Kamli Got (32° 461: 78° 20'). in the debris of quartzitic slates on the right bank of Lanj nala. The pyrite associated with pyrrhotite is of no economic significance.

Pyrite has been recorded in highly crushed carbonaceous slates of Katarigali Formation near the Chakoli bridge (32° 45' 30" : 76° 00' 00'), Bharaura (32° 46':75°58'),Kanthili (32° 47': 75° 57') and Sumu Kuthi (32° 48': 75° 56'). as disseminated cubes, veins, stringers and fine grained impregnation. Near Chakoli bridge, pyrite veins vary in thickness from a millimeter to 4.5 cm.

14 Total Mineral Reserve Available In District: -

Mainly three types of Minor mineral constituents like Sand, Stone and Bajri are required for any type of construction apart from other materials like cement and steel. In earlier times, mud houses/buildings were constructed with the use of mud. However, with the passage of time, new techniques of development activities were started. As such the demand of Minor minerals started on an increasing trend. In order to meet the requirement of raw material for construction, the local residents used to lift sand etc. from the river beds to meet out their bonafide requirement. However, after coming into being "The Himachal Pradesh Minor Mineral Rules 2015", the mining is regulated in accordance with the rules. From the geological report, it appears that there are deposits of various minerals. The important minerals that are available in this district in a commercial scale are River borne Sand, Stone, Hill slope Stone mines (Leases), Slate etc.

At present, based on existing running mining leases of stone/slate and available Mining plans (11 registered mining leases) mining operations is being carried out to produce stone/slate mining in the district. However, there is potential of stone and slte deposits have been identified in the District.

15 Quality /Grade Of Mineral Available In The District: -

The rock formations occupying the district range from the pre-Cambrian to the Quaternary period. Hard formations, form hilly and mountainous terrain and mainly comprise of igneous and metamorphic rocks, belonging to the Jutogh, Shali/ Largi and Shimla groups and occupy the major parts of the area in the northern, central and eastern parts. Granites and gneisses are intruded in the meta-sediments of the Shali/Largi and Shimla groups. In the western and southern parts sediments comprising of sandstone, shale, siltstone, conglomerate etc of the Dharamshala/Sabathu group and Siwalik group of Tertiary age are observed. Alluvium, terrace deposits, and fluvial deposits of the Quaternary period occur in the intermontane valleys, viz., Balh Valley, Sarkaghat Valley etc., and constitute an important unit from a groundwater point of view.

The construction grade aggregate materials of good quality of Minor minerals are present in the District. The slate and building materials are also important minerals of the District. As we have assessed Mineral availability of the district is fair and acceptable quality and it has commercial value. The Quartzitic rock and granitic gneiss, granite etc. are extensively quarried for the manufacturing of grit and are used in road metal, fencing blocks, building constructions etc. Granite & Granite Gneiss rocks are normally composed of mainly feldspar, quartz, mild amphibole, pyroxene, olivine, biotite etc. all these physical properties signify its good cementing properties and higher resistance which indicate its suitability for construction stone as the source areas have numerous fractures & joints.

16 Use Of Mineral

A lot of construction activity in the private & Government sectors is going on. Stone, Bajri(Grit) and Sand are the basic requirements for construction materials and there is a necessity for such activity to flourish so that the requirement of the material can be met locally. Stone Aggregates represent about 80% to 98% of quarry output, most of which is used in road construction, maintenance and repair. Stones are derived from rocks, which form the earth's crust and have no definite shape or chemical combination but are mixtures of two or more minerals. They are strong, durable and decent in appearance. Much of this goes to the production of road metal, to provide a sturdy base for roads. Stone is an essential and more permanent building material in construction than other natural building materials. Based on the type, Stones can be used in buildings for flooring, roofing, masonry paving roads and also as aggregates for concrete.

Only the harder more resilient rocks can be employed for most road surfacing requirements. Apart from road usage, substantial amounts are mixed (coarse gravel-sized stone with finer stone particles or sand) with cement and water to make concrete.

17 Demand And Supply Of The Mineral In The Last Three Years:

There is a huge demand for Stone Grit and M-Sand for the domestic and infrastructure sectors. Only a few Stone mines have environmental clearance for the extraction of Stone. There is a limited supply of Stone and there is a huge gap. There are no statistical data, regarding the demand and supply of minerals in the district. Due to the construction of National Highways, Tunnels, Hydro projects and public buildings for development works in the district, a large number of Stone chips & boulders are required. This will be met only by granting new leases in the district. As per the present data, a total 51 registered Mining leases have been granted in the District. Stone(Grit) and sand are the basic requirements for construction materials and have a good market in all regions of the State for the construction of buildings, roads, bridges, railway lines and other construction purposes. There are huge infrastructural activities such as roads, buildings, and railways are coming up by Govt. of India & PSUs. Out of the total production, approximately 70%-80% of the supply is utilized in government works, while the rest is consumed for private purposes. The certainty of the exact demand in the district depends upon various Govt projects & schemes etc, hence quite not impossible to quantify the exact demand. Certainly, there is an unavoidable gap between the demand and supply of road metal/stone in the district, hence to balance the demand-supply gap a few stone quarries have been proposed in certain areas. It is proposed to start the Stone production from larger areas to at least double the production of the district which will enhance the revenue of the State and also support the livelihood of the local people. The mining project not only brought economic benefits to the State by the ways of royalty of Stone but also benefits to the local people and lessees. It will help in general employment in rural areas in the State where the people are starving due to unemployment. A single mining project shall provide employment to approximately 10 to 20 people of the poorest section of the society and benefit more than 50 to 60 people indirectly. Further, infrastructure development will help in the development of the nation. The socio-economic condition of the area will be improved as mining activity will create additional employment for the local inhabitants to raise their socio-economic status. A significant contribution will be made by the lessee towards the societal development of the surrounding area in the form of DMFT/CSR fund.

18 Mining Leases Marked On The Map Of The District

At present about 11 Nos of mining leases (Pvt./Govt. Land) have been granted/executed and are under operation and the demand for furnished material is still high. The details of the Mining lease are as follows:

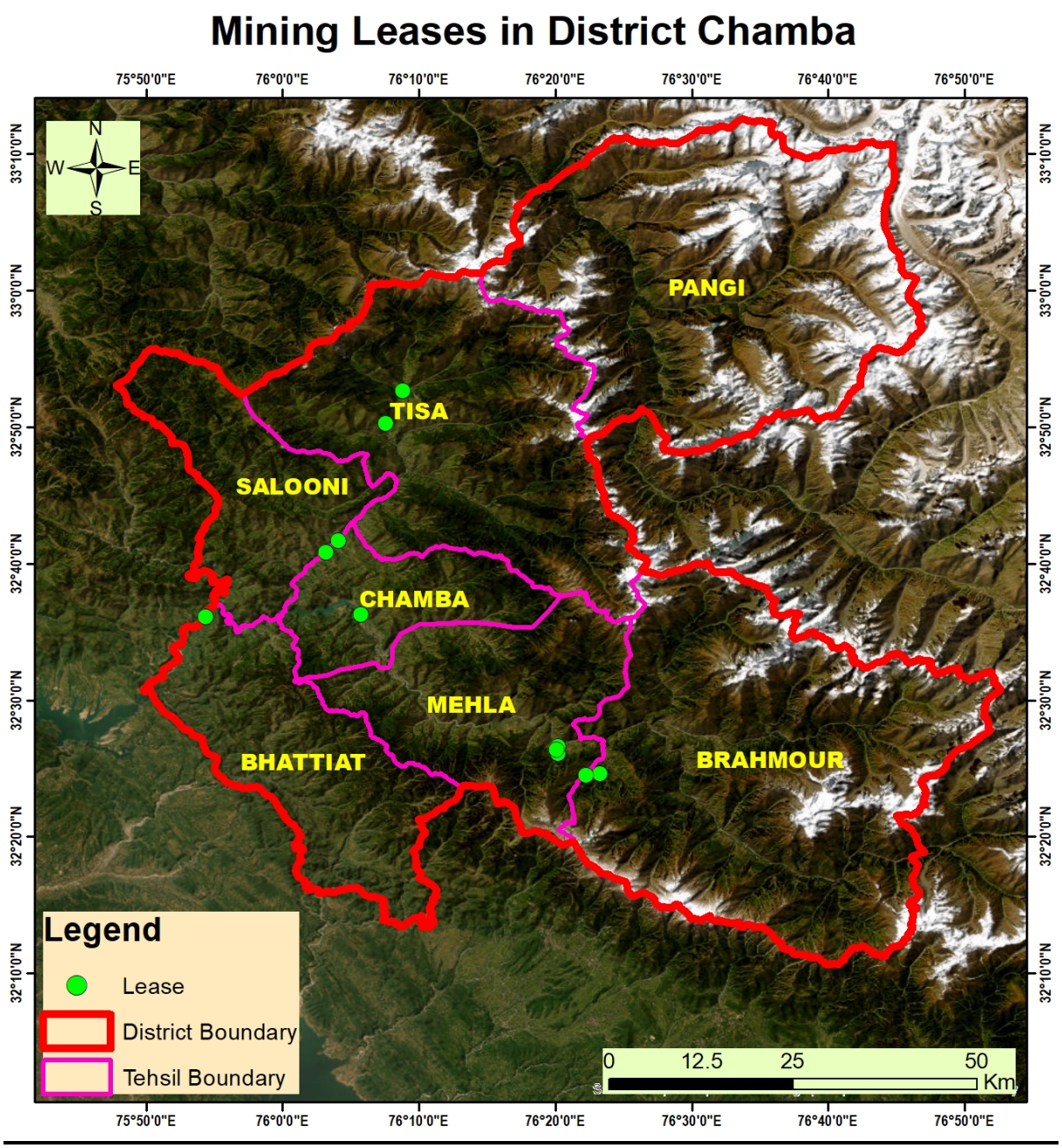


Image showing the location of the mining leases

19 Details Of The Area Of Where There Is A Cluster Of Mining Leases

The details of Quarries existing within a 500m radius are considered as clusters of Mining Leases as per the MoEF guidelines. However, there is no such cluster zone in the district as all granted leases are scattered in the entire district.

20 Details Of Eco-Sensitive Area, If Any, In The District;

There is no eco-sensitive area in Distt. Chamba

21 Impact On The Environment

Mining activities can have significant and diverse impacts on the environment across various domains, including air, water, noise, soil, flora and fauna, land use, agriculture, and forests. The specific impacts depend on factors such as the type of mining, mining methods, location, and scale of operations. Here are some common environmental impacts associated with mining:

Impact on the Air Environment

Mining operations can generate dust particles, leading to air pollution. This can affect respiratory health and contribute to soil and water pollution. In some lease surroundings, only a few households are living in the area and the population density of the village is very low. The area does not have any industrial activity in the core/buffer zone and hence, the ambient air quality of the area is good. Hence, the impact on air quality due to mining will not be significant.

Impact on Water Environment Surface

Runoff from mining sites can carry sediments, heavy metals, and pollutants into nearby rivers and streams, impacting aquatic ecosystems.

Groundwater: Improper disposal of mining waste can lead to the leaching of harmful substances into groundwater, affecting water quality.

Noise Pollution:

Blasting and Machinery Noise: Mining operations often involve heavy machinery and explosives, contributing to noise pollution. This can disturb wildlife, affect human health, and disrupt local ecosystems.

Soil Degradation:

Land Disturbance: The removal of vegetation and topsoil during mining can result in soil erosion, leading to reduced fertility and increased susceptibility to landslides.

Chemical Contamination: The deposition of mining waste on land can introduce harmful chemicals into the soil, affecting plant growth and soil quality.

Flora and Fauna Impact:

Habitat Destruction: Mining activities can lead to the destruction of natural habitats, displacing wildlife and disrupting ecosystems.

Land Use Changes:

Deforestation: Open-pit mining and large-scale extraction activities often require clearing extensive areas of forests, contributing to deforestation and loss of biodiversity.

Fragmentation: Mining can fragment landscapes, isolating populations of plants and animals and disrupting ecological connectivity.

Agricultural Impact:

Land Competition: Mining activities may compete with agriculture for land, leading to the displacement of farming communities and a loss of agricultural productivity.

Water Usage: Mining operations may compete with agriculture for water resources, affecting irrigation and water availability for crops.

Forest Impact:

Loss of Biodiversity: Mining-related deforestation can result in the loss of diverse plant and animal species, impacting overall biodiversity.

Carbon Sequestration: Forests act as carbon sinks, and their destruction during mining releases stored carbon into the atmosphere, contributing to climate change.

To mitigate these impacts, sustainable mining practices, strict regulations, proper waste management, and rehabilitation efforts are essential. Environmental impact assessments (EIAs) are often conducted before mining projects to identify potential risks and implement preventive measures

22 Remedial Measures To Mitigate The Impact Of Mining On The Environment

Mitigating the environmental impact of mining involves implementing various remedial measures to minimize negative effects on air, water, soil, flora and fauna, and overall ecosystems. Here are some common remedial measures to mitigate the impact of mining on the environment:

Remedial Measures for Air Pollution:

- All types of machinery and transport vehicles will be properly maintained and pollution checks will be done once in a year to keep the emissions from machinery and vehicles under control.
- Water sprinkling will be done on haul roads to control the emission of dust while transporting minerals and waste. Provision for water spray by tankers on 'Kuccha' road shall be done.
- Water sprinkling at the loading area.
- Tree plantation along the haul roads & approach road will be done. Plantation along the mine boundary shall be done with a tree density of 2000 trees per Hectare as per the norms of MoEF & CC, to control dust & noise.
- Use of personal protective equipment like dust masks.
- Ambient air pollution monitoring will be carried out.

Remedial Measures for Water Pollution:

- Mining is proposed to plan above the groundwater table.
- Garland drain shall be made around the Waste dump and the rainwater shall be collected in the garland drain and allowed to settle in a small pit for settling suspended particles before allowing discharge to natural drainage system.
- For domestic wastewater Septic Tank with a Soak Pit shall be provided, and discharge from the Soak Pit, if any shall be used for plantation.

Remedial Measures for Noise Pollution:

- Diesel-powered machinery, which is a major source of noise in open-cast mining shall be properly maintained. Attention shall be paid towards rigorous maintenance of the silencer of the diesel engines.
- Protective devices shall be provided for use of persons employed in the vicinity of high-noise areas.
- With the adoption of controlled blasting techniques, the ground vibrations will be minimized.
- Plantation around the lease boundary will cut the noise levels.
- Remedial Measures for Land Environment:

Some of the measures followed to minimize the impacts are as follows:

- The mining activities will be restricted within the lease area only.
- The waste material will be utilized for the construction of roads and also will be used by the local people for construction work.
- The surface runoff from the lease area will be retained within the lease and used for plantation, dust suppression and block cutting. So, there will be no soil erosion from the lease area and its surroundings due to mining activity.
- The dump will have an inward slope with catch drains at the inward side of the terrace and the catch drain of the individual terrace will be connected to the garland drain outside the periphery of the dump. The retaining wall and garland drain will be constructed around the dumps and the surface runoff water pass through the garland drain and finally settle in a settling pit before being released outside.
- **Biodiversity Conservation:** Implement conservation strategies to protect biodiversity, including the preservation of critical habitats, reforestation, and the creation of wildlife corridors.
- **Community Engagement:** Involve local communities in decision-making processes and ensure they benefit from mining activities. This may include providing

employment opportunities, supporting local infrastructure, and contributing to community development projects.

- **Closed-Loop Systems:** Design mining operations with closed-loop systems to minimize resource consumption and waste generation. This includes recycling and reusing water, materials, and energy within the mining process.
- **Monitoring and Compliance:** Establish regular monitoring programs to assess the environmental impact of mining activities. Ensure strict compliance with environmental regulations and standards.
- **Training and Awareness:** Provide training for mining personnel on environmentally friendly practices and the importance of conservation. Increase public awareness about the environmental impacts of mining and the efforts being made to mitigate them.
- **Post-Closure Planning:** Develop and implement plans for the post-closure phase of mining operations to ensure ongoing environmental monitoring, maintenance, and adaptive management.

By incorporating these remedial measures, mining operations can help minimize their environmental impact and contribute to sustainable resource extraction. It's important to recognize that effective mitigation requires collaboration among industry stakeholders, regulatory bodies, local communities, and environmental experts.

23 Reclamation Of Mined-Out Area

As per the Himachal Pradesh Minor Minerals Concession Rules, 2015, a reclamation plan is a mandatory part of the approval of the mining plan by the Geological Wing Department of Industries. In the case of hill slope or terrace mining the reclamation plan includes the planation of area. It is necessary to reclaim the land affected by mining for to following reasons:

- To put the land into productive use like agriculture, forestry or recreational purposes.
- To check soil erosion from dumps leading to the destruction of watersheds and siltation of rivers.
- Accumulation of huge quantities of water in worked-out pits may pose a threat to life and property.
- To combat adverse visual impact.

The afforestation programme is the most important programme to improve the environment and ecological balance of the area. Grasses and bushes that have fibrous roots are at the first instance grown which gives the binding property to the soil. After growing grasses

and bushes, other tree species in consultation with the experts will be raised, based on the characteristics of soil, topography and climatic conditions.

The main post-mine land use for the Project will be grazing based on a self-sustaining vegetation community using appropriate pasture grasses and scattered plantings of native tree and shrub species.

For successful reclamation following points are to be considered

- Listing inventory of pre-mining condition.
- Monitoring flexibility of mining programme in the light of efficient land reclamation.
- Evaluation of the post-mining requirements of the region and to decide on the needs and desires of the affected ground.
- To make reclamation planning suitable to the techno-economical and socio-political environment.
- To assess the physio-chemical characteristics of overburden.
- Extra cost of preservation, re-handling, spreading and levelling of subsoil and topsoil.
- Knowledge of hydrogeological/geomorphological conditions. Aesthetic and/or historic value of land.

The fast-growing plantation and re-grassing shall be done on the exhausted/excavated benches as well as in backfilled pits and will be done in consultation with local peoples or Govt. Authorities like the forest department etc. The mining lease shall be fenced properly in the entire periphery of the safety zone. The total mined-out area of the benches shall be dedicated to plantation and re-grassing. The average year-wise proposed bench area for the plantation is as under: -

a) The plantation/regressing and its maintenance cost will be borne by the applicant. Also, a green belt will be developed in consultation with the local panchayat and forest departments along approach roads in order to minimize pollution.
b) Based on the characteristics of soil, topography and climatic conditions of the area, plantation of grasses/bushes and other tree species will be done by the applicant.
c) Plantation before the onset of the monsoon season will be done progressively until the final closure of the mine.
d) Green Belt shall be properly designed in consultation with the forest department. Plantation shall be carried out as per the periodical plantation programmer.
e) Fast-growing and evergreen trees, trees with broadleaf resistance to specific pollutants and those that would maintain the regional ecological balance, soil and hydrological conditions shall be favoured.

f) Green belt area along the haul roads, buffer zone, dumping sites as well as the excavated benches shall be developed.

g) Besides this, only local labours shall be engaged for watch and ward and plantation activity with proper maintenance.

h) The plantation/regressing and its maintenance cost will be borne by the applicant. Also, a green belt will be developed in consultation with the local panchayat and forest department along approach roads in order to minimize pollution.

i) The estimated survival rate proposed to be achieved shall be 80%

24 Risk Assessment & Disaster Management Plan;

Most of the mines in the district are in Hilly areas. Since the mining benches, trenches or pits are developed on hard compact and medium-grain rocks hence, there may be a chance of possibilities of slope failure if mining activities are done in an unscientific manner. The Risk Assessment & Risk Management Plan will be prepared for the safety of man & machinery deployed in the mining activities as per Mining Act, Rules, and Regulations & DGMS circulars.

24.1 Risk Assessment:

- **Identify Hazards:**
  Conduct a thorough identification of potential hazards associated with mining activities, considering factors such as geology, equipment, processes, and external influences.
- **Risk Analysis:**
  Assess the likelihood and potential consequences of identified hazards. This involves quantifying risks to prioritize them based on severity and probability.
- **Vulnerability Assessment:**
  Evaluate the vulnerability of critical infrastructure, surrounding communities, and the natural environment to potential risks and hazards.
- **Stakeholder Engagement:**
  Involve relevant stakeholders, including local communities, government agencies, and environmental experts, in the risk assessment process to gather diverse perspectives and local knowledge.
- **Emergency Response Planning:**

Develop detailed emergency response plans for various scenarios, considering potential accidents, natural disasters, and other emergencies. Include evacuation routes, emergency shelters, and communication protocols.

24.2 Disaster Management Plan:

- **Risk Mitigation Strategies:**
  Implement risk mitigation strategies to minimize the likelihood and impact of identified hazards. This may involve engineering controls, process modifications, and the use of advanced technologies.
- **Safety Training and Awareness:**
  Conduct regular safety training for mining personnel, contractors, and local communities. Promote awareness of potential hazards and the importance of adhering to safety protocols. The required personal protective equipment should be provided and used in a manner that protects the individual from injury. A few minor injuries which can be prevented are slip, trip or fall hazards; hazards due to rock falls and collapse of unstable rocks, atmosphere containing toxic or combustible gases; protection from chemical or hazardous material etc.
- **Infrastructure Design:**
  Design mining infrastructure with safety in mind, incorporating features such as containment systems for hazardous materials, emergency exits, and protective barriers.
- **Contingency Planning:**
  Develop contingency plans for various emergency scenarios, outlining specific actions to be taken in the event of accidents, spills, fires, or other critical incidents.
- **Collaboration with Emergency Services:**
  Coordinate with local emergency services, hospitals, and law enforcement agencies to ensure a seamless response to emergencies. Conduct joint training exercises and drills to improve preparedness.
- **Emergency Equipment and Resources:**
  Maintain an inventory of emergency equipment, such as first aid supplies, firefighting equipment, and evacuation vehicles. Ensure that resources are strategically located for quick access.

A disaster management plan should be prepared for taking care of any disaster. Other risks that are included in this category are noise, as it occurs and it can lead to permanent disability. There are problems related to road traffic in and out issuers; inappropriate exposure of moving machines; mechanical failure and because of the large number of moving trucks and

dumpers there is a large quantity of dust present in roadways which affects the operators and can lead to accidents

By integrating comprehensive risk assessments and disaster management plans into mining projects, companies can enhance the safety of their operations, protect the environment, and contribute to the well-being of surrounding communities. It is essential to work closely with regulatory bodies and local stakeholders throughout the planning and implementation processes.

25 Details Of The Occupational Health Issues In The District

The persons employed in the mines are exposed to a number of hazards at work which adversely affect their health. Some of the important ones are dust, noise, heat, humidity, vibration etc. In recent times, there has been increasing awareness among the mining industry and workers about occupational diseases such as Coal Worker's Pneumoconiosis, Silicosis, Manganese Poisoning, Hearing Impairment etc. caused by exposure to health hazards at work. Almost all occupational diseases are known to cause permanent disablement and there is no effective treatment. However, most of the occupational diseases can be prevented by adopting proper occupational health measures and engineering control of airborne dust at the workplace. Following diseases have been notified as the diseases connected with mining operations for the purpose of sub-section (1) of Section 25 of the Mines Act, 1952:

In order to detect occupational diseases, the health surveillance programme shall be adopted in mines which includes:

- Initial Medical Examination of persons to be employed in mines.
- Periodic Medical Examination once every five years. General physical examination, chest radiographs, lung function tests and audiometrics.
- Classification of chest radiographs of workers as per ILO Classification.
- Medical examination within one year of superannuation.
- Evaluation of all cases of suspected pneumoconiosis by Pneumoconiosis Medical Board.

Maintenance of medical records till the person is in service and 10 years thereafter. The cases of silicosis detected during health surveillance programmes are referred to as Pneumoconiosis

As per the available record of five-year data, no patients of Silicosis & Tuberculosis have been adversely affected or reported due to the mining activities in the District

26 Plantation And Green Belt Development

Mining in the case of hill slope and terrace deposits is carried out by the formation of benches the height of the benches can vary from 2mX2m, 4mX4m, and 6mX6m, depending on the nature of the rock or deposits and the dimensions of the lease area. It is recommended to the lessee that a separate place has to be kept for dumping the topsoil which can be later on used for plantation purposes and re-grassing. As the mining operations are carried out from the top of the mining lease to the bottom, therefore, plantation and re-grassing have to be done every year on the excavated benches.

The fast-growing plantation and re-grassing shall be done on the exhausted/excavated benches as well as in backfilled pits and will be done in consultation with local peoples or Govt. Authorities like the forest department etc. The mining lease shall be fenced properly in the entire periphery of the safety The green belt along the lease boundary and both sides of the transportation road shall be developed in almost all the existing leases in the district. Maximum numbers of plants shall be planted each year around the lease boundary and both sides of the transportation road as mentioned in the mining plan. Some mine owners also planted a large number of plants outside the lease area to develop a green belt in the district. Deodar, Sal, Khair Pine, Cheil, etc. are some important plants commonly planted Chamba district.

In some cases where the nature of the rock is hard and there is no scope for plantation. lessee is asked to acquire a dedicated land from the private or local govt. bodies for plantation. Plantation is done in consultation with the forest department and local bodies.

A detailed record of the plantation is to be kept by the respective owner/agent/manager of the mine every year, which has been planted in the safety zone area and transport route, which is statutorily required. As per the norms of the Forest department, the plantation has to be carried out at the rate of 2500 local plants per hectare and along the roadside, at an interval of 2 meters in a zig-zag manner on both sides.

27 Other Information

The protection of mineral reserves as well as their sustainable exploitation for development use is one of the concerns of the State Government. As land and mineral reserves are the most important capital assets, protection of such capital assets would be a legitimate plan activity. Therefore, it is the responsibility of the state government to take an effective action plan to combat illegal mining and lifting which has led to huge revenue loss to state exchequer.

Provisions shall be made in the mining plans to protect the environment, though there are no trees in the mining area, even then intensive care will be taken to protect the nearby trees and to make the arrangements with the consultation of the Forest Department to make

compensatory plantation & contribution to the Van Mahotsav events etc. Proper arrangements shall be made to dump the waste generated from the mining activities. The topsoil and silty clay will also be dumped at proper places as per suggestions made in the mining plan. So, that it can be used for plantation or agriculture purposes after the mining is over.

Also, it is accepted that effective resource management cannot be done in isolation. The proponent therefore vigorously pursues approaches towards coordination and integration where possible, so as to lead to coordinated regulatory systems.

28 MONITORING & EVALUATION

The Ministry of Environment, Forest & Climate Change has published "Enforcement & Monitoring Guidelines for Sand Mining" in the year 2020 wherein Monitoring Mechanism has been defined very specifically and recommended that a uniform monitoring mechanism is required to assess the regulatory provision in quantitative terms, with robust institutional and legal framework. Based on past experience and suggestions available, the following requirements are suggested for defining a mechanism for monitoring of mining activities which will help in identification of mining which is operating either illegally or are violating the regulatory provisions. Some suggestion will facilitate direct or indirect information to help in such an assessment.

1. All precaution shall be taken to ensure that the water stream flows unhindered and process of Natural river meandering doesn't get affected due to mining activity.
2. River mining from outside shall not affect rivers, no mining shall be permitted in an area up to a width of 100 meters from the active edge of embankments or distance prescribed by the Irrigation department.
3. The mining from the area outside river bed shall be permitted subject to the condition that a safety margin of two meters (2 m) shall be maintained above the groundwater table while undertaking mining and no mining operation shall be permissible below this level unless specific permission is obtained from the Competent Authority. Further, the mining should not exceed nine-meter (9 m) at any point in time.
4. Survey shall be carried out for identifying the stretches having habitation of freshwater turtles or turtle nesting zones. Similarly, stretches shall be identified for other species of significant importance to the river eco-system. Such stretch with adequate buffer distance shall be declared as no-mining zone and no mining shall be permitted. The regulatory authority as defined for granting Environmental Clearance, while considering the application of issuance of ToR and/or EC for the adjacent block (to non-mining zone) of mining shall take due precaution and impose requisite conditions to safeguard the interest of such species of importance.
5. District administration shall provide detailed information on its website about the sand mines in its district for public information, with an objective to extend all information in public domain so that the citizens are aware of the mining activities and can also report to the district administration on any deviation observed. Appropriate feedback and its redressal mechanism shall also be made operational. The details shall include, but not limited to, lease area, geo-coordinates of lease area and mineable area, transport routes, permitted capacity, regulatory conditions for operation including mining, environmental and social commitments etc.
6. A website needs to be maintain to track the movement of centralised sand mining and a Centralised server system should be made to manage the data related to sand mining across India.
7. The mineral concession holders shall maintain electronic weighbridges at the appropriate location identified by the district mining officer, in order to ensure that all mined minerals from that particular mine are accounted for before the material is dispatched from the mine. The weighing bridge shall have the provision of CCTV camera and all dispatch from the mine shall be accounted for.
8. The mineral movement shall be monitored and controlled through the use of transit permit with security features like printing on IBA approved MICR papers, Unique bar/QR, fugitive ink background, invisible ink mark, void pantographs and watermarks papers or through use of RFID tagged transit permits and IT /IT-enabled services. Such monitoring system shall be created and made operationalised by State Mining department and district level mining officer shall be responsible for ensuring that all

legal and operational mines are connected and providing the requisite information on the system.

9. State Government shall constitute a District Level Task Force (DLTF) under the Chairmanship of Deputy Commissioner/District Magistrate/Collector with Superintendents of Police and other related senior functionaries (District Forest Officer, District transport officer, Regional officer- SPCBs, Senior Officer of Irrigation Department, District Mining Officer) with one/two independent member nominated by the Commissioner concerned. The independent member shall be retired government officials/teacher or ex-serviceman or ex-judiciary member. The DLTF shall keep regular watch over the mining activities and movement of minerals in the district. The DLTF shall have its regular meeting, preferably every month to reconcile the information from the mining activity, and other observations made during the month and take appropriate corrective and remedial action, which may include a recommendation for revoking mining lease or environmental clearance. The DLTF may constitute an independent committee of the expert to assess the environmental or ecological damage caused due to illegal mining and recommend recovery of environmental compensation from the miner's concern. The recommendation may also include action under the provision of E(P) Act, 1986.

10. The area not identified for mining due to restriction or otherwise are also to be monitored on a regular basis by the DLTF. Any observations of mining activity from the restricted area shall be reported and corrective measures shall be initiated on an urgent basis by the DLTF.

11. The dispatch routes shall be defined in the Environmental Clearance and shall be avoided through densely habituated area and the increase in the number of vehicle movement on the road shall be in agreement with the IRC guidelines / carrying capacity of the road. The alternate and dedicated route shall be explored and preferred for movement of mining to avoid inconvenience to the local habitat. The mining production capacity, by volume/weight, shall be governed by total permissible dispatch calculated based on the carrying capacity of dispatch link roads and accordingly, the production should be regulated.

12. The movement of minerals shall be reconciled with the data collected from the mines and various Naka/check posts. Other measures may also include a general survey of the potential mineable area in the district which has not been leased/auctioned or permitted for mining due to regulatory or other reasons.

13. The location and number of check post requirement shall be reviewed by DLTF on a regular basis so that appropriate changes in location/number could be made as per the requirement. Such review shall be carried out on a regular basis for the district on inter-state boundary or district providing multiple passages between two districts of different states.

14. The district administration shall compile the information from their district of the permitted and legal mined out minerals and other details and share such information and intelligence with the officials of the adjoining district (Inter or/and Intra State) for reconciliation. The information shall include the area of operation, permissible quantity, mined out minerals (production) the permitted route etc., and other observations, especially where the mine lease boundary is congruent with the district boundary. Such coordination meeting shall be held on a quarterly basis, alternatively in two district headquarters or any other site in two districts decided mutually by the District Magistrate.

15. The in-situ and ex-situ environmental mitigative measures stipulated as EMP, CER, CSR and other environmental and safety conditions in mines including the welfare of labours shall properly reflect in the audit report.