SURVEY DOCUMENT SHIMLA

DISTT.SHIMLA HIMACHAL PRADESH

INDEX

A) INDEX SHOWING CONTENTS OF FIGUERS /PHOTOGRAPHS

B) INDEX SHOWING CONTENT OF TABLES

STUDY ON THE DRAINAGE SYSTEM, MINERAL POTENTIAL AND FEASIBILITY OF MINING IN RIVER/ STREAM BEDS OF DISTRICT SHIMLA, HIMACHAL PRADESH.

1) INTRODUCTION

In pursuance to the orders, dated 27/02/2012 of the Hon'ble Supreme Court in the matter of Deepak Kumar Etc. Vs State of Haryana and Others, prior Environment Clearance has become mandatory for mining of minor Minerals irrespective of the area of Mining lease. As such, Ministry of Environment, Forest and climate Change, Govt. of India vide Notification dated 15/01/2016 and 20/01/2016 has constituted the District Level Environment Impact Assessment Authority(DEIAA) for grant of Environment Clearance for category "B 2" projects for mining of minor minerals.

In the aforesaid Notification of dated 15/01/2016 of Ministry of Environment, Forest and climate Change, Govt. of India, the procedure for preparation of District Survey Report which shall form the basis for application for Environment Clearance has been prescribed.
This survey shall contain: -

a) District wise detail of Rivers/Streams/nallas; and
b) District wise details of existing mining leases/ contracts in river/stream/khalla. beds.
c) District wise availability of sand or gravel or aggregate resources.

Based on the action plan as mentioned above, mining leases/ contracts shall be granted in accordance to the Himachal Pradesh Minor Minerals (Concession) and Minerals (Prevention of Illegal Mining, Transportation and Storage) Rules 2015 and observing the Policy Guidelines. Accordingly, the survey report of the river beds/ parts of river beds of District Shimla has been prepared. The rivers/streams were studied based on the following parameters excluding the hill slope mining.

a) Geomorphologic studies:

i) Place of origin.
ii) Catchment area.
iii) General profile of river stream.

iv) Annual deposition factor.

v) Replenishment.

vi) Total potential of minor minerals in the river bed.

b) Geological Studies:

i) Lithology of catchment area

ii) Tectonics and structural behavior of rocks

c) Climatic parameters:

i) Intensity of rainfall.

ii) Climate zone.

iii) Temperature variation.

Shimla District derives its name from the goddess Shyamala Devi, an incarnation of the Hindu Goddess Kali and came into existence on 1st September, 1972 on account of re-organization of the other Districts of the State. After re- organization, the erstwhile Mahasu District lost its entity and its major portion was merged with Shimla. In 1864, Shimla was declared as the summer capital of British India. It is comprised of 19 erstwhile Hill States and is bounded by Kinnaur District in the North—East, by Kullu and Mandi District in the North—West Solan and Sirmour districts in the Southwest and by the State of Uttarakhand in the South- East. The total area of the present district is 5,131 Sq. Kms. There are 10 major Towns in the district. These include one municipal corporation i.e Shimla , two Municipal Committees,(Rampur, and Theog), six notified area committees (Narkanda, Sunni, Choupal, Jubbal, Kotkhai, Rohru) and one cantonment Board (Jutogh).The District is Comprising of 7 Sub- Divisions, 12 Tehsils, and 6 Sub-Tehsils. The revenue Sub-Divisions are namely Shimla-Rural), Shimla (Urban), Theog, Rampur, Rohru. Chopal and Dodra Kawar. Except few small valleys the District is entirely mountainous. The elevation of the District ranges from 300 to 6000 meters. The District has a number of peaks such as Jakhoo in Shimla Town, Siah near Chail, Churdhar in Tehsil Chopal, Chanshal in Rohru Tehsil, Hatto in Kumarsain Tehsil and Shali in Seoni Tehsil. Mostly the terrain is a rough, steep valley with high peaks and thick forest of District. On the whole the soil is young and thin however these get heavier and comparatively acidic; with increase in altitude.The major part of the District falls under Zone IV (High Risk Zone) as per the Earthquake hazard zoning of India. Another rising concern in the region is the frequent number of landslides that often take place after heavy rains. The topography of the district is rugged and tough. There are no water bodies near the main city

and the closest river, the Sutlej, is about 21 km away, other major rivers that flow through the Shimla district, although farther from the city, are the Giri, and Pabbar (both tributaries of Yamuna).

In earlier times the local residents used to lift gravel etc. from the river beds to meet out their bonafide requirement, however after coming into being the Himachal Pradesh Minor Mineral Concession Revised Rules, 1971, the mining is regulated in accordance with the rules made in this behalf from time to time.

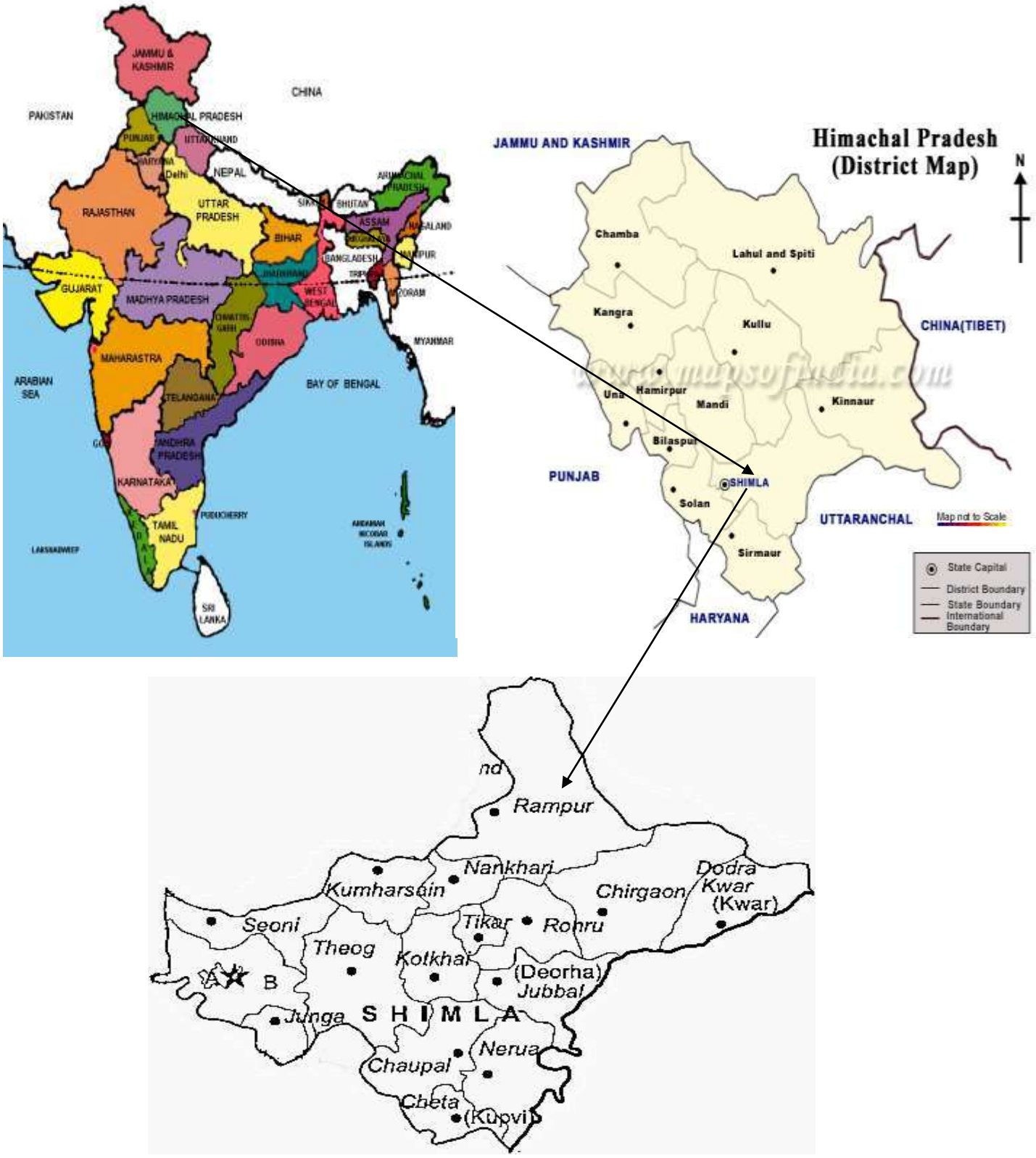


Figure No. 1: Location map of District Shimla

2) OVER VIEWOF MINING ACTIVITIES IN DISTRICT SHIMLA

Mainly three types of minor mineral constituents such as sand, stone, and bajri are required for any type of construction apart from other material 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 of building material. However, with the passage of time, new vistas of developmental activities were started. As such the demands of minor minerals in the District started as increasing trend. In order to meet the requirement of raw material for construction, the extraction of sand, stone and bajri is being carried out exclusively from the river beds. The demand of sand is mainly met through by river borne sand whereas the demand of bajri/ grit is either met through river borne collection or through manufactured grit by stone crusher The demand of dressed or undressed stone is met through the broken rock material from the hill slope. The local residents used to lift gravel etc. From the river beds to meet out their bonafide requirement, however after coming into being the Himachal Pradesh Minor Mineral Concession Revised Rules, 1971, the mining is regulated in accordance with the rules.

3) THE LIST OF MINING LEASES IN DISTRICT SHIMLA

At present about 21 Numbers of mining leases have been granted/executed under the ibid rules in the different parts of the District and all the mining leases fall under the category of Hill slope Mining as tabulated below: -

Table:-1. List of Mining Leases granted /executed for collection of stone, bajri and sand in district Shimla (H.P.)

Sr. no.	Name & Address	Location (in Mauza, Mohal)	Location Coordinates (Latitude and Longitude)	Area (Hectares Only)	Period in years (w.e.f.----to ----)
1.	Sh. Pramod Kumar S/o Sh. Mansa Ram, Vill. Naggar,	Naggar/ Sunni	N31^{0}13'34", E77^{0}03'36"	(0-84-11 Hect.)	31.12.2009 to 30.12.2019

	Teh. Sunni, Distt. Shimla				
2.	Sh. Vipin Sharma, V.P.O. Chaba, Teh. Sunni, Distt. Shimla	Dargi/Sunni	N31^{0}13'48", E77^{0}02'57.1"	(1-62-35 Hect.)	01.05.2015 to 30.04.2030
3.	Sh. Kundan Lal Verma, S/o Sh. T.R. Verma Suman Cottage Sanjauli, Teh. & Distt. Shimla	Sargatta/Junga	N31^{0}00'17.4", E77^{0}15'28.4"	(1-72-58 Hect)	30.04.2015 to 29.04.2020
4.	Smt. Kusum Kapoor, Bhogal Villa Sanjauli-6 Shimla	Kawalag Mazhar/Shimla	N31^{0}02'33", E77^{0}11'18"	(00-78-74 hect))	19.12.2013 to 18.12.2028
5.	M/s Sharma Stone Crusher, Prop. Sh. Manish Mohan Sharma VPO Salana, Tehsil & Distt. Shimla.	Salana/Shimla	N31^{0}02'41.4", E77^{0}05'44"	(1.0166 hect))	28.07.2015 to 27.07.2030
6.	Sh. Satya Prakash Verma S/o Sh. Padam dass R/o Village Mandar Tehsil Shimla (R)	Mandar/Shimla	N30^{0}08'40", E77^{0}00'35"	(0-90-83 Hect.)	11.07.2016 to 10.07.2026
7.	Sh. Anil Kalta S/o Sh. Sohan Lal, Vill. Maleth, P.O. Rewlakiar, Teh.Kotkhai, Distt. Shimla	Khola/Kotkhai	N30^{0}0840", E77^{0}00'35"	(1-12-11 Hect.)	28.05.2009 to 27.05.2024
8.	Sh. Narender Kumar Justa, Vill. Chamera, P.O. Rawla Kair Teh. Kotkhai	Chamera/Kotkhai	N31^{0}09'40", E77^{0}30'48"	(0-74-66 Hect.)	28.11.2015 to 27.11.2025
9.	Sh. Dixit Kaparate, VPO Purag Teh.Kotkhai, Distt. Shimla	Riyana/Theog	N31^{0}06'45", E77^{0}26'10"	(0-81-25 Hect.)	21.03.2011 to 20.03.2021
10.	Sh. Yogesh Kumar Sood VPO Mohri, Teh. Theog	Jungle Ishta/Theog		(0-90-52 Hect.)	13.07.2011 to 12.07.2021
11.	Sh. Yogesh Kumar Sood	**Kaduth/Theog**	N31^{0}08'20", E77^{0}24'43"	(0-75-42 Hect.)	13.07.2011 to 12.07.2021

	VPO Mohri, Teh. Theog				
12.	Sh. Sandeep Thakur S/o Sh. Kewal Ram, Vill. Talli, P.O. Chanair, Teh. Theog, Shimla	**Tikkar/Theog**	N31^{0}03'58", E77^{0}25'34"	(0-59-61 Hect.)	21.05.2015 to 20.05.2025
13.	Sh. Bharat Bhushan Verma VPO Sainj Teh. Theog	Tihana/Theog	N31^{0}03'38", E77^{0}26'20"	(0-94-64 Hect.)	12.10.2015 to 11.10.2020
14.	Sh. Bhinder Singh Verma Prop. M/s Verma Stone Crusher Village Gajeri P.O. Jais, Tehisl Theog Distt. Shimla	**Baila jandori/Theog**	N31^{0}06'23.9", E77^{0}23'26.5"	(0-36-58 Hect.)	15.10.2016 to 14.10.2016
15.	M/s O.P. Mehta V.P.O. Khaneri, Teh. Rampur, Distt. Shimla	Pashada/Rampur	N31^{0}28'00", E77^{0}40'30"	(1-10-78 Hect)	4.02.2012 to 3.02.2027
16.	Sh. Subhash Chand Vij, Vill. Daro, P.O. Narkanda, Teh. Kumarsain, Distt. Shimla	Dharo/Kumarsain	N31^{0}14'46', E77^{0}28'58"	(0-45-90 Hect.)	13.05.2015 to 12.05.2025 (10 years)
17.	Sh. Sachin Sood, M/s Himalyan Stone Crusher, Prop. Rampur Bsr.	Jubya Sanathli/Rampur	N31^{0}26'57", E77^{0}39'34"	(0-93-00 Hect.)	01.07.2015 to 30.06.2030 (15 years)
18.	Sh. Yahwinder Sigh Thakur S/o Sh. Milap Singh Thakur R/o Village Nirsu P.O. Dutt Nagar Tehsil Rampur Bushahr Distt. Shimla (H.P.)	Nirath/Rampur	N31^{0}22'01.3", E77^{0}32'43.2"	(01-53-62 Hect.)	07.06.2016 to 06.06.2026
19.	M/s R. Industries Prop. Sh. Rajinder Singh, Rampur Bsr.	Jhakri/Rampur	N31^{0}29'06", E77^{0}41'37"	(0-98-70 Hect.)	17.08.2016 to 16.08.2026
20.	Sh. Ajay Sauhta, S/o Sh. Vijay Singh Sauhta VPO Dhar, Teh.	Mungra Nadhal/Jubbal	N31^{0}03'54", E77^{0}49'40"	(0-84-72 Hect.)	04.06.2015 to 03.06.2030

	Jubbal, Distt. Shimla				
21.	Sh. Virender Banshtu Vill. Dalgoan, P.O. Kutara, Teh. Rohru, Distt. Shimla	Rantari/Rohru	N31^{0}14'55", E77^{0}45'05"	(0-71-20 Hect.)	16.02.2009 to 15.02.2024

4) DETAILS OF ROYALTY OR REVENUE RECEIVED IN LAST THREE YEARS

In earlier times, the houses/ buildings were constructed in form of small dwellings with walls made up of mud plaster, stone and interlocking provided with wooden frames. There were negligible commercial as well as developmental activities resulting in less demand of building material. However with the passage of time, construction techniques changed and new vistas of developmental activities were started with modern construction techniques. As such the demand of minor minerals in the District started an increasing trend. Mainly three types of minor mineral constituents such as sand, stone and bajri are required for the modern construction/developmental activities apart from other material like cement and steel. In order to meet the requirement of raw material for construction, the extraction of sand, stone and bajri is being carried out exclusively from the river beds. The demand of sand is mainly met through by river borne sand whereas the demand of bajri/grit is either met through river borne collection or through manufactured grit by stone crushers. The demand of dressed or undressed stone is met through the broken rock material from the hill slope. The royalty received since 2013-16 onwards is tabulated in the following table.

Table 2: Details of royalty or revenue received in last three years

Sr No.	Year	Royalty in lacs
1	2013-2014	314.75
2	2014-2015	268.44
3	2015-2016	314.05

5) DETAIL OF PRODUCTION OF SAND OR BAJARI OR MINOR MINERAL IN LAST THREE YEARS

Table 3: Detail of Production of Sand/Bajri/minor mineral

Sr No.	Year	Production of Sand	Production of Bajri	Production of Stone
1	2013-2014.	63337	665584	46027
2	2014-2015.	257233	130019	130499
3	2015-2016.	63154	198122	99696

6) PROCESS OF DEPOSITION OF SEDIMENTS IN THE RIVERS OF THE DISTRICT

- **Erosion, transportation and deposition:** Water flowing through a stream performs three kinds of geologic actions. Moving water erodes material from the bed and sides of the channel; it transports the eroded material to a new location, and then deposits it. Material deposited by streams is called **alluvium**. The ability of a stream to do work is a function of stream velocity and discharge.
- **Erosion**: Stream erosion is the detachment of material from the bed or sides of the channel. Approximately 95% of a stream's energy is used to overcome frictional effects imposed by the channel and internal molecular friction. This leaves only 5% of the stream's energy for vertical and lateral cutting. Flowing water erodes in three ways. First, flowing water dissolves materials from the channel contributing to stream's dissolve or, **Solution load**. Secondly, the impact of water, or **Hydraulic action** on the sides and bed of the channel dislodges materials and makes them available for transport as part of the stream load. Materials too heavy to suspend, scoot and roll across the bed, eroding the channel by **Abrasion** as a river winds its way from its source to its mouth. A number of processes of erosion take place such as:

1. **Corrosion** – This is the wearing away of the river channel by water + load (load = material carried in the river e.g. boulders, pebbles, sand etc)

2. **Attrition –** As the load is carried by the river, bits collide and these are further broken up.
3. **Solution** – This is where certain rocks (e.g. limestone) are dissolved by the river.

- **Transportation:** A river moves its load by:-

(1) - Rolling large stones and boulders. **(Stream load).**
(2) - Carrying sand, mud and silt in suspension. (**Suspended load).**
(3) - Carrying minerals in solution. **(Solution).**

Transportation is the movement of earth material, by water. The material transported through the stream is it's stream load. **Stream load** is composed of dissolved or solution load, suspended load, and bed load. The **dissolved load** comes primarily from ground water seepage into the stream. **Suspended load** is comprised of sediment suspended and transported through the stream. Turbulent flow suspends clay and silt in the stream. Suspended load comes from material eroded from the surface bordering the channel and deposited in the stream, as well as, erosion of the channel itself.

The **stream capacity** is the maximum load of sediment a stream can carry for a given discharge. As one might expect, stream capacity increases with increasing flow velocity. Increased water velocity imparts a greater frictional drag on bed to erode it. Turbulent flow occurs under higher velocity, thus increasing the water's ability to dislodge material from the bed or sides of the stream. **Stream competence** is the largest size material, the stream can move under a given discharge.

Bed load is that which is moved across the bed of the channel. Bed load is transported in two ways, **traction**, which is a scooting and rolling of particles along the bed. The second is **saltation**, a bouncing-like movement. Saltation occurs when particles are suspended in the stream for a short distance after which they fall to the bed, dislodging particles from the bed. The dislodged particles move downstream a short distance where they fall to the bed, again dislodging particles upon impact.

- **Deposition:** Deposition is the opposite of erosion. Deposition is where a river lays down

or drops the sediment or material that it carryies. Rivers carry lots of different sediments, including rocks, boulders, silt, mud, pebbles and stones. Normally, a river has the power to carry sediment. If the force of a river drops, the river cannot carry sediment. This is when the river deposits its sediments.

Types of deposition:

There can be much evidence of deposition in a river. Some examples are:

1. Areas of pebbles, gravels, and stones.
2. Areas where mud and sand are deposited.
3. Large boulders and stones in the middle of a river.
4. Tree branches and trees in the river.
5. Pollution like cans, bottles, crisp wrappers and other rubbish.

(A) Upper Course: In the upper course,

The river channel is small, narrow and rough and usually shallow.

- The stones and rocks increase wetted perimeter.
- The volume of water is low as there are very few tributaries flowing into it.

Features such as:-

Interlocking Spurs, Pot holes and waterfalls or Gorges are developed in the upper course of a stream.

Interlocking Spurs:

Interlocking spurs are alternate hills in the river valley. The river does not have a high water volume at this point and even though it is fast flowing, the river cannot laterally erode (sideways) to remove the spurs. Because of this, the river has to flow around the spurs, eroding vertically.

Potholes:

As the river is vertically eroding in the Upper Course, potholes are created when larger pieces of load that the river cannot remove by traction are twisted around by eddy currents. The river is not strong enough here to pull the large boulder, and the obstruction creates a swirling motion in the water. Eventually, the boulder creates a pothole, by abrasion on the river-bed.

Waterfalls and Gorge:

In the Upper Course, the river is not only eroding vertically (down) but towards its source The river erodes the softer rock underneath the harder rock on top faster, and this means the level

of the land along the river's course becomes lower over time and the waterfall retreats back towards the source.

(B) Middle Course: In the middle course:

- The river channel is wider and deeper.
- Its cross-section is asymmetrical.
- A steep river cliff develops on the concave bank and a gentle slip-off slope on the convex bank.

Features such as:

Meanders are developed in the middle course of the stream

Meanders:

In the middle course, the amount of water and material in the river increases as more tributaries join in. The bed widens, its slope becomes gentler, and the water flows much more slowly as the river flows out of the mountains. As a slow-moving river cannot keep heavy material moving, piles of gravel form along the banks. At this stage, the river carries its load of sand, mud, and small stones suspended in water. It also begins to swing from side to side, cutting into some banks and drifting away from others. As there are no obstacles such as rapids, the river's course becomes smoother and more regular. A floodplain is a wide and flat plain. It is built up by alluvium laid down on the river banks during repeated flooding. When there is a flood, the river overflows its banks. When the flood subsides, there is a decrease in the volume of water and the river starts to deposit its load. Most of the alluvium is deposited on the banks close to the river. With repeated flooding, the materials that are deposited on the river banks accumulate to form floodplains. The path of the middle river is always changing as it cuts sideways into the land and starts to deposit its load. Loops, called meanders and oxbow lakes are typical features of this part of the river. During a storm, meanders stop river water flowing easily. This cause water to build up in places, and may lead to flooding

(C) Lower Course:

In the lower course:

- The river channel is the widest and the deepest.
- It has the largest volume of water and load because of the numerous tributaries flowing into it.
- There is lateral erosion along this course.

Features such as

Leves, Braided Channels, Deltas and oxbow lake are developed in the upper course of a stream.

Levees:

In the monsoon, when the river volume is at its highest, the river is prone to flooding. As the river overflows its banks, friction with the floodplain slows down the flow. The loss of energy means load is deposited. The deposition is graded - this means that the larger particles are dropped first (being the heaviest) near the river bank edge and the smaller particles are taken further along the floodplain. The larger particles build up over repeated floodings to create a levees which increases the capacity of the river.

However, after Monsoon when the river volume and energy is at its lowest, deposition occurs in the river channel, raising the bed. This means that the capacity of the river is lowered and flooding again will occur in the monsoon months, creating bigger levees. This cycle raises the river higher than the landscape over time.

Braided Channels:

Braided channels are formed in the summer months when the river volume and energy are lowest. Deposition occurs in the channel of the load carried and these build up to form obstructions. The river has to divert its flow around these obstructions and this is called a braided channel.In the monsoon, when the river is at a higher level, the silt may either be removed or the river will be high enough to flow over the top of the obstructions.

Ox-bow Lake:

Ox-bow lakes are formed when two concave banks of the meanders erode and become joined together. The river would then flow straight. Deposition takes places and cuts the river from the meanders loops. As more Deposition takes place, the meander loop becomes independent and is called an ox-bow lake. An ox-bow lake is a horseshoe shaped or crescent shaped.

7) GENERAL PROFILE OF THE SHIMLA DISTRICT

Shimla lies in the south-western ranges of the Himalayas at 31.61°N 77.10°E. It has an average altitude of 2,206 metres (7,238 ft) above mean sea level The highest point in Shimla is the Jakhoo hill, which is at a height of 2,454 metres (8,051 ft).

The city is a Zone IV (High Damage Risk Zone) per the Earthquake hazard zoning of India. Weak construction techniques and an increasing population pose a serious threat to the already earthquake prone region.

There are no bodies of water near the main city and the closest river, the Sutlej, is about 21 km (13 mi) away.Other rivers that flow through the Shimla district, although further from the city, are the Giri, and Pabbar (both tributaries of Yamuna).

The green belt in the Shimla planning area is spread over 414 hectares (1,020 acres). The main forests in and around the city are of pine, deodar, oak and rhododendron. Environmental degradation due to the increasing number of tourists every year without the infrastructure to support them has resulted in Shimla losing its popular appeal as an ecotourism spot Another rising concern in the region are the frequent number of landslides that often take place after heavy rains.

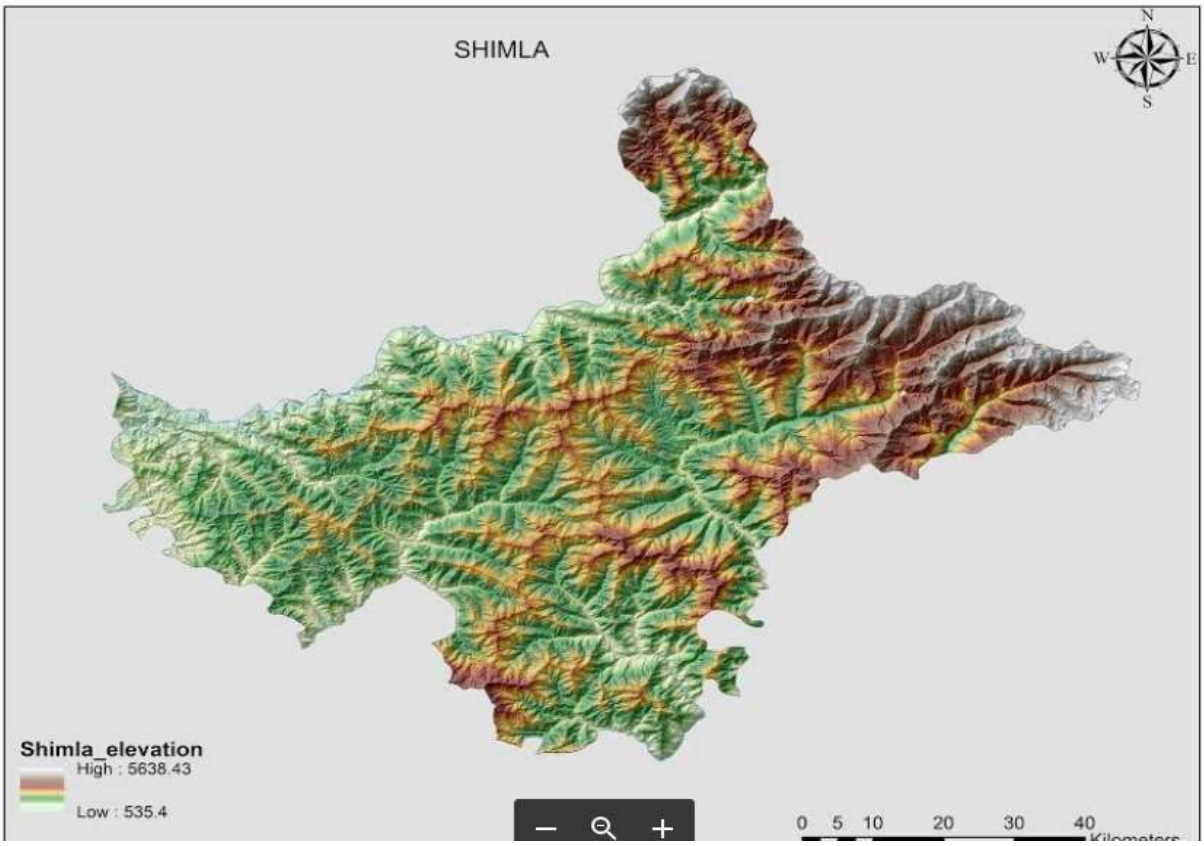


Figure No. 2 Relief Map of District Shimla

Climate of the Area

The region has four distinct seasons. The area experiences severe winter from December

to March followed by server's summer season lasting from April to June. The area receives rainfall under the influence of south west monsoon from July to mid-September followed by post-monsoon season lasting upto November.

The terrain in general has profound influence on the temperatures of a region. The temperature generally rises from the begning of March till June which is the hottest month of the year with mean minimum and maximum temperature of 10 C to 40C respectively. With the onset of monsoons by the end of the June temperature begins to fall. The drop in day temperature is much more than the drop in night temperature. The night temperature falls rapidly after the withdrawal of monsoons by mid-September. The month of January is cooler month with the mean maximum and minimum temperature being 8.9 C and 1.7 C respectively. Under the influence of western disturbance, the temperature falls appreciably during winters and it may go even below 0C.

Humidity is generally low throughout the year. During summer season, humidity is lowest 36%. During monsoon month, it goes as high as 80-90%. The average humidity during synoptic hours is 53% and 62% respectively. The highest levels of humidity are observed in the month of August.

1.1 Statistics of Shimla district

Location

State	Himachal Pradesh
District	Shimla
Year of Creation of District	1982
Total Area (In Sq Km)	5131 Sq. Kms
Total Assembly/ Constituencies	8
Major Rivers	1

Population (2001 census)

Male	4,25,0,39
Female	3,88,9,71

Rural	6,12,6,59
Urban	2,01,3,51
BPL Household	31681
Sex ratio per 1000	915
Density of population (per KM²)	159
Total Population	8,14,0,10

Administrative Units

Sub Divisions	7
Tehsil	12
Sub-Tehsil	6

Literacy

Male Literacy	89.59 %
Female Literacy	77.13 %
Total	83.3%

Sr. No	Name of the PRIs	Total Number	Total No. of ERs	Average population
1.	Zila Parishads	12	250	500000
2.	Panchayat Samitis	78	1673	80000
3.	Gram Panchayats	3226	26800	1900

Education

Govt. Degree College	12
Govt. Sanskrit College	02
Private College	07
Private Sanskrit College	03
Private M.Ed College	02
Private Law College	01
Private/ Govt. B.Ed College	10
University	02
Private University	01
Primary Schools	2318
Middle Schools	355
High Schools	119
Sr. Secondary Schools	242
Engineering Colleges	1
Medical Colleges	1
Other Colleges (in Shimla Town)	4

Health

Medical College	02
District Hospital	01
Civil Hospital	14
Community Health Center	08
Primary Health Centre	89
Health Sub Centre	01

Regional Hospitals	01
Block Hospitals (Civil)	09
PHC s / Sub-Centres	313
Subsidiary Health Centres	30
Dispensaries	341
Ayurvedic Hospitals (as on 31-12-2000)	03
Ayurvedic Dispensaries	147

3.4 Fauna

Due to wide variations in the attitude a large variety of fauna is available in the forests of the district. The black bears are common in the higher valley. The leopards are found throughout the district. Barking dears and gural are found at medium elevation the musk deer or kastura and serao are found in certain area most commonly found is the Porcupine which is found in almost in the entire district. Common mammals and birds in Shimla district is given in the table:

Table No. 4 Fauna in District Shimla

English Name	**Common Name**
Leopard Cat	Mirag, Baagh
Jungle Cat	Junglee Billi
Barking Deer	Kakkad
Fox	Lomdi, Fohiki
Jackal	Gidder
Ressus Monkey	Lal Bandar
Languor	Languor
Boar	Suar
Porcupine	Sehal
Hare	Khargosh, Sheru, Farru
Musk Deer	Kastura

Himalayan Thar	Thar
Black Beer	
Brown Beer	
Snow Leopard	
Wild Boar	
Spotted Deer	Chital
Sambar	
Flying Squirrel	
Leopard	Cheetah
Indian Civet	Shakraalu
The Great Himalayan Leafnosed Bat	Chamgaadar

Birds of Shimla:

English Name	**Common Name**
Vulture	Cheel, Gidh, Eell
Koel	Koel
Pigeon	Kabootar
Blue jay	Nilkantha
Hawk	Baaz
Black Partridge	Kala Tittar
Grey Partridge	Safed Tittar
Peacock	More
Common Quail	Bater
Chakor	Chakor
Crow	Kanwa
Parrot	Totta

Monal	Monal
Snow Cock	
Western Horned Tragopan	Jajurana
Fulvour breasted pied woodpecker	Kathfowra
Ring Dove	Gughi
Spotte Dove	Gughi
Shikra	
Tawny Eagle	
Green Pigeon	
Tits	
Black napped woodpecker	Woodpecker
Woodpecker	
Himalaya fly catcher	
Common Myna	Ghatari
Paradise flycatcher	Choti Pinja
Cranes	
Sarus Crane	Saras
House Sparrow	
Himalaya Green Finch	Chiria

8) LAND UTILIZATION PATTERN IN THE DISTRICT: FOREST, AGRICULTURE, HORTICULTURE, MINING ETC.

Land use pattern: The District is spread over deep small valleys and high elevations and cultivation is possible only in small terraces of holidays in the high hills or in the basins of stream / khads. However, in the deep valleys though very few in numbers, the cultivation

is spread over in a vast area. Most the land is either under shrub forests or greasy land with chir, pine trees upto the height of 1500Mtrs.from mean sea level and Kail, Deodar, Rai, Ban, Mauru, Rhododendron and Kanor on the high altitude. (It is only in the basins of the rivers, streams and khads that the land is little).

Sloppy areas of high altitudes are most suitable for horticultural purposes especially for the growing delicious varieties of apples and other stone fruits such as almonds, walnuts, apricots etc. Land holdings in the hilly terrain of the District are small in size, scattered and fragmented and comprise terraced fields in major part of the cultivated area. In order to do away with uneconomical land holdings, the State Govt. of Himachal Pradesh has taken certain steps for the consolidation of the holdings under the Consolidation of Holding Act and bulk of the uneconomic holdings have been done away.

Forests:

Forests play a vital role in shaping the characteristic conditions of an area. Besides, this also influences the economic and social life of the people considerably. The climatic condition prevailing in Himachal Pradesh and varying elevations are most suitable for the growth of forests. Shimla District, various important species of trees namely Deodar, Kail, Chil, Oak, Mohru and Kharu *etc.* are found in the forests and the major forests produce are resin and medicinal herbs. The available resin in the District is being processed by two resin and turpentine factories at Bilaspur and Nahan. However, the medicinal herbs are being exported in raw from out of the District.

The forests in the District are mainly in the tract of outer Shiwalik to the mid Himalayas. The soil is generally sandy-loom and depth is shallow except in the areas having vegetation cover where it is fairly deep In the region above 1500Mtrs. the soil is generally deep and contains a thin layer of leaf moulded species of Ban, Oak, Chil, Kail and Deodar. In the lower elevation scrub forms are found while in the higher altitude Chil, Deodar, Kail etc. are available, in the lower ranges with warmer aspects and sharp slopes with deep soil and favorable conditions, species of mixed forest of Bamboo and scrub are found.

Agriculture & Horticulture:

Agriculture is the main occupation of the people in the District. The District is having different types of soil and agro-climatic conditions which are quite suitable for growing of various types of cereals, off-season vegetables, temperate and stone fruits and other cash crops. The climate in the district varies from extreme hot in the lower elevations to extreme cold in the higher reaches. While in areas in the lower elevations are suitable for growing of cereal crops, stone and citrus fruits, places in higher reaches are most suitable for the growing of seed potatoes off-season vegetables and temperate fruits especially apples. Shimla District is one of the biggest apples growing Districts in the Himachal Pradesh as it has earned name in propagating a rich collection of many delicious varieties of apples. From the agricultural point of view, the District can be divided into three broad regions namely (i) Valleys and basin areas, [ii) mid hills (iii) high hills. The low lying areas of Rampur, Kumarsian, Seoni, Shimla, Jubbal, Kotkhai, Chaupal, Theog and Rohru Tehsils are suitable for growing of cereal crops. In the mid areas of these Tehsil, there is a great potentiality for growing of cereals, vegetables and horticultural products. However, the areas of higher altitudes are suitable for growing of apples, cherry, walnuts, almonds and seed potato. The major crops grown in the District are Wheat, Paddy, Maize, Barley, Mullets and Pulses. Maize and Wheat are the two main crops of the District. Besides these Paddy and Barley are also grown in some quantity. Growing of off-season vegetables has also been taken up in the District in a big way. Some progressive farmers have come forward for mushroom cultivation and its production is likely to go up in the near future.

9) PHYSIOGRAPHY OF DISTRICT SHIMLA

Shimla lies in the south-western ranges of the Himalayas at 31.61°N 77.10°E. It has an average altitude of 2,206 metres (7,238 ft) above mean sea level The highest point in Shimla is the Jakhoo hill, which is at a height of 2,454 metres (8,051 ft).

The city is a Zone IV (High Damage Risk Zone) per the Earthquake hazard zoning of India. Weak construction techniques and an increasing population pose a serious threat to the already earthquake prone region.

There are no bodies of water near the main city and the closest river, the Sutlej, is about 21 km (13 mi) away. Other rivers that flow through the Shimla district, although further from the city, are the Giri, and Pabbar (both tributaries of Yamuna).

The green belt in the Shimla planning area is spread over 414 hectares (1,020 acres). The main Forests in and around the city are of pine, deodar, oak and rhododendron. Environmental degradation due to the increasing number of tourists every year without the infrastructure to support them has resulted in Shimla losing its popular appeal as an ecotourism spot.[22] Another rising concern in the region are the frequent number of landslides that often take place after heavy rains.

Climate of the Area

The region has four distinct seasons. The area experiences severe winter from December to March followed by servers summer season lasting from April to June. The area receives rainfall under the influence of south west monsoon from July to mid-September followed by post-monsoon season lasting upto November.

The terrain in general has profound influence on the temperatures of a region. The temperature generally rises from the begning of March till June which is the hottest month of the year with mean minimum and maximum temperature of 10 C to 40C respectively. With the onset of monsoons by the end of the June temperature begins to fall. The drop in day temperature is much more than the drop in night temperature. The night temperature falls rapidly after the withdrawal of monsoons by mid-September. The month of January is cooler month with the mean maximum and minimum temperature being 8.9 C and 1.7 C respectively. Under the influence of western disturbance, the temperature falls appreciably during winters and it may go even below 0 C.

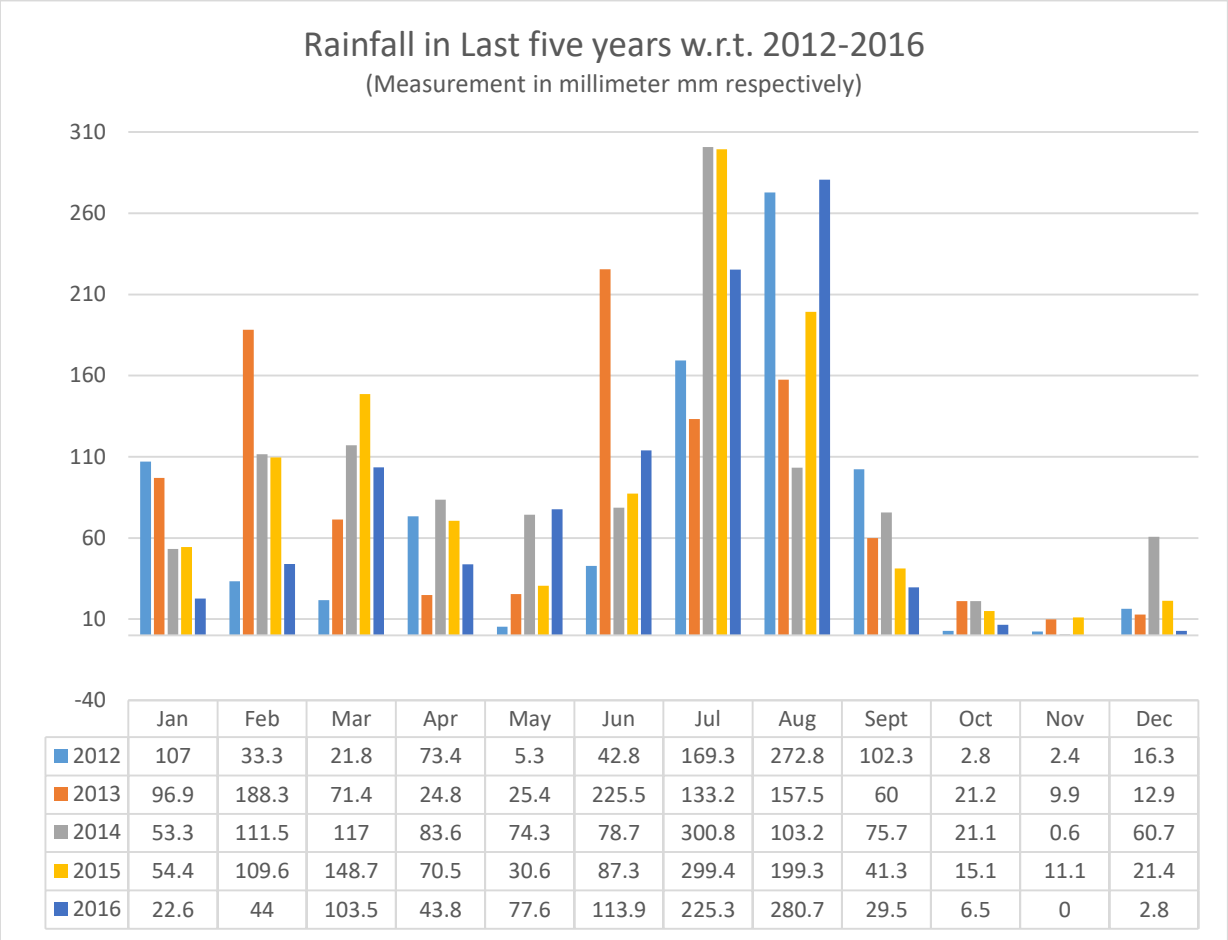
Humidity is generally low throughout the year. During summer season, humidity is lowest 36%. During monsoon month, it goes as high as 80-90%. The average humidity during synoptic hours is 53% and 62% respectively. The highest levels of humidity are observed in the month of August.

10) RAINFALL: MONTH-WISE

Rainy season generally starts from mid-July and extends up to mid-September. During winter the rains are scarce and extend in between 15th December to 15th February. The following Tables are showing the quantum of rainfall during the year 2012, 2013, 2014, 2015, 2016.

There are four broad seasons. Winter normally starts from mid-November and continues till mid-March. December, January and February are severe cold months when the winter season is at its peak. The upper reaches have snow and sleet while the rains are frequent in the lower areas Snow may fall as early as the beginning of October but usually the areas have snow-fall form the later part of December and continue till mid of March. The higher peaks experience heavier snowfall and it starts melting from March whereas from mid-March to mid-May climate in most parts of District is at its bloom because of the delightful spring. The nights are colder. The climate is comparatively hot from mid-May to mid-July. The places situated in the lower level i.e. on the banks of rivers and streams are, however, hot as in the plains. Rainy seasons generally start from mid-July and extend up to mid-September. Autumn season is generally very small from mid-September to mid-November. The Extended rainy season and early setting of winter are the seasons for its short duration. Due to variation in altitudes the temperature also varies considerably while minimum temperature in the higher reaches goes down much below O c during the peak winter months. The maximum temperature in the lower areas exceeds even 40° C during the summer months.

Table No. 5: Rainfall data of last five years



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
2012	107	33.3	21.8	73.4	5.3	42.8	169.3	272.8	102.3	2.8	2.4	16.3
2013	96.9	188.3	71.4	24.8	25.4	225.5	133.2	157.5	60	21.2	9.9	12.9
2014	53.3	111.5	117	83.6	74.3	78.7	300.8	103.2	75.7	21.1	0.6	60.7
2015	54.4	109.6	148.7	70.5	30.6	87.3	299.4	199.3	41.3	15.1	11.1	21.4
2016	22.6	44	103.5	43.8	77.6	113.9	225.3	280.7	29.5	6.5	0	2.8

11) GEOLOGY AND MINERAL WEALTH OF DISTRICT SHIMLA

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 18000km^{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.

The geological literature reveals that million years ago the area comprising the present Shimla District was a part of big sea called Tethys. Thereafter, at the end of the Murree period there was the third and most violent episode in the mountain building and the Himalayan mountain ranges started rising due to which a long narrow depression was formed in front of the sea where again the sediments were deposited. This period has a very congenial climate for life and the shallow water was abounding with a wide variety of fauna and flora. The fossil remains of these extinct animals are now found in the rocks and their studies have linked the evolution of life from the primitive to the advanced stage as the modem man.

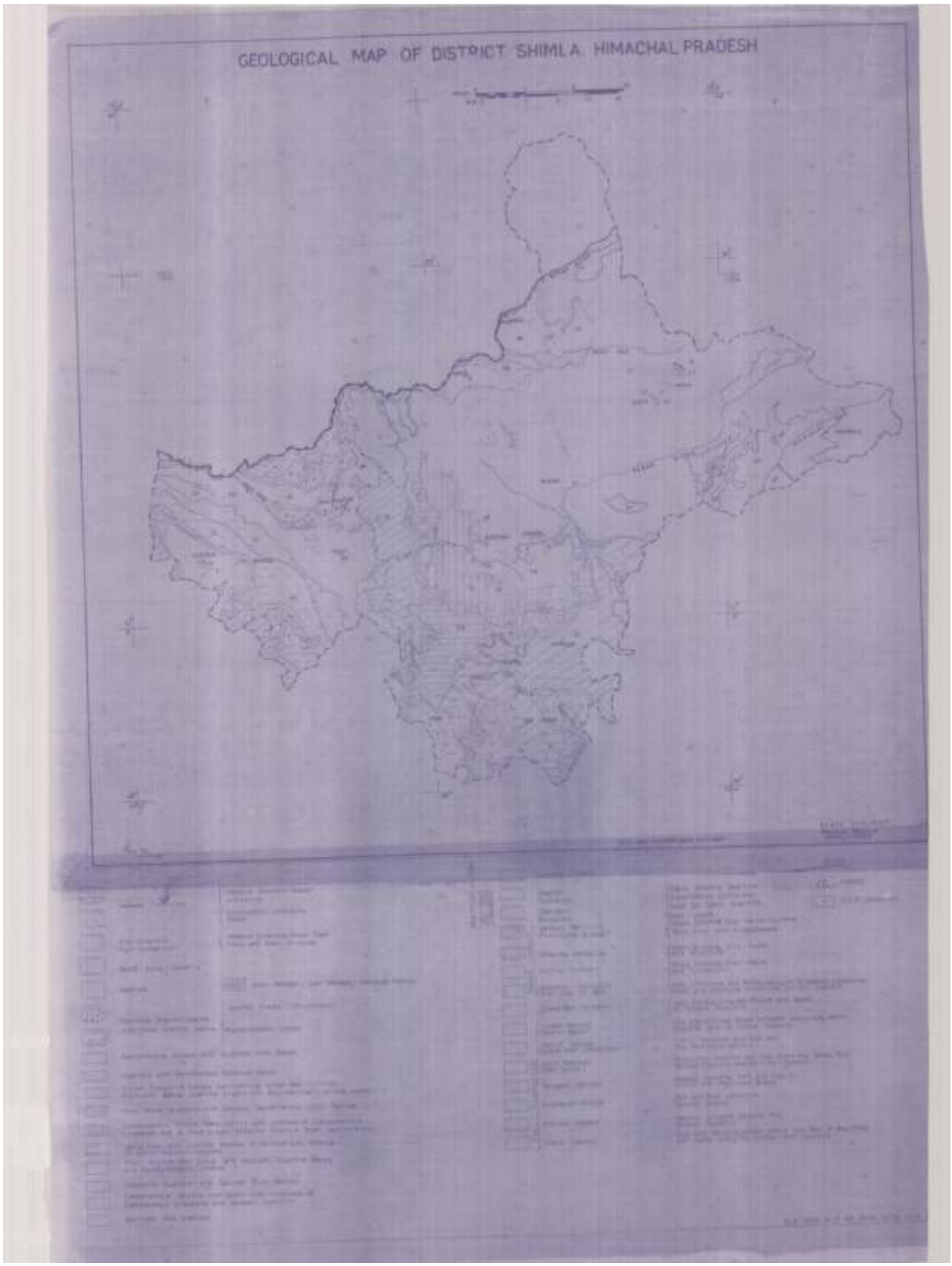


Figure No.3 : Geological map of District Shimla

The main type of rock formations that exists in and around the various parts of Shimla District are illustrated as

Jutogh formation

The Jutogh group is defined as a successive of metamorphosed sediments with a definite litho stratigraphic order. The Jutogh group has been divided in to eleven formations as illustrated below.

Lithostratigraphic classification of the Jatogh group:

Formation	Member	Lithology
Jankoti		Schist, Garnetiferous, gneiss, quartzite, local amphibolite and marble.
Chirgaon		Quartzite, quartz Schist, Sporadic, Schist. Local amphibolite and marble.
Rohru		Garnetiferous biotite schist, quartzite, local amphibolites.
Badrol		Quartzite, Quartz schist.
Naura	E	Psamatic gneiss, Quartzite, garnetiferous Staurolite schist.
	D	White marble, amphibolite in Graphitic schist.
	C	Psamatic gneiss, Quartz schist, amphibolite
	B	Mainly Garnetiferous schist and Quartzite, local porphyroblastic gneiss.
	A	Garnetiferous schist and Quartzite with bands of white marble, amphibolite and graphitic schist.
Kanda		Quartzite, Quartz schist and local mica schist.
Taradevi	C	Quartz schist.
	B	Dark grey garnetiferous phyllite.
	A	Carbonaceous phyllite and amphibolites.

Khirki.		Mainly pale white to grey quartzite, locally cross bedded, subordinate schist
Bhotli		Slate, phyllite, schist, quartzite, rare dolomite and amphibolites, local gneiss bands.
Manal	B	Pale White to grey quartzite, locally ripple-marked & cross-bedded, interbanded Carbonaceous Limestone
Panjerli	C	Carbonaceous Phyllite and Schist with limestone and Quartzite.
		Carbonaceous Limestone.

Panjerli, Manal, Kanda and part of Naura formations are exposed in Sirmour District whereas rests of the formations of Jutogh group are mostly exposed in the Upper parts of Shimla Districts i.e. Jubbal, around Pabber Valley and Chaupal area. In the upper reaches of the Pabbar Valley the Jutogh metasediments especially of the Jankoti formation are associated with granitoid gneisses. It comprises light grey, crudely foliated to non-foliated granitoid in the core, with prophyroblastic gneiss, minor augen and streaky gneiss along the peripheral zone.

In the upper reaches of the Pabbar 'Valley the Jutogh metasediments especially of the Jankoti Formation are associated with granitoid gneisses. In the Northern side of the Shimla District, the Manikaran Quartzite forms a very thick lithostratigraphic unit which has been traced from its closure near Malana in the North to Taklech, South-East of Rampur and is grouped as Rampur Quartzite. The Phyllites are generally Carbonaceous in nature associated with intercalations of Quartz-Mica-Schists with basic rocks. Tectonic window around Rampur is known as "Rampur Window", The Tectonic Sequence in the Rampur Group is as under:

Lithostratigraphic sequence of Rampur group (s.v srikantia and o.n bhargava 1998)

Group	Formation	Lithology
Rampur	Manikaran	Intrusive Granitoids, Grey and white massive Quartzite with bands of met basalt
	Banjar volcanic	Met basalt as dark green phyllite, interbed of white

		massive quartzite, grey phyllite.
	Bhallan	Slate, greenish phyllite schists with interbeds of white flaggy quartzite.

There are many upheavals in the Geological past which changed the shape of old coastline and land-forms. One of such major earth revolutions brought about widespread glaciations. The glaciers descended in the sea and the remnants of these glacial loads are called Blaini Boulder bed. After glaciations the climate gradually warmed up and in the next upheaval the area of the Shimla District was raised above the sea level. During the mountain building, the rocks deposited at the sea bottom were brought to rest over the younger rocks due to thrusting. The rocks were folded and uplifted.

These newly elevated mountains and torrential rivers started chiseling their valleys. Shimla is situated on the Jutogh formations whereas in surroundings, Rocks of Shimla group are exposed. The Shimla Group is divisible into four formations on the basis of certain characteristic lithological association and order of Super position.

Lithological classification of the shimla group (s.v srikantia and o.n bhargava 1998)

Formation	**Members**	**Lithology**
Sanjauli	Upper	Conglomerate, Arkosie sandstone, protoquartzite, grey and purple shale.
	lower	Greywacke sandstone, greywacke siltstone, shale and siltstone alternation, ortho quartzite.
Chhaosa		Shale and Siltstone alternation. greywacke siltstone and orthoquartzite
Kunihar		Shale and Siltstone alternation blue limestone with interbeds.
	D	Thick bedded to platy greyish blue limestone with Interbedded shale.
	C	Massive to bedded limestone-dolomite(local facies)

Basantpur	B	Shale, Siltstone with interbeds of lehticular limestone; Shale is sporadically Carbonaceous, inpersistent band of quatrzite and dolomite.
	A	Greyish white quartzite and conglomerate

Shimla Group of rocks is generally free from volcanic element. However, locally dolerite-diabase dykes are seen intruded into the Shimla group of rocks particularly in Basantpur formation in Basantpur-Seoni area. Out of the above four formations of Shimla Group of rocks, only part of two formations are well exposed in Shimla District whereas Shali group of rocks is exposed in the North of Shimla. There are eight formations of Shali group some of which are exposed from Drabala to Kingle along the Basantpur-Kingle road. Lithostratigraphical classification of the Shali Group of rocks is as under:

Lithostratigraphyof the Shali group:(S.V SRIKANTIA AND O.N BHARGAVA 1998)

Group	Formation	Lithology
	Bandla	Green and Purple Coloured Shale, Slate, Siltstone, earthy limestone, thin bedded orthoquartzite interbedsgreen brecciated rock and a fairly persistent band of white quartzarenite at the base. thin bedded orthoquartzite inter bedded Green brecciated rock Slate, Siltstone, earthy limestone thin bedded orthoquartzite inter
	Parnali	Cherty dolomite, grey limestone and white quartzarenite. White quatzarenite
	Makri	Grey, Green, Black and Purple Shales and slates, thin bedded limestone, thin bedded qurtzarenite with or without dolomite.
	Tattapani	Cherty dolomite, grey & Pink in colour with grey phyllitised shales

SHALI	Sorgharwari	Pink and grey cream textured limestone with shale partings
	Khatpul	Massive dolomite with sporadic quartzarenite and a thin red shale band at the base.
	Khaira	Mainly pink and purple also white quatzarenite
	Ropri	Brick red shale and siltstone with grey dolomite in the lower horizon; local development of salt ,salt grit and the marly lithocomplex"lokhan"

A) DETAIL OF RIVER, STREAM AND OTHER SAND SOURCES IN DISTRICT SHIMLA.

River System of District Shimla: -

Himachal Pradesh is a land of perennial rivers which have their sources in the higher mountains. **S**himla District is mainly covered by the catchment area of the rivers Satluj, Pabber, Shalvi and Giri. The District drains itself into these rivers. All these stream/khads are also perennial.

The Satluj, which is the principal river of the District, rises from Mansarovar Lake in the Eastern peaks of the Himalayas. Taking its course through District Kinnaur the river enters in Shimla District near Badhal in Rampur Tehsil and then takes course by touching Kumarsain Tehsil and Sunni Tehsil. The main khads falling in the river are Nogli, Maclihada, Rhaira and Kingal Khad. In addition, the Nallahs and other Khads of Khekhar, Chamola, Savera, Bagh etc. also feed the river. All the above mentioned Khads and nallahs are perennial being snow fed and have regular flow of water throughout the year, which ensures uninterrupted discharge of the river. It is the third important river in India, next to the Indus and Bramaputra by virtue of its cutting through the whole of the Himalaya.

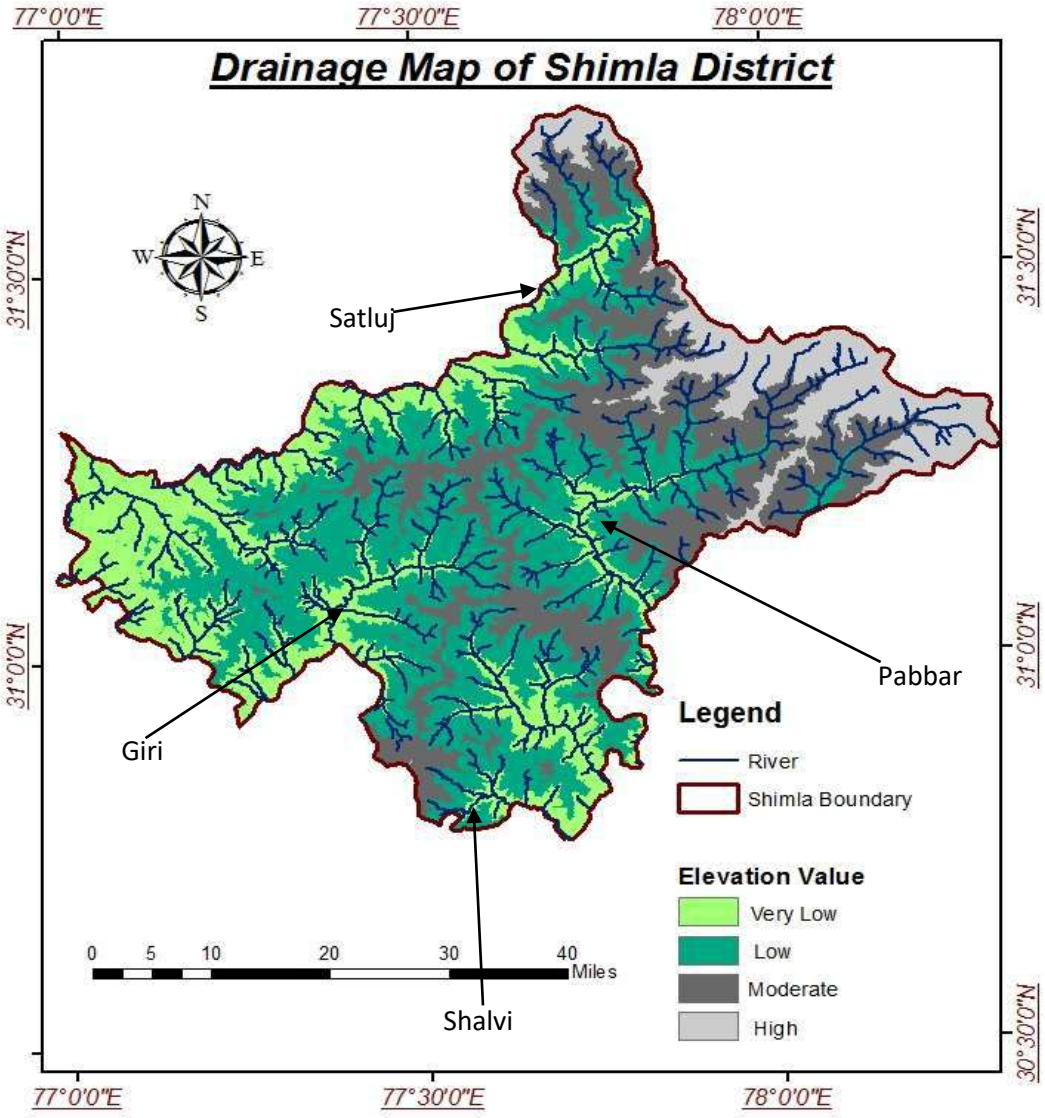


Figure No.4 :- Drainage map of District Shimla

Satluj River:

The Satluj River rises from the Southern slopes of the Kailash Mountain near Mansarovar / Rakas Lake at an altitude of about 5000 meter and enters in Himachal Pradesh near Shipkila and flows in the South-Westerly direction through District Kinnaur, Shimla, Kullu, Mandi and Bilaspur. Thereafter it leaves the Himachal Pradesh to enter the plains of Panjab at Bhakra where the highest gravity dam has been constructed on it. The upper tracts of the Satluj valley are under permanent snow cover. Its course in Himachal Pradesh is more than 300 Kms. from Rakshtal onwards with famous tributaries viz. the Spiti River, Ropa Nalla, Kashan River, Mulgaon, Yula, Wanger Nala, Throng, Rupi, Tirung,

Gayathing, Baspa, Duling, and Soldang Nalla etc. The river enters in to Shimla District near village Phagi and Wadhal at an altitude of 1235 mtrs. roughly. The Prominent human settlement that have come to the banks of Satluj river in Himachal Pradesh are Namgia, Kalpa, Rampur, Tattapani, Sunni and Bilaspur.

In upper reaches of Himachal Pradesh, the Satluj River is the single source of raw material for execution of developmental works by different agencies. Moreover, the demand of raw material for construction of various micro as well as Mega Hydro-electric Projects is also depended upon the river borne material of Satluj River.

Figure: - 5 view of river Satluj Shimla Himachal Pradesh.

Figure 6: River deposit near Duttnagar on left bank of river Satluj

Table No. 6 :- The key characteristic of the Satluj River are described below :

Name of the River	**Length (in km)**	**Catchment Area (in Sq.km)**	**Average Width(in mtrs.)**
Satluj River	90 Km.	2000 Sq. Kmtrs.	60 mtrs.
Origin of Satluj River	From base of Kailash Mountain near Mansarovar / Rakas Lake at an altitude of about 5000-meter above mean sea level. It enters in to Shimla District near village Phagi and Wadhal at an altitude of 1235 mtrs. roughly		
Important tributaries of the catchment.	Kut Khad, Ratu Gad, Gatti Gad, Ganvi Khad, Rai Khad, Manglad Khad, Barauni Khad, Kajo Khad, Banavali Khad, Jakho Khad, Sumun Khad, Nogli Khad, Kurpan Khad, Kyali Khad, Machhad Khad, Bhera Khad, Khaneti Khad, Beha Khad, Kingal Ki Khad, Kunda Nala, Pandoa Khad, Nauti Khad etc.		

Geological Conditions:

Geo-morphologically the Satluj River flows through high mountainous terrain to moderate low hills and intervening valleys of the different type of rocks. On entering Himachal Pradesh at Shipki-la-the Satluj River is joined by its principal tributary Spiti River which is fed by the Pin, Lingti and other smaller streams at Namgya. Downstream Kalpa in Kinnaur, it is joined by the Baspa river. It crosses the Great Himalaya range near Kalpa and at Rampur it crosses the Rocks of Rampur formation. The whole river stretch is represented by admixture or Boulders, Cobbles, Pebbles and Sand. The competency of the river is much higher especially during rainy season. The carrying capacity of Satluj River is much higher which may lead to 5 to 10 cms of annual deposition.

Total Potential of Satluj 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 No.7: The total potential of the Satluj River is given below in the table.

Name of River	Boulder	River borne Bajri.	Sand	Total
Satluj River	29,03,040	21,77,280	21,77,280	72,57,600
Annual Replenishment				
	1,74,182	1,30,637	1,30,637	4,35,456

Recommendations: It is evident from the above table that about 72,57,600 metric tons of different sizes of minor minerals are available upto depth of one meter in the river bed of Satluj River in Shimla District. Similarly, the annual deposition of minor mineral in the river bed is calculated approximately to the tune of 4,35,456 metric tons. It is therefore recommended that mineral concession can be granted in the river bed of Satluj River from downstream of Wadhal up to near Kiarl i.e. last boundary where the Satluj river leaves Shimla District after leaving the safe distances/buffer zone from the Hydro Electric Projects, I&PH schemes and other points of public community Projects.

Pabbar River System: The Pabbar River rises from the base of Chander Nahan peak in between Sangla Tehsil of Kinnaur District and Rohru Tehsil of Shimla District at an altitude of 3200 mtrs. roughly. The river takes South-Eastern course and passes through Tehsil Chirgoan, Rohru, Jubbal and merge with the river Tons at Tiuni in Uttrakhand. The river receives the entire drainage in these threeTehsils and is fed by Shikri, Andra, and Hatkoti etc. Stream/Khads. All these stream/khads are also perennial. The Pabbar river delivers a substantial amount of sediment load in the form of sand, stone and river borne bajri particularly during snowmelt and flood seasons. Pabbar River in Himachal Pradesh covers a catchment area of approximately 1200 Sq. km., out of which 42% is above EL.2000 m and it is mostly snow bound. The total length of river in District Shimla Himachal Pradesh is about 67 km. In the upper regions, mostly the area is sparsely populated, because of the steep mountain ranges, remote location and in accessibility. The river flows in a south westerly direction down to Rohru Township, there it turns to southeasterly direction. About 20 km south east of Jubbal, it leaves Himachal Pradesh territory and enters Uttarakhand.

The carrying capacity of the Pabbar river is good enough as different khad/Nallah joins the river at different spots. Two major khads i.e. Andra khad and Gumma khad joins the river at Chirgaon and both the tributaries having a good carrying capacity of annual deposition of sediments like stone & sand in river bed.

Figure 7: View of Pabber river Rohru Distt.Shimla

Table No. 8: - The key characteristic of the river and its major tributaries are described below

Name of the River	**Length (in km)**	**Catchment Area (in Sq.km)**	**Average Width(in mtrs.)**
Pabbar River	67 Km.	1200 Sq. Km.	60 mtrs.
Origin of Pabbar River	From base of Chander Nahan peak, 3200 Meter above Mean Sea Level.		
Important tributaries of the catchment.	Khanyara Khad(Right Bank Tributary), Gumlati khad(left Bank Tributary, Andra khad (Right Bank Tributary), Peja khad (left Bank Tributary), Masrat khad (Right Bank Tributary), Pakhal khad (left Bank Tributary), Shikdi khad (Right Bank Tributary), Dhar khad (left Bank Tributary), Dogra khad (Right Bank Tributary), Bishalti Nala (Right Bank Tributary), Ramwi khad (left Bank Tributary), Salanti khad, (Right Bank Tributary), Kunu khad (Right Bank Tributary), Nalia khad (Right Bank Tributary), Occha khad (Right Bank Tributary) etc.		

Geological Conditions:

The Pabbar River in most of its course flows through high mountainous terrain to moderate low hills and intervening valleys of the Jutogh Group of rocks. The carrying capacity of the said river is good enough as different khad Nallah joins the river at different spots. Two major khads i.e. Andra khad and Gumma khad joins the river at Chirgaon and both the tributaries having a good carrying capacity. It is also important to mention here that the track of Pabbar River is very long and this river is the only source of sand and other building material in the area. As such Department of Industries, Geological Wing, Himachal Pradesh used to auction the Pabbar River till March, 2003. However, no auction could done, thereafter due to applicability of Forest Department, Notification dated 15/1/1952 and 25/2/1952, wherein all the waste land in the ownership of Govt.

has been declared as Forest land and thus attracted the provision of FCA, 1980. This resulted in to scarceness/shortage of minor mineral in the area which further cause the illegal mining in the river bed. Keeping in consideration of unscientific and excessive mining in Pabbar river, the Govt. vide Notification dated 21.02.2004 imposed a complete ban on excavation/collection of sand, stone and bajri from the catchment of Pabbar River and its tributaries, right from its origin and up to its confluence with the Tons river at the border of Himachal Pradesh near Tiuni (Uttarakhand). However, the Government again partially modified the earlier notification of dated 21.02.2004 and vide fresh Notification No. Udyog-ll(Chh)5-27/92-l, dated 16.08.2004 allowed excavation collection of sand stone and bajri in certain parts of Pabbar river and its tributaries in certain selected area i.e. Andra Khad, Badyara-Seema portion, Kuddu-Snail portion, Bachhan Nala, Bijauri area and Tikkari area subject to general conditions of River/Stream Bed Mining Policy Guidelines-2004 but no mineral concession has been applied by anyone even in the selected allowed areas for mining due to the applicability of Forest Conservation Act. However, on the basis catchment area, annual deposition and other various factors, the potential of Pabbar river for granting mineral concession have been again studied in detail.

Total Potential of Pabbar 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 5 Cm. The total potential of the Pabbar River is given below in the table:

Table 9 :- Total Potential of Pabbar River

Name of River	Boulder	River borne Bajri.	Sand	Total
Pabbar River	18,91,008	18,91,008	16,20,884	54,02,880
Annual Replenishment				
	94,550	94,550	81,044	2,70,144

Recommendations:

It is evident from the above table that about 54,02,880 metric tons of different sizes of minor minerals are available upto depth of one meter in the river bed of Pabbar River in Shimla District. Similarly, the annual deposition of minor mineral in the river bed is calculated approximately to the tune of 2,70,144 metric tons. It is therefore recommended that mineral concession can be granted in the river bed of Pabbar River from downstream of Chirgaon (confluence of Andhra Khad) up to Sawra and thereafter from downstream to Anti up to Snail by leaving the safe distances/buffer zone from the Hydro Electric Projects, I&PH Scheme and other points of public community Projects.

THE GIRI RIVER, originates from the hills North of Churdhar near Khara Pathar and flows from Kharapather, Kotkhai, Gumma, Chailla and Sainj area before entering in the Sirmour District. The principal feeder of the Giri is Ashwani Khad, which rises from Mahasu in the Shitnala range and after receiving a considerable contribution from the eastern face of the hill upon which the Shimla town stands, joins the Giri at a point where the river turns South-East . The Giri and its tributaries also retain perpetual flow of water.

Giri River:

The Giri river originate near Uphill to Kharapathar at an Altitude of about 2600 mtrs. above mean sea level and flows from near Kharapather, Kotkhai, Gumma, Chailla and Sainj area before entering in the Sirmour District. Roughly it covers a length of 55 kms. from origin up to Kawnati (entery point in Sirmour District). The Giri River carries good quantity of Boulder, Cobbles, Pebbles and Sand material as a no. of perennial tributaries joins the Giri River at various points. Some mineral bearing horizons of Giri River were earlier used to auction prior to 2003, which was withheld later on due to applicability of Forest Conservation Act-1980.

Table 10: The key characteristic of the river and its major tributaries are described below in the table.

Name of the River	**Length (in km)**	**Catchment Area (in Sq.km)**	**Average Width(in mtrs.)**
Giri River	55Km.	550 Sq Kmtrs.	45mtrs.
Origin Of Giri River	From hillocks of Khara Pathar, 2600 Meter above Mean Sea Level.		
Important tributaries of the catchment.	Chehar Khad, Chanar Khar, Pajole-ka-Nala, Dasna ka Nala, Kiyar-ki-Khad, Chhoti Nala, Basari River, Chakhred Khad Mangled Khad, Ashni River etc.		

Geological Conditions:

The Gir River in most of its course flows through high mountainous terrain to low hills and intervening valleys of the Jutogh Group of rocks. The carrying capacity of the said river is good enough as different khad Nallah joins the river at different spots. The track of Giri River is long enough and it covers about length of 55 Kms. in District Shimla.

Total Potential of Giri 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 3 Cms. The total potential of the Giri River is given in the table:

Table 11: - Total Potential of Giri River is given in the table below.

Name of River	Boulder	River borne Bajri.	Sand	Total
Giri River	13,30,560	9,97,920	9,97,920	33,26,400
Annual Replenishment				
	39,916	29,938	29,938	99,792

Recommendations:

It is evident from the above table that about 33,26,400 metric tons of different sizes of minor minerals are available upto depth of one meter in the river bed of Giri River in Shimla District. Similarly, the annual deposition of minor mineral in the river bed is calculated approximately to the tune of 99792 metric tons. It is therefore recommended that mineral concession can be granted in the river bed of Giri River after leaving the safe distances/buffer zone from the Hydro Electric Projects, I&PH Scheme and other points of public community Projects from downstream of Anu up to Pajole (confluence of Pajole ka Nala) and thereafter from downstream to Devthi near Chailla up to Karganun i.e. last boundary where the Giri river enters in the Sirmour District.

Shalvi Nadi:

The Shalvi River originates from Kupar Spring, Tibba about an altitude of 3358 mtrs. and passes through Garli, Sihana, Janglog, Gadah, Koti, Maraun, Jhikali Pull, Batewari, Dadrana, Tarsanu, Nerwa, Biri, Banrgaon, Sugraithi, Batera etc. areas of Shimla District before entering in to Sirmour District of Himachal Pradesh near Atal. The river has a good potential of minor minerals i.e. Cobble, Pebbles, sand and river borne bajri as a no. of tributaries nallas/choes joints the Shalvi river at various places.

Table 12: -The key characteristic of the river and its major tributaries are described below in the Table

Name of the River	**Length (in km)**	**Catchment Area (in Sq.km)**	**Average Width(in mtr)**
Shalvi River	40 Kms.	400 Sq Kmtrs.	45 mtrs.
Origin of Shalvi River	From base of Kupar Spring, Tibba, 3358 meter above Mean Sea Level.		
Important tributaries of the catchment.	Kujnal Khad, Chahag Khad, Ghardi Khad, Shirut Khad, Khaliti Khad, Kyarti Khad, Nauti Khad, Kyarun Khad, Shautha Khad, Lakhawati Khad, Deya khad, Dharara Khad, Gharat Khad, Mashran Khad, Phaula Khad, Gurti Khad and Ali Khad etc.		

Geological Conditions:

The Shalvi river in most of its course flows through high mountainous terrain to low hills and intervening valleys of the Jutogh Group of rocks. The carrying capacity of the said river is good enough as different khad Nallah joins the river at different spots. The track of Shalvi River is long enough and it covers about length of 40 Kms. in District Shimla.

Total Potential of Shalvi 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 4 Cms.

Table 13: The total potential of the Shalvi River is given below in the table.

Name of River	Boulder	River borne Bajri.	Sand	Total
Shalvi River	9,67,680	7,25,760	7,25,760	24,19,200

Annual Replenishment				
	38,708	29,030	29,030	96,768

Recommendations:

It is evident from the above table that about 24,19,200 metric tons of different sizes of minor minerals are available upto depth of one meter in the river bed of Shalvi River in Shimla District. Similarly, the annual deposition of minor mineral in the river bed is calculated approximately to the tune of 96,768 metric tons. It is therefore recommended that mineral concession can be granted in the river bed of Shalvi River after leaving the safe distances/buffer zone from the Hydro Electric Projects, I&PH Scheme and other points of public community Projects from downstream of Koti up to up to near Atal (confluence with Ali Khad) i.e. last boundary where the Shalvi river enters in the Sirmour District .

Table 14: - Salient features of drainage system, mineral potential and suitable location for mining are given in the table below:

Drainage system	**Mineral potential**				**Suitable location for mining**
	Boulder	River borne Bajri.	Sand	Total	
RIVER SATLUJ	29,03,040	21,77,280	21,77,280	72,57,600	Wadhal up to near Kiarl
RIVER PABBER	18,91,008	18,91,008	16,20,884	54,02,880	Chirgoan upto Snail
RIVER GIRI	13,30,560	9,97,920	9,97,920	33,26,400	Devithi upto Kargunan
RIVER SHALVI	9,67,680	7,25,760	7,25,760	24,19,200	Koti upto Atal

12) RECOMMENDATIONS

The part of river/stream beds recommended for grant of mineral concessions in this report are based on reconnaissance survey conducted for whole of district Shimla, however before grant of any mineral concession in a particular river/stream bed, the guidelines contained in River/Stream bed mining policy are to be followed in addition to site specific conditions as specified bv the Joint Inspection Committee and recommendation thereof. In the ibid Policy Guidelines, following general conditions are mentioned.

1 No River/Stream bed mining shall be allowed without the recommendations of the Sub-Divisional Level Committee.

2 No River/Stream bed mining shall be allowed without getting clearance under Forest Conservation Act, 1980 if the area attracts the provisions of FCA. 1980.

3 No River/Stream bed mining shall be allowed within 75 meters from the periphery of soil conservation works, nursery plantation, and check dams or within the distance as recommended by the Sub-Divisional Committee, whichever is more.

4 No River/Stream bed mining shall be allowed within $1/5^{th}$ of its span or 5 meters from the bank or as specified by the Sub-Divisional Committee during the course of joint inspection which ever more is.

5 No River/Stream bed mining shall be allowed within 200 meters U/S and D/S of Water Supply Scheme or the distance as specified by the Sub- Divisional Committee during the course of joint inspection whichever is more.

6 No River/Stream bed mining shall be allowed within 200 meters U/S and 200 to 500 mtrs. D/S of bridges depending upon the site-specific conditions or as recommended by Joint Inspection Committee.

7 No approach road from PWD road shall be allowed to River/Stream beds mining, unless lessee/contractor obtains written permission from XEN PWD for making road leading to all intake places from the PWD Roads.

8 No mechanical mining through mechanical excavator including any other earth moving machines like JCB, Bouldozer, Pocklain, Loders etc. shall be carried out in river or stream bed by the lease holder or permit holder or contractor as the case may be.

9 No boulder/cobbles/hand broken road ballast shall be allowed to be transported outside the

State from River/Stream beds, so as to reduce pressure on the River/Stream beds.

10 No digging of more than 3 feet shall be allowed in River/Stream beds.

11 Every leaseholder shall supply in advance, the Registration Nos of vehicle engaged in transportation of mineral from mining area to his industrial unit. This would ensure checking of illegal vehicles carrying minerals.

12 Every lessee/contractor shall ensure that his labou/r does not involve in fish poaching.

13. No blasting shall be allowed in river/stream beds.

Irrespective of it following geoscientific considerations are also suggested to be taken into account during the river bed mining in a particular area:

1. Abandoned stream channels or terrace and inactive floodplains may be preferred rather than active channels and their deltas and floodplains.
2. Stream should not be diverted to form inactive channel.
3. Mining below subterranean water level should be avoided as a safeguard against environmental contamination and over exploitation of resources.
4. Large rivers and streams whose periodic sediment replenishment capacities are larger, may be preferred than smaller rivers.
5. Segments of braided river system should be used preferably falling within the lateral migration area of the river regime that enhances the feasibility of sediment replenishment.
6. Mining at the concave side of the river channel should be avoided to prevent bank erosion. Similarly meandering segment of a river should be selected for mining in such a way as to avoid natural eroding banks and to promote mining on naturally building (aggrading) meander components.
7. Continued riverbed material mining in a given segment of the river will induce seasonal scouring and intensify the erosion activity within the channel. This will have an adverse effect not only within the mining area but also both in upstream and downstream of the river course. Hazardous effects of such scouring and enhanced erosion due to riverbed mining should be evaluated periodically and avoided for sustainable mining activities.
8. Mining Lease (ML) areas should be demarcated on the ground with Pucca pillars so as to avoid illegal unscientific mining.
9. The auction shall be done as per the recommendation /approval of the Sub-Divisional Level Committee.

13) CONCLUSION

During the preparation of the present report four different rivers/streams were inspected and has been studied in detail, as the rest of the streams/rivers either have very insignificant annual replenishment/ approachability problem or are very narrow at most of the places and as such are not fit for grant of mineral concession for mineral based industries, however it is also important to mention here that because of the regular demand of sand, stone and bajri for the developmental activities in the respective areas, such streams are prone to illegal mining, as such if any person/party applies for open sale of mineral, the mining for open sale may be granted to meet out the local demands, or any exigency subject to the approval from the joint Inspection Committee. These mineral concessions shall also reduce demand load and will be helpful to minimize illegal extraction of minerals, failure of which may result in illegal mining at odd hours and shall be haphazard and more detrimental to the local ecology.

It is also important to mention here that the annual replenishment in a particular river bed depends upon no. of tributaries joining the main river, average rainfall, erosion occurred, meandering pattern, profile of the particular river, geology of the adjoining rocks and weathering condition in that area. However, during preparation of survey report the replenishment factor has been calculated at lower side which may increase in coming years, especially during high floods and monsoon seasons.

After detail discussion on the survey document the committee members were of the opinion that the annual replenishment factor cannot be fixed and it may vary from time to time. Thus in the conclusion of the survey document this additional information is incorporated that "*It is also important to mention here that the annual replenishment in a particular river bed depends upon no. of tributaries joining the main river, average rainfall, erosion occurred, meandering pattern, profile of the particular river, geology of the adjoining rocks and weathering condition in that area. However, during preparation of survey report the replenishment factor has been calculated at lower side which may increase in coming years, especially during high floods and monsoon seasons*".

Hence the survey document is hereby approved DEIAA.