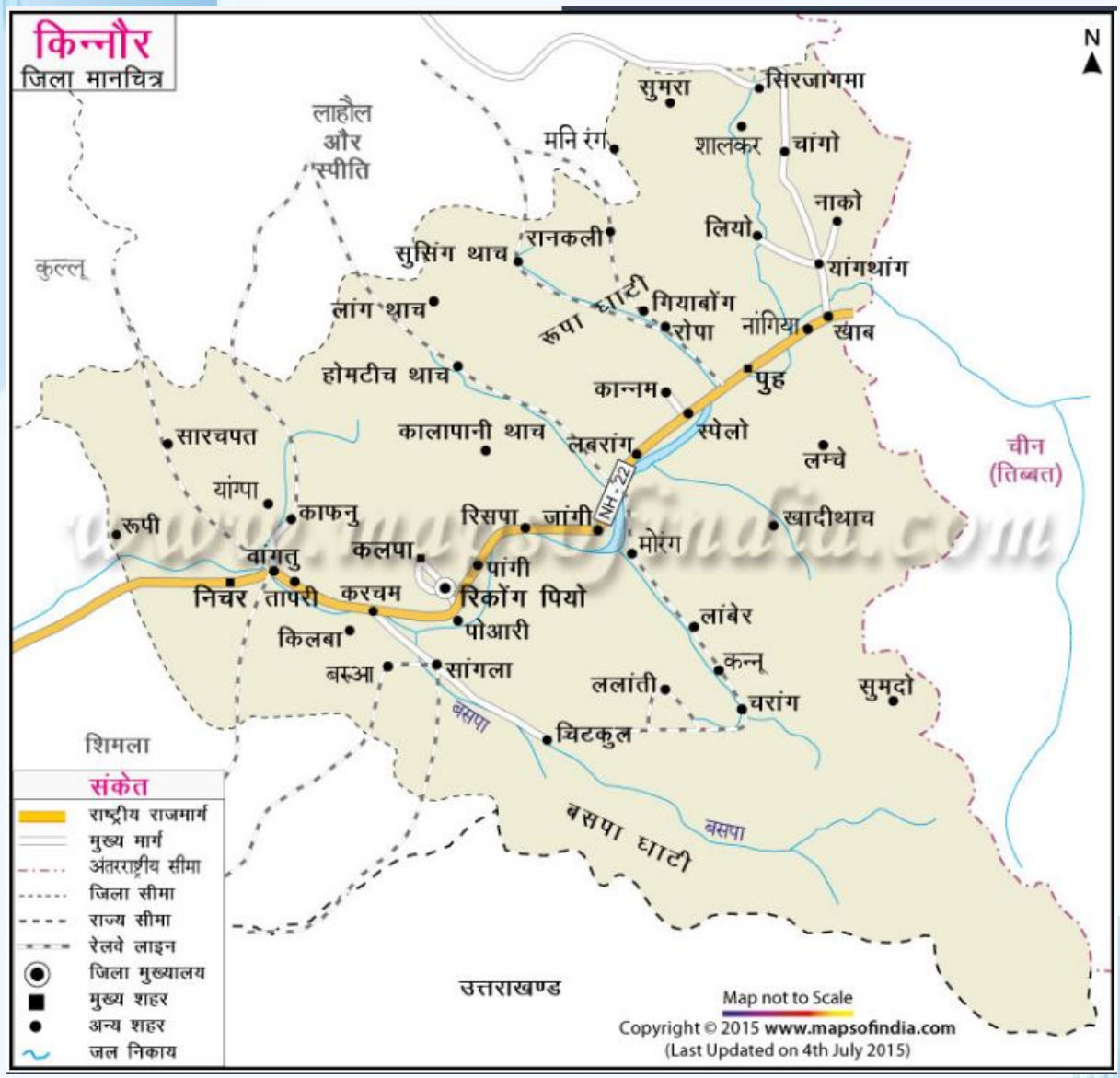
# DISTRICT SURVEY REPORT-2024
# District- Kinnaur Himachal Pradesh




## 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.

Basis for appraisal of EC (River Bed Mining Projects)

| 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 KINNAUR 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 Kinnaur 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 Kinnaur 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 Kinnaur 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, situated in the western Himalayas, covers an area of 55,673 square kilometers (34,594 square miles). The state's altitudes range from 350 meters to 6,975 meters above sea level. It lies between Latitude 30°22'40"N to 33°12'20"N and Longitude 75°45'55"E to 79°04'20"E. Himachal Pradesh boasts a deeply dissected topography, complex geological structure, and a rich temperate flora in sub-tropical latitudes. Its drainage system comprises both rivers and glaciers, with Himalayan rivers crisscrossing the entire mountain chain. These rivers—such as the Chandra Bhaga (Chenab), Ravi, Beas, Sutlej, and Yamuna—are perennial and fed by snow and rainfall. The state's climate varies significantly due to extreme elevation differences, ranging from hot and sub-humid tropical conditions in the southern tracts to cold, alpine, and glacial climates in the northern and eastern mountain ranges. Notably, areas like Dharamsala receive heavy rainfall, while places like Lahaul and Spiti remain cold and nearly rainless.

Moving on to Kinnaur district: it is situated between 77°045' and 79°000'35" East Longitude and 31°055'50" and 32°005'15" North Latitude. Kinnaur lies in the northeastern part of Himachal Pradesh, sharing its eastern border with Tibet and the Zanskar mountains. The district starts at a point called "Parechhu" and extends to the Chor Gad valley in the east via the Shipki La pass. To the south and southeast, it borders Uttarakhand, while the western side is adjacent to Kinnaur district. Lahaul and Spiti, as well as Kullu, touch Kinnaur from the north and northwest.

Here are some key details about Kinnaur:

Headquarter: Recong Peo

Altitude: 2,769 meters

Languages spoken: Kinnauri (Hamskad), Sangnaur, Jangiam, Shumecho, etc.

Kinnaur is renowned for its stunning landscapes, including three high mountains: Zanskar, Greater Himalaya, and Dhauladhar. The main river in Kinnaur is the Sutlej, with tributaries like Spiti and Baspa. The valleys are adorned with dense forests, orchards, fields, and picturesque villages. At the peak of Mount Kinnar Kailash, you'll find a natural rock Shivling (Shiva lingam). Kinnaur district, one of Himachal Pradesh's twelve administrative districts, is divided into three areas (Kalpa, Nichar, and Pooh) and has six tehsils. Its administrative

headquarters is in Reckong Peo. Additionally, the revered Kinnaur Kailash mountain, one of the Panch Kailash sites, graces this region. As of 2011, Kinnaur is the second least populous district in Himachal Pradesh, following Lahaul and Spiti.

Located approximately 235 kilometers (146 miles) from the state capital, Kinnaur shares its northeastern border with Tibet. The district is enclosed by three high mountain ranges: Zanskar, the Himalayas, and Dhauladhar. These mountains shape the valleys of Baspa, Satluj, and Spiti, along with their tributaries. Kinnaur's slopes are adorned with thick forests, orchards, fields, and charming hamlets. The old Hindustan-Tibet Road traverses the Kinnaur valley along the Sutlej River, eventually entering Tibet via the Shipki La pass. Kinnaur ranks as the second richest district in terms of per capita income after Solan in Himachal Pradesh. It gained separate district status on May 1, 1960, having previously been part of the north-eastern segment of the erstwhile Chini Tehsil in Mahasu district.

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

At present about 51 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 1: The details of the Mining lease are as follows:**

| Sr. No. | Name and Address of Mining Lease Holder | Khasra No./Location in Mauza/Mohal | Area (Hectares/Bighas | Lease Period | Coordinates | |
|---|---|---|---|---|---|---|
| 1. | Shri Daulat Ram Negi | 10/1/1, 232/1/1, 232/2/1 (Kilba) | (01-39-18 Hect.) | 04.11.2020 to 03.11.2025 | 31°30'39.51"N | 78° 9'58.77"E |

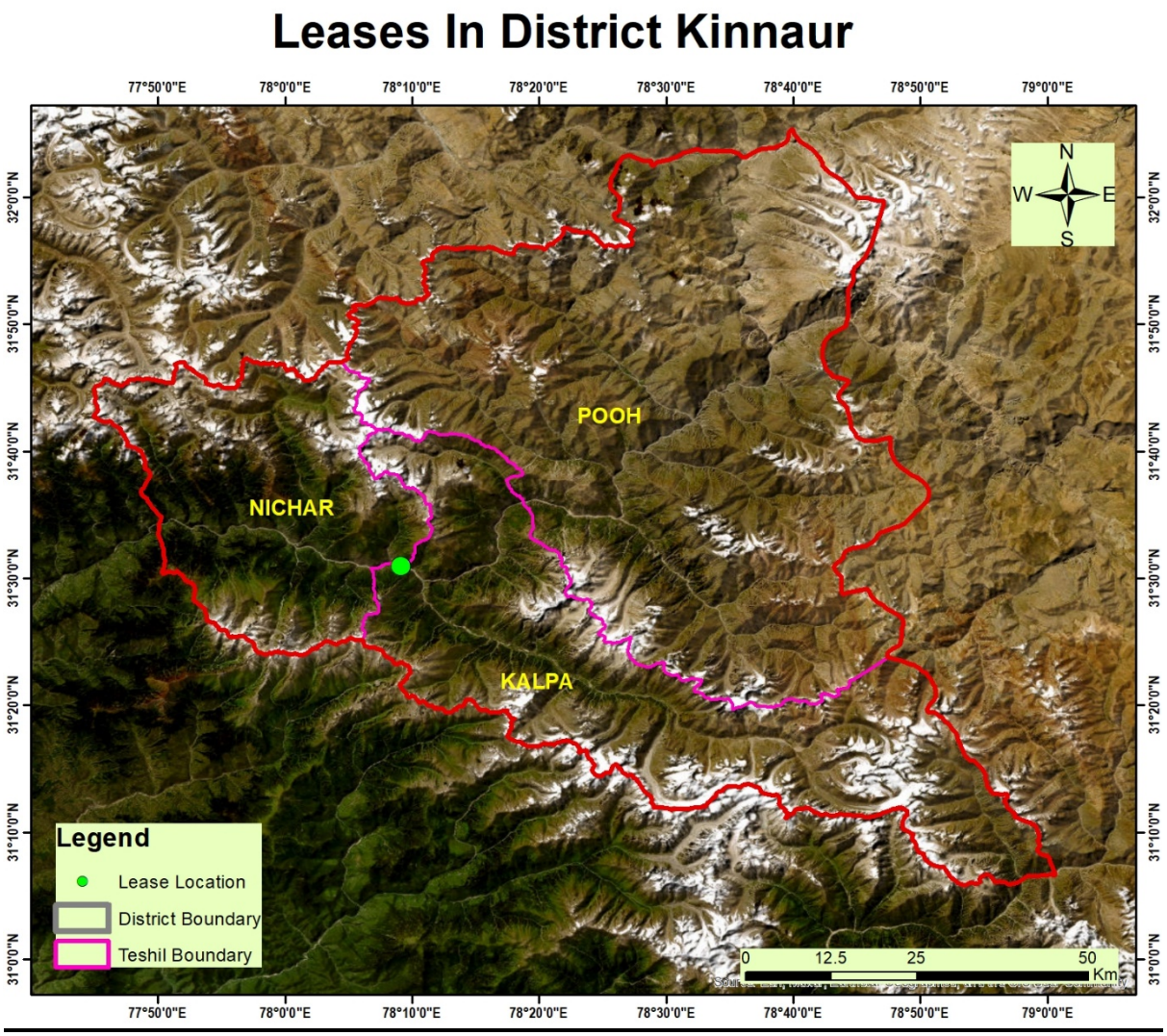



**Image Showing The Location Of The Mining Lease**

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

### Detail of Revenue Collected by Mining Office Kinnaur H.P. in Last 04 Years

| Sr. No. | Financial Year | Revenue collected Offline (In Rs) | Revenue Collected Online (In Rs) | Total Revenue Collected (In Rs) |
|---|---|---|---|---|
| **1** | 2020-21 | | 38752681 | 38752681 |
| **2** | 2021-22 | 1152000 | 17768142 | 18920142 |
| **3** | 2022-23 | | 17016496 | 17016496 |
| **4** | 2023-24 | 4615120 | 23537466 | 28152586 |

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

**Table 2: Production of Minor Mineral in Metric Tonnes**

| FY | 2020-21 | 2021-22 | 2022-23 | 2023-24 |
|---|---|---|---|---|
| **Sand** | 185291.364 | 60763.593 | 32335.714 | 91000.768 |
| **Stone** | 265577.909 | 217128.104 | 169607.301 | 222002.014 |
| **Bajri** | 175196.09 | 38376.49 | 14480.724 | 4546.687 |

## 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 Kinnaur district of Himachal Pradesh River Satluj and River Baspa 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 Kinanur District

The comparison of the pre-monsoon and post monsoon drainage map of the district shows that during pre-monsoon the tributaries of river are spread in lesser catchment area but post monsoons because of increase in water levels in the main river, its tributaries and sub tributaries cover much larger catchment area. This clearly underlines the dependence on rain water in the area. The general drainage pattern of the Rivers/ streams in the district is dendritic pattern. All rivers/streams flowing in Kinnaur district are tributaties of Satluj River catchment. The sources and the run along with other characteristics of the important rivers and the streams draining various parts of Kinnaur are as follows:-

#### 7.2.1 Satluj River

Sutlej the principal river of the district arises in the Himalayas and has plentiful perennial source of water. It enters Kinnaur district from the Tibetan territory by a pass and reaches the boarder of Kullu. This river is called Shatarahu in Sanskrit literature, Sutundri in vedic literature, Zaradros or Heisidrus in Greek, Zungtee and Muksung in Tibetan as well as other being Sampoo, Sumudrung and Sutoodra. It arises from the lake mansarover in the Tibetan hinglands and cuts the Zanskar range at shipkila and enters district Kinnaur. The tributaries of the river.

Sutlej in this district is the spiti river, the Ropa, the Taiti, the keshang, the Mulgoon, the Yula, the wanger, the shorang and the Rupi on the right bank whereas the Tirung, the Gyanthing, the baspa, the Duling and the Saoldung are its left bank contributaries. River Satluj originates at Rakshas Tal Lake near Mansarover Lake, and is called as 'Longcchen Khabab' in Tibet. It flows generally towards west and southwest till it enters India at Shipkilla at an altitude of 6608 metres. The river cuts through the great Himalayan and the Zanskar range. River Satluj has been reported as 4th order stream in accordance with the glacier-inventory norms (Muller, 1978) and as 5th order from Nathapa and downstream up to Bilaspur town.

The highest point in the basin is about 4400 m. The streams on the eastern bloc flow in escarpments along most of their course. Drainage represents lower order streams joining the trunk stream at 90°. The streams on the eastern blocks are longer and more in number compared to those on the western blocks. The main river Satluj flows through a crystalline basement belonging to Vaikrita Group near Khab where the area lies in the Kaurik-Chango fault zone. Quaternary reactivation of these faults has led to bedrock incision by Satluj which flows in a gorge for most of its course. Its major right bank tributaries are Spiti, Chaso, Ropa, Kerang, Kashang, Sorang, Kurpan, Ganvi, Behna and Karsog, whereas its major left bank tributaries are Titang, Nesang, Tidong, Baspa, Duling, Soldang, Nogli and Sainj.

### 7.2.2 Spiti River

It is the second major river in the district. It has its source in the far-north on the eastern slopes of the mountain ranges which run between Lahul and spiti. Before meeting the Sutlej at the place called Khab, at an altitude of 2,589 meters, Spiti is joined by many feeders which meet on both the banks. The Chaladokpo (Left bank), the Yulang, the Lipak and the Tirasang (Right bank) are its main tributaries.

### 7.2.3 Baspa River

The Baspa river another feeder of Sutlej arises from Dhaula Dhar Mountain ranges of Lower Himalayas and psses through valley bearing its name and meets the Sutlej at Karchham, at an elevation of 5,945 feet, after a distance of 72 kilometers. Its channel is wide and forms many islands of stones and pebbles. The Zupkia, the Thathang, the Boring, the Rukti and the Suthi are its important tributaries.

### 7.2.4 Other Significant Tributaries

(i) The Yulang originating between Shiakhar and Leo joins the Spiti River after coursing for about 13 kilometers.

(ii) The Ropa rises on the south-western range which bounds Kinnaur on the side of Lahul and Spiti and after coursing 45 kilometers, it falls into Sutlej near Shiaso Village. The Pojur or Taiti is one of the largest feeders of the Ropa which runs for about 40 kilometers from south- easterly direction.

(iii) The Kashang, a hill torrent with considerable water volume has a southeasterly direction and joins the Sutlej between Pangi and Sunnam places.

(iv) The Mulagoon is a large torrent which after crossin about 24 kilometers in the south-easterly direction falls into Sutlej. It originates on the range that separate Kinnaur from Lahul and Spiti. The Hindustan Tibet road crosses it near the Pangi where it is crossed by NH-22 near Kalpa link.

(v) The Yula originates on the eastern declivity of the range forming the boundary between Kinnaur and Lahul ans Spiti district.it joins the Sutlej after flowing a path of 23 kilometers.

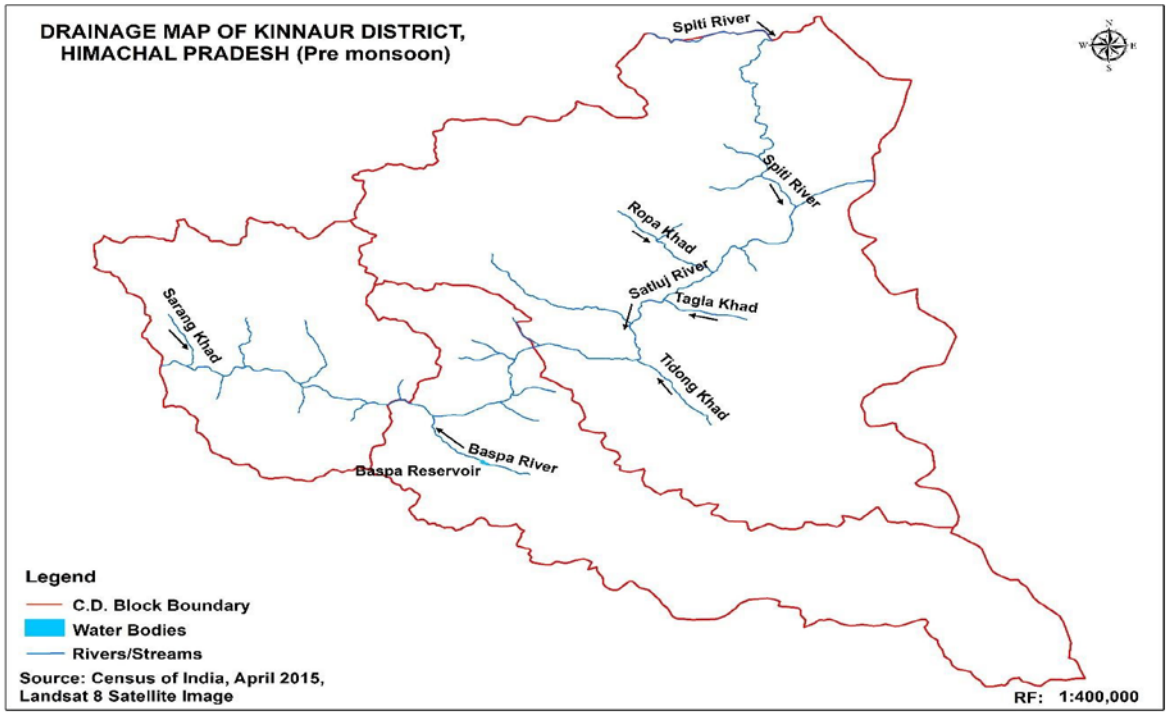
(vi) The Wanger formed by the torrent of Bhabha and Soorchi falls into the Sutlej on the right side at Wangtu. It flows from the eastern declivity of Damuk Ghue.

(vii) The Tidong rises on the south-eastern frontier, towards Garhwal and holding north-westerly course along the North western base of the huge Ruldung range, it falls into the Sutlej near Rispa on the left bank.

### *7.3 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.



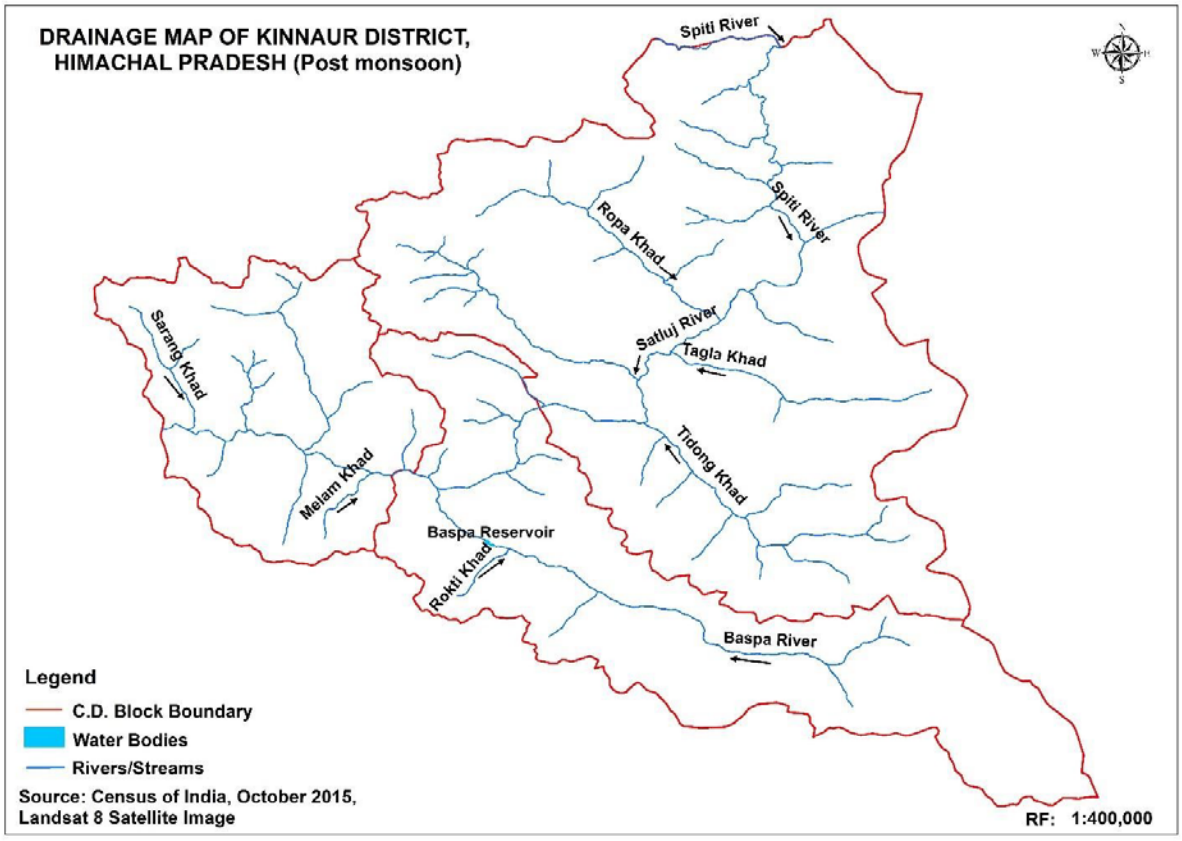




**Image Showing Drainage pattern of District Kinnaur (Pre-Monsoon & Post Monsoon)**

### 7.3.1 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.

### 7.3.2 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 to 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.

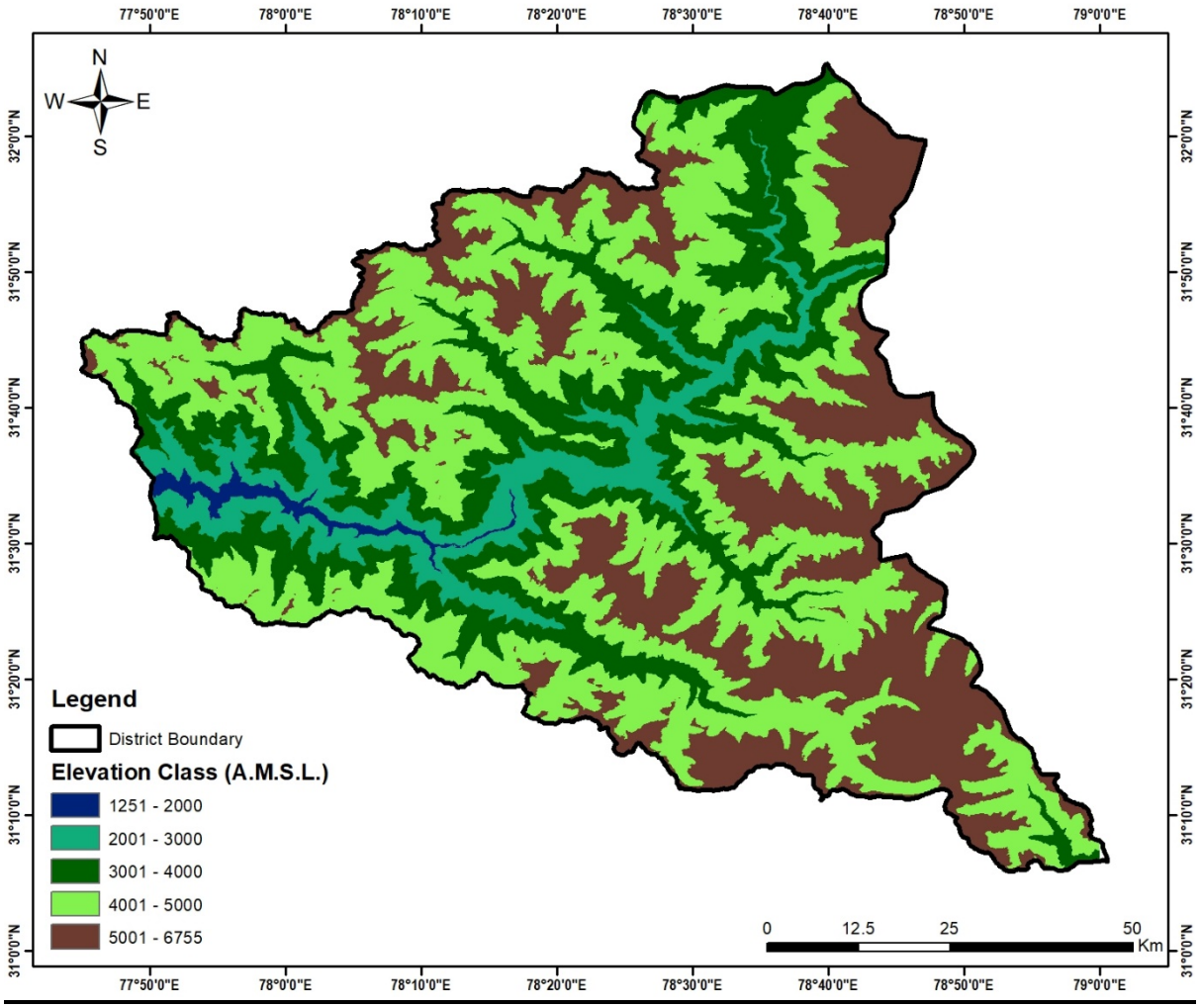



***Figure Showing Elevation Map Of The District***

### *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 Kinnaur 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 Kinnaur 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 Kinnaur district ranges from 1250 m to 6755 m above mean sea level with varied agro-climatic conditions. Geomorphologically the Kinnaur district and the Satluj Catchment area 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.

Kinnaur District, located in the Indian state of Himachal Pradesh, is characterized by diverse geomorphic units due to its unique topography and climatic conditions. The geomorphic units of Kinnaur District can be broadly categorized as follows:

**1. High Mountainous Region (Greater Himalayas)**

Elevation: 4,000 meters and above.

Characteristics: This region includes some of the highest peaks in the district, such as Kinner Kailash. The terrain is rugged, with steep slopes, deep gorges, and glacial formations. Snow-covered peaks, glacial valleys, and alpine meadows dominate this region.

Processes: Glacial and periglacial processes are significant in shaping this landscape, with active glaciers contributing to the geomorphology.

**2. Middle Himalayan Range**

Elevation: 2,500 to 4,000 meters.

Characteristics: This region is marked by moderate to high mountain ranges, deeply dissected by river valleys. The slopes are steep, and the terrain is more accessible than the Greater Himalayas. Forested areas and pastoral lands are common in this zone.

Processes: Fluvial erosion and weathering are the primary processes shaping the landscape.

**3. Lower Himalayan Region (Shivalik Hills)**

Elevation: 1,500 to 2,500 meters.

Characteristics: This zone consists of lower mountain ranges with more gentle slopes. The region is characterized by dense forests, agricultural terraces, and human settlements.

Processes: Fluvial erosion, mass wasting, and weathering play crucial roles in shaping the landscape.

**4. River Valleys**

Main Rivers: Sutlej, Baspa, Spiti.

Characteristics: The river valleys are narrow and deep, with steep valley sides. These valleys are crucial for the district's agriculture, settlements, and transportation. River terraces, alluvial fans, and floodplains are common features.

Processes: Fluvial processes dominate, with rivers cutting through the mountains, creating V-shaped valleys, and depositing sediments along the banks.

**5. Glacial and Periglacial Landforms**

Characteristics: This unit includes moraines, cirques, and U-shaped valleys formed by past and present glacial activity. Glacial lakes and extensive scree slopes are also common in this region.

Processes: Glaciation, frost action, and solifluction are key processes influencing the landscape.

**6. Alluvial Fans and Piedmont Plains**

Location: Found at the base of the hills where rivers descend into lower valleys.

Characteristics: These are depositional landforms created by sediment deposition from rivers. They are often areas of fertile soil and are used for agriculture.

Processes: Fluvial deposition is the primary process shaping these areas.

**7. Karst Topography**

Characteristics: Limited to specific areas, karst topography may be present where limestone bedrock is subjected to chemical weathering, leading to features like caves, sinkholes, and underground streams.

Processes: Chemical weathering, particularly dissolution, is the primary process here.

These geomorphic units together form the complex and dynamic landscape of Kinnaur District, each contributing to the region's unique ecological and geological character.

## 8. Description of Quarries and Recommendations

### 8.1 Wangtu Quarry:

On the left bank of the river Sutlej about 1.8 km upstream of the Nathpa reservoir there is a deposit of river born material. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 620 metres in length and about 30 metres in width.


**Google Earth view of Wangtu Quarry**

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 18749 | 14582 | 8333 | 41664 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.2 Kilba Quarry:**

On the left bank of the river Sutlej, downhill side of village Kilba, there is a deposit of river born material. The deposits comprises of materials, such as boulders, cobble, pebble, sand and clay. This deposit is about 820 metres in length and about 60 metres in width.

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 cm.


**Google Earth view of Kilba Quarry**

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 49594 | 38573 | 22042 | 110208 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

### 8.3 Shongtong Quarry:

On the right bank of the river Sutlej about 200 metres upstream of the Shongtong village sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 260 metres in length and about 40 metres in width.


***Google Earth view of*** **Shongtong Quarry Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 10483 | 8154 | 4659 | 23296 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

### 8.4 Powari Quarry:

On the left bank of the river Sutlej downhillside of the Powari village there is deposit of river born material. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 490 metres in length and about 82 metres in width.


***Google Earth view of* Powari Quarry**

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 40501 | 31501 | 18001 | 90003 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

## 8.5 Khadura Quarry:

On the right bank of the river Sutlej downhill side of the Khadura village sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 240 metres in length and about 50 metres in width.


***Google Earth view of*** **Khadura Quarry**

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 12096 | 9408 | 5376 | 26880 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

### 8.6 Ribba Quarry:

On the right bank of the river Sutlej on the upstream side of the confluence of Raldong Khad village sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 220 metres in length and about 60 metres in width.


***Google Earth view of*** **Ribba Quarry**

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 13306 | 10349 | 5914 | 29568 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals is available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

### 8.7 Skibba Quarry:

On the right bank of the river Sutlej about 200 metres of the upstream of the Akpa bridge, sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 240 metres in length and about 120 metres in width.


***Google Earth view of*** **Skibba Quarry Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 29030 | 22579 | 12902 | 64512 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.8 Korti -A Quarry:**

On the right bank of the river Sutlej about 2 km of the upstream of the Akpa bridge sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 360 metres in length and about 80 metres in width.


***Google Earth view of* Korti Quarry A Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 29030 | 22579 | 12902 | 64512 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

## 8.9 Rispa Quarry:

On the left bank of the river Sutlej and downhill side of the Rispa village sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 510 metres in length and about 100 metres in width.


***Google Earth view of* Rispa Quarry**

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 51408 | 39984 | 22848 | 114240 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.10 Korti -B Quarry:**

On the right bank of the river Sutlej about 2.5 km downstream of the Moorang bridge sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 470 metres in length and about 120 metres in width.


***Google Earth view of*** **Korti Quarry B Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

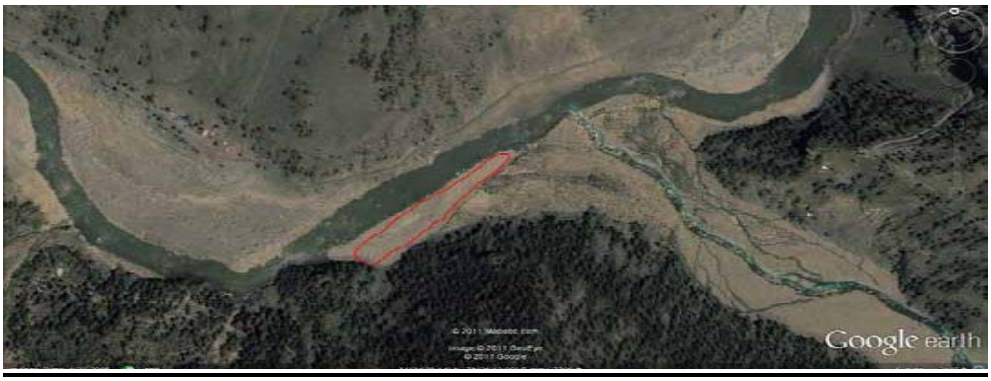
| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 56851 | 44218 | 25267 | 126336 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.11 Tirung Quarry:**

On the left bank of the river Sutlej about 150 metres downstream of the confluence of Tirung Khad sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 350 metres in length and about 35 metres in width.




***Google Earth view of* Tirung Quarry**

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 12348 | 9604 | 5488 | 27440 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.12 Jangi-A Quarry:**

On the right bank of the river Sutlej upstream of the confluence of Tirung Khad on left bank sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 320 metres in length and about 60 metres in width.


***Google Earth view of*** **Jangi Quarry-A Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 19354 | 15053 | 8602 | 43008 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.13 Khokpa Quarry:**

On the left bank of the river Sutlej about 100metres upstream of the confluence of Khokpa nala on left bank sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 400 metres in length and about 40 metres in width.


***Google Earth view of*** **Khokpa Quarry**

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 16128 | 12544 | 7168 | 35840 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.14 Jangi-B Quarry:**

On the right bank of the river Sutlej about 500 metres downstream of the Moorang bridge sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 520 metres in length and about 35 metres in width.


***Google Earth view of*** **Jangi-B Quarry Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 18346 | 14269 | 8154 | 40768 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.15 Jangi-C Quarry:**

On the right bank of the river Sutlej upstream downhill side of the Jangi village sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 220 metres in length and about 50 metres in width.


***Google Earth view of*** **Jangi-C Quarry Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 11088 | 8624 | 4928 | 24640 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

### 8.16 Jangi-D Quarry:

On the right bank of the river Sutlej upstream of the Jaqngi-C quarry sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 400 metres in length and about 50 metres in width.


***Google Earth view of*** **Jangi-D Quarry Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 20160 | 15680 | 8960 | 44800 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.17 Kirang Quarry:**

On the right bank of the river Sutlej on the confluence of Kirang Khad sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 240 metres in length and about 45 metres in width.


***Google Earth view of*** **Kirang Quarry**

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 10886 | 8467 | 4838 | 21192 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.18 Spillow-A Quarry:**

On the right bank of the river Sutlej about 1 km upstream of the Kirang bridge sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 300 metres in length and about 60 metres in width.


***Google Earth view of* Spillow-A Quarry**

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder(in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 18144 | 14112 | 8064 | 40320 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.19 Spillow-B Quarry:**

On the right bank of the river Sutlej about 2 km upstream of the Kirang bridge sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 430 metres in length and about 45 metres in width.


***Google Earth view of* Spillow-B Quarry**

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder(in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 19505 | 15170 | 8669 | 43344 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.20 Spillow-C Quarry:**

On the right bank of the river Sutlej downstream of the confluence of Ropa Khad sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 250 metres in length and about 45 metres in width.


***Google Earth view of* Spillow-C Quarry**

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder(in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 11340 | 8820 | 5040 | 25200 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.21 Nesang Quarry:**

On the right bank of the river Sutlej about 250 metres downstream of the Nesang bridge sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 400 metres in length and about 35 metres in width.


***Google Earth view of*** **Nesang Quarry**

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder(in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 14112 | 10976 | 6272 | 31360 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.22 Giamul Quarry:**

On the right bank of the river Sutlej about 500 metres downstream of the confluence of the Shiaso Khad sufficient deposit of river born material is there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. This deposit is about 250 metres in length and about 60 metres in width.


***Google Earth view of* Giamul Quarry Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder(in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 15120 | 11760 | 6720 | 33600 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.23 Ropa Quarry:**

On the right bank of the river Sutlej, Ropa Khad merges into the river Sutlej on the upstream of village spillow. In this stream sufficient deposit of river born minor minerals are there. The deposit is comprises of river born material such as boulders, cobble, pebble, sand and clay. From downstream of the village Ropa to village Sagnam the minor minerals can be collected / exploited to meet the increasing demand of the minor minerals. In this 7 km long portion of the stream is about 80-100 metres wide.


***Google Earth view of Ropa Quarry***

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder(in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 564480 | 439040 | 250880 | 1254400 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.24 Chango Quarry:**

On the right bank of the river Sutlej, Spiti river merges into the river Sutlej at Khab. In this stream only few deposit of minor minerals are there, comprises of river born material such as boulders, cobble, pebble, sand and clay. On the right bank of this stream, about 2 km downstream of the village Chango deposit of about 340 metres long and 30 metres wide is an accessible deposit of minor mineral.


***Google Earth view of* Chango Quarry**

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder (in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 10282 | 7997 | 4570 | 22848 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.25 Shalkhar Quarry:**

On the right bank of the river Sutlej, Spiti river merges into the river Sutlej at Khab. In this stream only few deposit of minor minerals are there, comprises of river born material such as boulders, cobble, pebble, sand and clay. On the left and right bank of this stream, about 3 km downstream of the village Shalkhar deposit of about 400 metres long and 60 metres wide is an accessible deposit of minor mineral.


***Google Earth view of Shalkhar Quarry***

**Minor Mineral Potential**

As the stream cut its course through sky-scraping mountains which is the prominent source of annual deposition in the river beds. During flood season, the water carries heavy sediment load comprising gravels and sand which are deposited along the bed of stream. The following mineral potentials have been calculated based on the mineral constituent upto a depth of one metre. The annual deposition of minor mineral in the river bed has been taken as annual deposition of 9-10 Cm.

**Table Showing Minor Mineral Potential**

| Mineral Potential | | | |
|---|---|---|---|
| **Boulder(in MT)** | **River Born Bajri (in MT)** | **Sand (in MT)** | **Total Mineable Mineral Potential (in MT)** |
| 24192 | 18816 | 10752 | 53760 |

**Recommendation**

It is evident from the above table that sufficient quantity of different sizes of minor minerals are available upto depth of one metre in thequarry. It is therefore recommended that mineral concession can be granted in this quarry.

**8.26 Summary of Recommendation**

**Table showing details of the quarries**

| Sr. No. | Name of Quarry | Length | Width | Area |
|---|---|---|---|---|
| 1 | Wangtu | 620 | 30 | 18600 |
| 2 | Kilba | 820 | 60 | 49200 |
| 3 | Shongtong | 260 | 40 | 10400 |
| 4 | Powari | 490 | 82 | 40180 |
| 5 | Khadura | 240 | 50 | 12000 |
| 6 | Ribba | 220 | 60 | 13200 |
| 7 | Skibba | 240 | 120 | 28800 |
| 8 | Korti-A | 360 | 80 | 28800 |
| 9 | Rispa | 510 | 100 | 51000 |
| 10 | Korti-B | 470 | 120 | 56400 |
| 11 | Tirung | 350 | 35 | 12250 |
| 12 | Jangi-A | 320 | 60 | 19200 |
| 13 | Khokpa | 400 | 40 | 16000 |
| 14 | Jangi-B | 520 | 35 | 18200 |
| 15 | Jangi-C | 220 | 50 | 11000 |
| 16 | Jangi-D | 400 | 50 | 20000 |
| 17 | Kirang | 240 | 45 | 10800 |
| 18 | Spillow-A | 300 | 60 | 18000 |

| | | | | |
|---|---|---|---|---|
| 19 | Spillow-B | 430 | 45 | 19350 |
| 20 | Spillow-c | 250 | 45 | 11250 |
| 21 | Nesang | 400 | 35 | 14000 |
| 22 | Giamul | 250 | 60 | 15000 |
| 23 | Ropa | 7000 | 80 | 560000 |
| 24 | Chango | 340 | 30 | 10200 |
| 25 | Shalkhar | 400 | 60 | 24000 |

***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 Giri, Satluj 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

Kinnaur is located in the north-eastern part of the Himachal Pradesh and is situated between 31º05’05” to 32º05’15” north latitude and 77º45’00” to 79º00’35” east longitude The district has a total area of 6401 sq. km. which cover 11.5 per cent area of the state. The population density in the District is 11 persons per square Kms. The District has the 58.36% of literacy rate.

Kinnaur is bounded on the east by the Ngari region of western Tibet; the district is separated from the Tibet by the Zaskar mountains. The Dhaula Dhar range of mountains forms its southern boundary and it separates Uttar Kashi district of Uttar Pardesh and Rohru tahsil of Shimla district from it. Srikhand Dhar separates the district from Kulu and Rampur regions in the west. In the north Kinnaur district is separated from the Spiti region of Lahaul and Spiti district by the rivers Spiti and Pare near the international boundary with Tibet. Kinnaur is bounded on the east by the Ngari region of western Tibet; the district is separated from the

Tibet by the Zaskar mountains. The Dhaula Dhar range of mountains forms its southern boundary and it separates Uttar Kashi district of Uttar Pardesh and Rohru tahsil of Shimla district from it. Srikhand Dhar separates the district from Kulu and Rampur regions in the west. In the north Kinnaur district is separated from the Spiti region of Lahaul and Spiti district by the rivers Spiti and Pare near the international boundary with Tibet.

**Salient Features of the district:**

Geographical Area - 6401 Sq. Km
Total Population - 71,270 (2001 census)
Number of Sub-Divisions - 03

1 Poo
2 Kalpa
3 Nichar

Number of Tehsils - 5

1 Kalpa
2 Nichar
3 Sangla
4 Pooh
5 Moorang

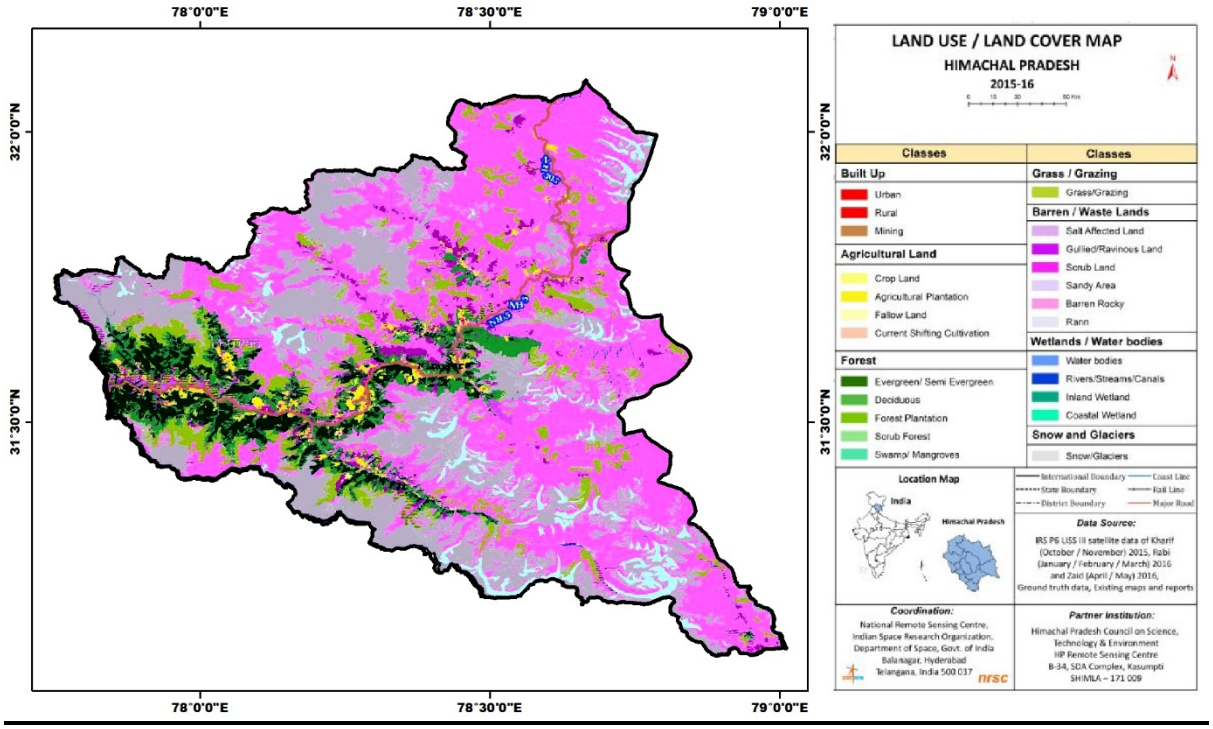
Number of C.D. Block - 3

1 Poo
2 Kalpa
3 Nichar

Number of Gram Panchayat - 65
Number of villages - 660
Total Population -78334 (2001census)
Density per Sq Km -12

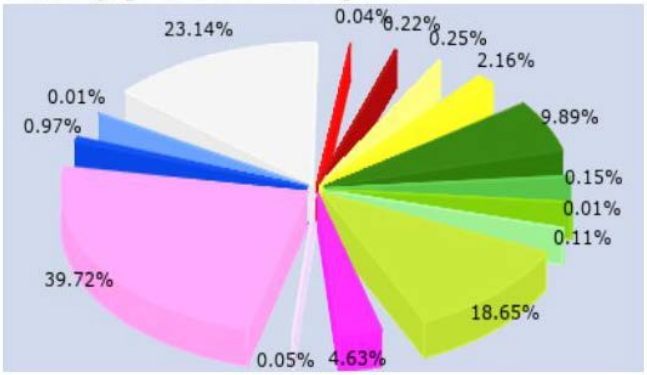
## 9. Land Utilization Pattern In The District: Forest, Agriculture, Horticulture, Mining Etc.

The economy of Kinnaur 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* Kinnaur *District*

LULC Information (2015-16) for Kinnaur
Total Geographical Area : 6401 Sq. Km




| LULC Class | Area (Sq.Km) | LULC Class | Area (Sq.Km) |
|---|---|---|---|
| Builtup,Urban | 2.55 | Builtup,Rural | 14.08 |
| Agriculture,Crop land | 16.19 | Agriculture,Plantation | 138.43 |
| Forest,Evergreen/ Semi evergreen | 632.92 | Forest,Deciduous | 9.52 |
| Forest,Forest Plantation | 0.49 | Forest,Scrub Forest | 6.96 |
| Grass/Grazing | 1193.84 | Barren/unculturable/ Wastelands, Scrub land | 296.52 |
| Barren/unculturable/ Wastelands, Sandy area | 3.21 | Barren/unculturable/ Wastelands, Barren rocky | 2542.44 |
| Wetlands/Water Bodies, River/Stream/canals | 62 | Wetlands/Water Bodies, Reservoir/Lakes/Ponds | 0.5 |
| Snow and Glacier | 1481.33 | | |

## *Land Use Land Cover Statistics of District Kinnaur*

### *9.1 Agriculture*

Kinnaur is predominantly an agriculture district. agricultural Agriculture development in the hilly areas posse peculiar problems due to steep and difficult terrain, small and scattered holdings, depleting fertility of soil by constant erosion, the crop yield are vary low. The crop season is limited to only six, months due to intensive cold and snow fall. However, the economy of the district is highly agro-pastorage. Land holdings are generally small and scattered almost every family has a piece of land. Soils generally consists of sand, sandy loam, clay loam, stony and graval. Wheat, barley, maize, potato, vegetables and pulses are the main corps of the district.

For the development of the district in the agricultural front, intensive agriculture aiming at increasing the yield per unit of area is being given highest priority by adopting various programmes/measures like seed distribution programme of high yielding varieties, potato development scheme, control of pests and diseases, development of vegetables and seed production programme, use of improved implements, local manure resources, subsidy in fertilizers and soil conservation.

The following are the main crops in the District;- • Wheat

- Maize
- Paddy
- Oil seed
- Pulses
- Potato
- Sugercane
- Ginger
- Vegitables (Peas, Tomato, Capsicum, Cabbage, Culiflower)
- Spices (Peper and Coriander)

### *9.2 Horticulture*

The climate of Kinnaur district is very congenial for the development of horticulture and apples in particular. With the introduction of improved techniques, expertise in orchard growing and transportation facilities, the production of fruits is also increasing year to year. Kinnaur district has a distinct place in the country for its quality apples and temperate fruit like wall nuts, almonds, chilgoza, raisin, apricot etc. The main commercial verities of apple grown are Royal Delicious, Rich Red, Red Delicious and Golden Delicious which are directly marketed to Chandigarh, Delhi, Madras, Calcutta and Bombay markets.

Ever since the creation of district, constant emphasis has been always given on the Horticulture to boost up the traditional economy and considerable strides have been made in this regard after the creation of the district. The area under apples was 2,026 Hactares in 1980-81 which was increase to 4431 Hectare in 1991-92. While the production of the apple in the district has increased from, 7151 tonns to 16530 tonns during the period. Total production of the fruits in the district, which includes apples, nuts and dry fruit citrus fruits etc., was of 7812 tonnes in 1980-81 which has increase to 16879 tonnes during 1991-92.

Departmental be keeping stations are also functioning in the district at Pounta, Bhabha, Kilva, Urni and Giabong which produced 900 kilograms of honey during the year 1990-91.

Apple, Plum, Apricot, Chilgoza, Almonds are the important fruits grown in the Kinnaur district.

### *9.3* ***Animal Husbandry***

Livestock resources of the district consist of sheep and goats. Milch cattle are very few and yield very little milk. With the exception of Chaura village, buffaloes are conspicuous by their absence all over Kinnaur. Before the percolation of modern developments in Kinnaur the wealth of the family used to be measured in term of the sheep and goats the family had. Kannauras had the flourishing trade with western Tibet and Ladakh until and beginning of sixties particularly in wool, pashmina, goats and sheep through barter system.

The improvement of the bread of livestock the main concern of the department of Animal Husbandry in the districts which has been taking a considerable stride in the district. There were 18 veterinary Hospitals, 28 veterinary dispensaries and 1 mobile veterinary dispensary in the district in 1991. Apart from these, 31 artificial in semi nation centers were also functioning. Besides there are poultry units at Tapri, Two Bull centers at Sangla, 1 Sheep breeding farm at Karchham and a Yak breeding centre at Sangla. Cross breed Jersey Cow and Marino breed of Sheep have become very popular among the progressive farmers.

One fodder development farm run by the Animal Husbandry department is functioning Thang Karma. To solve the fodder problem the department is providing improvement verity of fodder seeds like Lucerne, berseen, orchards grass and grass roots to the farmers.

### *9.4* ***Fisheries***

There is vast network of perennial rivers, streams and Khads in the district and there is a great scope of the development of fish culture. The Himachal Pradesh fisheries department has established a Trout farm at Sangla 1961-62 incubating the Trout eggs which were brought here from Barot Fish Farm in Mandi district.

### *9.5* ***Forest***

The forests play a vital role in shaping the climatic condtions of the area. The forests provide valuable timber, medicinal herbs, raw material for large and small scale industries and also provide employment and play a vital role in conserving the soil and ensure timely and sufficient rain.

In Kinnaur district forest type fall naturally into following three main divisions;

(i) The moist zone forests are found on the left side of the Satluj valley with northern exposure into Nichar. They comprise the Tranda range of forests. The forest are particularily continous. From the river side at 3500 feet to alpine pasture at 12000 feet on the right base consists of grass lands and higher up are the forest belt. Along the side stream, the forest are well developed and Pinus Longifolia, Pinus Wllichiana, Cedrus Deodara, PicesSmithiana, Abies Pindro, Pinus Gordianaform a broad belt of forest along with the side of Satluj valley and the side streams between the clif of the gorge below the alpino pastures.. on the lower slope upto 5000 feet, Chir pines occurs in pure form and higher up given way to Quercus incana and Rhodeondron arboretum. On shelter ravine bank between 5000 to 12000 feet

Cedrus Deodara and Pinus Wallichiana form Interine forest, higher up form 7000 to 10000 feet Picea Samithiana with mixture of broad leaf species predominate.

(ii) The dry zone is spread in middle Kinnaur where the deodar reaches its optimum development and form large area of pure forest. It extends from Nichar to Chini and also found in Sangla valley. At the lower levels pine trees abound while in the higher tracts blue pine, spruce and silverfire trees are found. Neozapines (Chilgoja) which produceedible nuts grow in this zone are the only forest of neza in India bearing the Peer Panjal range.

(iii) The areid zone includes the parts adjoining to Tibetan border where the deodar develops well only on cool aspects and comparatively at higher elevation than else where. In this zone, the forests is consisting of rose dog and dwarf bushes and vast barren, desolate and rocky areas are devoid of tree cover.

The following various species of plants and forest trees are generally found in the Kinnaur district:

| **Botanical Name** | **Local Name** |
|---|---|
| Borboris Aristata | Komal |
| Borboris lycium | Kashnala |
| Borboris potiolaris | Karundu |
| Botula utilis | Bhojpatra |
| Capparis spinosa | Bussar |

| | |
|---|---|
| Cedsus Deodara | Deodar |
| Clematis graveolens | Bailen climbars |
| Cotonoaster bacillaris | Reesh |
| Colyrus Colurna | Sheloi |
| Dephno qleoides | Agru |
| Elsholtzia Polystachya | Pag |
| Frazinus xarithoxyloides | Thun |
| Ilex dipyrona | Kaderu |
| Indigfora gorardina | Kathi |
| Juglana zogia | Akharot |
| Myraino africana | Chitring |
| Pinus excelsa | Kail |
| Pinus girardiana | Neoza |
| Pinus longifolia | chir |
| Prunus armeniaca | Chuli |
| Prunus padus | Jamu |
| Prunus persixa | Baimi, Aau |
| Prunus puddum | Phaja |
| Pyrus communis | Nashpati |
| Pyrus malus | Seo |
| Pyrus pashia | Kainth |
| Rhus punjabensis | Tittri |
| Rhus syccedanca | Sish |
| Rumex lastatus | Shrub |
| Rumex napalansis | Shrub |
| Spiraoa eindbeana | Kusht |
| Spyringa embedi | Shapar |
| Vibusnum cotinifotium | Tustuskhatele |

**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**

Nature has endowed the tract with various fauna due to considerable variation in the elevation and climate. The following are the species of animals and birds commonly found in the district:

| | |
|---|---|
| Bharal | Snow leopard |
| Brown bear (Lal Bhalu or snow bear | Upland hare |
| Hill Fox (Lomri) | White nosed weasel |
| Common Jungle cat | Yellow Bellied weasel |
| Porcupine | Himalyan Wolf or chanku in local parlance |
| Common Europeonbat | House hare |
| Common Musk threw must rat (Chachmdor | Chakor |
| Common etter udibilao | Woodpecker |
| Common rat | Crow |
| Common Indian rat or root rat | Peasant |
| Common House mouse | Monal |
| Dark brown lcat bat | Hawk |
| Flying fox | Eagle |
| Ghoral | Dove |
| Great Himalayan leaf nosed bat | Pigeon |
| Himalayan Langur | Snow cock |
| Himalayan black bear (Bhalu, Richh) | Tragopan |
| Himalayan thar | Plash |

| | |
|---|---|
| Himalayan Palm Civet | Koklash |
| Himalayan ibex | Chakor |
| Indian mountjack migrating (Jungle Bakri) | Musk deer |
| Jackal (Gidhar, shial) | Red dynx or caracal (Sinaghush) |
| Large brown fluying squired | Rhesus Monkey |
| Leopard cat (Chita Bill) | Serow |
| Leopard or Panther (Tandwa) | Small Tibetan grey fox |
| Long eared rat | |

## 10. Physiography Of The District

Himachal Pradesh, situated in the western Himalayas, covers an area of 55,673 square kilometers (34,594 square miles). The state's altitudes range from 350 meters to 6,975 meters above sea level. It lies between Latitude 30°22'40"N to 33°12'20"N and Longitude 75°45'55"E to 79°04'20"E. Himachal Pradesh boasts a deeply dissected topography, complex geological structure, and a rich temperate flora in sub-tropical latitudes. Its drainage system comprises both rivers and glaciers, with Himalayan rivers crisscrossing the entire mountain chain. These rivers—such as the Chandra Bhaga (Chenab), Ravi, Beas, Sutlej, and Yamuna—are perennial and fed by snow and rainfall. The state's climate varies significantly due to extreme elevation differences, ranging from hot and sub-humid tropical conditions in the southern tracts to cold, alpine, and glacial climates in the northern and eastern mountain ranges. Notably, areas like Dharamsala receive heavy rainfall, while places like Lahaul and Spiti remain cold and nearly rainless.

Moving on to Kinnaur district: it is situated between 77°045' and 79°000'35" East Longitude and 31°055'50" and 32°005'15" North Latitude. Kinnaur lies in the northeastern part of Himachal Pradesh, sharing its eastern border with Tibet and the Zanskar mountains. The district starts at a point called "Parechhu" and extends to the Chor Gad valley in the east via the Shipki La pass. To the south and southeast, it borders Uttarakhand, while the western side is adjacent to Kinnaur district. Lahaul and Spiti, as well as Kullu, touch Kinnaur from the north and northwest.

Here are some key details about Kinnaur:

Headquarter: Recong Peo

Altitude: 2,769 meters

Languages spoken: Kinnauri (Hamskad), Sangnaur, Jangiam, Shumecho, etc.

Kinnaur is renowned for its stunning landscapes, including three high mountains: Zanskar, Greater Himalaya, and Dhauladhar. The main river in Kinnaur is the Sutlej, with tributaries like Spiti and Baspa. The valleys are adorned with dense forests, orchards, fields, and picturesque villages. At the peak of Mount Kinnar Kailash, you'll find a natural rock Shivling (Shiva lingam). Kinnaur district, one of Himachal Pradesh's twelve administrative districts, is divided into three areas (Kalpa, Nichar, and Pooh) and has six tehsils. Its administrative headquarters is in Reckong Peo. Additionally, the revered Kinnaur Kailash mountain, one of the Panch Kailash sites, graces this region. As of 2011, Kinnaur is the second least populous district in Himachal Pradesh, following Lahaul and Spiti.

Located approximately 235 kilometers (146 miles) from the state capital, Kinnaur shares its northeastern border with Tibet. The district is enclosed by three high mountain ranges: Zanskar, the Himalayas, and Dhauladhar. These mountains shape the valleys of Baspa, Satluj, and Spiti, along with their tributaries. Kinnaur's slopes are adorned with thick forests, orchards, fields, and charming hamlets. The old Hindustan-Tibet Road traverses the Kinnaur valley along the Sutlej River, eventually entering Tibet via the Shipki La pass. Kinnaur ranks as the second richest district in terms of per capita income after Solan in Himachal Pradesh. It gained separate district status on May 1, 1960, having previously been part of the north-eastern segment of the erstwhile Chini Tehsil in Mahasu district.

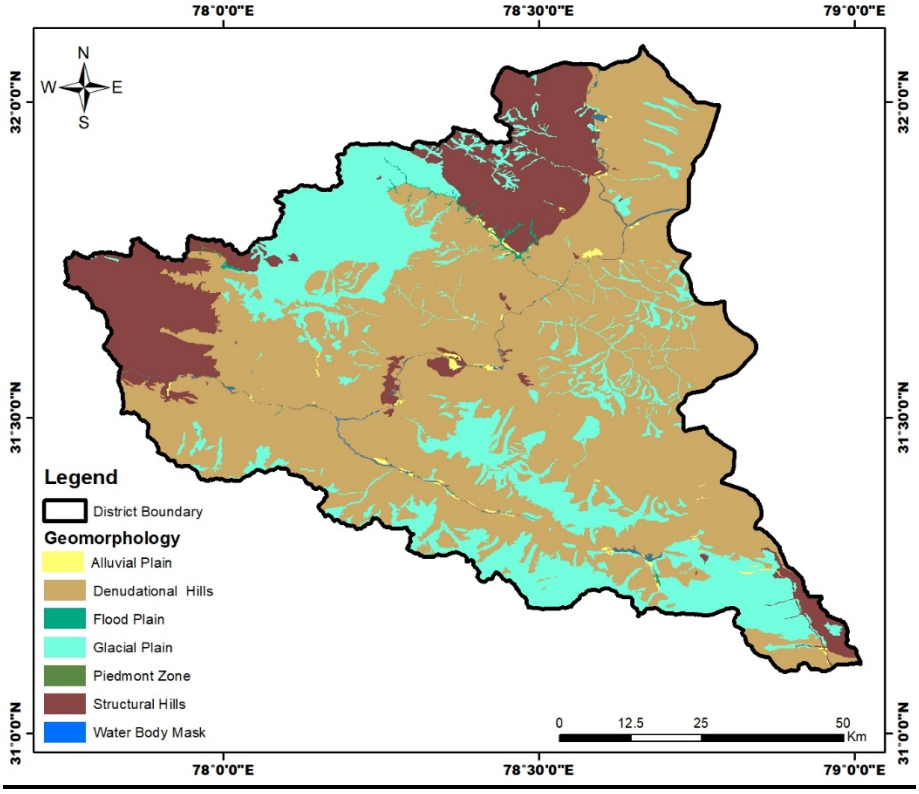



***Image Showing Physiography of the District***

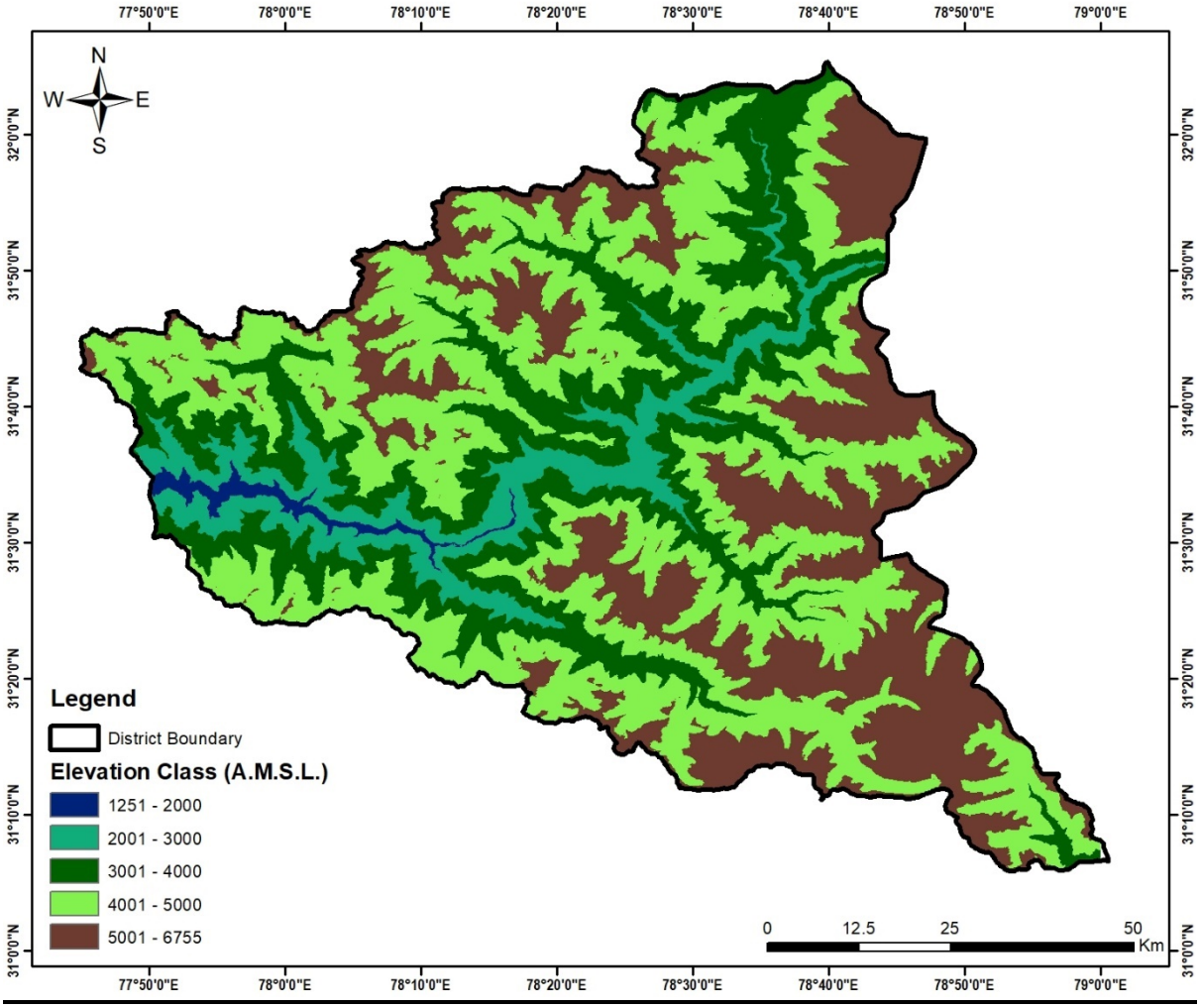



***Image showing elevation profile of District***

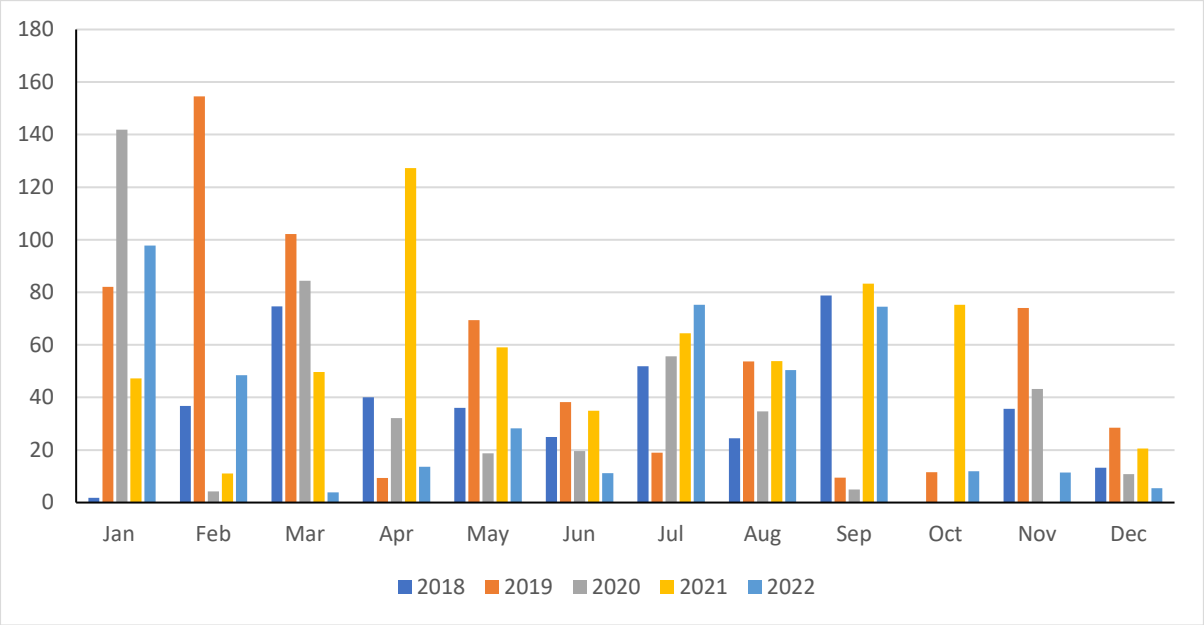
## 11. Rainfall

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 Kinnaur*

| KINNAUR DISTRICT RAINFALL IN MILLIMETERS (R/F) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
| | RAINFALL (in mm) | | | | | | | | | | | |
| 2018 | 1.8 | 36.8 | 74.6 | 40.1 | 36 | 24.9 | 51.9 | 24.5 | 78.8 | 0 | 35.7 | 13.3 |
| 2019 | 82.1 | 154.6 | 102.2 | 9.4 | 69.4 | 38.2 | 19 | 53.7 | 9.5 | 11.5 | 74 | 28.5 |
| 2020 | 141.9 | 4.2 | 84.4 | 32.1 | 18.7 | 19.6 | 55.7 | 34.7 | 5 | 0 | 43.2 | 10.8 |
| 2021 | 47.2 | 11 | 49.7 | 127.3 | 59.1 | 34.9 | 64.4 | 53.8 | 83.3 | 75.2 | 0 | 20.6 |
| 2022 | 97.8 | 48.4 | 3.9 | 13.6 | 28.2 | 11.2 | 75.3 | 50.4 | 74.5 | 11.9 | 11.4 | 5.4 |

***Source: Meteorological Department, Govt. of India***




***Graph Showing Annual Rainfall Data Of District Kinnaur From The Year 2018 To 2022***

## 12. Geology And Mineral Wealth

Himachal Pradesh, as part of the erstwhile Panjab State by virtue of having Kinnaur 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 18000km2area 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

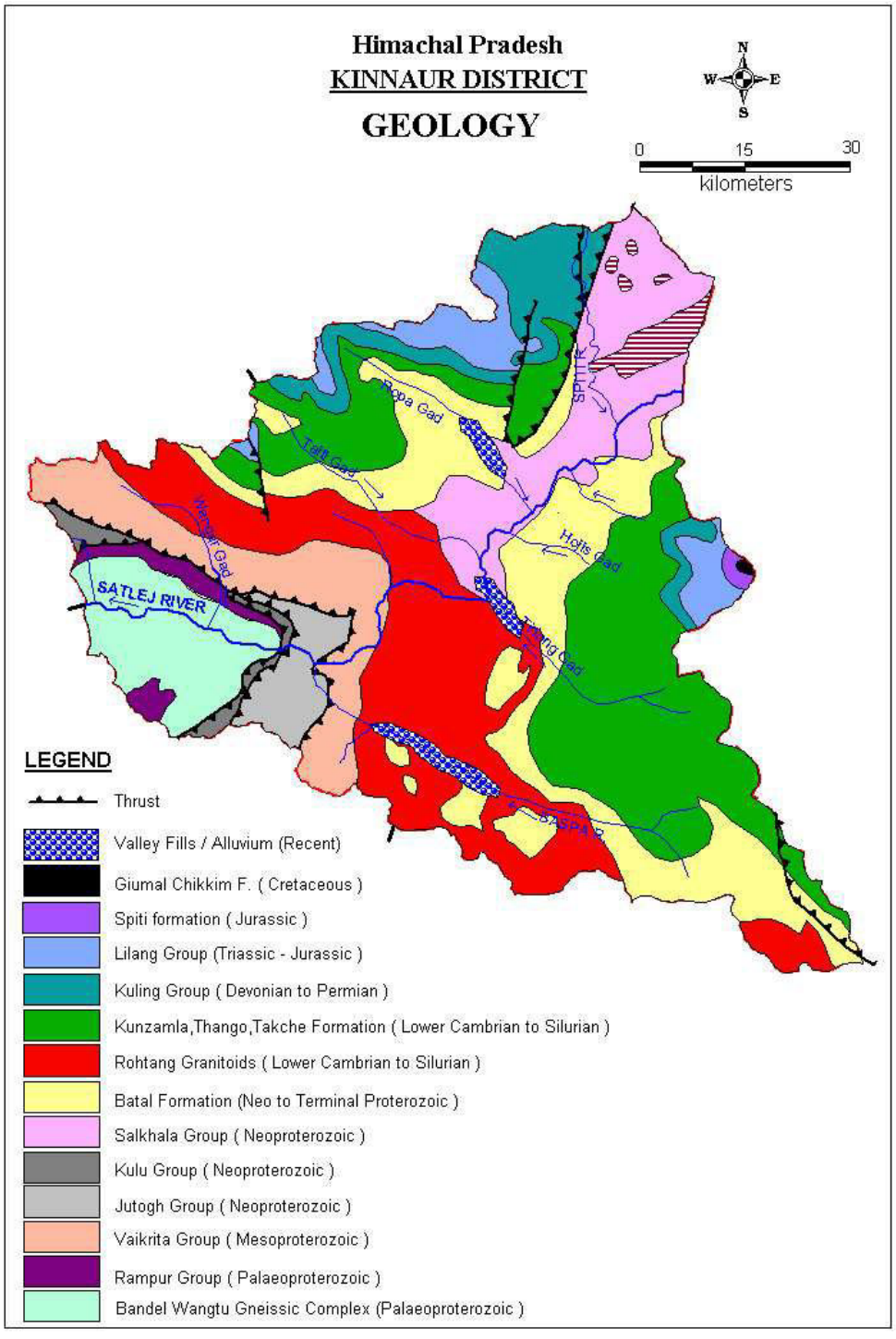
coverage of Shali-Shimla, Largi-Rampur, Deoban-Jaunsar-Krol-Tal belt (Srikantia and Sharma, 1976, Bhargava, 1976, Sharma 1977).

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.

Geologically Himachal Pradesh can be broadly divided into two major geo-tectonic zones viz. the Lesser Himalayan tectogen in the south and the Tethys Himalayan Tectogen in the north. These two tectonic zones are juxtaposed with each other along a major tectonic break collectively designated as Main Central Thrust in the sense defined by Srikantia (1988). Mandi District lying within the Lesser Himalaya and the Siwalik Foothill comprises rocks ranging in age from Proterozoic to Quaternary. The oldest rocks are of undifferentiated Proterozoic age, comprising carbonaceous phyllite, schist, gneiss, quartzite and marble.

**Stratigraphic sequence**

| Age / Period | Group / formation | Lithology |
|---|---|---|
| Quaternary | Alluvium, Terrace & Fluvial deposits | Alluvium, clay, sand, gravel, pebbles, boulders and cobbles |
| Tertiary | Nako Granitoid | Granitoids |
| Mesozoic | Giumal – Chikkim<br>Spiti formation,<br>Lilang Group | Shales Sandstone, Siltstone<br>Carbonate rich sedimentary rocks |
| Palaeozoic | Kuling Group<br>Kunzamla, Thango,<br>Takche formation | Sandstones, shales, conglomerates |
| Proterozoic | Batal formation<br>Salkhala, Kulu, Jutogh<br>Vaikrita, Rampur Group,<br>Bandal Wangtu Gneissic Complex | Slates, phyllites, quartzites and schists, Amphibolites, Gneisses, granites, Pegmatites |




## General Geology

According to the geological survey of India, the known geological formations in the district are as follows:

**Between the boarder of Kinnaur and Shimla district and Jangi:**

The geological formations exposed in this area have been named as Sarahan Series. The Sarahan Series constitute schists and gneisses with granite and pegmatite intrusions and basic rocks. The main type of schist is biotite schist, quartz-muscovite schist and quartz- talc schist. These are intruded by basic intrusions, which have been metamorphosed to amphibole schists.

Gneises of the Sarahan series are grey in color and medium to coarse grained in texture. They frequently pass in the schist. Igneous rocks belong to three different periods of intrusions. The rocks of the sarahan Series belong to pre-Cambrian period.

**Between Jangi and Shipkila:**

The rocks of this series have been designated to Jangi Series. It comprised slates, carbonaceous slates, graphite phyllites, chlorite, phyllite, sand stone grading into quartzite and thin bands of limestone. These formations range from preCambrian to Cambrian age.

**Area North and West of Shipkila:**

The formations exposed in this area belong to Ordovician, Silurian and Carboniferous. The Ordovician and Devonian are represented be red quartzites and grits, often underlain by conglomerates and passing upward into shales with bands of limestone and dolomite. The limestone bands have yielded fossils of mollusks, brachiopods, corals, gastropods and trilobites. The overlying rocks are known as Muth-quartzite belongs to Devonian age. The Devonian is succeeded by great development of limestone and dolomite belonging to Lower and Upper Carboniferous and Permian system. The limestone, which are extensively crushed and bracciated, vary from pure limestone and dolomite. These formations are rich in fossils.

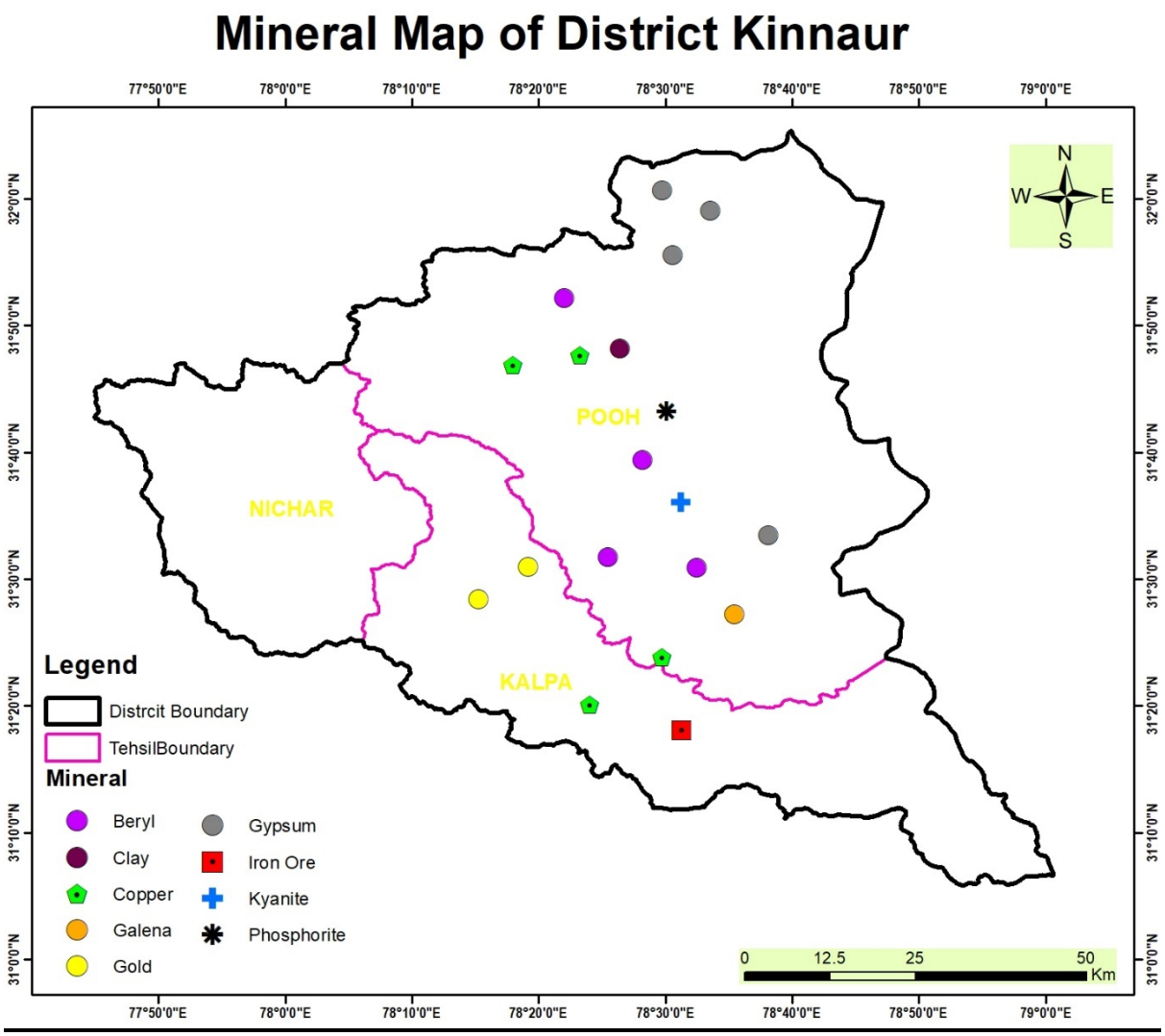



***Image Showing Mineral Wealth of District Kinnaur***

## Minerals

**Building Stones:**

Building stones are naturally occurring rocks of igneous, sedimentary or metamorphic origin which are sufficiently consolidated to enable them to be cut or shaped into blocks or slabs for use as walling, paving or roofing materials in the construction of buildings and other structures. Stones suitable for building occur throughout the geological column and have a worldwide distribution. Their exploitation is limited where overburden or structural complexities make their production uneconomic or where national or internationally designated conservation or heritage sites preclude active quarrying. The principal rock types used as building stone are limestone, sandstones, slates, quartzite, granites and river born material. Building stone is also commonly referred to as 'Dimension Stone' in many countries.

Important building stones which area mined in Kinnaur District are sandstone, quartzite, slate, granite and river born material (Boulders, cobbles etc).Sandstone is mainly used for domestic

constructions and house wares. Sandstone blocks are used for building constructions. Slate is mostly used for roofing of houses providing traditional appearance and for paving of courtyards in the district.

**River born material:**

The cobbles, pebbles, boulders and sand of the Newer Formation are the important source of raw material for constructions and for running stone crushers in the district. In Kinnaur district the river born material is found along the banks of the streams and river where the velocity of the water decreases due to natural barriers or where the tributaries join the main stream.

Beryl:

I. Pale blue beryl has been reported from the Wangtu bridge (31º 32': 78° 15') and for some distance up the Satluj and Shipki La (31º 49' : 78º 45') Pass.

II. Beryl associated with pegmatite has been reported from near Riuni village (78º04'20" : 31º04'16") and Nalgan Ghatti (31° 19'20" : 78° 12'15").

III. Sporadic bluish coloured transluscent hexagonal crystals of beryl arenoticed in the pegmatites intrusive into the schistose rocks of the Vaikrita Group in Morang (31° 36'00': 78° 26'30') Tirung (31º34'30' : 78º 27'00') area.

IV. Greenish blue beryl is found in the pegmatite along its contact withthe country rocks near Ribba (31º 35' 15' : 78º 22' 00") and near the confluence of Kashanj Khad and Satluj river.

V. Small crystals of beryl within pegmatite veins traversing the Rakcham granite have been reported from the area between Pangi (31º36':78º 21') and Akpa (31°35'00" : 78º 22' 45").

***Beryl***

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***Clay***

Clay occurrences in Himachal Pradesh can be broadly classified into (i) lacustrine and fluvial, (ii) residual associated with granite and (iii) associated with the Middle and Upper Siwaliks.

China clay occurs as alteration product of granite, gneiss and pegmatite near Lipa (31° 39': 780 24').

***Copper***

(i) Malachite encrustations are reported in the Manchhap nala (31° 25' 30": 78° 33' 30") section.

(ii) Few specks of pyrite and chalcopyrite with malachite stains have been noticed in quartz veins near Mangsula (31° 22' 30":78° 30' 30"). These veins are more frequent near the Granite Batal Formation contact.

(iii) A few malachite stains have been noticed in the phyllites of the Batal Formation near Lippa (31° 39': 78° 38").

(iv) Two small old workings for copper are observed near Rangbar (31° 49':78° 24') in the Ropa valley. It consists mainly of malachite and azurite coatings along the joint planes and fissures of quartzite bands in the Kunzam La Formation. An old working of copper is reported near Sangnam (31° 47': 78° 28'). 550 ppm Cu values have been obtained from here.

( v) Sparsely disseminated pyrite occurs in quartzites and phyllites north east of Sangnam. In a nala north of Giabong, malachite and azurite stains are seen in phyllites.

***Galena***

(i) Specks of galena have also been noticed along thin quartz veins in the gneisses near Nalgan ghati (31º 19' 20": 78º12' 50").

(ii) A few specks of galena are observed in a minor shear zone exposed east of Alingdar (31º 26' 30'; 78º 38'30").

***Gold***

Small Quantity of Gold are obtained from sand bars along the Satluj River between Morang ( 31º36' N -78º28' E) and Wangtu ( 31º 32' N -78º 04' E).

***Gypsum***

Large deposits of gypsum occur associated with the Lipak Formation between Liwa Thach (31º 55' : 78º 30') and Kapusa (32º04':78º34') especially in the Yulang Valley, north of Chango, and in the Yangthang (31º53': 78º: 37') area. A small area around Shalkar (32º00':78º 34') was covered by detailed mapping and reserves of 1.25 million tonnes were inferred upto 25m down depth extension. The total in- situ reserves in this belt, however, may be over 100 million tonnes. Small occurrences of gypsum are known from similar beds exposed near Tari Khango Pass. The gypsum is mostly of alabaster type,soft, white, granular, with common large pockets of anhydrite and small selenite zones. It is considered to be of evaporitic origin. Thin bands of white granular gypsum associated with the maroon shales of Yamranjha Formation occur near Bayulkhona Thach (31º 24' : 78º 40').

***Iron Ore***

Magnetite tuff are reported from Mangru La ( 31º 22' : 78º30') in which small scale smelting had also been carried out. The magnetite occurs as profuse disseminations as octahedral crystals in the Volcanogenic sediments which shows very low grade metamorphic and are grouped with Kunzam La Foramtion.

***Kayanite***

Kyanite blades measuring eight to 15cm in length in kyanite staurolite schist have been reported from Morang (31º 36'00" : 78º 26' 30")-Tirung (31º 34' 30" : 78º 27' 00") area.

***Phosphorite***

In Kinnaur district black cherty nodules have been reported in the shale of Kuling Formation contain 21% P2O5 . The phosphatic horizon is about 21 m thick but percentage of nodule is very low.

***Lithium:***

The granite pegmatite veins intrusive into the rocks of Vaikrita Lipak Formations in the Yangthang (31053' :78037') area show 300- 1000 ppm Li values.

***Mineral water:***

At Changrizang (32° 03': 78° 40') water flows at 46.5°C from seven or eight small vents within a space of 20m. It is strongly charged with H2S and leaves saline encrustations. Hot spring are also reported from Skiba, Thopan, Karcham, TapTi, and Roura Thach.

***Molybdenum:***

Single, steel grey grain of molybdenite has been noticed in rocks near the snout of Jabgya glacier.

***Radioactive Minerals***:

Anamolous radioactivity value is observed near Ropa village (31º48:78º26) where the black slates of the Batal Formation are exposed. The yellowish encrustations along fracture planes in the Wangtu Granite are reported to be carnotite.

***Rock Phosphate:***

In Kinnaur district black cherty nodules have been reported in the shale of Kuling Formation contain 21% P2O5 . The phosphatic horizon is about 21 m thick but percentage of nodule is very low.

***Rubidium:***

The pegmatite veins intrusive into the Carboniferous rocks in the Yangthang (31° 53': 78° 37') area contain upto 350 ppm of rubidium.

***Tourmaline:***

Tourmaline has been reported in the pegmatite traversing the gneisses and Granites around Rakchhan (31º 23' :78026') and Chhitul (31º 21' :78º 26'). In Khokpea nala, a small lens of tourmaline rich graphite schist is exposed within the Vaikrita Group. Similar concentration is noticed in quartzite about a kilometer south east of Shangi (31º 33':78º29').

- Copper found near Ranwar and Ropa. Silver Found near Chhagaon.
- Gypsum in Shailkhar and Chhagaon.
- Rough slate Found in Sangla Valley.
- China clay found in the area of Asrang and Lippa.
- Mica Found in Tangling Khad.

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 Kinnaur,

there is a increase in construction activities especially in roads and Hotel industries, as such the demand for minor minerals in the area 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.

The district does not have any large mines. At present, the Collection of in-situ stone from the hilly terrain/ river bed 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.

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 Kinnaur District occur largely in the form of rocks (Hill Slope) or River bed material such as Granite, Gneiss, Quartzite, Phyllite, 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 Kinnaur 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). Kinnaur district is situated between 77°045’ and 79°00’35" East Longitude and 31°055’50" and 32°005’15" North Latitude. Kinnaur lies in the northeastern part of Himachal Pradesh, sharing its eastern border with Tibet and the Zanskar mountains. The district starts at a point called “Parechhu” and extends to the Chor Gad valley in the east via the Shipki La pass. To the south and southeast, it borders Uttarakhand, while the western side is adjacent to Kinnaur district. Lahaul and Spiti, as well as Kullu, touch Kinnaur from the north and northwest..

Surface Hill slope mining makes up a huge percentage of mining projects in the Kinnaur district. 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

Kinnaur is renowned for its stunning landscapes, including three high mountains: Zanskar, Greater Himalaya, and Dhauladhar. The main river in Kinnaur is the Sutlej, with tributaries like Spiti and Baspa. The valleys are adorned with dense forests, orchards, fields, and picturesque villages. At the peak of Mount Kinnar Kailash, you'll find a natural rock Shivling (Shiva lingam). Kinnaur district, one of Himachal Pradesh's twelve administrative districts, is divided into three areas (Kalpa, Nichar, and Pooh) and has six tehsils. Its administrative headquarters is in Reckong Peo. Additionally, the revered Kinnaur Kailash mountain, one of

the Panch Kailash sites, graces this region. As of 2011, Kinnaur is the second least populous district in Himachal Pradesh, following Lahaul and Spiti.

Located approximately 235 kilometers (146 miles) from the state capital, Kinnaur shares its northeastern border with Tibet. The district is enclosed by three high mountain ranges: Zanskar, the Himalayas, and Dhauladhar. These mountains shape the valleys of Baspa, Satluj, and Spiti, along with their tributaries. Kinnaur's slopes are adorned with thick forests, orchards, fields, and charming hamlets. The old Hindustan-Tibet Road traverses the Kinnaur valley along the Sutlej River, eventually entering Tibet via the Shipki La pass. Kinnaur ranks as the second richest district in terms of per capita income after Solan in Himachal Pradesh. It gained separate district status on May 1, 1960, having previously been part of the north-eastern segment of the erstwhile Chini Tehsil in Mahasu district.

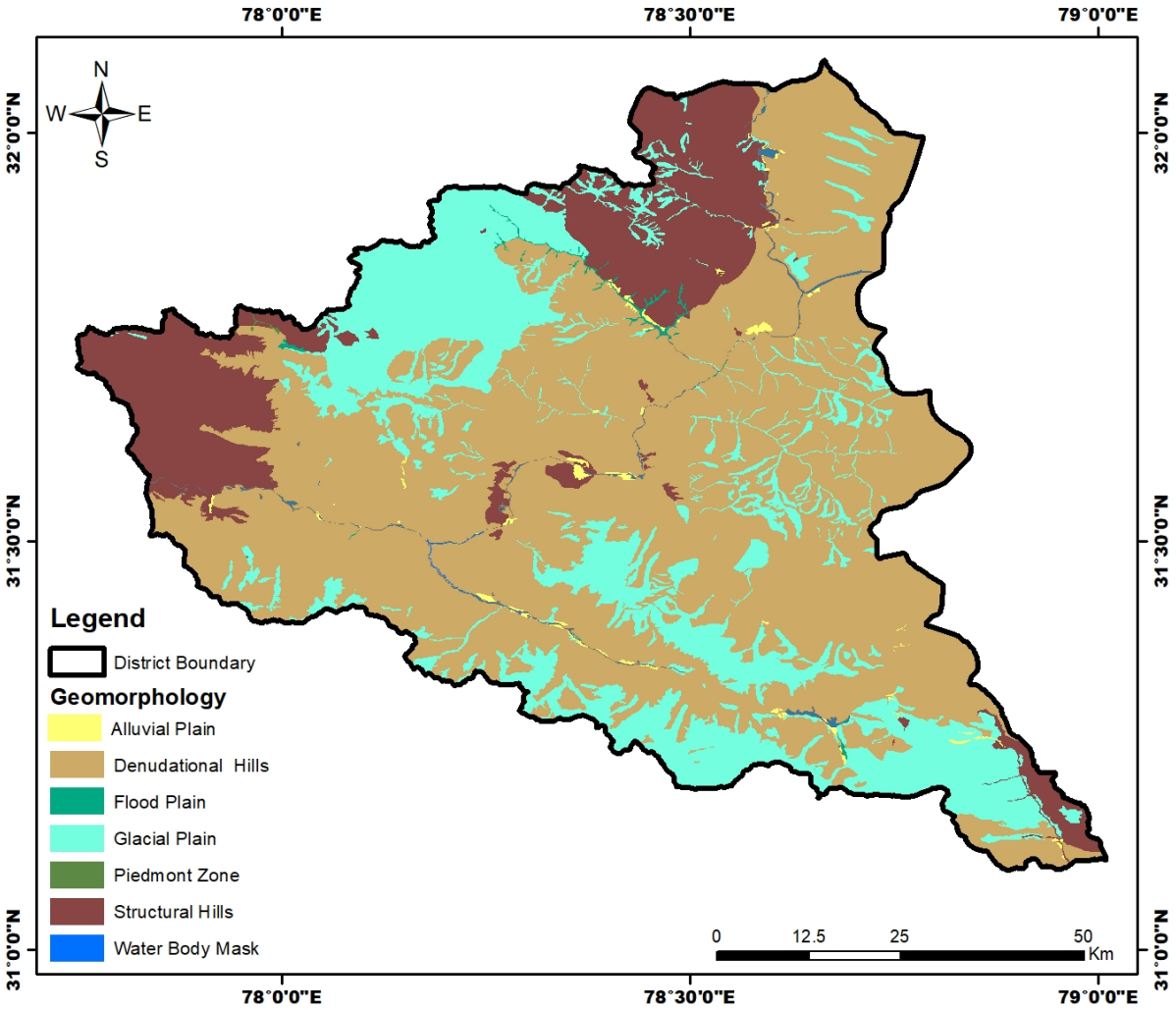



***Image Showing Physiography of the District***

## 4. Geology Of The District

Himachal Pradesh, as part of the erstwhile Panjab State by virtue of having Kinnaur 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.

Geologically Himachal Pradesh can be broadly divided into two major geo-tectonic zones viz. the Lesser Himalayan tectogen in the south and the Tethys Himalayan Tectogen in the north. These two tectonic zones are juxtaposed with each other along a major tectonic break collectively designated as Main Central Thrust in the sense defined by Srikantia (1988). Mandi District lying within the Lesser Himalaya and the Siwalik Foothill comprises rocks ranging in age from Proterozoic to Quaternary. The oldest rocks are of undifferentiated Proterozoic age, comprising carbonaceous phyllite, schist, gneiss, quartzite and marble.

**Stratigraphic sequence**

| Age / Period | Group / formation | Lithology |
|---|---|---|
| Quaternary | Alluvium, Terrace & Fluvial deposits | Alluvium, clay, sand, gravel, pebbles, boulders and cobbles |
| Tertiary | Nako Granitoid | Granitoids |
| Mesozoic | Giumal – Chikkim Spiti formation, Lilang Group | Shales Sandstone, Siltstone Carbonate rich sedimentary rocks |
| Palaeozoic | Kuling Group Kunzamla, Thango, Takche formation | Sandstones, shales, conglomerates |

| | | |
|---|---|---|
| Proterozoic | Batal formation Salkhala, Kulu, Jutogh Vaikrita, Rampur Group, Bandal Wangtu Gneissic Complex | Slates, phyllites, quartzites and schists, Amphibolites, Gneisses, granites, Pegmatites |

**General Geology**

According to the geological survey of India, the known geological formations in the district are as follows:

**Between the boarder of Kinnaur and Shimla district and Jangi:**

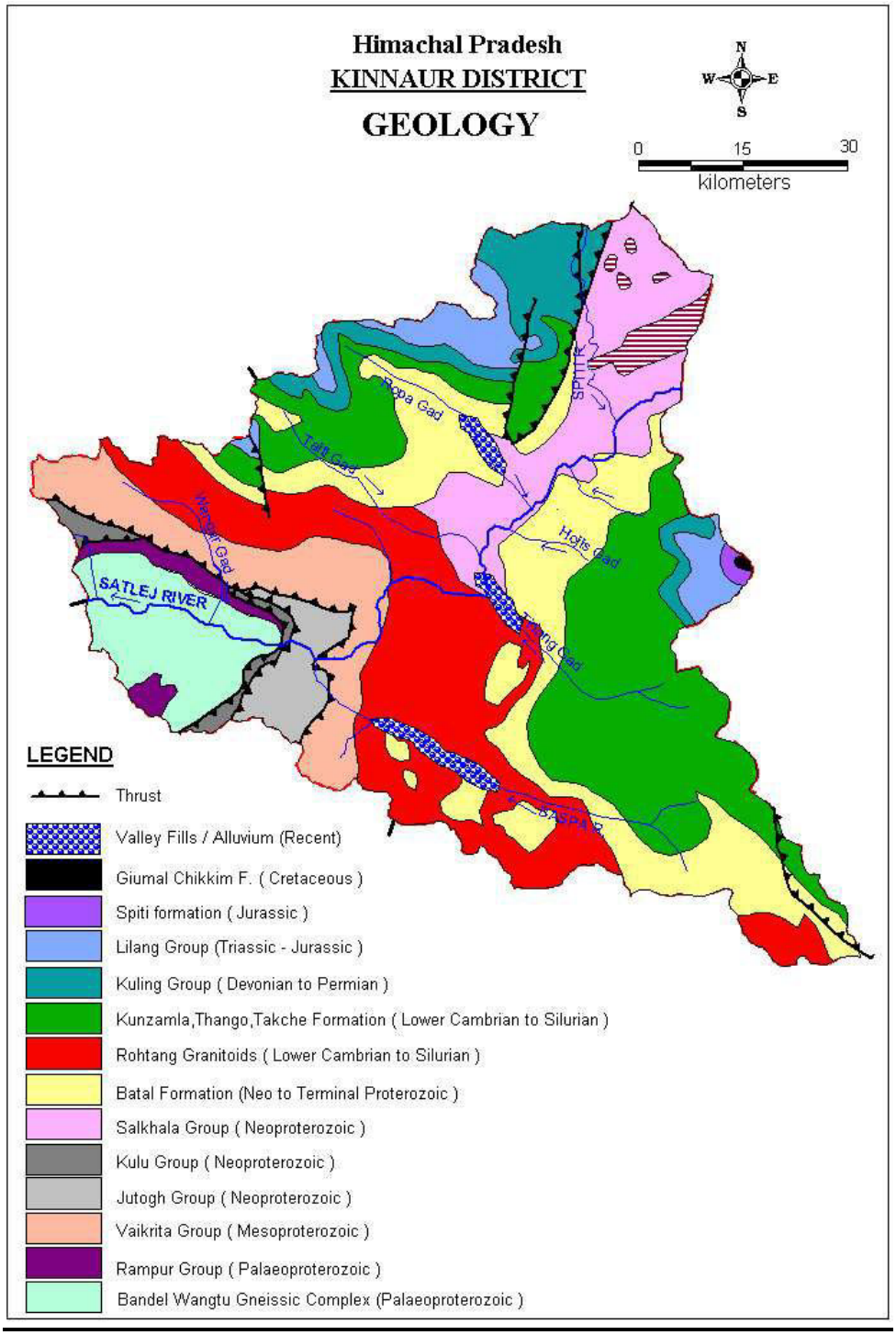
The geological formations exposed in this area have been named as Sarahan Series. The Sarahan Series constitute schists and gneisses with granite and pegmatite intrusions and basic rocks. The main type of schist is biotite schist, quartz-muscovite schist and quartz- talc schist. These are intruded by basic intrusions, which have been metamorphosed to amphibole schists. Gneises of the Sarahan series are grey in color and medium to coarse grained in texture. They frequently pass in the schist. Igneous rocks belong to three different periods of intrusions. The rocks of the sarahan Series belong to pre-Cambrian period.

**Between Jangi and Shipkila:**

The rocks of this series have been designated to Jangi Series. It comprised slates, carbonaceous slates, graphite phyllites, chlorite, phyllite, sand stone grading into quartzite and thin bands of limestone. These formations range from preCambrian to Cambrian age.

**Area North and West of Shipkila:**

The formations exposed in this area belong to Ordovician, Silurian and Carboniferous. The Ordovician and Devonian are represented be red quartzites and grits, often underlain by conglomerates and passing upward into shales with bands of limestone and dolomite. The limestone bands have yielded fossils of mollusks, brachiopods, corals, gastropods and trilobites. The overlying rocks are known as Muth-quartzite belongs to Devonian age. The Devonian is succeeded by great development of limestone and dolomite belonging to Lower and Upper Carboniferous and Permian system. The limestone, which are extensively crushed and bracciated, vary from pure limestone and dolomite. These formations are rich in fossils.




**Geology Map of District Kinnaur**

## 5. Drainage Of Irrigation Pattern

In Kinnaur district close to 255 irrigation works were supplying water to households for domestic and irrigation purpose. Out of the total works, traditional water harvesting structures account for 71.7 percent and the rest are lift irrigation structures and individual tanks accounting for 28.3% of the total irrigation works. Kinnaur as a whole does not have any ground water sources being used for irrigation because of the low

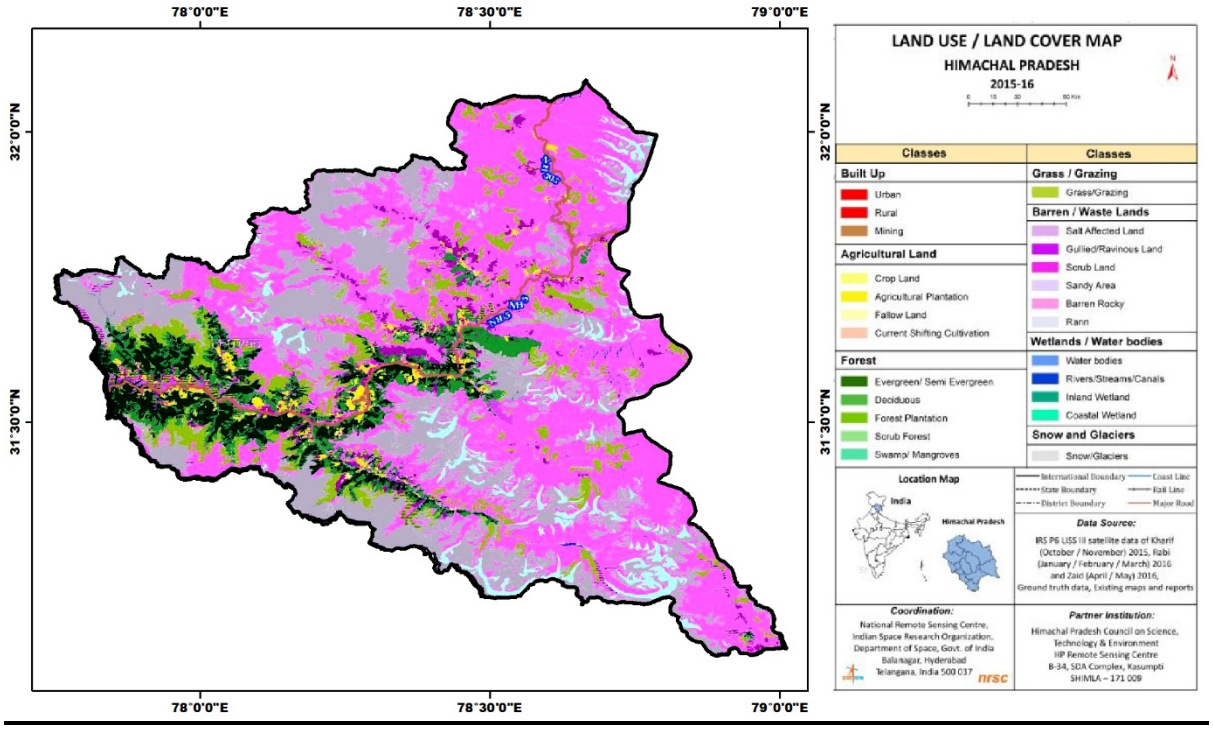
potential of ground water in the district. Also, the number of water extraction devices in the district has been reported to be zero in all the three blocks. Kuhls, khads and nallah are the major sources of irrigation and are used by farmers to draw water to their fields under gravity flow by digging channels.

**Demand for water sources:**

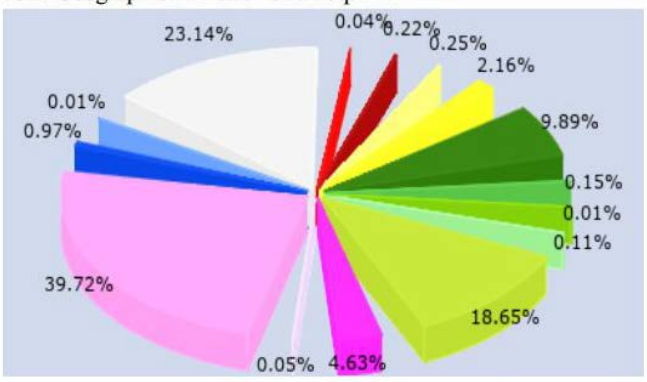
The present water demand of the district has been assessed to be 13.67 MCM annually. Out of the total water demand 10.6 mcm (78 percent) is the requirement from crop production. Nearly 2.149 mcm is required for domestic and drinking purposes and another 0.9 mcm (or 6%) is required for livestock water requirement purpose. There is no water requirement for industries and power generation. Among the blocks Nichar block has highest water requirement with 5.37 mcm (39.2%), followed by Kalpa block with 4.4 mcm (or 32 %) and Pooh block with 1.16 mcm (or 28.3%).

## 6. Land Utilization Pattern In The District

The economy of Kinnaur 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.



LULC Information (2015-16) for Kinnaur
Total Geographical Area : 6401 Sq. Km




| LULC Class | Area (Sq.Km) | LULC Class | Area (Sq.Km) |
|---|---|---|---|
| Builtup,Urban | 2.55 | Builtup,Rural | 14.08 |
| Agriculture,Crop land | 16.19 | Agriculture,Plantation | 138.43 |
| Forest,Evergreen/ Semi evergreen | 632.92 | Forest,Deciduous | 9.52 |
| Forest,Forest Plantation | 0.49 | Forest,Scrub Forest | 6.96 |
| Grass/Grazing | 1193.84 | Barren/unculturable/ Wastelands, Scrub land | 296.52 |
| Barren/unculturable/ Wastelands, Sandy area | 3.21 | Barren/unculturable/ Wastelands, Barren rocky | 2542.44 |
| Wetlands/Water Bodies, River/Stream/canals | 62 | Wetlands/Water Bodies, Reservoir/Lakes/Ponds | 0.5 |
| Snow and Glacier | 1481.33 | | |

***Land Use Land Cover Statistics of District Kinnaur***

### *7.1 Agriculture*

Kinnaur is predominantly an agriculture district. agricultural Agriculture development in the hilly areas posse peculiar problems due to steep and difficult terrain, small and scattered holdings, depleting fertility of soil by constant erosion, the crop yield are vary low. The crop season is limited to only six, months due to intensive cold and snow fall. However, the economy of the district is highly agro-pastorage. Land holdings are generally small and scattered almost every family has a piece of land. Soils generally consists of sand, sandy loam, clay loam, stony and graval. Wheat, barley, maize, potato, vegetables and pulses are the main corps of the district.

For the development of the district in the agricultural front, intensive agriculture aiming at increasing the yield per unit of area is being given highest priority by adopting various programmes/measures like seed distribution programme of high yielding varieties, potato development scheme, control of pests and diseases, development of vegetables and seed production programme, use of improved implements, local manure resources, subsidy in fertilizers and soil conservation.

The following are the main crops in the District;- • Wheat

- Maize
- Paddy
- Oil seed
- Pulses
- Potato
- Sugercane
- Ginger
- Vegitables (Peas, Tomato, Capsicum, Cabbage, Culiflower)
- Spices (Peper and Coriander)

### *7.2 Horticulture*

The climate of Kinnaur district is very congenial for the development of horticulture and apples in particular. With the introduction of improved techniques, expertise in orchard growing and transportation facilities, the production of fruits is also increasing year to year. Kinnaur district has a distinct place in the country for its quality apples and temperate fruit like wall nuts, almonds, chilgoza, raisin, apricot etc. The main commercial verities of apple grown are Royal Delicious, Rich Red, Red Delicious and Golden Delicious which are directly marketed to Chandigarh, Delhi, Madras, Calcutta and Bombay markets.

Ever since the creation of district, constant emphasis has been always given on the Horticulture to boost up the traditional economy and considerable strides have been made in this regard after the creation of the district. The area under apples was 2,026 Hactares in 1980-81 which was increase to 4431 Hectare in 1991-92. While the production of the apple in the district has increased from, 7151 tonns to 16530 tonns during the period. Total production of the fruits in the district, which includes apples, nuts and dry fruit citrus fruits etc., was of 7812 tonnes in 1980-81 which has increase to 16879 tonnes during 1991-92.

Departmental be keeping stations are also functioning in the district at Pounta, Bhabha, Kilva, Urni and Giabong which produced 900 kilograms of honey during the year 1990-91.

Apple, Plum, Apricot, Chilgoza, Almonds are the important fruits grown in the Kinnaur district.

### *7.3 **Animal Husbandry***

Livestock resources of the district consist of sheep and goats. Milch cattle are very few and yield very little milk. With the exception of Chaura village, buffaloes are conspicuous by their absence all over Kinnaur. Before the percolation of modern developments in Kinnaur the wealth of the family used to be measured in term of the sheep and goats the family had.

Kannauras had the flourishing trade with western Tibet and Ladakh until and beginning of sixties particularly in wool, pashmina, goats and sheep through barter system.

The improvement of the bread of livestock the main concern of the department of Animal Husbandry in the districts which has been taking a considerable stride in the district. There were 18 veterinary Hospitals, 28 veterinary dispensaries and 1 mobile veterinary dispensary in the district in 1991. Apart from these, 31 artificial in semi nation centers were also functioning. Besides there are poultry units at Tapri, Two Bull centers at Sangla, 1 Sheep breeding farm at Karchham and a Yak breeding centre at Sangla. Cross breed Jersey Cow and Marino breed of Sheep have become very popular among the progressive farmers.

One fodder development farm run by the Animal Husbandry department is functioning Thang Karma. To solve the fodder problem the department is providing improvement verity of fodder seeds like Lucerne, berseen, orchards grass and grass roots to the farmers.

### *7.4 Fisheries*

There is vast network of perennial rivers, streams and Khads in the district and there is a great scope of the development of fish culture. The Himachal Pradesh fisheries department has established a Trout farm at Sangla 1961-62 incubating the Trout eggs which were brought here from Barot Fish Farm in Mandi district.

### *7.5 Forest*

The forests play a vital role in shaping the climatic condtions of the area. The forests provide valuable timber, medicinal herbs, raw material for large and small scale industries and also provide employment and play a vital role in conserving the soil and ensure timely and sufficient rain.

In Kinnaur district forest type fall naturally into following three main divisions;

(i) The moist zone forests are found on the left side of the Satluj valley with northern exposure into Nichar. They comprise the Tranda range of forests. The forest are particularily continous. From the river side at 3500 feet to alpine pasture at 12000 feet on the right base consists of grass lands and higher up are the forest belt. Along the side stream, the forest are well developed and Pinus Longifolia, Pinus Wllichiana, Cedrus Deodara, PicesSmithiana, Abies Pindro, Pinus Gordianaform a broad belt of forest along with the side of Satluj valley and the side streams between the clif of the gorge below the alpino pastures.. on the lower slope upto 5000 feet, Chir pines occurs in pure form and higher up given way to Quercus incana and Rhodeondron arboretum. On shelter ravine bank between 5000 to 12000 feet

Cedrus Deodara and Pinus Wallichiana form Interine forest, higher up form 7000 to 10000 feet Picea Samithiana with mixture of broad leaf species predominate.

(ii) The dry zone is spread in middle Kinnaur where the deodar reaches its optimum development and form large area of pure forest. It extends from Nichar to Chini and also found in Sangla valley. At the lower levels pine trees abound while in the higher tracts blue pine, spruce and silverfire trees are found. Neozapines (Chilgoja) which produceedible nuts grow in this zone are the only forest of neza in India bearing the Peer Panjal range.

(iii)The areid zone includes the parts adjoining to Tibetan border where the deodar develops well only on cool aspects and comparatively at higher elevation than else where. In this zone, the forests is consisting of rose dog and dwarf bushes and vast barren, desolate and rocky areas are devoid of tree cover.

The following various species of plants and forest trees are generally found in the Kinnaur district:

| **Botanical Name** | **Local Name** |
|---|---|
| Borboris Aristata | Komal |
| Borboris lycium | Kashnala |
| Borboris potiolaris | Karundu |
| Botula utilis | Bhojpatra |
| Capparis spinosa | Bussar |
| Cedsus Deodara | Deodar |
| Clematis graveolens | Bailen climbars |
| Cotonoaster bacillaris | Reesh |
| Colyrus Colurna | Sheloi |
| Dephno qleoides | Agru |
| Elsholtzia Polystachya | Pag |
| Frazinus xarithoxyloides | Thun |
| Ilex dipyrona | Kaderu |
| Indigfora gorardina | Kathi |
| Juglana zogia | Akharot |
| Myraino africana | Chitring |
| Pinus excelsa | Kail |
| Pinus girardiana | Neoza |
| Pinus longifolia | chir |
| Prunus armeniaca | Chuli |
| Prunus padus | Jamu |
| Prunus persixa | Baimi, Aau |
| Prunus puddum | Phaja |

| | |
|---|---|
| Pyrus communis | Nashpati |
| Pyrus malus | Seo |
| Pyrus pashia | Kainth |
| Rhus punjabensis | Tittri |
| Rhus syccedanca | Sish |
| Rumex lastatus | Shrub |
| Rumex napalansis | Shrub |
| Spiraoa eindbeana | Kusht |
| Spyringa embedi | Shapar |
| Vibusnum cotinifotium | Tustuskhatele |

**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**

Nature has endowed the tract with various fauna due to considerable variation in the elevation and climate. The following are the species of animals and birds commonly found in the district:

| | |
|---|---|
| Bharal | Snow leopard |
| Brown bear (Lal Bhalu or snow bear | Upland hare |
| Hill Fox (Lomri) | White nosed weasel |
| Common Jungle cat | Yellow Bellied weasel |
| Porcupine | Himalyan Wolf or chanku in local parlance |
| Common Europeonbat | House hare |
| Common Musk threw must rat (Chachmdor | Chakor |
| Common etter udibilao | Woodpecker |
| Common rat | Crow |
| Common Indian rat or root rat | Peasant |
| Common House mouse | Monal |
| Dark brown lcat bat | Hawk |
| Flying fox | Eagle |
| Ghoral | Dove |
| Great Himalayan leaf nosed bat | Pigeon |
| Himalayan Langur | Snow cock |
| Himalayan black bear (Bhalu, Richh) | Tragopan |
| Himalayan thar | Plash |
| Himalayan Palm Civet | Koklash |
| Himalayan ibex | Chakor |
| Indian mountjack migrating (Jungle Bakri) | Musk deer |
| Jackal (Gidhar, shial) | Red dynx or caracal (Sinaghush) |
| Large brown fluying squired | Rhesus Monkey |
| Leopard cat (Chita Bill) | Serow |
| Leopard or Panther (Tandwa) | Small Tibetan grey fox |
| Long eared rat | |

# 8 Surface Water And Ground Water Scenario Of The District

## 8.1 Surface Water

The comparison of the pre-monsoon and post monsoon drainage map of the district shows that during pre-monsoon the tributaries of river are spread in lesser catchment area but post monsoons because of increase in water levels in the main river, its tributaries and sub tributaries cover much larger catchment area. This clearly underlines the dependence on rain water in the area. The general drainage pattern of the Rivers/ streams in the district is dendritic

pattern. All rivers/streams flowing in Kinnaur district are tributaties of Satluj River catchment. The sources and the run along with other characteristics of the important rivers and the streams draining various parts of Kinnaur are as follows:-

**Satluj River**

Sutlej the principal river of the district arises in the Himalayas and has plentiful perennial source of water. It enters Kinnaur district from the Tibetan territory by a pass and reaches the boarder of Kullu. This river is called Shatarahu in Sanskrit literature, Sutundri in vedic literature, Zaradros or Heisidrus in Greek, Zungtee and Muksung in Tibetan as well as other being Sampoo, Sumudrung and Sutoodra. It arises from the lake mansarover in the Tibetan hinglands and cuts the Zanskar range at shipkila and enters district Kinnaur. The tributaries of the river.

The highest point in the basin is about 4400 m. The streams on the eastern bloc flow in escarpments along most of their course. Drainage represents lower order streams joining the trunk stream at 90°. The streams on the eastern blocks are longer and more in number compared to those on the western blocks. The main river Satluj flows through a crystalline basement belonging to Vaikrita Group near Khab where the area lies in the Kaurik-Chango fault zone. Quaternary reactivation of these faults has led to bedrock incision by Satluj which flows in a gorge for most of its course. Its major right bank tributaries are Spiti, Chaso, Ropa, Kerang, Kashang, Sorang, Kurpan, Ganvi, Behna and Karsog, whereas its major left bank tributaries are Titang, Nesang, Tidong, Baspa, Duling, Soldang, Nogli and Sainj.

**Spiti River**

It is the second major river in the district. It has its source in the far-north on the eastern slopes of the mountain ranges which run between Lahul and spiti. Before meeting the Sutlej at the place called Khab, at an altitude of 2,589 meters, Spiti is joined by many feeders which meet on both the banks. The Chaladokpo (Left bank), the Yulang, the Lipak and the Tirasang (Right bank) are its main tributaries.

**Baspa River**

The Baspa river another feeder of Sutlej arises from Dhaula Dhar Mountain ranges of Lower Himalayas and psses through valley bearing its name and meets the Sutlej at Karchham, at an elevation of 5,945 feet, after a distance of 72 kilometers. Its channel is wide and forms many islands of stones and pebbles. The Zupkia, the Thathang, the Boring, the Rukti and the Suthi are its important tributaries.

**Other Significant Tributaries**

(i) The Yulang originating between Shiakhar and Leo joins the Spiti River after coursing for about 13 kilometers.

(ii) The Ropa rises on the south-western range which bounds Kinnaur on the side of Lahul and Spiti and after coursing 45 kilometers, it falls into Sutlej near Shiaso Village. The Pojur or Taiti is one of the largest feeders of the Ropa which runs for about 40 kilometers from south-easterly direction.

(iii) The Kashang, a hill torrent with considerable water volume has a southeasterly direction and joins the Sutlej between Pangi and Sunnam places.

(iv) The Mulagoon is a large torrent which after crossin about 24 kilometers in the south-easterly direction falls into Sutlej. It originates on the range that separate Kinnaur from Lahul and Spiti. The Hindustan Tibet road crosses it near the Pangi where it is crossed by NH-22 near Kalpa link.

(v) The Yula originates on the eastern declivity of the range forming the boundary between Kinnaur and Lahul ans Spiti district.it joins the Sutlej after flowing a path of 23 kilometers.

(vi) The Wanger formed by the torrent of Bhabha and Soorchi falls into the Sutlej on the right side at Wangtu. It flows from the eastern declivity of Damuk Ghue.

(vii) The Tidong rises on the south-eastern frontier, towards Garhwal and holding north-westerly course along the North western base of the huge Ruldung range, it falls into the Sutlej near Rispa on the left bank.

## 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.

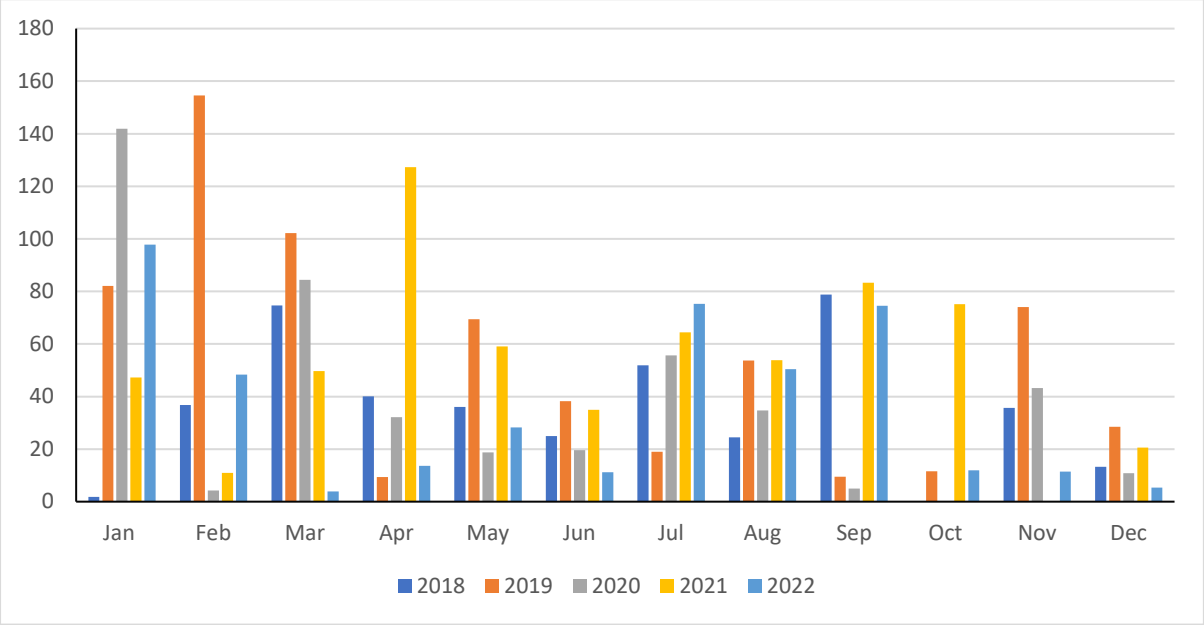
## 9 Rainfall Of The District And Climatic Condition

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 Kinnaur***

| KINNAUR DISTRICT RAINFALL IN MILLIMETERS (R/F) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
| | RAINFALL (in mm) | | | | | | | | | | | |
| 2018 | 1.8 | 36.8 | 74.6 | 40.1 | 36 | 24.9 | 51.9 | 24.5 | 78.8 | 0 | 35.7 | 13.3 |
| 2019 | 82.1 | 154.6 | 102.2 | 9.4 | 69.4 | 38.2 | 19 | 53.7 | 9.5 | 11.5 | 74 | 28.5 |
| 2020 | 141.9 | 4.2 | 84.4 | 32.1 | 18.7 | 19.6 | 55.7 | 34.7 | 5 | 0 | 43.2 | 10.8 |
| 2021 | 47.2 | 11 | 49.7 | 127.3 | 59.1 | 34.9 | 64.4 | 53.8 | 83.3 | 75.2 | 0 | 20.6 |
| 2022 | 97.8 | 48.4 | 3.9 | 13.6 | 28.2 | 11.2 | 75.3 | 50.4 | 74.5 | 11.9 | 11.4 | 5.4 |

***Source: Meteorological Department, Govt. of India***




***Graph Showing Annual Rainfall Data Of District Kinnaur From The Year 2018 To 2022***

## 10 Details Of The Mining Leases In The District

| Sr. No. | Name and Address of Mining Lease Holder | Khasra No./Location in Mauza/Mohal | Area (Hectares/Bighas | Lease Period | Coordinates | |
|---|---|---|---|---|---|---|
| 1. | Shri Daulat Ram Negi | 10/1/1, 232/1/1, 232/2/1 (Kilba) | (01-39-18 Hect.) | 04.11.2020 to 03.11.2025 | 31°30'39.51"N | 78° 9'58.77"E |

## 11 Details Of Royalty Or Revenue Received In Last Four Years

| Sr. No. | Financial Year | Revenue collected Offline (In Rs) | Revenue Collected Online (In Rs) | Total Revenue Collected (In Rs) |
|---|---|---|---|---|
| **1** | 2020-21 | 59303956 | 10417020 | 69720976/- |
| **2** | 2021-22 | 5842000 | 25481580 | 31323580/- |
| **3** | 2022-23 | 26396206 | 47766900 | 74163106/- |
| **4** | 2023-24 | 20892558 | 80747788 | 101640346/- |

## 12 Details Of Production Of Minor Mineral In Last Four Years

| Sr. No. | Financial Year | Revenue collected Offline (In Rs) | Revenue Collected Online (In Rs) | Total Revenue Collected (In Rs) |
|---|---|---|---|---|
| **1** | 2020-21 | | 38752681 | 38752681 |
| **2** | 2021-22 | 1152000 | 17768142 | 18920142 |
| **3** | 2022-23 | | 17016496 | 17016496 |
| **4** | 2023-24 | 4615120 | 23537466 | 28152586 |

## 13 Mineral Map Of The District:

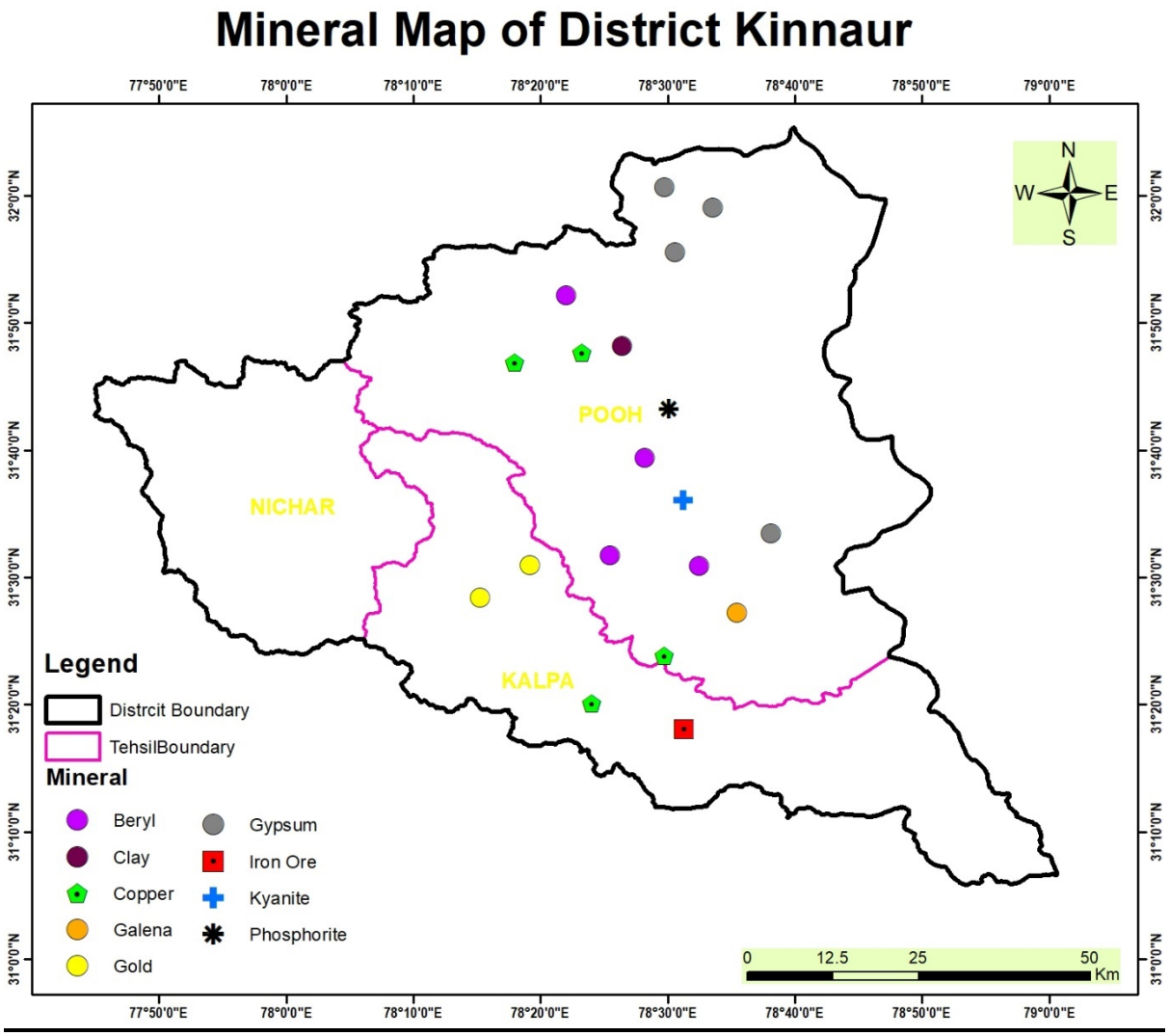



***Image Showing Mineral Wealth of District Kinnaur***

## Minerals

**Building Stones:**

Building stones are naturally occurring rocks of igneous, sedimentary or metamorphic origin which are sufficiently consolidated to enable them to be cut or shaped into blocks or slabs for use as walling, paving or roofing materials in the construction of buildings and other structures. Stones suitable for building occur throughout the geological column and have a worldwide

distribution. Their exploitation is limited where overburden or structural complexities make their production uneconomic or where national or internationally designated conservation or heritage sites preclude active quarrying. The principal rock types used as building stone are limestone, sandstones, slates, quartzite, granites and river born material. Building stone is also commonly referred to as 'Dimension Stone' in many countries.

Important building stones which area mined in Kinnaur District are sandstone, quartzite, slate, granite and river born material (Boulders, cobbles etc).Sandstone is mainly used for domestic constructions and house wares. Sandstone blocks are used for building constructions. Slate is mostly used for roofing of houses providing traditional appearance and for paving of courtyards in the district.

**River born material:**

The cobbles, pebbles, boulders and sand of the Newer Formation are the important source of raw material for constructions and for running stone crushers in the district. In Kinnaur district the river born material is found along the banks of the streams and river where the velocity of the water decreases due to natural barriers or where the tributaries join the main stream.

Beryl:

I. Pale blue beryl has been reported from the Wangtu bridge (31º 32': 78° 15') and for some distance up the Satluj and Shipki La (31º 49' : 780 45') Pass.

II. Beryl associated with pegmatite has been reported from near Riuni village (78º04'20" : 31º04'16") and Nalgan Ghatti (31° 19'20" : 78° 12'15").

III. Sporadic bluish coloured transluscent hexagonal crystals of beryl arenoticed in the pegmatites intrusive into the schistose rocks of the Vaikrita Group in Morang (31° 36'00': 78° 26'30') Tirung (31º34'30' : 78º 27'00') area.

IV. Greenish blue beryl is found in the pegmatite along its contact withthe country rocks near Ribba (31º 35' 15' : 78º 22' 00") and near the confluence of Kashanj Khad and Satluj river.

V. Small crystals of beryl within pegmatite veins traversing the Rakcham granite have been reported from the area between Pangi (31º36': 78º 21') and Akpa (31°35'00": 78º 22' 45").

Beryl

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(v) Small crystals of beryl within pegmatite veins traversing the Rakcham granite have been reported from the area between Pangi (31º36': 78º21') and Akpa (31°35'00" : 78º 22' 45").

**Clay**

Clay occurrences in Himachal Pradesh can be broadly classified into (i) lacustrine and fluvial, (ii) residual associated with granite and (iii) associated with the Middle and Upper Siwaliks. China clay occurs as alteration product of granite, gneiss and pegmatite near Lipa (31°39': 78º 24').

**Copper**

(i) Malachite encrustations are reported in the Manchhap nala (31° 25' 30": 78° 33' 30") section.

(ii) Few specks of pyrite and chalcopyrite with malachite stains have been noticed in quartz veins near Mangsula (31° 22' 30":78° 30' 30"). These veins are more frequent near the Granite Batal Formation contact.

(iii) A few malachite stains have been noticed in the phyllites of the Batal Formation near Lippa (31° 39': 78° 38").

(iv) Two small old workings for copper are observed near Rangbar (31° 49':78° 24') in the Ropa valley. It consists mainly of malachite and azurite coatings along the joint planes and fissures of quartzite bands in the Kunzam La Formation. An old working of copper is reported near Sangnam (31° 47': 78° 28'). 550 ppm Cu values have been obtained from here.

( v) Sparsely disseminated pyrite occurs in quartzites and phyllites north east of Sangnam. In a nala north of Giabong, malachite and azurite stains are seen in phyllites.

**Galena**

(i) Specks of galena have also been noticed along thin quartz veins in the gneisses near Nalgan ghati (31º 19' 20": 78º12' 50").

(ii) A few specks of galena are observed in a minor shear zone exposed east of Alingdar (31º 26' 30'; 78º 38'30").

**Gold**

Small Quantity of Gold are obtained from sand bars along the Satluj River between Morang ( 31º36’ N -78º28’ E) and Wangtu ( 31º 32’ N -78º 04’ E).

**Gypsum**

Large deposits of gypsum occur associated with the Lipak Formation between Liwa Thach (31º 55’ : 78º 30’) and Kapusa (32º04’:78º34’) especially in the Yulang Valley, north of Chango, and in the Yangthang (31º53’: 78º: 37’) area. A small area around Shalkar (32º00’:78º 34’) was covered by detailed mapping and reserves of 1.25 million tonnes were inferred upto 25m down depth extension. The total in- situ reserves in this belt, however, may be over 100 million tonnes. Small occurrences of gypsum are known from similar beds exposed near Tari Khango Pass. The gypsum is mostly of alabaster type,soft, white, granular, with common large pockets of anhydrite and small selenite zones. It is considered to be of evaporitic origin. Thin bands of white granular gypsum associated with the maroon shales of Yamranjha Formation occur near Bayulkhona Thach (31º 24’ : 78º 40’).

**Iron Ore**

Magnetite tuff are reported from Mangru La ( 31º 22’ : 78º30’) in which small scale smelting had also been carried out. The magnetite occurs as profuse disseminations as octahedral crystals in the Volcanogenic sediments which shows very low grade metamorphic and are grouped with Kunzam La Foramtion.

**Kayanite**

Kyanite blades measuring eight to 15cm in length in kyanite staurolite schist have been reported from Morang (31º 36'00” : 78º 26’ 30”)-Tirung (31º 34’ 30” : 78º 27’ 00”) area.

**Phosphorite**

In Kinnaur district black cherty nodules have been reported in the shale of Kuling Formation contain 21% P2O5 . The phosphatic horizon is about 21 m thick but percentage of nodule is very low.

**Lithium**:

The granite pegmatite veins intrusive into the rocks of Vaikrita Lipak Formations in the Yangthang (31053’ :78037') area show 300- 1000 ppm Li values.

**Mineral water:**

At Changrizang (32° 03': 78° 40') water flows at 46.5°C from seven or eight small vents within a space of 20m. It is strongly charged with H2S and leaves saline encrustations. Hot spring are also reported from Skiba, Thopan, Karcham, TapTi, and Roura Thach.

**Molybdenum:**

Single, steel grey grain of molybdenite has been noticed in rocks near the snout of Jabgya glacier.

**Radioactive Minerals:**

Anamolous radioactivity value is observed near Ropa village (31º48:78º26) where the black slates of the Batal Formation are exposed. The yellowish encrustations along fracture planes in the Wangtu Granite are reported to be carnotite.

**Rock Phosphate:**

In Kinnaur district black cherty nodules have been reported in the shale of Kuling Formation contain 21% P2O5 . The phosphatic horizon is about 21 m thick but percentage of nodule is very low.

**Rubidium:**

The pegmatite veins intrusive into the Carboniferous rocks in the Yangthang (31° 53': 78° 37') area contain upto 350 ppm of rubidium.

**Tourmaline:**

Tourmaline has been reported in the pegmatite traversing the gneisses and Granites around Rakchhan (31º 23' :78026') and Chhitul (31º 21' :78º 26'). In Khokpea nala, a small lens of tourmaline rich graphite schist is exposed within the Vaikrita Group. Similar concentration is noticed in quartzite about a kilometer south east of Shangi (31º 33':78º29').

- Copper found near Ranwar and Ropa. Silver Found near Chhagaon.
- Gypsum in Shailkhar and Chhagaon.
- Rough slate Found in Sangla Valley.
- China clay found in the area of Asrang and Lippa.
- Mica Found in Tangling Khad.

## 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 (Hill slope) and available Mining plans (1 registered mining lease) 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 01 No 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::

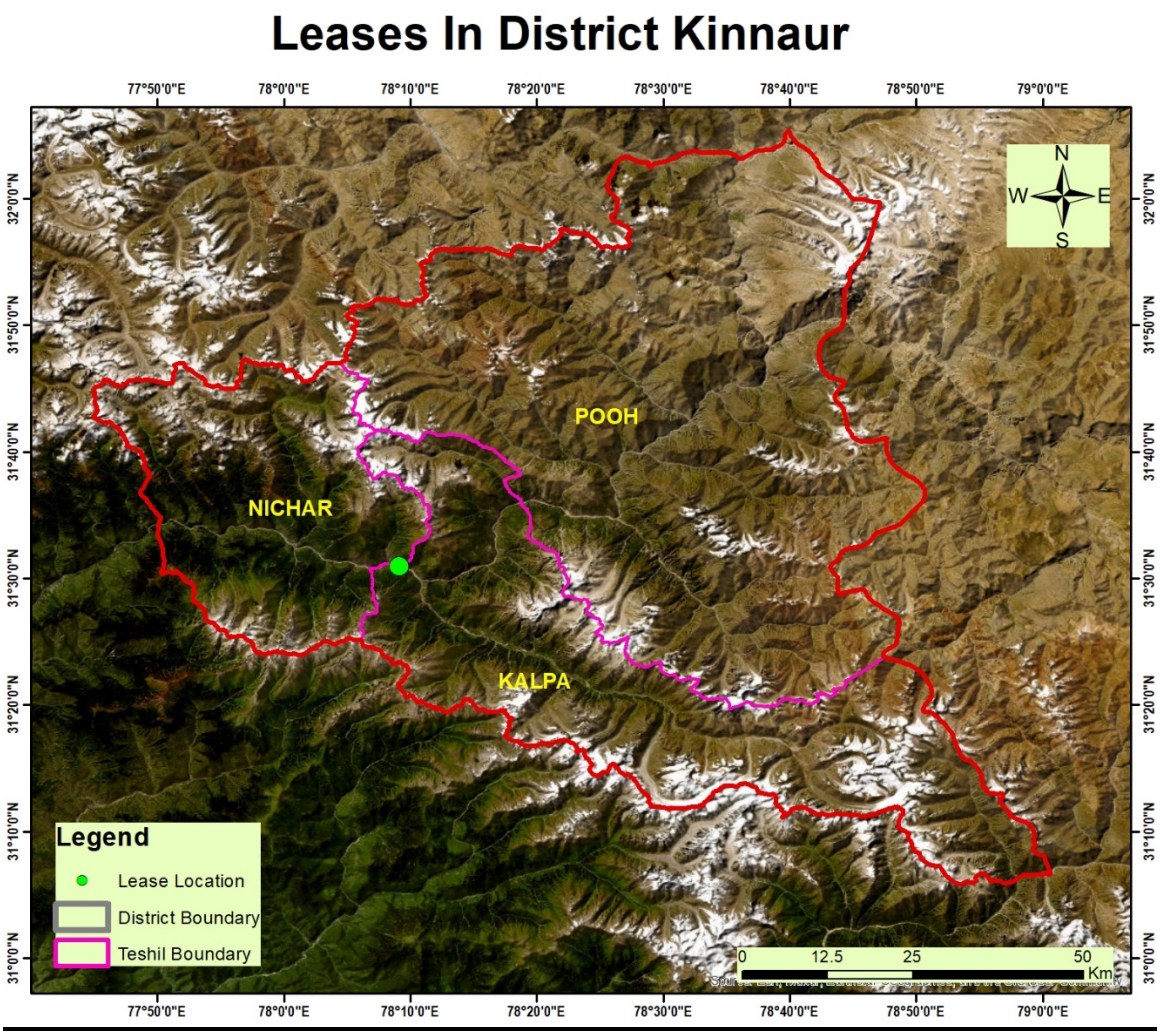


***Image showing the location of the mining leases***

## 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:

a) Rupi Bhaba Wild Life Santuary

b) Rakchham Chitkul Wild Life Santuary

c) Lippa Asrang Wild Life Santuary

## 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 Kinnaur 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.

# 26 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.