DISTRICT SURVEY REPORT- 2024
District- Solan Himachal Pradesh

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

Prepared and submitted by Department of Industries, Himachal Pradesh

Finalized & approved by SEIAA, Himachal Pradesh in its 69th (A) meeting held on dated 20th August, 2024 vide Agenda Item No. 1.

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						

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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 the 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. Mining sector is an important segment of the Indian economy. Since independence, there has been a pronounced growth in the mineral production both in terms of quantity and value. India produces as many as 87 minerals, which includes 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 mineral have been defined under section 3(e) of 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 large sector and in small sector. The large sector comprises of limestone projects for manufacturing cement and other lime products while the small mining sector comprises mining of minor minerals like sand, stone, bajri, slate, shale and clay etc. which are basically building material to meet up the demand for infrastructure development of the state.

In pursuance to the orders of 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 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 Imapact Assessmenyt 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 District Survey Report during the year 2016 and the said District Survey Report 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 application for Environment Clearence, 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 Solan 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, stream and other sources. The mineral potential has been calculated based on field investigations taking in to consideration the geology of the catchment area of the river/streams and other sources.

2 OVERVIEW OF MINING ACTIVITY OF DISTRICT SOLAN

The Solan District is divided into 5 (Five) Sub-Divisions. In all these Sub-Divisions viz. Solan, Kandaght, Arki, Nalagarh and Kasauli active mining operations for exploitation of minor mineral are being carried out in these Sub-Divisions. However, in the river/ stream beds, the mining operations are strictly carried out as per the River/ Stream Mining Policy Guidelines. There are two major rivers i.e. Sirsa and Gamber which are flowing through three Sub-Divisions i.e. Solan, Arki and Nalagarh. There are also other few Khads/ Nalla flowing in the said Sub-Divisions, from where the minor minerals are being exploited.

Minor Minerals such as building stones, Gravel, ordinary sand etc. are the main constituents required for the modern development activities. As such the consumption of minor minerals in the District has increased many folds with the pace of developmental activities and increased demand of minor minerals from the Neighboring States. The type and quantity of construction material used, depends upon the structural design and type and nature of work. The quantity of minor mineral consumption in a particular area is a thermometer to assess the development of the area. Thus, with the pace of development activities, the consumption of minor minerals also increase.

In order to meet the requirement of raw material for construction, the extraction of sand, stone boulder and bajri is being carried out exclusively from the riverbeds and hill slopes. The demand of sand is mainly met through by river borne sand whereas the demand of bajri/grit is either met through river borne collection or through manufactured grit by stone crushers. Also, the demand of dressed or undressed stone is met through the broken rock material from the hill slope. The local residents used to lift gravel etc. from the river beds to meet out their bonafide requirement, however, after coming into force the Himachal Pradesh Minor Minerals (Concession) and Minerals (Prevention of illegal mining, transportation and Storage) Rules, 2015, the mining of minor minerals in the State is allowed in accordance to these rules. Presently, in this District mineral concessions are being granted through grant of mining Lease.

In the district of Solan as on 31.12.2023, total eighty (80) numbers of mining leases have been granted as per the provisions contained in the Mines and Minerals (Development & Regulation) Act, 1957 and the minor mineral Rules made thereunder. Out of these, two (02) mining leases have been granted under the category of major mineral for extraction of mineral limestone for manufacturing cement and 78 under the category of minor minerals. Twenty (20) mining leases are granted for free sale of sand & stone and fifty eight (58) number of mining leases have been granted for establishment of stone crusher unit under the category of Hill slope/ riverbed Mining.

3 GENERAL PROFILE OF THE DISTRICT:-

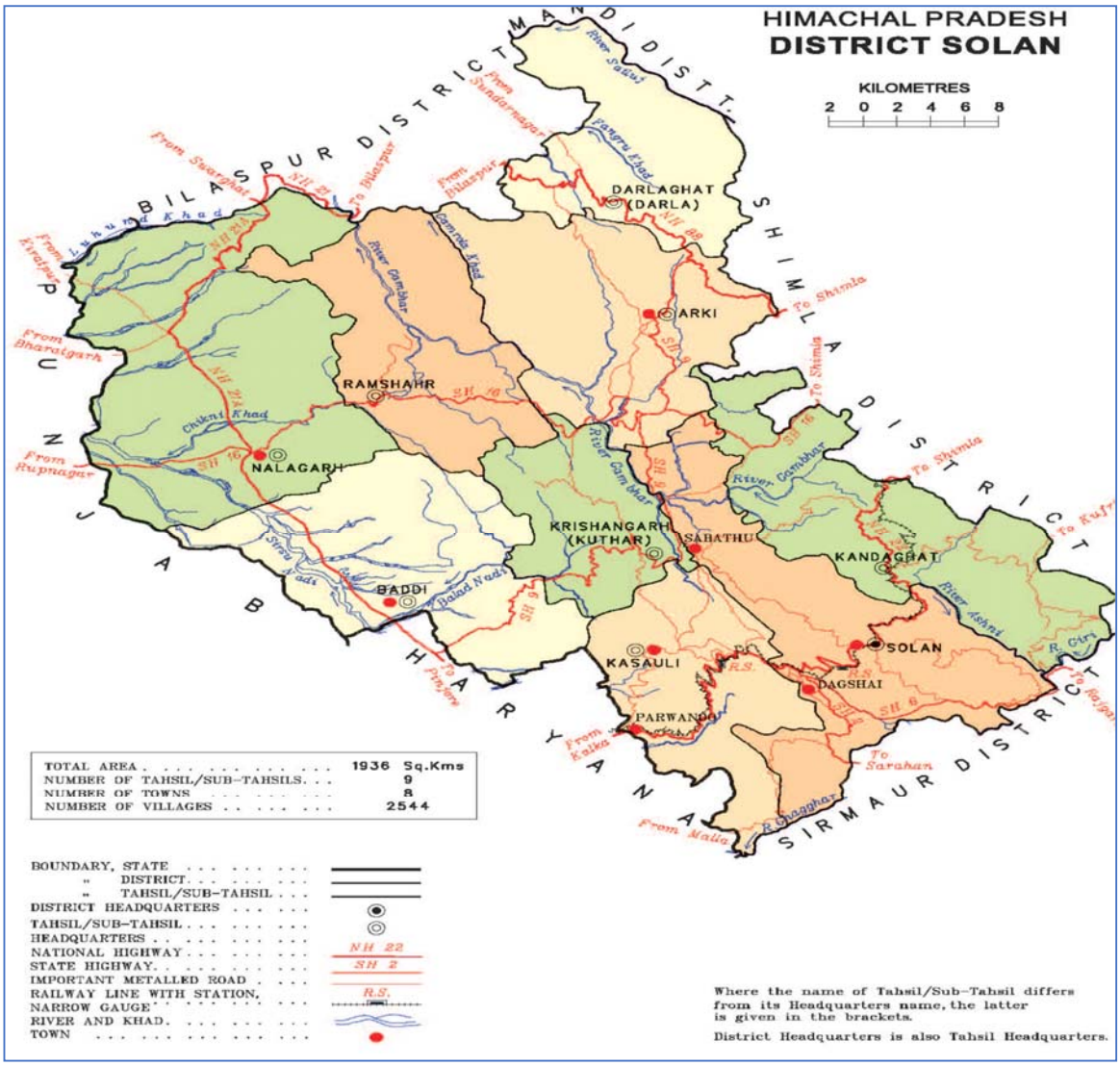
Solan district has emerged on the map of Himachal Pradesh on 1st September, 1972 as a result of reorganization of erstwhile Shimla and Mahsu districts. Solan district is known as Gateway to Himachal Pradesh as the national Highway No. 22 passes through this district.

The important minerals available in the district are Lime Stone and building stone. The Lime stone mining is located at Darlaghat and Kashlog area of the district, whereas building stone is mostly found in Barog area of the district. Besides, some quantity of sand is also available in the district which is used for construction activity. On the basis of these resources, there is some scope of setting up ventures in the line of lime, cement, stone grit etc. in the district.

For Administrative purpose, the district has been divided 6 tehsils, namely Solan, Kandaghat, Kasauli, Nalagarh, Arki, Baddi and three sub-tehsil namely Krishangarh, Darlaghat & Ramshahar. There are five blocks in the district namely Solan, Kandaghat, Dharmpur, Nalagarh and Kunihar. There are five blocks in the district namely Kunihar, Nalagarh, Dharmpur, Solan & Kandaghat. There are 211 panchayats in the district covering 2383 villages.

Salient Features

A) Geographical Data		
i). Latitude		30°5´ & 31°15
ii). Longitude		76°42´ & 77°20´
iii). Geographical Area	-	1936 Sq. Km
B) Administrative Units		
Sub-Divisions	-	5
Tehsils	-	6
Blocks	-	5
Gram-Panchayats	-	211
Inhabited Villages (2011 Census)	-	2383
Assembly Area	-	5
C) Population (Total)		5,76,670 (2011 census)



Solan district is drained by streams/rivers forming part of the drainage basins of the Sutlej, the Yamuna and the Ghaggar rivers. However, a major part of the district is drained by tributaries of the Sutlej river viz., Ghambar River and Sirsa Nadi. The Ghambar River flows almost from the central part of the district towards the northeast to join the Sutlej River in Gobind Sagar Lake. Another important tributary of the Sutlej River is the Sirsa Nadi, flowing towards the northwest in the Nalagarh valley. The Giri River and its tributary, Assan flow towards the south in the eastern part over a small area and are part of the Yamuna river basin. Ghaggar River flows towards the southwest and marks the southeastern boundary of the district. Most of the rivers/streams/khads maintain base flow for a major part of the year. In hilly terrain, the drainage density is high and fine, but it becomes coarse in foothills, Kandi areas and valleys. The Satluj River flows in a longitudinal course from the northwest to the southeast, whereas its tributaries originate from the higher reaches of Sub Himalaya, between Nalagarh Thrust and MBT, and flow in transverse courses in a south-southwest direction. The catchment areas of these piedmont rivers (tributaries of Satluj) are mainly comprised of Lower Tertiary and Tertiary (Lower and Middle Shiwaliks) rocks. Mudstones and sandstones are the predominant rock types in the Lower and Middle Shiwaliks, respectively. The important geomorphic features observed within the Dun basin are alluvial fans and river terraces. Alluvial fans are a fan- or cone-shaped sedimentary bodies that accumulated at the base of the Sub Himalayan mountain front, south of Nalagarh thrust, down-slope from the point where piedmont rivers emerge from the uplands.

In general, the area is a part of the Siwalik range. The Siwalik hills are located within the political boundaries of Pakistan, India, Nepal, and Bhutan, and range between 6 to 90 km in width. They gradually become steeper and narrower in relief and width respectively, from northern Pakistan to Bhutan (over 2000 km in length). Ongoing erosion and tectonic activity have greatly affected the topography of the Siwaliks. Their present-day morphology is comprised of hogback ridges, consequent, subsequent, obsequent, and request valleys of various orders, gullies, choes (seasonal streams), earth-pillars, rilled earth buttresses of conglomerate formations, semi-circular choe-divides, talus cones, colluvial cones, water-gaps, and choe terraces. The obsequent streams are generally short and steep while the consequent is located in the centre of the valley. Associated badlands features include the lack of vegetation, steep slopes, high drainage density, and rapid erosion rates. To the south of the Siwaliks are the Indo-Gangetic plains and in the north, they are bordered by the Lesser Himalayas Intermittently located between the Siwaliks and the Lesser Himalayas (exclusively in India and Nepal) are duns, flat-bottomed longitudinal structural valleys with their own drainage systems. These essentially comprise several large Himalayan piedmont alluvial fans and terraces, which formed as a result of tectonic episodes in the flanking Siwaliks. The duns also consist of lacustrine, fluvial, aeolian and swamp-environment deposits, and range from Middle Pleistocene to Holocene in age. During their formative stage, most of the duns were slightly narrower and gradually expanded over time through the erosion of the adjacent Siwalik sediments (a continuing process). In Nepal, these duns were often naturally filled with alluvial sediments of lacustrine and fluvial deposits, thus burying palaeolithic sites that were later exposed through erosion. The monsoon rains temporarily supply seasonal streams (locally known as choes, khads, or nalas) located both within the Siwalik Hills and the adjacent dunes. These stream banks and their terraces yield sizeable numbers of lithic artefacts, owing to the shared location for both water and raw material.

Four broad geomorphic units can be identified in the district:-

1. Low Structural hills and valleys unit of Siwalik Foothill belt.
2. High Structural hills and valleys of the Lesser Himalayan zone with Panchmunda and Krol peaks.
3. Piedmont Plains northwest of Nalagarh and
4. Fluvial valley

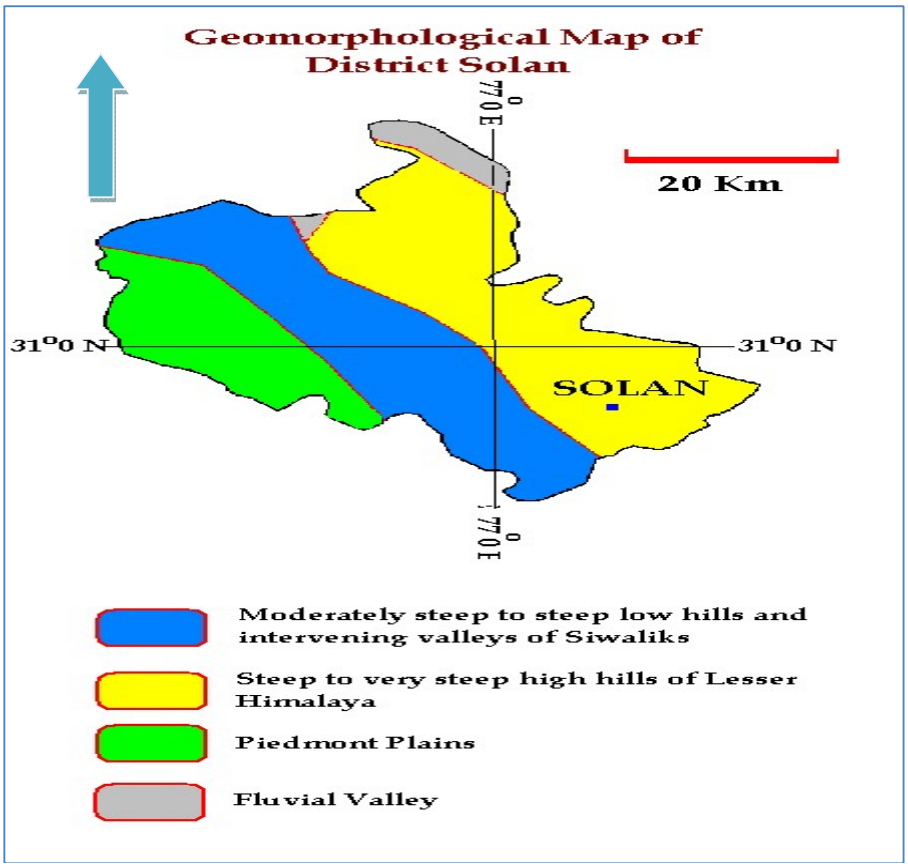


Image showing the geomorphological map of district Solan

The area lies in Nalagarh Dun (Part of Pinjaur Dun) in Sub Himalayas. The Sub Himalayas, the southernmost division of the Himalayas, is separated from the Lesser Himalayas by the Main Boundary Thrust in the North and the Southern boundary is demarcated from the Indo- Gangetic Plain by the Himalayan Frontal Fault (HFF).

The Satluj River and its tributaries (Mainly the Sarsa River) are the major drainage system in this Dun. The Satluj River flows in a longitudinal course from the northwest to the southeast, whereas its tributaries originate from the higher reaches of Sub Himalaya, between Nalagarh Thrust and MBT, and flow in transverse courses in a south-southwest direction. The catchment areas of these piedmont rivers (tributaries of Satluj) are mainly comprised of Lower Tertiary and Tertiary (Lower and Middle Siwaliks) rocks. Mudstones and sandstones are the predominant rock types in the Lower and Middle Siwaliks, respectively. The important geomorphic features observed within the Dun basin are alluvial fans and river terraces. Alluvial fans are a fan- or cone-shaped sedimentary bodies that accumulated at the base of the Sub Himalayan mountain front, south of Nalagarh thrust, down-slope from the point where piedmont rivers emerge from the uplands.

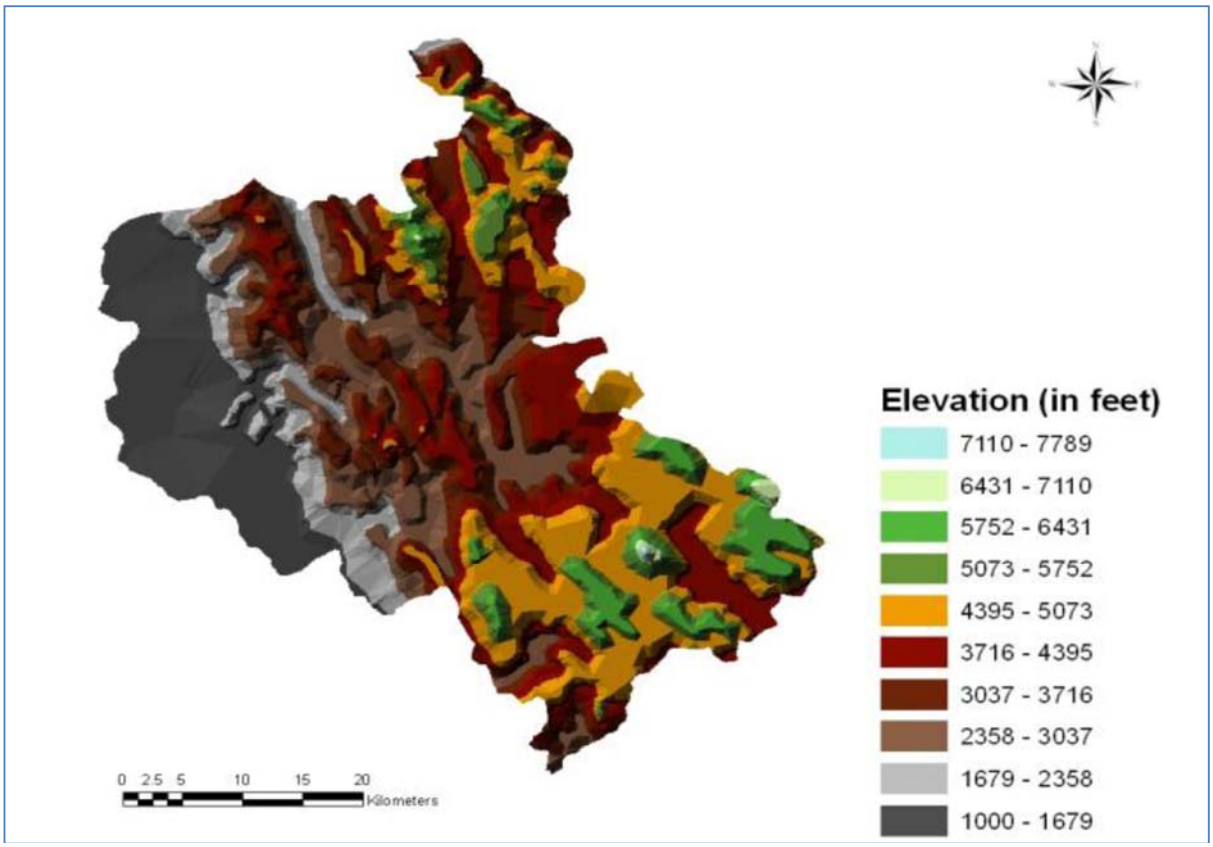


Image showing the Elevation profile of District Solan

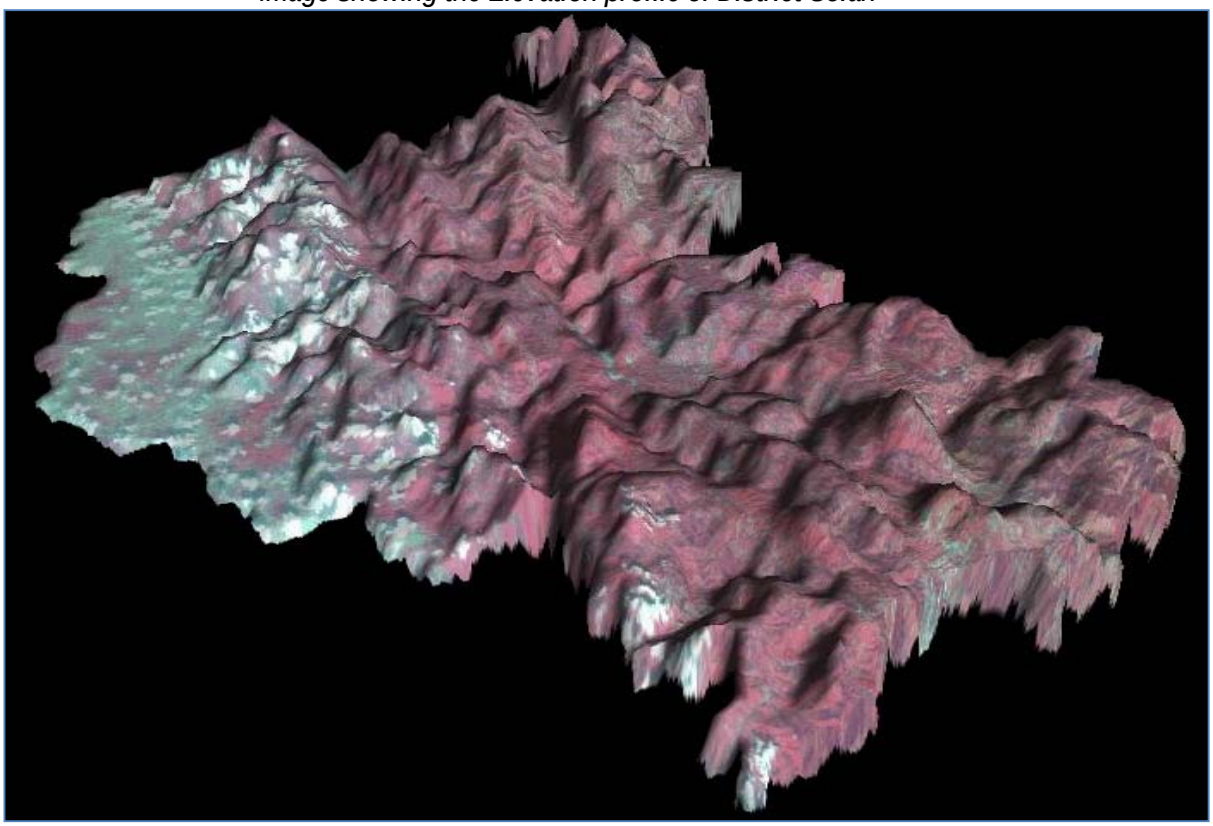
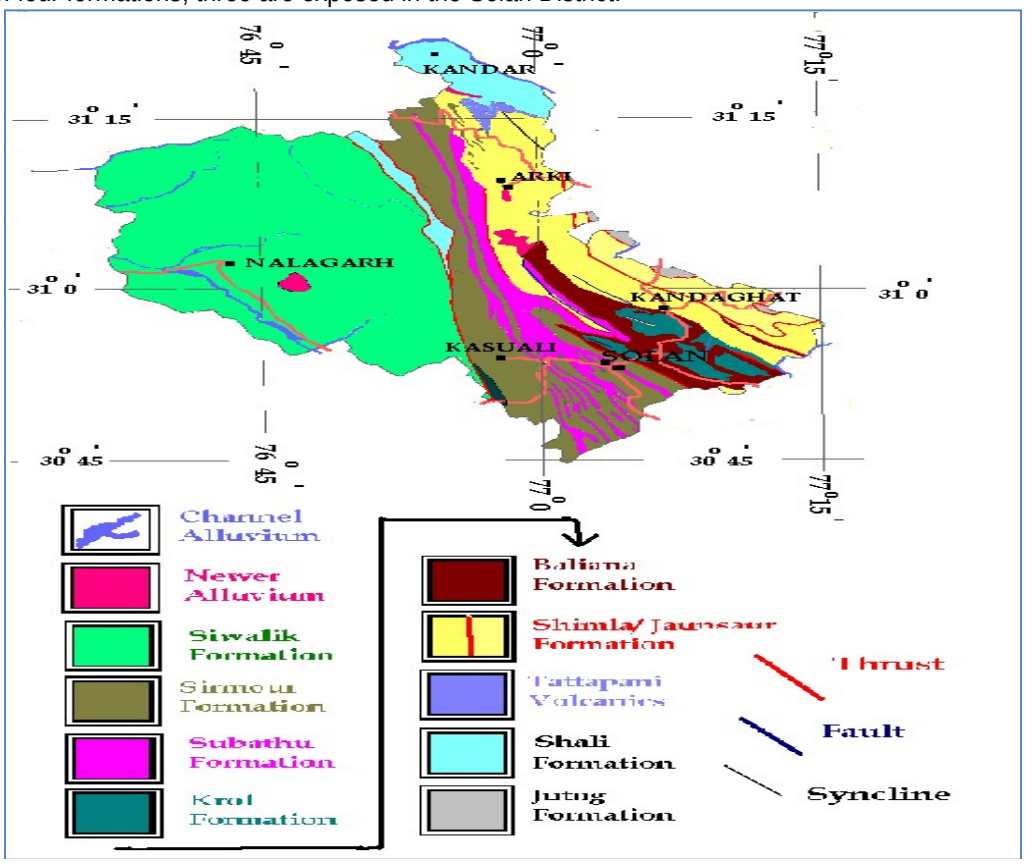


Image showing 3-D Surface View of District Solan

4 GEOLOGY OF THE DISTRICT

Solan District lying within the Lesser Himalaya and the Shivalik foothill comprises rocks ranging in age from Proterozoic to Quaternary. The oldest rocks of undifferentiated proterozoic age belong to the Jutogh group Comprising carbonaceous phylite, Schist, Gneiss, Quartzite and marble. The Sundernagar group of Rocks of Meso-Preoterozoic age represented by quartzite with basic flows. The Deoban/Shali Group of Rocks (Meso-Proterozoic) Comprising limestone, dolomite, (at Places tromatolytic) Slate & Quartzite occurs along the Main Boundary fault and also in the North-eastern part of the District. Theargillo-arenaceous sequence of Shimla/Jaunsur Group rests unconformable over the Deoban Group and assigned meso-Proterozoic age. Both Shimla and Jaunsaur Group, comprising diamicite, pink dolomite, carbonaceous shale and slate besides quartzite bands. The Krol Group, which overlies the Balaini Group, is dominantly a carbonaceous sequence with minor shale and sandstone. The Regional Geology and the General Stratigraphy of the Solan District are as given below:-

In the western side of the Solan District Shimla Group of rocks are exposed. It is divisible into four formations on the basis of certain characteristic lithological association and order of super position. Out of four formations, three are exposed in the Solan District.



Formation	Member	Litho logy	Remarks
Sanjauli	Upper Lower	Conglomerate, arkosic sandstone, Proto quartzite, Grey and Purple Shale. Greywacke sandstone, Greywacke Siltstone, Shale and Siltstone alternation, Ortho quartzite.	Exposed in Shimla
Chhoasa		hale and siltstone alternation with siltstone	

		and orthoquartzite.	
Kunihar		Shale and siltstone alternation with limestone.	
Basantpur	D. C. B. A.	hick bedded to platy grayish blue limestone with interbedded shale. Massive to bedded limestone-Dolomite. Shale, siltstone with interbeds of lenticular limestone; shale is Sporadically carbonaceous. Impersistent band of Quartzite and dolomite. Greyish white Quartzite and conglomerate	Partially exposed in Shimla Distt. And partially exposed in Solan District.

---------- Unconformity ----------

The best development of the Basantpur formation is exposed between Tal village near Arki, pass Ghiana and northward up to the Satluj.

Kunihar formation succeeds the Bilaspur formation and is best developed in the vicinity of Kunihar and traceable from Kakarhatti to Bamot. Along the Kalthu Dhar, the limestone interbeds are exposed which contain algal, stromatolites.

Kunihar marks the contact between the former and the Chhaosa where the Kunihar latterly pinches out to facies, the Chhaosa directlt overlies the Basantpur.

The best development of the Chhaosa formation can be seen along the Shimla- Bilaspur highway between Danoghat and Theog.

In the Eastern side of the Solan District, Shimla sequences are succeeded by a younger sequence of formation designated as the Blaini, Infra Krol forming two parallel and apparently independent belts. These are respectively referred to as the outer Krol Belt over the Shimla Group and the inner Krol Belt over the Jauansar Grup. The Krol Hill, Kamli-Dhar synclinal complex belong to the outer Krol Belt. Blaini formation is seen from Halog towards the Giri Valley in the South-East and then extends towards Nago Dhar in the North. The Blaini forms the base of the infra Krol-Krol sequence of outer Krol Belt.

Outer- Krol- Belt

Formation	Member	Lithology
	E-	Pale calcareous sandstone, Qurtzerenite
		1. Banded grey and pale cream white calcilurtite with interbeds of red and black shale.
		Alternation of cherty limestone and shale
	D	Rare conglomerate and sandstone.
		Massive dark blue dolomite
	C-	

	B-	2. Calcilutite
	A.	1. Red shale with subordinates green shale and thin dolomite and limestone.
Krol Formation:		2. Dolomite, oolitic limestone.
		Alternation of calcilutite and shale, argillite.
Krol Sandstone		Quartzarenite and friable sandstone with fragments of phosphatic shale
Infra Krol		Black shale and slates closely interbedded with thin bands of Infra Krol, slaty Quartzite.

Blaini Group

Shimla Group

In the Solan area the black shale of Infra –Krol pass up through a transition unit of shale and slate Quartzite of Krol sandstone. North- West of Solan, development of thin bedded sand stone is noticed. Krol sandstone formation as generally massive and pale grey and coarse to medium grained rock. The friable variety is mainly developed in the Solan- Barog area.

shale, ash grey tuff, chert/ phosphorite, carbonaceous shale, grit and quartz arenite and recorded algal structures and trilobite. Subathu Formation is composed of olive green shale, limestone, quartzite and laterite. The Sirmour Group is represented by a thick pile of palaeogene sediments exposed in the foothill, bounded by the Main Boundary Fault and Krol Thrust. It comprises shale, fossiliferous limestone, quartz arenite, siltstone, clay, sandstone and local pebble bed. The Shiwalik Group of Middle Miocene and Early Pleistocene age comprises coarse clastic fluviatile deposits of sandstone, clay and conglomerates. The Quaternary sediments (Older Alluvium and Newer Alluvium) along prominent channels consisting of sand, silt, clay, pebbles and cobbles of Middle to Late Pleistocene and Holocene age.

The general trend of the rocks is NW-SE and E-W directions with dip varying from 10 to 40 on either side. Beside Main Boundary Fault, Krol, Giri, Chail and Jutogh Thrust, two major synformal axes running NW-SE also passes through Krol and Tal Group of rocks.

Nalagarh, Barsar and Bilaspur thrust are in general parallel to the Main Boundary Fault. The Pinjaur Dun is developed between the detached anticlinal ridges of Siwalik molasses (mainly Upper Siwalik Formation) in the south and Lower Tertiary (Dagshai, Kasauli and Subathu)/ Tertiary (Lower and Middle Siwalik) rocks in the North. Subathu, Dagshai and Kasauli formations occurrence within foot-hill Palaeogene belt are termed as Sirmour Group of rocks. They extend from the Ravi to the Yamuna in the Himachal Himalaya

Lithostratigraphic Classification of the Sirmour Group

Formation	Member	Lithology
Kasauli		Massive sandstone, subordinate shale

Dagshai	Pabo Chimnum	Alternationof sandstone and clay. Red, Green and Indigo blue coloured Mudstone, Shale, Quartzarenite.
Subathu	B.	Green Shale. Foraminiferal limestone and oyster marls, Quartzaenite, local Carbonaceous shale, calcareous sandstone.

In the main belt, the base of the Subathu formation is exposed at Subathu town, there is considerable tectonisation along the contact. The sabathu of the Himachal Foot-hill Palaeogene belt at places contain phosphatic nodules with olive green shales. This sequence contains fossils like Gastropods and divergent terrestrial vertebrates.

The Dagshai formation overlies the Subathu formation along a gradational contact. No break in sedimentation is noticed. The rocks of this formation are characterized by the presence of purple sandstone and clays with pink clay conglomerate and also grey sandstone. This formation is well developed/exposed at Kasauli.

The Kasauli Formation comprises essentially of sandstone with subordinate shale. From Dagshai to the Kasauli, the contact is normal and transitional. This formation is also fossiliferous contains plant fossils.

The close of sedimentation of the Sirmour basin almost coincided with the development of a new fore deep to its South for a new cycle of sedimentation of the Siwalik Group. The period witnessed a southward migration of the Cenozoic basin.

The rocks of the Sirsa Catchments are represented by the Siwalik Group, Older Alluvium and Newer Alluvium. The stratigraphy of the Sirsa catchments with litholgy of the area is as given below in the table:

Lithostratigraphy of the Kothiwali Khol catchment and its Surrounding

Group		Lithology	Age
Newer	Chhanel Alluvium	Grey micaceous, fine to coarse grained sand, silt and clay. Cyclic sequence of grey clay micaceous sand, silt and clay. Brownish grey clay, sand and gravel boulders.	Quaternary
Older	Dun Alluvium Gravels	Multi cyclic sequence of brown to grey silt, clay with	
Siwalik Group	Upper Siwalik	Sand stone, clay and conglomerate alterations. Massive sandstone with minor conglomerate and local variegated clay stone.	Neogene
	Middle Siwalik	Predominantly medium to course	

	Lower B	grained sandstone and red clay alterations, soft pebby with sub ordinate clay stone, locally thick prisms of conglomerate.	
	Lower A	Alteration of fine to medium Siwalik grained sporadically pebble sandstone, calcareous cement and prominent chocolate and medium maroon clay stone in the middle part. Red mauve clay stone with thin intercalations of sandstone.	

The Dun is boarded by Nalagarh thrust in the north and detached Siwalik hills (mainly comprising of Upper Siwalik) in the south. With in the Dun, Quaternary sediments are exposed as Alluvial fan and river terraces. North of Nalagarh thrust, Tertiary (Siwalik Group) and lower Tertiary (Subathu Group) rocks are exposed. The Sub Himalaya, the Southern most division of the Himalaya, is separated from the Lesser Himalaya by the Main Boundary Thrust (MBT) in the north and southern boundary is demarcated from the Indo-Gangetic Plain by the Himalayan frontal Fault (HFF). The northern part of the Sub-Himalaya is characterized by a series of intrabasinal thrusts.

The Nalagarh Thrust marks the northern boundary of the Dun, which brought the Tertiary/Lower Tertiary rocks over the quaternary Dun sediments. The Satluj River and its tributaries are the major drainage system in the Dun. The Satluj River flows in a longitudinal course from the north west to the southeast, whereas its tributaries originate from the higher reaches of Sub- Himalaya, between Nalagarh Thrust and Main Boundary Thrust and flow in transverse courses in a South-Southwest direction. The catchments areas of these piedmont rivers (tributaries of Satluj) are mainly comprised of Lower Tertiary and Tertiary (Lower and Middle Siwaliks) rocks. Mudstones and sandstones are the predominant rock types in the Lower and Middle Siwaliks, respectively. The important geomorphic features observed within the Dun basin are alluvial fans and river terraces. Alluvial fans are fan- or cone-shaped sedimentary bodies that accumulated at the base of the Sub-Himalayan mountain front, south of Nalagarh thrust, down slope from the point where the piedmont rivers emerge from the uplands. Extensive road cuttings and river cuts provide an excellent opportunity to examine nearly continuous exposures (from fan head to toe and transverse view) of these fan sediments. A series of alluvial fans are observed exposed around present-day rivers, between Kiratpur in the West and Pinjaur in the East. Many alluvial fans are exposed around Luhund Khad, Kundlu-ki-khad, Chikni and Mahadeva River etc. The Kundlu-ki- Khad fan is about 15 Kms. long and 6 Kms. wide, whereas the Luhund Khad fan is about 11 Kms. long and 7 Kms.wide.

Siwalik Group:

The Siwalik deposits are one of the most comprehensively studies fluvial sequences in the world. They comprise mudstones, sandstones and bedded conglomerated laid down when the region was a vast basin during Middle Miocene, to Upper Pleistocene times. The sediments were deposited by rivers flowing southwards from the Greater Himalayas, resulting in extensive multi-ordered drainage systems. Following this deposition, the sediments were uplifted through intense tectonic regimes (commencing in Upper Miocene times), subsequently resulting in a unique topographical entity i.e. the Siwalik Hills. The Siwaliks are divided stratigraphically into three major Sub-groups-Lower, Middle and Upper. These Sub-groups are further divided into individual formations that are all laterally and vertically exposed today in varying linear and random patterns. Ongoing erosion and tectonic activity has greatly affected the topography of the Siwaliks. Their present-day morphology is comprised of hogback ridges, consequent, subsequent, obsequent and resquent valleys of various orders, gullies, chose (seasonal streams),earth-pillars, rilled earth buttresses of conglomerate formations, semi-

circular chose-divides, talus cones, colluvial cones, water-gaps and chose terraces. Associated badlands features include the lack of vegetation, steep slopes, high drainage density and rapid erosion rates.

In the advent of Neogene, a depression was formed in front of the rising mountains (Proto-Himalaya). This depression becomes a repository of a thick sequence of molassic sediments of the Siwalik. The Siwalik Group comprises of conglomerates, friable micaceous sandstone, siltstone and clay stone.

The conglomerates in general are poorly cemented but at places they are very hard. These consist mainly of pebbles and cobbles of quartzite. The stray pebbles of granite, limestone, sandstone, breccia and lumps of clay stone are also observed at places. Often the size of pebbles is large enough to be called as boulders. The conglomerates not only occur as regular band but also as lenticular bands with alternative with micaceous sandstone and claybeds.

The sediments were brought down 2 to 25 million years ago by the numerous fast flowing rivers issuing forth from rapidly rising Mountain mass of the Himalaya, in the north.

The Siwalik Group is divisible into three sub-groups respectively the Lower, Middle and Upper on the basis of the lithostratigraphy as given in the table.

Lower Siwalik:

The Lower Siwalik consists essentially of a sandstone-clay alternation. In District Solan, the lower sequence of the lower Siwalik consists of medium grained sub graywacke inter bedded with thick red clay, but higher up in sequence, sandstones are coarser and clasts become more frequent while the clays are less developed. The uppermost horizon consists of conglomerate with well- rounded clast of grey quartzite possibly derived from the Shali. The total thickness is about 1600 Mtrs.

b. Middle Siwalik:

The Middle Siwalik Sub-group comprises of large thickness of coarse micaceous sandstone along with some interbeds of earthy clay and conglomerate. It normally succeeds the Lower Siwalik along a gradational contact. The sandstone is less sorted than those in Lower Siwalik. Clay bands are dull coloured and silty. The general thickness is 1400 to 2000 mtrs.

c. Upper Siwalik:

The Upper Siwalik is mainly represented by sandstone interbedded with silt and conglomerate. The lower portion of the Upper Siwalik mainly consists of soft, massive, pebbly sandstone with intercalations of conglomerates. In the upper portion, the conglomerate intercalation is replaced by the clay intercalations. The general thickness in the District is about 2300mtrs.

Older Alluvium:

The Older Alluvium in Dun valley is designated as Dun gravels while in the plains as Varanasi (Ambala). It is a multicyclic sequence of brown to grey silt, clay with Kankar and reddish brown to grey micaceous sand with pebbles.

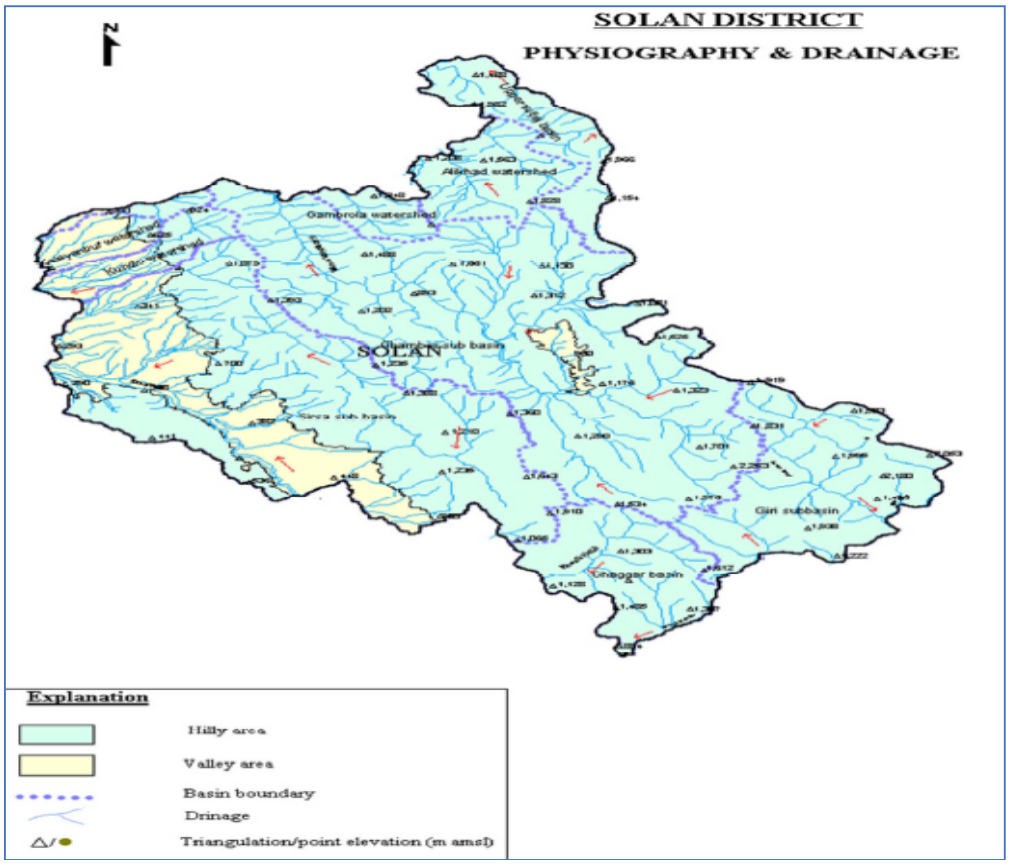
Newer Alluvium:

Newer Alluvium has been subdivided into Fan Alluvium compassing of brownish grey clay, sand and gravel sequence, lies disconformable over Older Alluvium within a narrow zone immediately to the south of Siwalik hill and terrace alluvium exposed as depositional terraces of Satluj and Sirsa River and comprising of cyclic sequence of grey, micaceous, fine to coarse grained sand, silt and clays. Channel Alluvium exposed as point bar/channel bars within the active channels is composed of grey, fine to coarse micaceous sand and silts.

5 DRAINAGE AND IRRIGATION PATTERN

The district lies between north latitude 30°44'53" to 31°22'01" and east longitude 76°36'10" to 77°15'14" and is covered by Survey of India degree-sheets 53A, 53B, 53E and 53F. The District is bounded by Mandi and Bilaspur Districts in the North, Punjab State in the West, Haryana State and Sirmour District in the South and Shimla District in the East.The elevation of the District ranges from 300 to 2200 Mtrs. above mean sea level. The District has some parts with a very low altitude. The terrain is mostly mountainous except valley of Saproon in Solan, Tehsil Doon in Nalagarh Tehsil and Kunihar in Arki Tehsil. The mountains of lower elevations are found in Western and Southern parts of the District comprising of Nalagarh and Arki Tehsils while higher ranges start from Central region and extend up to North-Eastern corner of the District comprising Solan. Kasauli, Kandaghat and parts of Arki Tehsil, Mangal and Berrel Panchayats of Arki Tehsil are situated on a very high mountain ranges and difficult terrain.

District Solan is covered by catchments area of three important rivers namely Satluj, Yamuna and Ghaggar. Main tributary of Yamuna is Asni and those of Satluj River are Kiar-Ka-Nala, Ghamber Khad, and Kuthar Nadi etc. Kaushalya Nadi is the main tributary of Ghagar. Sirsa is the main stream in Nalagarh Sub-Division. It has its source in the Hill above Kalka and runs North-West along the base of the Shivalik eventually joining the Satluj at Avankot in Ropar Distt. The branching drainage pattern so established is tree like, is termed as dendritic drainage pattern.



Map Showing Drainage Pattern & various features

Process of Deposition of Sediments in the River Bed

Deposition is the opposite of erosion. Deposition is where a river lays down or drops the sediments or material that it is carrying. Rivers carries lots of different sediments, including rocks, boulders, silt, mud, pebbles and stonnes. Normally, a river has the power to carry sediments. If the force of a river drops, the river cannot carry sediment. This is when the river deposits its sediment.

Constituents of minor mineral

The work done by a river consists of the following

Erosion
Transport of the material produced by erosion

Accumulation (deposition) of the transported material

The erosion and transport of material go hand in hand with the deposition of the latter. There is not a single river that doesn't carry fragmental material and deposit it. Even at the early stages, in the development of a river, when the erosion and transport definitely prevail over accumulation, the material carried by the river is deposited in some of the sections. During youthful stage of the river, these deposits are unstable and when the volume of water and stream velocity increases (during flood), they may start moving again downstream. The load carried by a stream includes the rock waste supplied to it by rain wash, surface creep, slumping etc. by tributaries, external agents such as glaciers, wind, together with, acquired by its own erosion work. The term load doesn't specifically mean the maximum amount of debris, that a stream could carry in a given set of conditions, that amount is referred to as the

transporting power or capacity of a river. The term load is technically defined as the total weight of solid detritus transported in unit time. The transporting capacity of a stream rises very rapidly as the discharge and the velocity increases. Experiments show that with debris of mixed shapes and sizes, the maximum load that can be carried is proportional to something between the third and fourth power of the velocity. But the fragments of a given shape, the largest size that can be moved (not the actual mass of mixed debris) is proportional to the sixth power of the velocity, provided of course that the depth of water is also adequate for the purpose. As the velocity of a river is checked, the bed load s first to come to rest with continued slackening of the flow, the larger ingredients of the suspended load are dropped, followed successively by finer and finer particles. When the stream begins to flow more vigoroussly, the finer materials are the first to move again. A river begins to sort out its load or burden as soon as it receives it. The proportion of fine to coarse amongst the deposited materials tend on average to increase downstream, but there may be interruptions of this tendency because of addition of coarse debris from tributaries or from landslides and steepening of the banks.

Both discharge and load depend on the climate and geology (litholgy, structure and relief) of the river basin concerned and both co-operate in carving out the channels down.

<table>
<tr><td rowspan="2">Size</td><td colspan="3">Rounded, Subrounded, Subangular</td></tr>
<tr><td colspan="2">Fragment</td><td>Aggregate</td></tr>
<tr><td rowspan="6">256 mm--
128 mm-
64-10mm-
6-2 mm--
<2 mm--</td><td>Boulder</td><td rowspan="5">“ Roundstone”</td><td>Boulder gravel Boulder conglomerate</td></tr>
<tr><td>Cobble</td><td>Cobble gravel Cobble conglomerate</td></tr>
<tr><td>Pebble</td><td>Pebble gravel Pebble conglomerate</td></tr>
<tr><td colspan="2">Granule</td><td>Granule gravel</td></tr>
<tr><td colspan="2">Sand</td><td>Sand
Sandstone</td></tr>
<tr><td colspan="2">Silt</td><td>Silt
Siltstone</td></tr>
</table>

	Clay	Clay Shale

General Geo-morphological Characteristics of Rivers/Streams

(i) Transport of Sediment by Streams and Rivers
The material transported by a stream can travel as:
Bed load
Suspended load
Dissolved load (salts, chemicals

(ii) Stream capacity
Maximum quantity of solid material that a stream can carry
Related to velocity (discharge)
Higher after a rain (more sediment in water
Stream competence (or competency)
Measure of the maximum size of particles the stream can transport
Predict erosive capabilities

Types of rivers or streams
Meandering
These streams are very sinuous, and tend to migrate back and forth across the floodplain (or meander), over time. The word "meander" comes from the name of a sinuous river in Turkey, named the Menderes.

Braided
These streams have lots of lenticular-shaped in-channel bars. The stream channel bifurcates around these bars, and follows a pattern resembling braided hair.

Fluvial Geomorphology
Erosion is the set of all processes by which soil and rock are loosened and moved downhill or downslope. The most important process of erosion is due to running water. Erosion by running water acts in two basic forms: overland flow and channel flow.

Splash Erosion
Most running water starts off as rain. Rain drops have diameters of between 0.5 to 7 mm and hit the ground at between 1 - 9 m/sec. The force of the impact loosens material and throws it into the air. This is called splash erosion. In violent thunderstorms over 200 tonnes/hectare can be disturbed. On a sloping surface, soil is shifted downhill as grains are moved slightly greater distances downhill than uphill. More importantly, however, it leads to a decrease in the permeability of the surface due to openings being sealed by particles. There is therefore less infiltration and an increase in overland flow

Overland Flow
Runoff starts as a broad sheet. The sheet exerts a drag force over the ground surface and some weathered products may be removed. This is sheet erosion. Generally, after traveling a short distance, small channels or rills are formed, which coalesce into gullies, concentrating the erosive action.

The amount of erosion of a slope depends on the
Length and steepness of the slope
Rainfall intensity
Permeability and structure of the surface
Amount of vegetation cover.

Channel Flow

Stream erosion is "the progressive removal of mineral matter from the surfaces of a stream channel which itself may consist of bedrock or regolith" (Strahler). Erosion will only occur when the stream has an excess of energy. In mountainous streams, the rough channel walls may amount to 96% of the potential energy of the stream. Some energy is also spent in transporting load previously acquired. Erosion will result if the energy available > cohesion of particles.
The quantity of water passing through the channel is termed the discharge (m2/sec) and is equal to the channel cross-sectional area (m2) times the average stream velocity (m/sec).
The amount of sediment carried by the stream is called the stream load (kg/m3)

Sub-processes of erosion

a. Hydraulic Action

- The force of the running water alone. This is very important in weak alluvial deposits, especially in times of flood, when fast flowing; turbulent water undermines the channel banks.

b. Abrasion

- the scouring caused by the impact of rock particles that are being transported. Abrasion features include plunge pools, potholes and chutes. Abrasion is proportional to velocity2, so a three-fold increase in velocity leads to nine times as much abrasion. The mutual erosion of two particles is known as attrition

c. Solution (Corrosion)

- chemical reactions between ions in solution and exposed minerals. It is particularly important in limestone areas or on beds of rock salt and gypsum, but all common minerals are soluble to some extent.

Stream Velocity

Stream velocity can be estimated from Manning's equation

$$V = \frac{1}{n}\left(\frac{A}{P}\right)^{\frac{2}{3}} S^{\frac{1}{2}}$$

Where A = cross-sectional area, P = wetted perimeter, S = slope and n = roughness coefficient. The value of n will vary from around 0.02 for a smooth channel to 0.03 for rough gravel. Other factors such as surface irregularities, changes in cross-section, obstructions, vegetation and degree of meandering will also affect the roughness coefficient. In general, as you go downstream, the slope decreases (lowers velocity) and n decreases (raises velocity). At any point along the stream's course, an increase in the depth of the stream's channel (e.g. during floods) will lead to an increase in A/P, with a consequent increase in velocity.

Erosion Velocities

The easiest grains to erode are in the fine to medium sand size range (see figure 1). Particles greater than this size have a proportionally greater volume to surface area ratio, so are harder to erode. For clays, ionic bonding leads to increased cohesion between clay particles, making them harder to erode. Clays are also platy minerals and form smooth surfaces. Laminar flow over the smooth surface decreases the ability of the stream to erode the particles. Clays also infill between larger grains and so are protected by the larger grains. Sands, therefore, may be moved during "normal" river flow, but it is

only when floods increase the stream's velocity that the larger and smaller particles can be moved. Once the particles are being transported, there is an orderly deposition of particles with the largest being deposited first and clays being held almost indefinitely. Hence the sediment becomes sorted downstream.

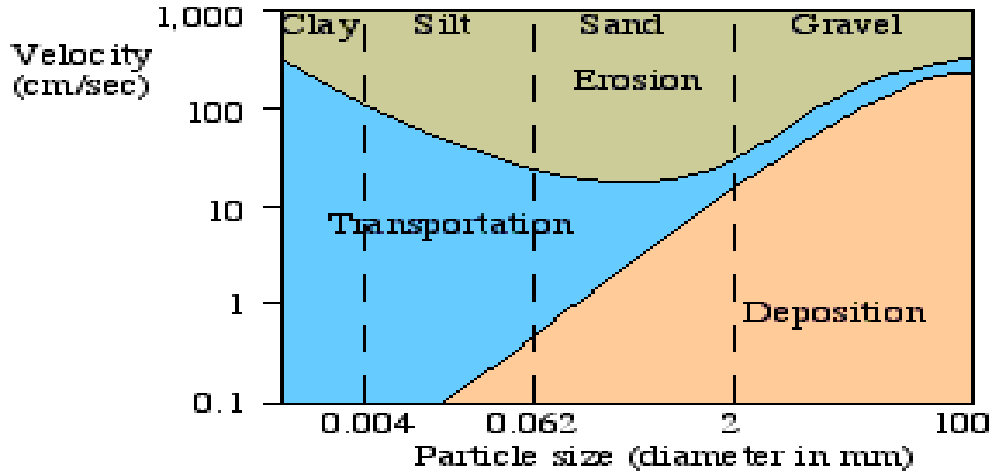


Figure 1. Diagram showing the stream velocity required to erode, transport and deposit particles of various sizes.

Transportation

The particles carried by streams is known as the stream load. Particles may be carried by
Floatation. Of very minor significance.
Solution. Ions of dissolved minerals that may travel downstream indefinitely. The most common are Na, Ca, K, Mg, Cl, SO4 and HCO3. One estimate of U.S. Rivers was that they carry 300 million tonnes of dissolved load each year, and 250 million tonnes of solid load.
Suspension. The temporary support of particles when turbulence is greater than the settling velocity of the particle. Clay and silt are normally transported in suspension, but sand may be carried this way in floods.

Saltation. Intermittent "jumping" of grains that are lifted by turbulence, but are too heavy to remain in suspension.

Traction. The sliding or rolling of particles along the stream floor. Particles moved in this way comprise the bed load. Bed load normally constitutes around 10% of the solid load, but may be up to 50% during floods, when the major work of the stream is done.

Transportation is aided by the buoyancy of water, e.g. quartz grains are Å 2000 times the density of air, but only two and a half times that of water. Unequal velocities at the top and bottom of boulders also assist transportation, as does steep gradients.

The total load of particles of all sizes that a stream can carry is known as its capacity. It is proportional to discharge, which is proportional to velocity. A faster flowing stream therefore has a higher capacity. If a stream's capacity is less than its load, the stream cannot carry its load, so deposition occurs. If capacity exceeds load, the stream has excess energy (gravitational, potential energy), so it can erode more sediments. Streams switch back and forth from depositional to erosional agents, depending on load vs. capacity. A stream can erode along one stretch and deposit along another, since gradient and channel shape/size vary along the stream's course. Streams can erode during periods of higher velocity or discharge (floods) and deposit during periods of lower velocity or discharge. Anything that alters the sediment load delivered to the channel or that alters the stream's capacity to carry that load will cause the stream's gradient or channel geometry to change in response

The largest particle that a stream can transport is known as its competency. Assuming that there is sufficient depth to cover the particles, then competence is proportional to the square of velocity.

Deposition

Deposition will occur when a loss of energy results in a decrease in velocity. This may be due to such things as declining gradient, a decrease in water volume, an increase in cross-sectional area (particularly pools, lakes, and oceans), or by local obstructions. An excessive load produced by increased erosion in the drainage basin or tributary valleys, or from glaciofluvial outwash will also inevitably lead to deposition. The accumulations of stream deposits are called alluvium.
Note: There is a constant interaction between erosion, transportation and deposition. During a flood, the bed of a stream at a particular point may be eroded, but as the flood subsides the bed is filled again. Similarly, in different parts of the stream, velocity differs and hence one part of the stream may be eroding its bank, while on the opposite bank deposition is taking place.

Downstream Adjustments

Overall, despite some variations, effluent streams (those that receive water from the water table) generally show the following changes downstream:
discharge increases (due to more tributaries and a greater drainage area)
total load increases (due to more tributaries and a greater drainage area)
channel size increases (to cope with the increased discharge and load)
particle size decreases (due to increased abrasion/attrition and changes in velocity)
the smoothness of the channel increases (due to decreased particle size)
gradient decreases

Stream velocity downstream is increased by the smoother channels, but decreased by lower gradients. Under normal conditions, velocity is proportional to discharge0.1, so there is a slight overall increase in the average velocity of the stream - despite the appearance of faster flowing mountain streams at the headwaters. In such streams, the amount of turbulence and associated eddies and backward flowing portions of the streams means that the average velocity is lower than the smoother flowing waters downstream. During floods, however, when the major work of the stream is done, velocity is proportional to discharge0 (i.e. it is constant), so the increased velocity associated with floods allows the erosion and transportation of a large range of particle sizes throughout the drainage system.
It can be seen from these relationships that peak discharge conditions that occur during floods are very important in determining the form of rivers and the features associated with them, and not the "normal" river level.

These changes take place in an orderly manner and lead to a longitudinal profile that is smooth and concave. This is known as a graded profile (see Figure 2 and Chernicoff & Whitney, fig, 14-7,).

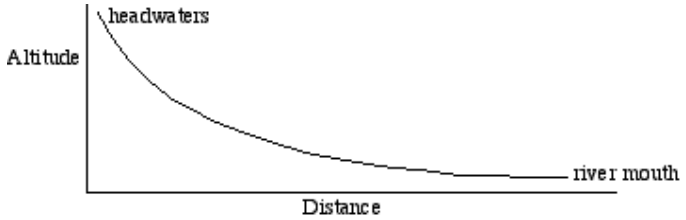


Figure 2. Long profile of a graded stream, showing a regular change in gradient.

For a stream with an irregular profile, erosion will be more pronounced at places of higher than normal

gradient, such as at falls and rapids, and sedimentation will occur in areas of low gradient, such as lakes. The "bumps" are therefore ironed out until the graded profile is achieved.

Over geological time, providing that tectonic forces do not change the base level, any stream, irrespective of length, discharge, and bedrock, will achieve such a state of "dynamic equilibrium".

It is a "dynamic" system, as there is constant re-adjustment of the channel in response to local variations in the volume, velocity and load, that leads to a local balance between the sediment being transported and the energy available. That is, short term changes of scour and fill may occur, but in the long term the gradient and velocity are such that the available load can be transported without erosion or deposition dominating in any particular place. Over geological time, erosion dominates and the whole profile is lowered until a peneplain is developed close to base level. The base level is the lowest level that a stream can erode its channel. A temporary base level results from obstructions such as resistant outcrops, lakes, dams etc. that lead to temporary sub-profiles

An increase in base level will lead to aggradations, the built up of sediment on valley floors and the development of thick deposits of alluvium.

A decrease in base level will lead to such things as nick points that migrate upstream, alluvial terraces, valley in valley topography and entrenched meanders.

The rise in sea level from 18,000 to 10,000 years ago means that most present river systems don't demonstrate ultimate base level control by modern sea level. Estuaries (in streams with minor solid loads) and deltas (large loads) demonstrate adaptations to the changed conditions.

RIVER/ STREAM AND AVAILABILITY OF MINOR MINERALS

The description and details of the major river and streams w.r.t. the availability of mineral is as under:-

a). LOHAND KHUD:-

A tributary of Satluj River.

Altitude at the origin	- 500 mtrs. above mean sea level (Near Village Kothi)
Total length	- 11.5 Kms.
General Width	- 80-100 mtrs.
Climate of Catchments	- Humid.
Seismicity	-Seismic Zone-iv
General slope: -	8^0 to 10^0 up to first 5 Kms. 5^0 to 7^0 from 5 Kms. Onward up to Entrance point in Punjab.
Total catchments are	- 38 Sq. Kms.
General direction of flow	-NNW-SSE.

Geological condition:

The tributary flows through the moderately low hills and intervening valley of the Siwaliks and flood plains. The area is represented by admixture of Boulders, Cobbles, Pebbles and sand of Flood plain. The banks are controlled by stable lands. Therefore Geo-technically, the area is represented by Himalayan fore deep zone and structural ridges and valleys. The rocks belong to quaternary age.

Both the banks are stable and banks of flood plains are represented by lowslopes. The competency of the river is much up to 500 mtrs. Contours. All catchments area are represented by Middle Siwalik of

Siwalik Formation. The carrying capacity is very less right from its origin to the entrance point in Punjab area leading to 2 to 4cm annual deposition of minerals.

The total calculation of boulders, river born bajri and sand is done by taking average %age of each mineral, but it may differ at specific site, depending upon the type of land form competency/capacity at that particular place.

Total potential (M.T.) of minor mineral in the bed (up to 1 Mtrs. depth):-
Total Minor Mineral available in the bed = 1366200 M.T.
Total boulder available in the bed 40% (approx.) = 546480 M.T.
Total sand available in the bed 30% (approx.) = 409860 M.T.
Total sand available in the bed 30% (approx.) = 409860 M.T.

	Annual replenishment	Boulder 40%	Sand 30%	Bajri 30%
Total	40986 M.T.	16394.4 M.T.	12295.8 M.T.	12295.8 M.T.

Hence keeping into consideration the field observations and the availability of minor minerals, 1366200 M.T. of the minerals can be allowed to be lifted from the river bed.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in the entire River stretch can exceed the quantity as mentioned above which is based on specific study at specific time.

RATTA NADI:

General:

A tributary of Satluj River.

Altitude at the origin	- 500 Mtrs. above mean sea level (Near Village Chhoti Batauli).
Total length	- 8.5 Kms.
General width	- 60-80Mtrs.
Altitude at confluence	- 360mtrs. above mean sea level (Near at Malka Majra).
Climate of catchments	- Humid.
Seismicity	- Seismic zone IV.
General slope	- 8^0-10^0upto 2.5 Kms -2^0-4^0 up to from 2.5Kms. onward up to confluence
Total catchment area	- 36.05 Sq.Kms.
General direction of flow	-NE-SW.

The tributary flows through the moderately low hills. Geologically, the area is represented by flood plains. The rocks of both banks are represented by flood plains and are embarked by the stable land. These flood plains belong to quartnary age. The area is represented by Himalayan fore deep zone and structural ridges and valleys.

Both banks are stable banks of stable land of flood plains. The river banks are very low and hardly demarcated with the course of riverbed; hence riverbed mining can damage the banks. Thus, extra care

shall have to be taken at time of mining operations. All the catchment areas are represented by upper and Middle Siwalik formation and flood plains having Boulder/Cobbles/Pebbles and sand etc. Hence during rainy season when competency increases, it brings plenty of sand including Boulders, Cobbles/Pebbles and sand etc. The river bed is having wide width as it runs almost along the flood plains. Hence deposition of the mineral on river bed will increase the lateral erosion due to flat course of the river bed.

The carrying capacity suddenly reduces after 400 Mtrs. above MSL and leading to only 2cm. to 4cm. annual deposition of mineral.

Total potential (M.T.) of minor minerals (up to 1 mtrs. depth)	:	785400 M.T.
Boulders available in the river bed 40%(approx.)	:	314160 M.T.
Bajri available in the river bed 30%(approx.)	:	235620 M.T.
Sand available in the river bed 30%(approx.)	:	235620 M.T.
Total annual replenishment		
Boulder replenishment in the river bed 40%(approx.)	:	9424.8 M.T.
Sand replenishment in the river bed 30%(approx.)	:	7068.6 M.T
Bajri Sand replenishment in the river bed 30%(approx.)	:	7068.6 M.T
Total	:	23562 M.T

Hence keeping into consideration the field observations and the availability of minor minerals, 785400 M.T. of the minerals can be allowed to be lifted from the river bed subject to the prevailing conditions of various Acts, Rules & Policies for grant of mineral concession and in accordance to the observations/ recommendations of the Joint Inspection Committee.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

SARSA NADI:

GENERAL:

A tributary of Satluj River.

Altitude at the origin	- 400 mtrs. above mean sea level enters In H.P. (near Daso-Majra Village).
Total length	- 35 Kms.
General Width	- 80-100 mtrs. above mean sea level enters in Punjab near Village Paswala
Main tributaries	- 6, all are on right bank.
Climate of Catchments	- Humid.
Seismicity	-Seismic Zone-iv
General slope :-	12^0 to 15^0 up to first 23Kms. -1^0 to 2^0 from 23Kms. Onward up to Punjab Border.
General direction of flow	-East to West
Total catchments area	-378.05 Sq.Kms.

The said Nadi flows through moderately how hills and all along the foothills of Siwalik Himalayas. The area represented by the flood plains and the deposits on both bank are represented by stable flood plains belonging to quaternary age.

Competency is not much; it brings very less boulders with it during rainy season. Since said river is fed mostly by flood plains and hence during rainy season sand is dominated and filled in the river bed. Since the said Nadi is almost flat, having very less gradient. Thus, carrying capacity is less in Himachal Pradesh as compare to Haryana. Annual deposition of mineral is 2 to 3cms.
The total potentials of minor mineral in the bed (up to 1 mtrs. depth) are given below:-

Total potential (M.T.) of minor minerals	:	4158000 M.T.
Boulders available in the river bed30%(approx.)	:	1247400 M.T.
Sand available in the river bed 35%(approx.)	:	1455300 M.T.
Bajri available in the river bed 35%(approx.)	:	1455300 M.T.

Total annual replenishment103950 M.T.		
Boulder replenishment in the river bed 30%(approx.)	:	31185 M.T.
Bajri available in the river bed 35%(approx.)	:	36382.5 M.T.
Sand available in the river bed 35%(approx.)	:	36382.5 M.T.

Hence keeping into consideration the field observations and the availability of minor minerals, 4158000 M.T. of the minerals can be allowed to be lifted from the river bed subject to the prevailing conditions of various Acts, Rules & Policies for grant of mineral concession and in accordance to the observations/ recommendations of the Joint Inspection Committee.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

BALAD NADI:

A tributary of Satluj River.

Altitude at the origin	- 800 mtrs. above mean sea level (Near Chewag springs).
Total length	-17.5 Kms.
General Width	- 50-70 mtrs.
Climate of Catchments	- Humid.
Seismicity	-Seismic Zone-iv
General slope: -	-20^0 to 30^0 up to first 2Kms. -12^0 to 15^0 from 2Kms.to 6.5Km. - 18^0 -20^0 from 6.5Km to 9.5 Km. - 8^0- 10^0 from 9.5Km to 17.5Km.
General direction of flow	-North to South
Total catchments area	-87.50 Sq.Kms.

The tributary flows through moderately steep to low flood plains. The area is represented by Himalayan fore deep zone. The rocks on both banks are represented Middle Siwaliks sandstone and clay bands of Siwalik Formation and in the lower part i.e. from Brotiwala to Baddi, the

banks are embarked by flood plains. These formations are belonging to Middle Miocene to early Pleistocene age and Neuocene age.

The river shows how the grading effected by geological structures. The point of least competency and carrying capacity coincide with sudden change in lithology. The riverbed where it enters from sand stone formation to flood plains there is sudden increase in the width of the river bed. With the increase of width of bed, the competency and carrying capacity reduces considerably. The carrying capacity of annual mineral deposition is only 3 to 4 cms per annum.

Total potential (M.T.) of minor minerals in the bed:	1386000 M.T.
Boulders available in the river bed 40% (approx.) :	554400 M.T.
Bajri available in the river bed 30% (approx.) :	415800 M.T.
Sand available in the river bed 35% (approx.) :	415800 M.T
Total annual replenishment of minor minerals in the bed :	48510 M.T.
Boulders available in the river bed 40% (approx.) :	19404 M.T.
Bajri available in the river bed 30% (approx.) :	14553 M.T.
Sand available in the river bed 30% (approx.) :	14553 M.T.

Hence keeping into consideration the field observations and the availability of minor minerals, 1386000 M.T. of the minerals can be allowed to be lifted from the river bed subject to the prevailing conditions of various Acts, Rules & Policies for grant of mineral concession and in accordance to the observations/ recommendations of the Joint Inspection Committee.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

PALI MAHADEV RIVER

A tributary of Satluj River.

Altitude at the origin	- 700 mtrs. above mean sea level (Near Village Bara & Belh).
Total length	- 22 Kms.
General Width	- 50-60 mtrs.
Climate of Catchments	- Humid.
Seismicity	-Seismic Zone-iv
General slope:-	-25^0 to 30^0 up to first ½ Kms (From upstream). -20^0 to 25^0 from ½ Kms.to 1Km. - 18^0 -20^0 from 1Km to 3.5 Kms. - 12^0- 10^0 from 3.5Km to 10Kms.
General direction of flow	-North to South
Total catchments area	-45.75 Sq.Kms.

The tributary flows through moderately steep to low hills. Geologically, the area is represented by Himalayan fore deep zone of structural ridges and valleys. The rocks on both banks are represented by sandstone and clay bands of Siwalik Group belonging to Middle Miocene and in the

lower part of the river bed, banks are represented by stable land of flood plains belonging to Neuocene age.

The both banks are having stable banks of flood plains and sandstone rocks through all along it course. All catchment area is represented by sandstone and flood plains having boulders of different size cemented with matrix of Sand and Pebble/Cobbles etc. The point of least competency and carrying capacity coincide with sudden change in lithology. The river when it enters from sandstone formation to flood plains, there is sudden increase in width of the valley. The annual deposition of mineral is only 3cm to 4cms as catchment area is mostly represented by sandstone and flood plans.

Total potential (M.T.) of minor minerals in the bed : (up to Depth 1 Mtrs.)			1597200 M.T.
Boulders available in the river bed	40% (approx.)	:	638880 M.T.
Bajri available in the river bed	30% (approx.)	:	479160 M.T.
Sand available in the river bed	30% (approx.)	:	479160 M.T
Total annual replenishment of minor minerals in the bed :			55902 M.T.
Boulders available in the river bed	40% (approx.)	:	22360.8 M.T.
Bajri available in the river bed	30% (approx.)	:	16770.6 M.T.
Sand available in the river bed	30% (approx.)	:	16770.6 M.T.

Hence keeping into consideration the field observations and the availability of minor minerals, 1597200 M.T. of the minerals can be allowed to be lifted from the river bed subject to the prevailing conditions of various Acts, Rules & Policies for grant of mineral concession and in accordance to the observations/ recommendations of the Joint Inspection Committee.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

<u>KUNDLU RIVER;</u>

A tributary of Satluj River.

Altitude at the origin	- 500 mtrs. above mean sea level (Near Village Jharni).
Total length	- 13 Kms.
General Width	- 40-50 mtrs.
Climate of Catchments	- Humid.
Seismicity	-Seismic Zone-IV
General slope :-	-20^0 to 22^0 from 2.75 Kms. -10^0 to 15^0 2.75Km to 10.25 Kms.
General direction of flow	-NNW- SSE
Total direction of flow	-53.5 Sq.Kms.

Geomorphalogically, the tributary flows through the moderately to low slope angle. All along its course the banks are represented by stable land of flood plains. Therefore river bed mining can be

carried out without damage of banks. All the catchment represented by flood plains except near the origin, where it is represented by sandstone and alternate bands of clay. The flood plains consist boulders of different sizes cemented with matrix of sand and Pebbles/Cobbles. The annual deposition of mineral is about 3cm to 4cm as mostly the said river flows with very negligible grade.

Total potential M.T. minor mineral in the bed : 772200 M.T.
Boulders availability in the river bed 40% (approx.) : 308880 M.T.
Sand availability in the river bed 30% (approx.) : 231660 M.T.
Bajri availability in the river bed 30% (approx.) : 231660 M.T.
Annual replenishment of minor mineral are 27027 M.T.
Boulders availability in the river bed 40% (approx.) : 10810.8 M.T.
Sand availability in the river bed 30% (approx.) : 8108.1 M.T.
Bajri availability in the river bed 30% (approx.) : 8108.1 M.T.

Hence keeping into consideration the field observations and the availability of minor minerals, 772200 M.T. of the minerals can be allowed to be lifted from the river bed subject to the prevailing conditions of various Acts, Rules & Policies for grant of mineral concession and in accordance to the observations/ recommendations of the Joint Inspection Committee.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

<u>CHIKNI RIVER:</u>

A tributary of Satluj River.

Altitude at the origin - 360 mtrs. above mean sea level (Near Village Ghansot).
Total length - 8.5 Kms.
General Width - 50 to 60 mtrs.
Climate of Catchments - Humid.
Seismicity -Seismic Zone-IV
General slope :- -10^0 to 15^0 in 8.5 Kms.
Total catchment area -56.50 Sq.Kms.
General direction -NNE to SSW

Geomorphalogically, the tributary flows through the moderately to low hills of the Himalayan foothills. The area is represented by the flood plains and the rocks on both banks are represented by stable land of flood plains. Therefore geotechnically the area is represented by Himalayan fore deep zone and structural ridges and valleys. The rocks belong to quarternary age.

The both banks are stable banks of flood plains and are represented by boulders of different size cemented with matrix of sand and Pebbles/Cobbles etc. Hence during rainy season when competency increase it carries Boulders/ Pebble/Cobbles and Sand.

The carrying capacity is very less thus annual deposition of mineral leading to only 3cm to 4cms.

Total potential of minor mineral in the bed : 617100 M.T.

Boulders availability in the river bed 40%(approx.) : 246840 M.T.
Sand availability in the river bed 30%(approx.) : 185130 M.T.
Bajri availability in the river bed 30%(approx.) : 185130 M.T.
Annual replenishment of minor mineral in the river bed: 21598.5 M.T.
Boulders availability in the river bed 40%(approx.) : 8639.4 M.T.
Sand availability in the river bed 30%(approx.) : 6479.55 M.T.
Bajri availability in the river bed 30%(approx.) : 6479.55 M.T.

Hence keeping into consideration the field observations and the availability of minor minerals, 617100 M.T. of the minerals can be allowed to be lifted from the river bed subject to the prevailing conditions of various Acts, Rules & Policies for grant of mineral concession and in accordance to the observations/ recommendations of the Joint Inspection Committee.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

KARSOLI RIVER:

GENERAL:

A tributary of Satluj River.

Altitude at the origin - 350 mtrs. above mean sea level (Near Village Banchha).
Total length - 45 Kms.
General Width - 20 to 30 mtrs.

Climate of Catchments - Humid.
Seismicity -Seismic Zone-IV
General slope: - -10^0 to 15^0
Total catchment area -26.50 Sq.Kms.
General direction -North to South

Geomorphalogically, the tributary flows through the moderately to slope area along the flood plains. Geotechnically, the area is represented by Himalayan fore deep zone of structural ridges and valleys. The both banks are represented by stable land of flood plains belonging to quarternary age.

The both banks are stable banks of flood plains. All catchment area represented by the flood plains having boulders of different size cemented with sand and Pebbles/Cobbles etc. However in smaller stretch of the river bed, there is very less competency of the river and it is unable to bring with it sufficient quantity of Boulders/ Pebble/Cobbles and Sand as such the carrying capacity is very less. Therefore it is recommended that lifting of Boulders/ Pebble/Cobbles and Sand further cannot be allowed as it has already been over exploited. However, if there is any private agriculture land falls in the river bed, a mineral concession may be granted.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall,

surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

KAUSHALYA RIVER:

A tributary of Satluj River.

Altitude at the origin	- 900 mtrs. above mean sea level (Near Village Koti).
Total length	- 3.5 Kms.
General Width	- 20 to 25 mtrs.
Climate of Catchments	- Humid.
Seismicity	-Seismic Zone-IV
Total catchment area	-35 Sq.Kms.
General direction of flow	- North to South

Geomorphalogically, the tributary flows through the moderately steep to steep low hills and intervening valley of Siwaliks/ Dharmshal formation. Geotechnically the area is represented by Himalayan fore deep zone and structural ridges and valleys. of the Himalayan foothills. The rocks on both banks are represented by moderately hard sandstone and alternate clay bands belonging to Middle Miocene to early Pleistocene age.

Both the banks are stable banks of moderately hard sandstone formation. The whole catchment area is represented by hard sandstone having boulders of different size and Pebbles/Cobbles etc. Since the gradient of the riverbed is higher, thereby carrying capacity increases leading to 5cm to 6cm annual deposition of mineral

Total potential (M.T)of minor mineral in the bed :			101640 M.T.
Boulders availability in the river bed	60%(approx.)	:	60984 M.T.
Sand availability in the river bed	20%(approx.)	:	20328 M.T.
Bajri availability in the river bed	20%(approx.)	:	20328 M.T.
Annual replenishment of minor mineral in the river bed:			5590 M.T.
Boulders availability in the river bed	60%(approx.)	:	3354 M.T.
Sand availability in the river bed	20%(approx.)	:	1118 M.T.
Bajri availability in the river bed	20%(approx.)	:	1118 M.T.

Hence keeping into consideration the field observations and the availability of minor minerals, 101640 M.T. of the minerals can be allowed to be lifted from the river bed subject to the prevailing conditions of various Acts, Rules & Policies for grant of mineral concession and in accordance to the observations/ recommendations of the Joint Inspection Committee.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

Mandhala River:

A tributary of Satluj River.

Altitude at the origin	- 600 mtrs. above mean sea level (Near Village Koti).

Total length - 6 Kms.
General Width - 60-70 mtrs.
Climate of Catchments - Humid.
Seismicity -Seismic Zone-IV
General slope :- -10^0 to 15^0 from 2 Kms.
-5^0 to 10^0 from 2Km onward.
General direction of flow -NNW- SSE
Total direction of flow -15 Sq.Kms.

The tributary flows through the moderately low hills and intervening valley of the Siwaliks and flood plains. The area is represented by admixture of Boulders, Cobbles, Pebbles and sand of Flood plain. The banks are controlled by stable lands. Therefore Geo-technically, the area is represented by Himalayan fore deep zone and structural ridges and valleys. The rocks belong to quaternary age.

Both the banks are stable and banks of flood plains are represented by lowslopes. The competency of the river is much up to 600 mtrs. contours. All catchments area is represented by Middle Siwalik of Siwalik Formation. The carrying capacity is very less right from its origin to the entrance point in Punjab area leading to a 2 to 4cm annual deposition of minerals.

The total calculation of boulders, river born bajri and sand is done by taking average of each mineral, but it may differ at specific site, depending upon the type of land form competency/capacity at that particular point.

Total potential (M.T.) of minor mineral in the bed (up to 1 Mtrs. depth):-
Total Minor Mineral available in the bed = 514800 M.T.
Total Bouldesr available in the riverbed 30%(approx.)= 154440 M.T.
Total Sand available in the riverbed 40%(approx.) = 205920 M.T.
Total Bajri available in the riverbed 40%(approx.) = 205920 M.T.
Total annual replenishment : 12870 M.T.
Total Boulders availability in the river bed 30%(approx.) : 3861 M.T.
Total Sand availability in the river bed 35%(approx.) : 5148 M.T.
Total Bajri availability in the river bed 35%(approx.) : 5148 M.T.

Hence keeping into consideration the field observations and the availability of minor minerals, 514800 M.T. of the minerals can be allowed to be lifted from the river bed subject to the prevailing conditions of various Acts, Rules & Policies for grant of mineral concession and in accordance to the observations/ recommendations of the Joint Inspection Committee.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

<u>Surajpur Chao:</u>

A tributary of Satluj River.
Altitude at the origin - 520 mtrs. above mean sea level
(Near Village Satinala).

Total length - 8.5 Kms.
General Width - 40-50 mtrs.
Climate of Catchments - Humid.
Seismicity -Seismic Zone-IV
Total Catchment area -11.25Sq.Kms.
General slope :- -2^0 to 5^0 upto 5 Kms.
-5^0 to 10^0 from 5Km to 8 Kms.
General direction of flow -NNW- SSE

Geomorphalogically, the tributary flows through the moderately low hills intervening valley of the Shiwaliks and flood plains. The area presented by admixture of Boulders, Cobbles, Pebbles and Sand of Flood plains. The banks are controlled by the stable land. All the catchment represented by flood plains except near the origin, where it is represented by sandstone and alternate bands of clay. The annual deposition of mineral is about 2cm to 4cm. as most of the said river flows with very negligible grade.

Total potential M.T. minor mineral in the bed : 504900 M.T.
Boulders availability in the river bed 30%(approx.) : 151470 M.T.
Sand availability in the river bed 35%(approx.) : 176715 M.T.
Bajri availability in the river bed 35%(approx.) : 176715 M.T.
Annual replenishment of minor mineral are: 15147 M.T.
Boulders availability in the river bed 30%(approx.) : 4544.1 M.T.
Sand availability in the river bed 35%(approx.) : 5301.45 M.T.
Bajri availability in the river bed 35%(approx.) : 5301.45 M.T.

Hence keeping into consideration the field observations and the availability of minor minerals, 504900 M.T. of the minerals can be allowed to be lifted from the river bed subject to the prevailing conditions of various Acts, Rules & Policies for grant of mineral concession and in accordance to the observations/ recommendations of the Joint Inspection Committee.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

<u>Banbirpur/ Manpura Khad:-</u>

This stream is a tributary of Sarsa river. It originates near village Kharyana at an altitude of about 650 metres. It is about 6.50 Kms. In length and flows in East to West direction. The slope angle varies from 10^0 to 15^0 and general width is 50-70 metres. During the reconnaissance of the stream it has been observed that due to suspension of all mining activities since 2011, alluvial deposits have adequately been replenished.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations

total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

Kulhariwala Khad:-

Kulhariwala Khad is a tributary of Sarsa River. It originates from Dhaular PF at altitude of about 650 metres. It is about 7.5 Kms. in length and flows in NNE-SSW direction. The slope angle varies from 5^0 to 10^0 and general width is 40-50 metres. During the reconnaissance of the stream it has been observed that adequate alluvial deposits are available as no mining activities are being carried out in this Khad since long.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

Nanakpur Nadi-

This stream of Nalagarh Sub-division is a tributary of Sarsa River and flows in the directionNNE-SSW direction. It has its origin from Banoi PF of Tehsil Kasauli at altitude of about 900 metres. After flowing for a distance of about 4-5 Kms. in the State, it enters into the State of Haryana near village Khera. The slope angle varies from 10^0 to 15^0 and general width is 40-60 metres. During the reconnaissance of the stream it has been observed that adequate alluvial deposits are available as no mining activities are being carried out in this stream since long.

The above calculations of annual repleni
shment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

Ramnagar/ Kalujhanda Nadi-

This stream is the easternmost stream of Nalagarh Sub-division and is a tributary of Sarsa River. Most of the part of this stream falls in the State of Haryana however, it has its origin from Banoi PF of Tehsil Kasauli in the State of Haryana however, it has its origin Banoi PF of Tehsil Kasauli in the State of Himachal Pradesh at altitude of about 900 metres. The slope angle varies from 10^0 to 15^0 and general width is 60-70 metres. During the reconnaissance of the stream it has been observed that adequate alluvial deposits are available as no mining activities are being carried out in this stream since long.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

p). Gamber Khad:

A tributary of Satluj River.

Altitude at the origin - 1120mtrs. above mean sea level (Near Village Koti).

Total length - 107 Kms.

General Width - 30-50 mtrs.

Climate of Catchments - Humid.

Seismicity -Seismic Zone-IV

General slope -10^0 to 15^0 upto 20 Kms.
-20^0 to 25^0 from 20 Kms to 30.5 Kms
-10^0 to 12^0 from 30.5 Kms to 36.5 Kms
-12^0 to 15^0 from 36.5 Kms to 59 Kms
-8^0 to 10^0 from 59 Kms to 90 Kms
-20^0 to 25^0 from 90 Kms to 107 Kms

General direction of flow -SE-NW

Total catchment area -15 Sq.Kms.

Geomorphologically, the river flows through the moderately low hills and intervening valley of the Siwaliks and its equivalent formations and flood plains. The area represented by admixture of Boulders, Cobbles, Pebbles and sand of Flood plain. The banks are controlled by sandstone and stable land of flood plains.

The competency of the river is much up to 700 mtrs. contours. All catchments area is represented by Middle Siwaliks of Siwalik Formation. Since the river stretch is more, and the carrying capacity is very high due to high gradient from the origin to the entrance point in Gobind Sagar. Which may leads to 5-6cms annual deposition of minerals in the riverbed.

The total calculation of boulders, river born bajri and sand is done by taking average percentage of each mineral, but it may differ at specific site, depending upon the type of land form competency/capacity at that particular point.

Total potential (M.T.) of minor mineral in the bed (up to 1 Mtrs. depth):-

Total Minor Mineral available in the bed = 5649600 M.T.
Total Boulder available in the riverbed 60%(approx.) = 3389760 M.T.
Total Sand available in the riverbed 20%(approx.) = 1129920 M.T.
Total Bajri available in the riverbed 20%(approx.) = 1129920 M.T.

Annual replenishment of minor mineral in river bed: = 310728 M.T.
Total availability of minor minerals in the river bed: 2259840 M.T.
Total Boulders availability in the river bed 60%(approx.) : 1355904 M.T.
Total Sand availability in the river bed 20%(approx.) : 451968 M.T.
Total Bajri availability in the river bed 20%(approx.) : 451968 M.T.

Hence keeping into consideration the field observations and the availability of minor minerals, 5649600 M.T. of the minerals can be allowed to be lifted from the river bed subject to the prevailing conditions of various Acts, Rules & Policies for grant of mineral concession and in accordance to the observations/ recommendations of the Joint Inspection Committee.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with

various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

ASNI RIVER:

General:

A tributary of Satluj River.

Altitude at the origin	- 1100 mtrs. above mean sea level (Near Village Paroth).
Total length	- 12 Kms.
General Width	- 10-20 mtrs.
Climate of Catchments	- Humid.
Seismicity	-Seismic Zone-IV
General slope	-8^0 to 10^0 from 4.5 Kms. -5^0 to 8^0 from 4.5Km to 8.5 Kms.
General direction of flow	-North to South

Geomorphologically, the tributary flows through the steep to low hills and intervening valley of Jutogh, Shimla Group of Krol Formation. The Valley is controlled by geological structures. Geo-technically, the area is represented by Himalayan fore deep zone and structural ridges and valleys. The rocks on both banks are represented by different types of rocks.

Both the banks are stable and banks of different formations and valley is represented by steeps slopes of hard rocks and gentle slope of soft rocks. All catchments area is represented by different formations, hence during rainy season when its competency increases it brings plenty of Boulders/Cobbles/Pebbles and Sand. The carrying capacity is very less right from its origin to the entrance point in Punjab area leading to a 5cm to 6cm annual deposition of minerals.

Total potential (M.T.) of minor mineral in the bed: = 237600 M.T.
(up to 1 Mtrs. depth):-

Bouldesr available in the riverbed 50%(approx.) = 118800 M.T.
Sand available in the riverbed 25%(approx.) = 59400 M.T.
Bajri available in the riverbed 25%(approx.) = 59400 M.T.

Annual replenishment of minor mineral in river bed: = 13068 M.T.
Boulders availability in the river bed 50%(approx.) : = 6534 M.T.
Sand availability in the river bed 25%(approx.) : = 3267 M.T.
Bajri availability in the river bed 25%(approx.) : = 3267 M.T.

Hence keeping into consideration the field observations and the availability of minor minerals, 237600 M.T. of the minerals can be allowed to be lifted from the river bed subject to the prevailing conditions of various Acts, Rules & Policies for grant of mineral concession and in accordance to the observations/ recommendations of the Joint Inspection Committee.

The above calculations of annual replenishment are not fixed as geologically the catchment area encompasses mainly Shiwalik Formation and lesser Himalayas which have various strata composed of boulders/ beds sandstone, siltstone, clay stone, soil, quartzarenites, phylites and hard shale, stone with various quartzites. Consequently the load on the rivers further depends upon the intensity of rainfall, surface run off in the area which in terms varies every year. Therefore, based on the site observations total mineral concessions in entire River can exceed the quantity as mentioned above which is based on specific study at specific time.

Daseran River:

General:

A tributary of Satluj River.

Altitude at the origin	- 1100 mtrs. above mean sea level (Near Village Palani Ghati).
Total length	- 4 Kms.
General Width	- 10-20 mtrs.
Climate of Catchments	- Humid.
Seismicity	-Seismic Zone-IV
General slope: -	-8^0 to 10^0 in the whole stretch.
General direction of flow	-South to North

Geomorphologically, the tributary flows through moderately steep hills and intervening valleys of the Dharamshala formation. Geo-technically, the area is represented by Himalayan fore deep zone and structural ridges and valleys. The rocks on both banks are represented by sandstone of Dharamshala formations. Both banks are stable banks of sandstone and alluvium. The competency of the river is much less as length of the river bed is very less and whole catchment area is represented by sandstone formation. Thus due to very less competency, the said river may not be put on auction or any type of concessions to anybody may not be granted.

NOTE: - The mineral reserves have been calculated only up to1.00 metre depth however, in general the minor mineral in the form of sand, stone, boulder, bajri is is available at least upto a depth of 03-05 meters. 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 consequently 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.

6 LAND UTILIZATION PATTERN IN THE DISTRICT

The District is spread over the valleys and higher elevations. The cultivation is possible only in small terraces in the hills or along the stream/ Khad in most parts of the District However, in the valleys the cultivation is spread over a vast area. Except the valley area most of the land is either under shrub forests or grassy land with chill trees up to the height of 1,500 Mtrs. from the mean sea level and Kail and Deodar on the high altitudes. It is only in the Doon, Saproon and Kunihar valleys that the land is mostly flat and fertile. The settlement operations in the District were carried out at different times as most of the area was forming the princely hill States.

Agriculture is the main stay of the rural economy of the District 54.96 percent of the working population of the District is engaged in agriculture. Maize, Wheat, Rice and Pulses etc. are the main crops of the District. Cash crops such as sugarcane in Nalagarh Tehsil and Potato in Kandaghat Tehsil are grown. Besides, vegetable cultivation has also taken a boost. Despite hilly topography of the District additional area has been brought under cultivation.

A large number of cultivators in the District are growing mushroom on commercial scale, as the climatic conditions in the District are most conducive for growing mushrooms, special incentives are being offered to small and marginal farmers. The soil in the district varies from light to sandy heavy and in the valley areas it is sandy loam types of soil. Climate is the main factors responsible for the proper development of agriculture in the area. The district has different type of soils, which offer great potentialities for growing various types of cereals, fruits, vegetables and other cash crops. Climate of the District Is mostly sub tropical in the lower reaches and moist temperature in upper reaches.

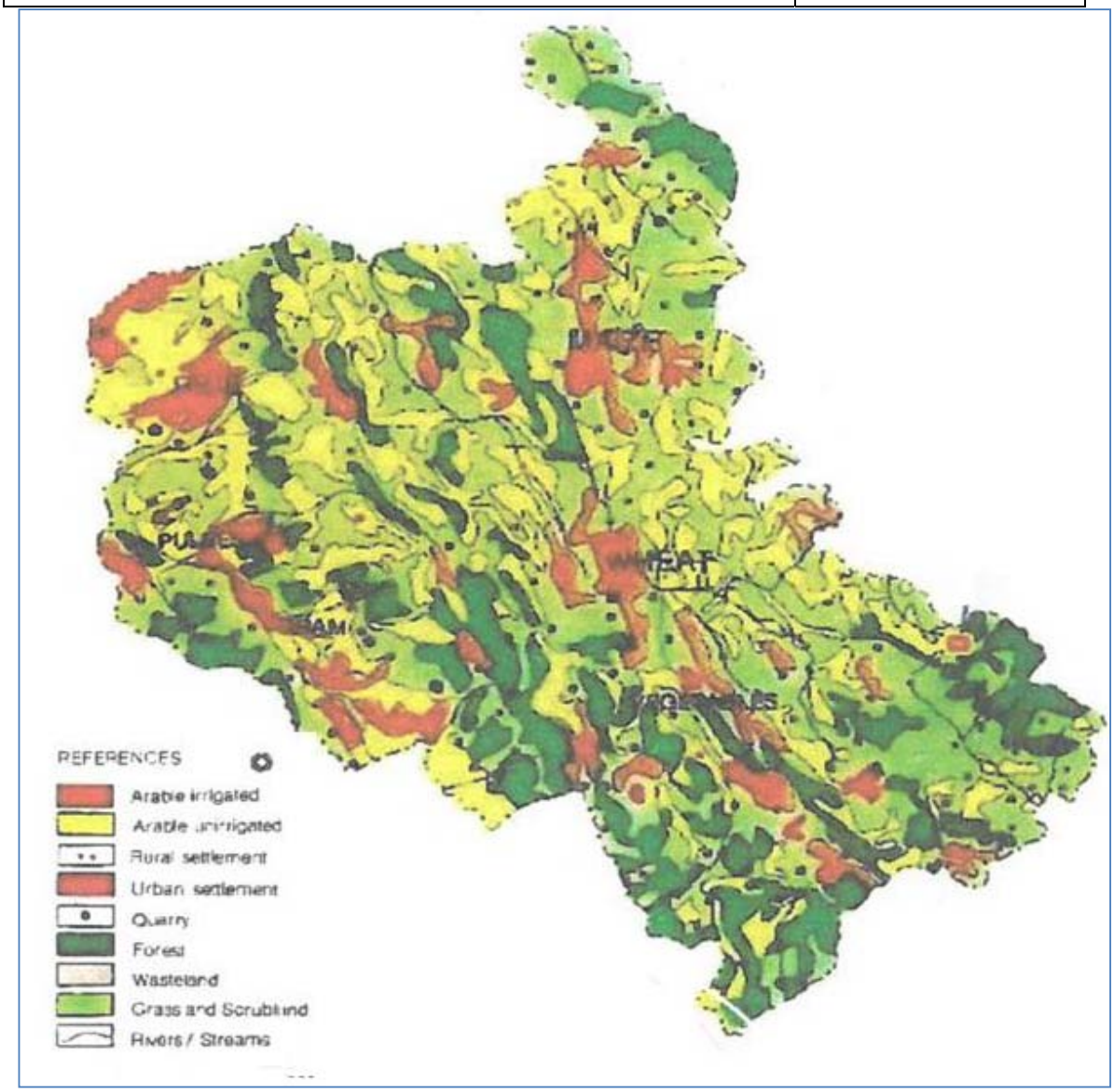
The hilly and agro-climatic condition of the district is very congenial for the development of the horticulture in general and cultivation of temperate and stone fruits in particular. Apart from stone and citrus fruits, apples are also being grown in the higher reaches of the district and its cultivation is mainly in Chail area of Kandaghat Tehsil.

Due to wide variations in the altitude, soil depth and available moisture, the vegetation met within this division shows a great variation. Chil, Khair, Bamboos and other broad leaved species like Chhal, Simbal, Jhingan etc. are the most important species met within this area. Tropical Euphorbia scrub forest to Shiwalik Chil, pine and little Ban oak forests are found in this area. Vegetation changes due to water and slopes. Undergrowth consists of Phullakri, Karaunda, Ghandela and top storey consists of Kashmal, Katni, Kainth, Tirmira, Khair, Bel, Banarasi, Kangu, Malkora, Dub, Dhaula and lobb are the various types of grases found in this District. The climbers that are generally found are Hedera Lelix, Smilex, Bauhnia vehili, Smilaxspp, Gulab, Acacia Pinnata etc.

There is a great variety of wild life met within this District. The main wild life animals found are; Leopard, Ghoral, Indian wild Bear, Kakar, Hyena, Wild bear, Porcupine, Hone, Squirrels. Leopard is found throughout the area up to an elevation of about 2,200mtrs. In scrub forests Ghoral is found above an elevation of 1200mtrs. In Mangal area various types of birds like Chukar, Black Petridge, Kaleshna and Jungle fowl are also found in the District. Besides the already mentioned birds, a number of other birds like Peacock, Parrot, Sparrow, Piegeon and Doves are also found. The entire tract of Kunihar forest falls in Satluj catchment.

Land Utilization Pattern of the District (in '000Hects)	
Area Under Forest	20.3
Irrigated Area	14.9

Unirrigated Area	38.4
Culturable waste (including gauchar and groves)	14.9
Area not available for cultivation	11.7



Map Showing land use pattern of the District

(6.1) AGRICULTURE

From an agricultural point of view, the district can be divided into three distinct regions:

1. Valley area of Nalagarh, Saproon and Kunihar
2. Mid Hills
3. Higher Hills of Solan, Kasauli and Kandaghat Tehsil

Most of the Nalagarh Dun Valley area consists of foothills and Sarsa Nadi and its tributaries up to an elevation of 1000 meters above mean sea level with a sub-tropical climate. The soils are mostly sandy loam in texture with scattered loamy patches. The area is highly prone to erosion due to weak geological formations and scanty vegetation. The moisture retention capacity is poor. 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.

The source of water and irrigation in Nalagarh Tehsil can be classified into the following four classes:-

1. Kuhls
2. Well used for domestic purposes
3. Well used for irrigation
4. Tubewells

Major food crops are grouped into three categories

1. Cereals
2. Pulses
3. Other food crops like Chillies, ginger, sugarcane and turmeric.

The area under Non- food crops is of two types i.e.

1. Oil seeds
2. Other non-food crops such as cotton, tobacco and fodder crop

The area and percentage of area under each category of the crop are given below in the figure. The annual rotation of the crop is given in the figure. The figures below also show production and percentage of production in district Solan. The area under vegetables and their production are given in the figure below.

Table Showing Crop Pattern Surrounding lease area

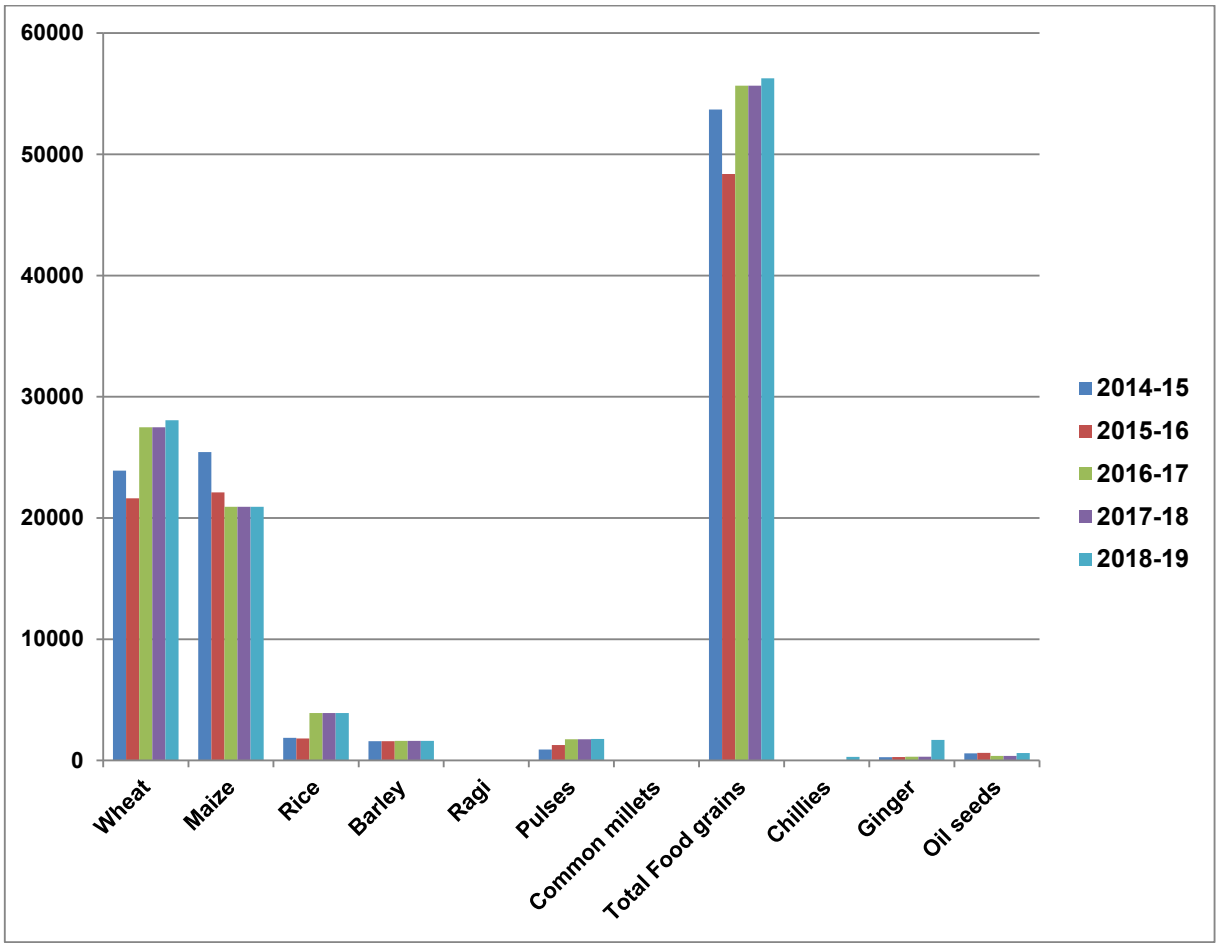
Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Maize				Wheat				Maize			
Maize			Toria			Wheat			Maize		
Maize			Potato			Wheat			Maize		
Maize			Potato			Potato			Maize		
Bhindi				Cauliflower				French Bean/Tomato/brinjal/CapsicumCucubits			
Sesame						Sarson/Raya/G.Sarson					
Ginger/Caucasia/Turmeric				Potato		Wheat			Ginger		
Paddy						Wheat					
Paddy						Barseem					
Paddy						Potato					
Kulthi Mash					B. Sarson/Raya/G. Sarson/Taramira(Eruca Sativa)						
Mash						Wheat					

Maize+ Mash	Wheat
Arhar	

Table showing area under Different Crops in Hectares

Table showing Area under Different Crops (in Hectares) at District Solan											
Year	Wheat	Maize	Rice	Barley	Ragi	Pulses	Common millets	Total Food grains	Chillies	Ginger	Oil seeds
2014-15	23901	25435	1869	1584	…	901	…	53690	15	268	589
2015-16	21619	22101	1806	1578	…	1276	…	48380	25	280	628
2016-17	27481	20929	3901	1613	...	1739	...	55663	28	308	377
2017-18	27481	20929	3901	1613	...	1739	...	55663	28	308	377
2018-19	28062	20929	3901	1613	…	1761	…	56266	291	1687	611

Source: Directorate of Land Records, HP

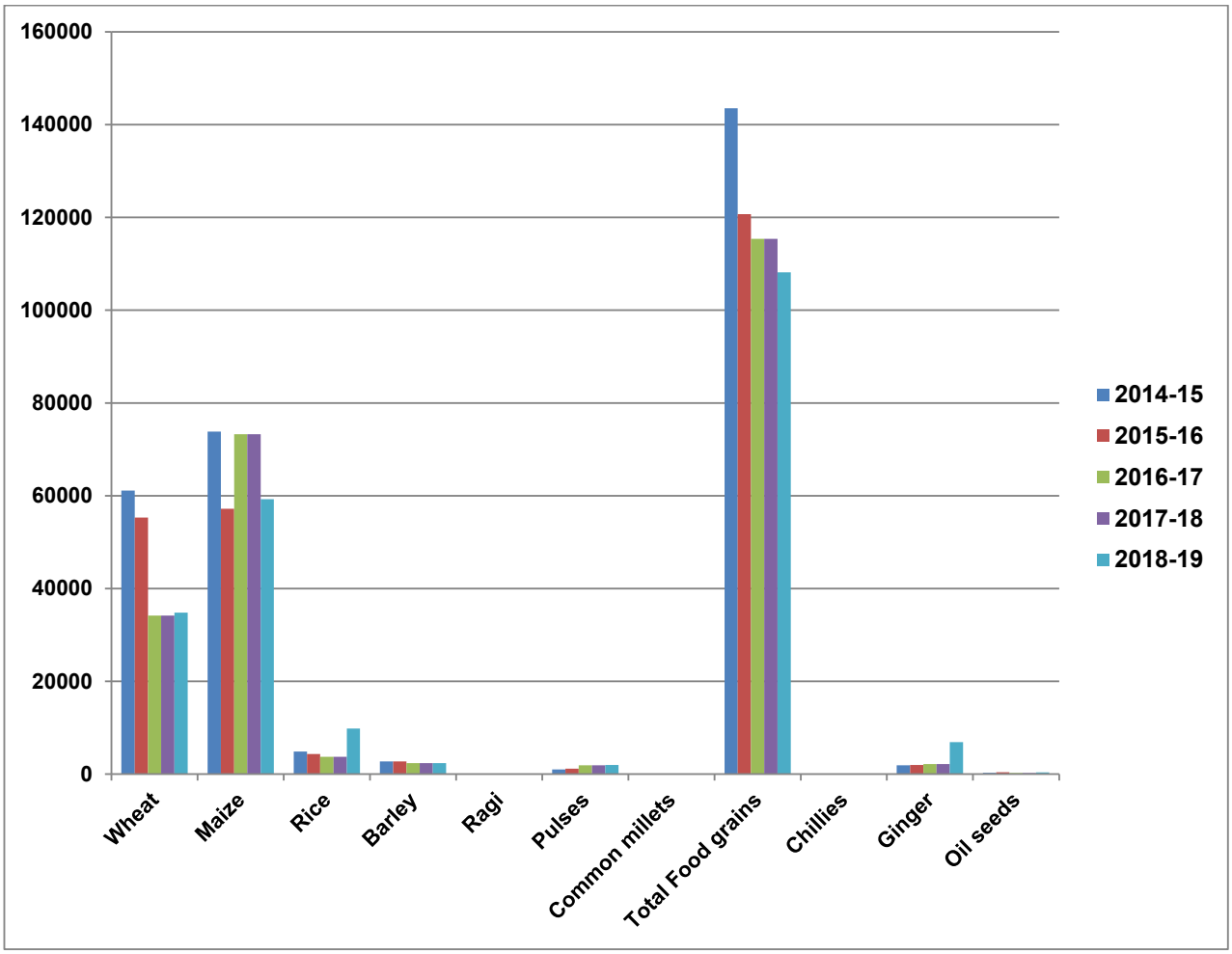


Graph Showing Area under Different Crops in Hectares

Table showing Production of Different Crops in MT

Table showing Production of Different Crops (in MT) at District Solan											
Year	Wheat	Maize	Rice	Barley	Ragi	Pulses	Common millets	Total Food grains	Chillies	Ginger	Oil seeds
2014-15	61128	73837	4874	2714	...	989	...	143542	6	1879	276
2015-16	55292	57210	4347	2704	...	1162	...	120715	9	1963	384
2016-17	34154	73279	3694	2378	...	1898	...	115403	11	2159	231
2017-18	34154	73279	3694	2378	...	1898	...	115403	11	2159	231
2018-19	34797	59230	9813	2371	...	1964	...	108175	98	6882	372

Source: Directorate of Land Records, HP

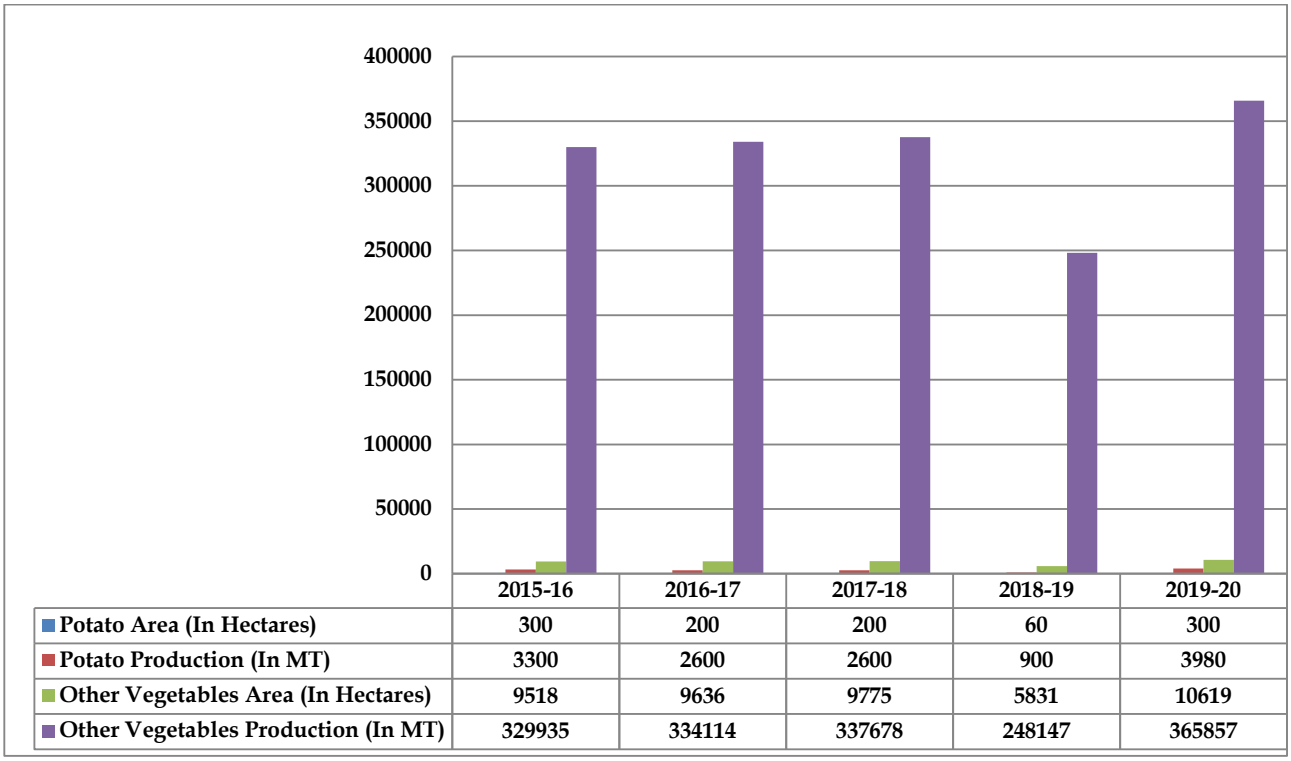


Graph Showing Production of Different Crops in MT

Table showing Area & Production of Vegetables in Tonnes

Table showing Area & Production of Vegetables (Distt Solan)				
Year	Potato		Other Vegetables	
	Area (In Hectares)	Production (In MT)	Area (In Hectares)	Production (In MT)
2015-16	300	3300	9518	329935
2016-17	200	2600	9636	334114
2017-18	200	2600	9775	337678
2018-19	60	900	5831	248147
2019-20	300	3980	10619	365857

Source: Directorate of Land Records, HP



	2015-16	2016-17	2017-18	2018-19	2019-20
Potato Area (In Hectares)	300	200	200	60	300
Potato Production (In MT)	3300	2600	2600	900	3980
Other Vegetables Area (In Hectares)	9518	9636	9775	5831	10619
Other Vegetables Production (In MT)	329935	334114	337678	248147	365857

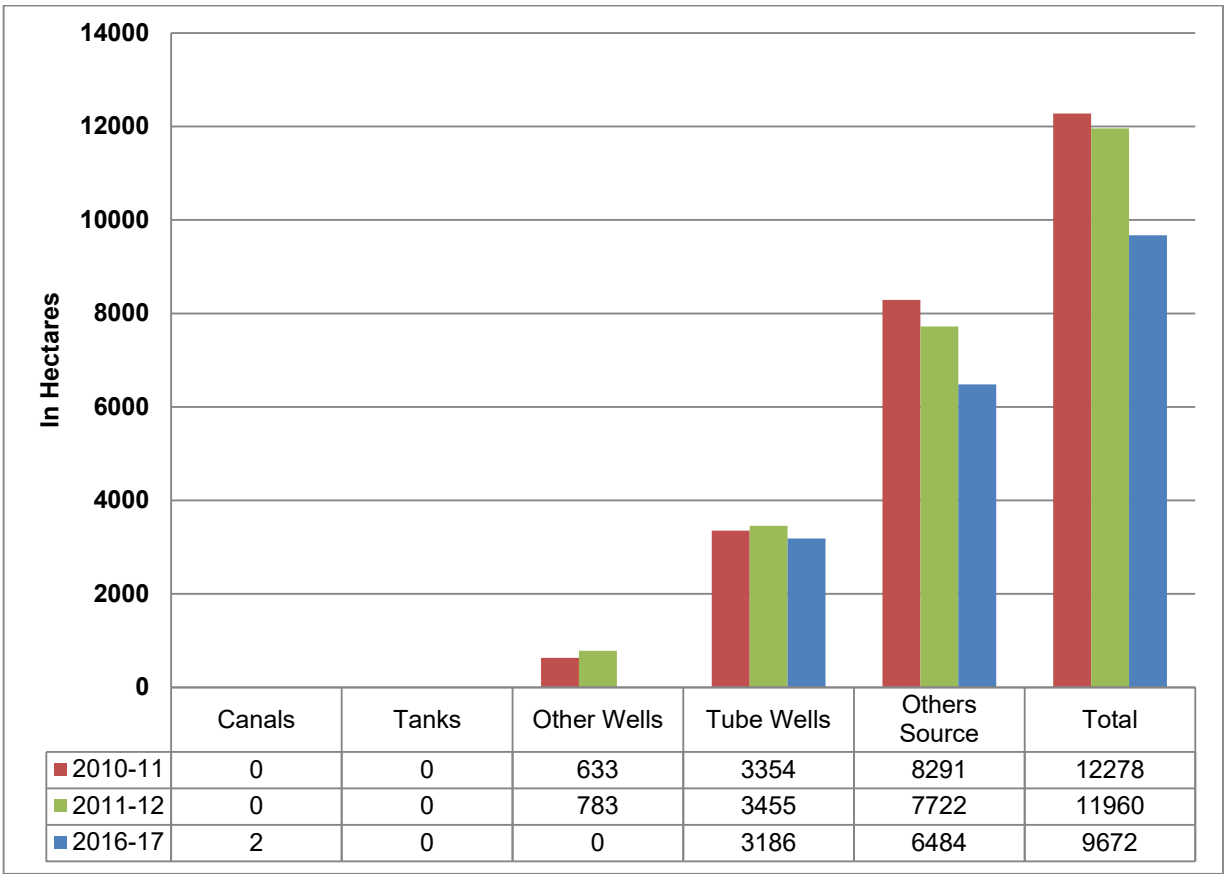
Graph showing Area & Production of Vegetables at District Solan

Table showing Net Irrigated Area of District Solan by source (in hectares)

Table showing Net Irrigated Area of Solan by source (in Hectares)

Year	Canals	Tanks	Other Wells	Tube Wells	Others Source	Total
2010-11	…	…	633	3354	8291	12278
2011-12	…	…	783	3455	7722	11960
2016-17	2	…	…	3186	6484	9672

Source: Directorate of Land Records, HP



	Canals	Tanks	Other Wells	Tube Wells	Others Source	Total
2010-11	0	0	633	3354	8291	12278
2011-12	0	0	783	3455	7722	11960
2016-17	2	0	0	3186	6484	9672

Graph showing Net Irrigated Area of District Solan by source (in hectares)

(6.2) HORTICULTURE

The topography and the agro-climatic conditions of the district are quite suitable for the production of various fruits. The topography of the district can be grouped into three categories namely high hill areas located at a higher elevation, mid-hill areas and low-lying valley areas. Fruit of different varieties depending upon the terrain, climatic conditions and soil of the area are grown in the district. The main horticulture produce of the area are can be classified into the following five categories.

1. Apple
2. Other temperate fruits
3. Subtropical fruits
4. Nuts and dry fruits
5. Citrus fruits

In the Nalagarh Dun valley following fruits are mainly grown

i. Mango
ii. Litchi
iii. Mandarin
iv. Sweet orange
v. Lime
vi. Lemon
vii. Guava

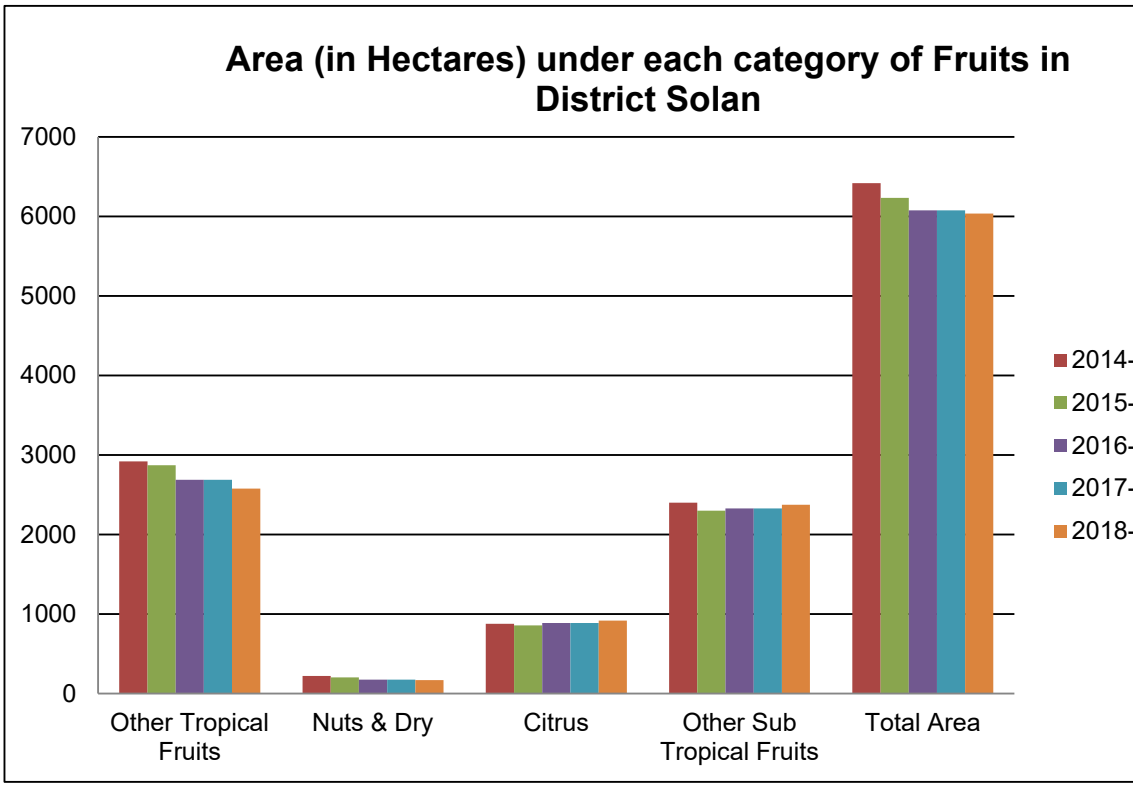
The area under each fruit and the percentage of the area to the total district area as well as the percentage of the area under fruit in each category is given in the table below. The table also shows

the production of each fruit in district Solan. Also, the tables below show the area covered under each category and the total production as per the 2012-13 survey.

Table showing Area under each category of fruits in District Solan

Table showing Area (In Hectares) under Each Category of Fruits in District Solan					
Year	Other Tropical Fruits	Nuts & Dry	Citrus	Other Sub Tropical Fruits	Total Area
2014-15	2919	222	877	2400	6418
2015-16	2871	204	858	2301	6234
2016-17	2688	174	886	2329	6077
2017-18	2688	174	886	2329	6077
2018-19	2576	170	916	2374	6036

Source: Directorate of Horticulture, HP



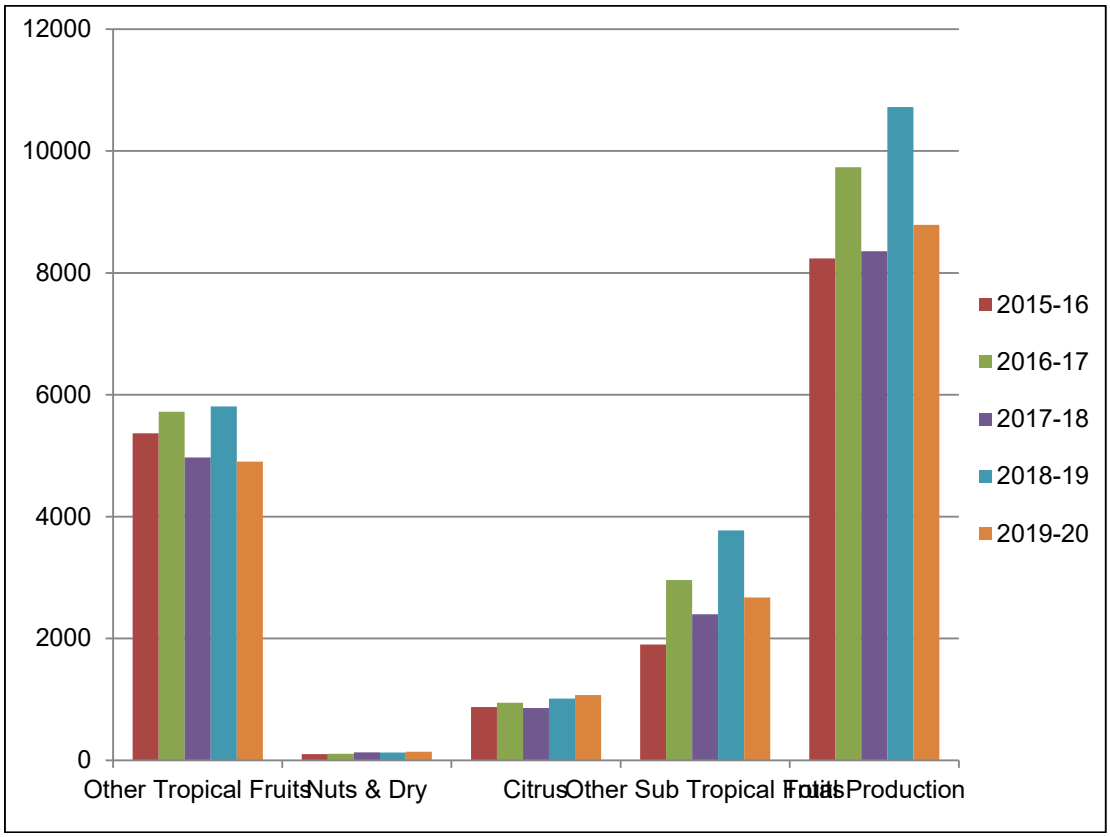
Graph showing Area under each category of fruits in District Solan

Table showing Production under each category of fruits in District Solan

Table showing Production (In MT) under Each Category of Fruits in District Solan					
Year	Other Tropical Fruits	Nuts & Dry	Citrus	Other Sub Tropical Fruits	Total Production
2015-16	5365	100	874	1899	8238
2016-17	5723	105	945	2960	9733
2017-18	4971	130	858	2397	8356

2018-19	5809	128	1013	3773	10723
2019-20	4902	141	1072	2672	8787

Source: Directorate of Horticulture, HP



Graph showing Production under each category of fruits in District Solan

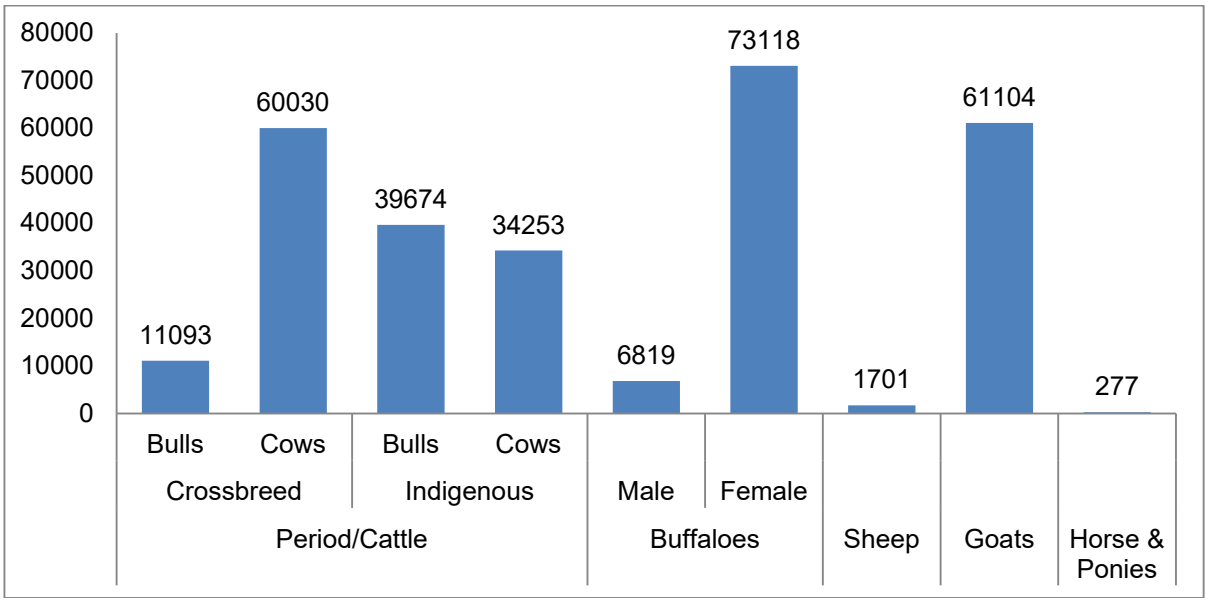
(6.3) ANIMAL HUSBANDRY

The economy of the district is predominantly agrarian but the role of Animal Husbandry is equally important as the farmers have to keep the cattle for the purpose to plough the agricultural fields and obtaining manure for maintaining the fertility of the fields and meeting the daily needs of milk of their family. The total population of the livestock in District Solan is given in the figure below and the population of the Buffaloes and cattle in District Solan is given in the figure.

Table showing Livestock census in District Solan

Table showing Livestock census in District Solan										
Year	Status	Period/Cattle				Buffaloes		Sheep	Goats	Horse & Ponies
		Crossbreed		Indigenous		Male	Female			
		Bulls	Cows	Bulls	Cows					
2012	At Solan	11093	60030	39674	34253	6819	73118	1701	61104	277

Source: Directorate of Animal Husbandry, HP

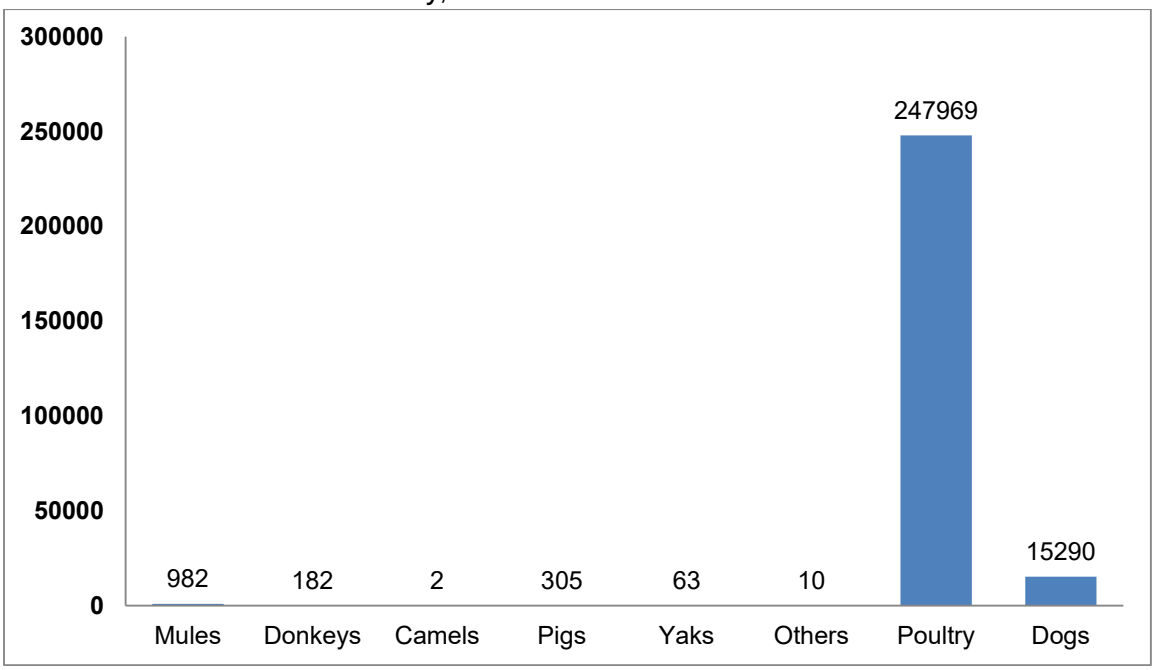


Graph showing Livestock census in District Solan

Table showing other Livestock censuses in District Solan

Table showing Other Livestock censuses in District Solan							
Other Livestock							
Mules	Donkeys	Camels	Pigs	Yaks	Others	Poultry	Dogs
982	182	2	305	63	10	247969	15290

Source: Directorate of Animal Husbandry, HP



Graph showing other Livestock census in District Solan

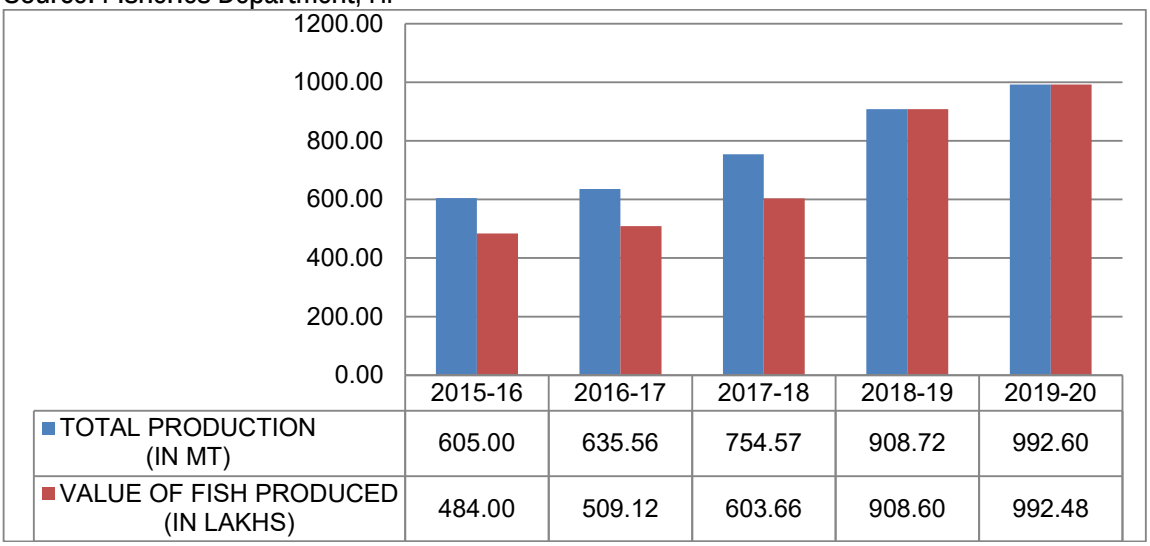
(6.4) FISHERIES

There is a vast network of perennial rivers, khads and streams in the district. Following prominent of fish, family are found in the rivers and streams of Solan district: The fisheries of the district comprises of natural fish fauna, inhabiting in the rivers and khads of the district, which are viz. Tor Putitora (Mahaseer), Schizothore Plagiostomus (Gulguli), Lebeodero (Gid), Labeo calbasu (Kalbans), Mastacembulus armatus (Bam), Channa Puntatus (Sal), Wallago attu (Malhi), Mystus seenghala (Singhara), Hetro peneustis fassilies (Singhi), Labeo dicheilus (Kunhi) and Cirohinus mrigala (Mori).

Table showing Annual Production of fisheries at District Solan

Table showing Annual Production of Fisheries at District Solan		
YEAR WISE	TOTAL PRODUCTION (IN MT)	VALUE OF FISH PRODUCED (IN LAKHS)
2015-16	605.00	484.00
2016-17	635.56	509.12
2017-18	754.57	603.66
2018-19	908.72	908.60
2019-20	992.60	992.48

Source: Fisheries Department, HP



Graph showing Annual Production of fisheries at District Solan

(6.5) FLORA

In Solan district the forest range from the scrub, sal and bamboo forest of the low hills to the fur and alpine forests of the higher elevation. The lowest point of the South Western boundary of the district is 270 meters above sea level and there are peaks of more than 2000 meter above the mean Sea Level. The forests grown between these two extremes vary with the elevation itself.

Tree

1. *Pinus roxhuighie*
2. *Mauotus philippnensis*
3. *Pyrus pashia*
4. *Emblica offcinalis*
5. *Acacia catechu*
6. *Terminalia tomentosa*
7. *Carissa opaca*
8. *Rubus ellipticus*
9. *Myrsina afericana*

10. Colebrookia oppoitifolia
11. Murraya koiniggii
12. Adhatoda vassica
13. Zicyplnis jujube
14. Mnrraya koenigii
15. Adhotoda vasica

Table showing the most prominent varieties of trees in the area

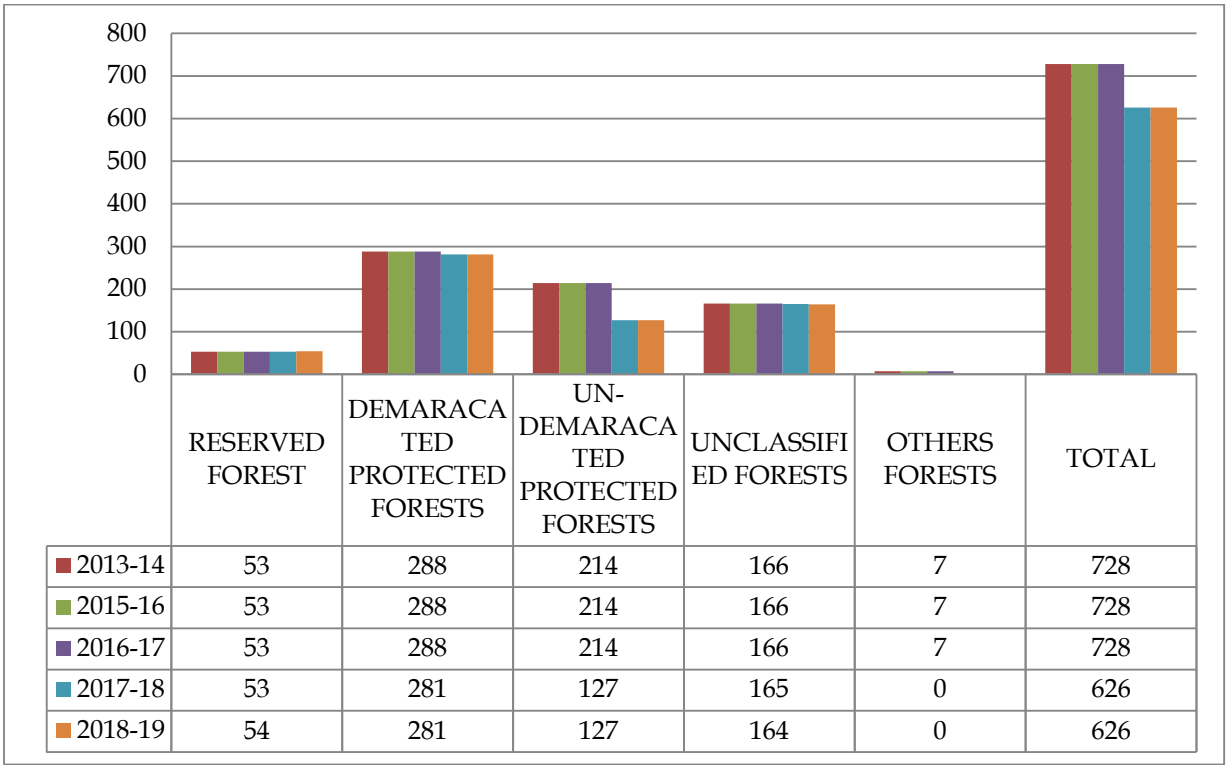
Mango	(Magni feraindica)
Tali	(Dalbergia sisoo))
Pipal	(Ficus religiosa)
Behul	(Grewia oppsitifolia)
Chil	(Pinus Rose burghi)
Simbal	(Bombere malabaricum)
Tuni	(Cedrcla toana)
Jamun	(Engenia jambolana
Bamboo	
Brah	
Tos	
Broadleaf species	
Ber and other bushes	

Table showing Classification of Forest Area (in sq.km) in District Solan

Table showing Classification of Forest Area (in sqkm) of District Solan

YEAR	RESERVED FOREST	DEMARCATED PROTECTED FORESTS	UN-DEMARCATED PROTECTED FORESTS	UNCLASSIFIED FORESTS	OTHERS FORESTS	TOTAL
2013-14	53	288	214	166	7	728
2015-16	53	288	214	166	7	728
2016-17	53	288	214	166	7	728
2017-18	53	281	127	165	…	626
2018-19	54	281	127	164	…	626

Source: Forest Department, HP



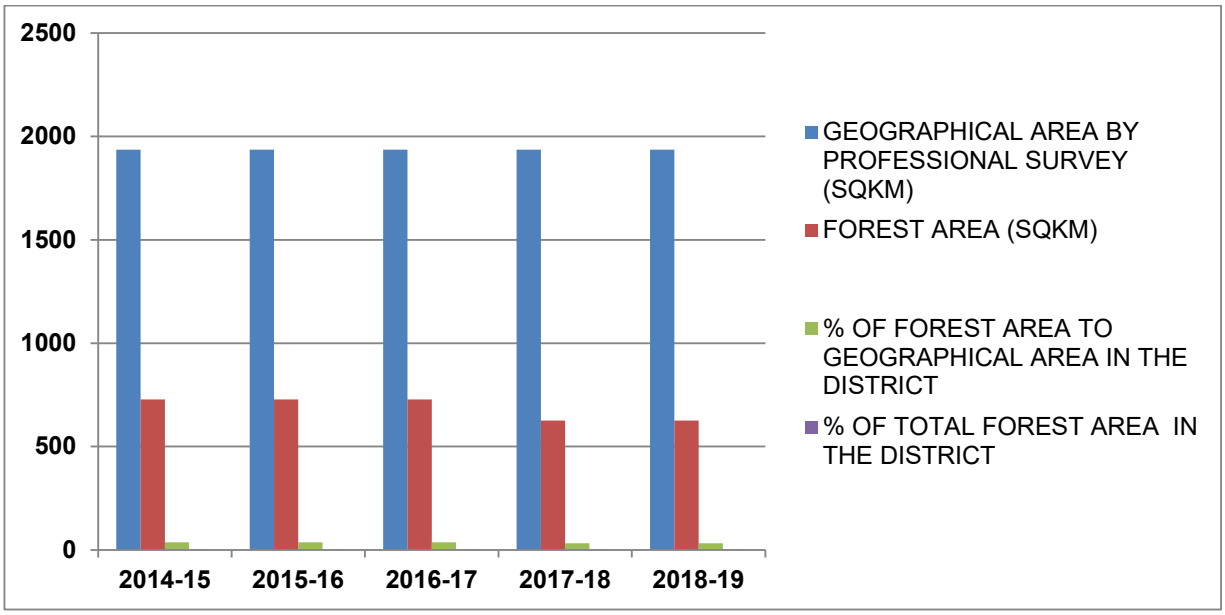
	RESERVED FOREST	DEMARACATED PROTECTED FORESTS	UN-DEMARACATED PROTECTED FORESTS	UNCLASSIFIED FORESTS	OTHERS FORESTS	TOTAL
2013-14	53	288	214	166	7	728
2015-16	53	288	214	166	7	728
2016-17	53	288	214	166	7	728
2017-18	53	281	127	165	0	626
2018-19	54	281	127	164	0	626

Graph showing Classification of Forest Area (in sqkm) in District Solan

Table showing Geographical forest area (in sq.km.) of district

Table showing Forest Area of District Solan				
YEAR	GEOGRAPHICAL AREA BY PROFESSIONAL SURVEY (SQKM)	FOREST AREA (SQKM)	% OF FOREST AREA TO GEOGRAPHICAL AREA IN THE DISTRICT	% OF TOTAL FOREST AREA IN THE DISTRICT
2014-15	1936	728	37.6	2
2015-16	1936	728	37.6	2
2016-17	1936	728	37.6	2
2017-18	1936	626	32.33	1.65
2018-19	1936	626	32.33	1.65

Source: Forest Department, HP



Graph showing Geographical forest area in sq.km.) of district Solan

(6.6) FAUNA

Animals

Due to wide variations in the attitude, a large variety of fauna is available in the forests of the district.

The common animals:-

- Leopard (Bagher)
- Hare
- Wild Bore (Jangli Soor)
- Jackal
- Barking Deer (Kakkar)
- Monkey
- Sambar
- Pig

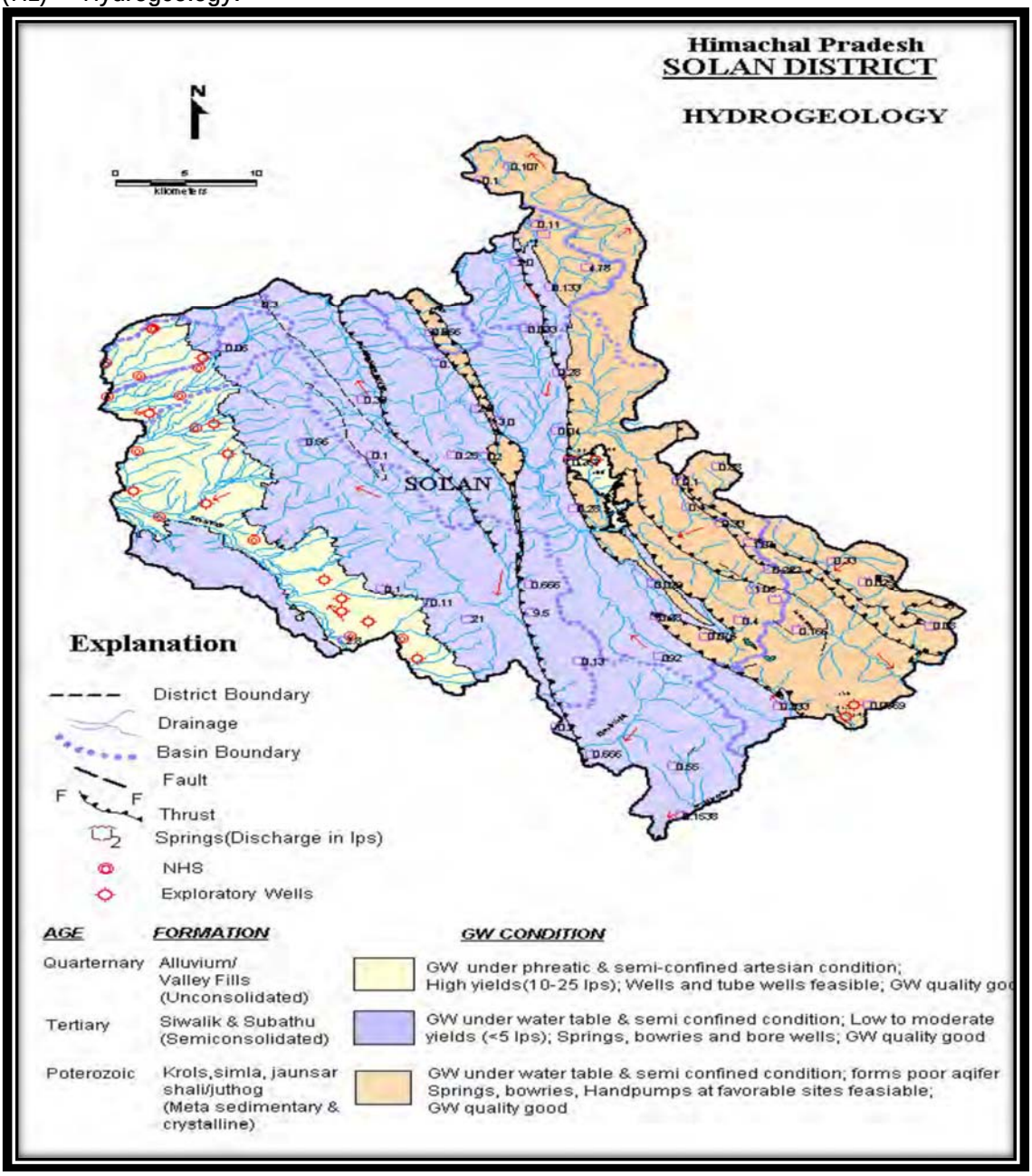
Birds: -

In the Habban, Rajgarh and Sarahan ranges, plenty of beautiful birds like monal are available. The Koklas are found in the Deodar and sometimes in fir forests and prefer moist wooded forests with under growth. Following are the common birds in the district:-

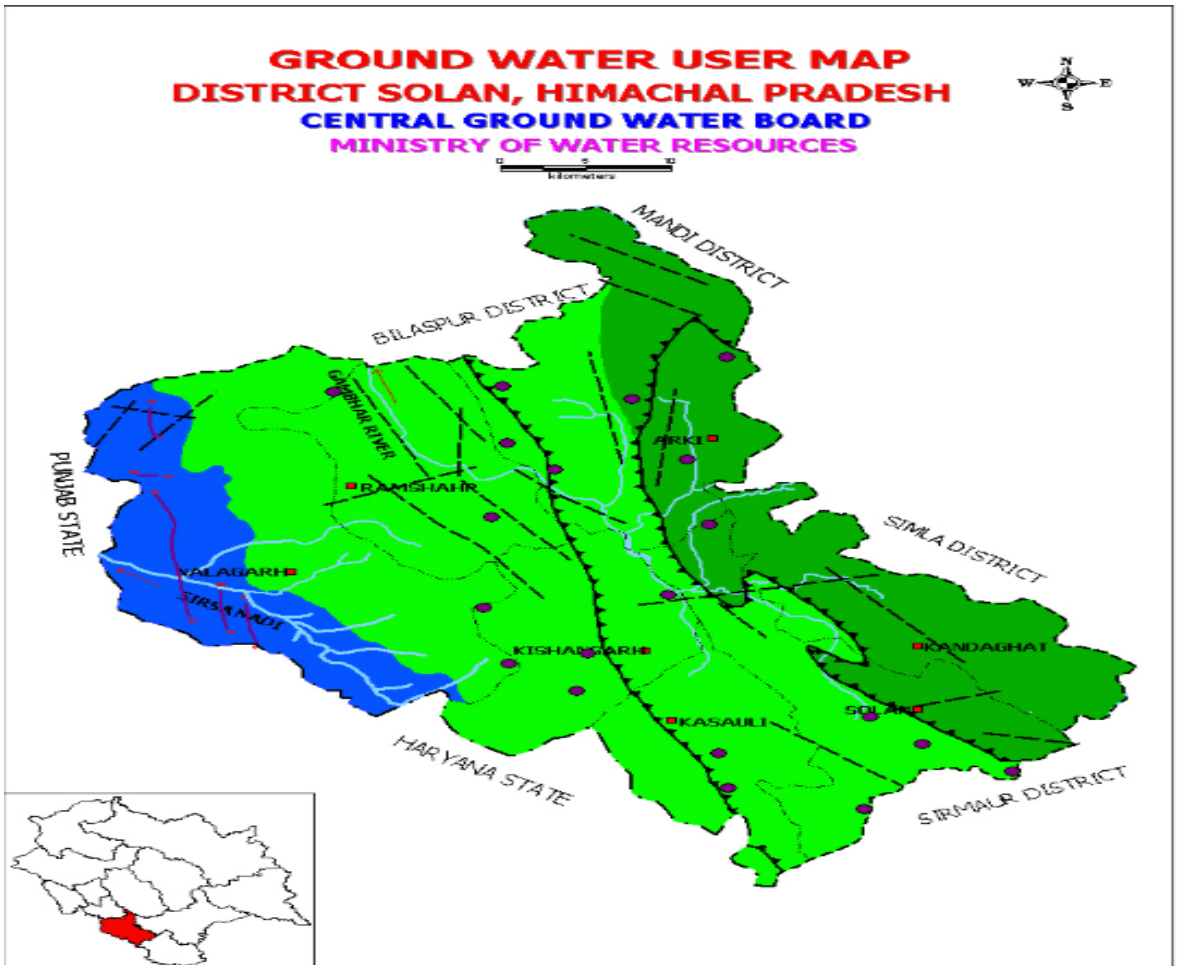
- Chakor
- Crow
- Red Jungle Fowl (Jangli Murga)
- Black Partridge (Kala Titar)
- Grey Partridge (Safed Titar)
- Woodpecker
-

7 SURFACE WATER AND GROUND WATER SCENARIO OF THE *DISTRICT*

(7.1) Hydrogeology:-



Geologically, the area is underlain by formations ranging in age from Quaternary to PreCambrain. Phyllite, slate, quartzite, limestone, schist, dolomites, granite and gneisses constitute the older (hard rocks) formations. The valley fills deposits in the district which represent the Quaternary deposits and are restricted in the western part of Bagheri – Kherachak – Baddi area. Major part of the area is covered by Shiwaliks & Tertiary group of rocks. The district can be divided into porous and fissured formations. Ground water occurs under water table to semiconfined condition in porous formations with depth to water level varies from near ground level to more than 30 m bgl mainly in valley fill/ alluvial areas. In fissured formations, springs are the major source of water supply. Springs located along major thrust/ faults (structurally weak planes) are high yielding.



Ground Water User Map

Legend

District Solan

	Wells feasible	Rigs suitable	Depth of Well (m)	Discharge (lpm)	Suitable artificial Recharge structures
Soft rock aquifers	Tube well	Percussion & Percussion cum Rotary	100-120	1200-2500	Check dam, Check dam cum ground water dam, Recharge shaft
	Dug well	Manual	10-20	300-500	
Hard rock aquifers	Tube well	DTH with Odex	100-150	1000-2000	
	Dug well	Manual	10-20	300-500	
	Spring development			30-2000	
Thrust			Fault/Lineament		
Water level contour (m bgl) (Pre monsoon decadal mean, 1993-2002)			Tehsil boundary		
Major drainage			District boundary		
Spring			State boundary		

Large numbers of hand pumps have been constructed by the state government for developing ground water in the district for domestic water supply. For ground water regime monitoring, CGWB has established 12 NHS in the district where ground water levels are monitored four times and ground water quality is monitored once in pre-monsoon period. Central Ground Water Board has so far drilled 15

exploratory wells in the district, ranging in depth from 65 to 300 m bgl. The discharge in the wells constructed ranges from 2 to 30 lps for drawdown between 2 to 24 m. The transmissivity value ranges from 11 to 1480 m2 / day. The ground water quality in the district is generally good with EC less than 1,000 μS/ cm. The ground water resources are estimated for the 230 sq. km valley area (Nalagarh valley) for the year 2004. The net annual ground water availability is 6,936.12 ha m against 718.30 ha m existing gross groundwater draft for irrigation. The stage of ground water development is 14.77 % and falls under "SAFE" category. 37 Heavy ground water development in irrigation sector and recently setup industrial areas in Solan district (Baddi/ Barotiwala) are likely to cause ground water depletion as well as pollution problem and thus there is need to adopt rainwater harvesting for augmenting ground water resources.

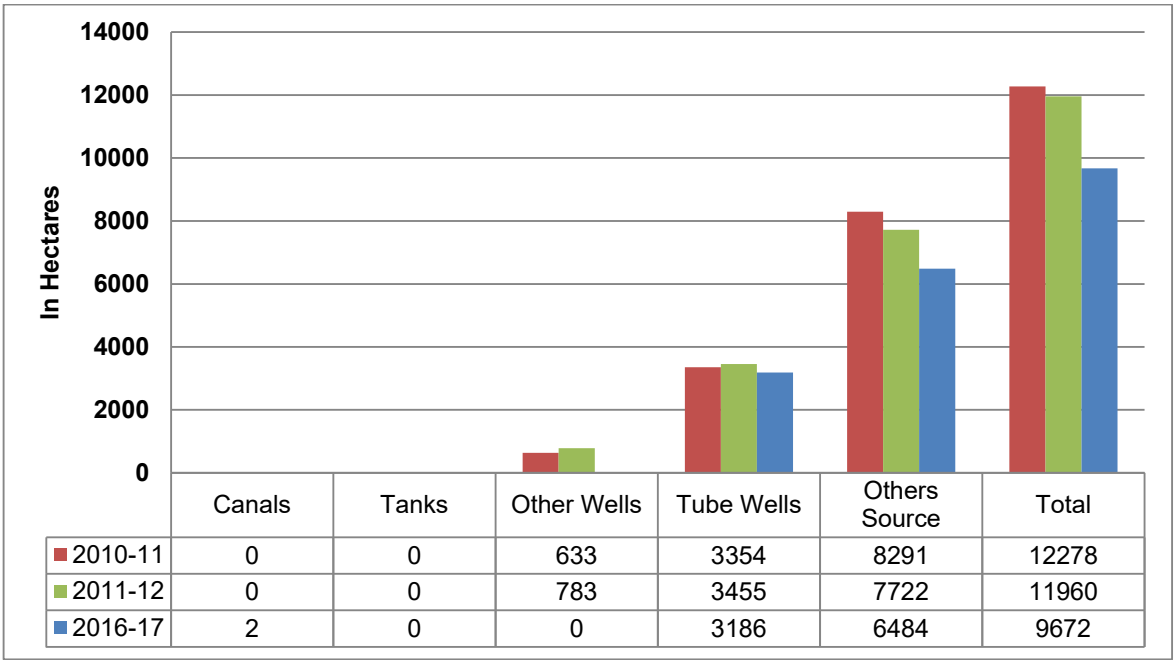
Roof top rain water harvesting structures and construction of check dam/ subsurface dam, recharge well/ shafts can be adopted as a measures for harvesting/ augmenting ground water resources in the district.

The water resources have mainly been divided into four viz, lift irrigation, tube well, kuhl and tank irrigation. These have been examined in terms of completed, functional, non-functional and ongoing. The irrigated area under irrigated schemes was about 2,668 ha, out of which Nalagarh block had the highest share. The number of villages covered and the beneficiaries were also the highest in this block. Tube well had little scope in the area. Kuhl were other major source of irrigation. In case of functional schemes, kuhl was the most important source. The actual irrigated area was about 1,000 ha. Lift irrigation was another major source of irrigation. The non-functional schemes were very few. But by making those functional about, 300 ha of land can be put under irrigation. There were few sites where different schemes of irrigation needed repair and maintenance. There was sufficient scope for increasing the area under irrigation which will help in increasing the land/ crop productivity in the blocks/ district. The potential area indicated that about 269 ha of land could be put under lift irrigation out of which 90 ha was in Kandaghat and 55 ha in Solan block. With the help of kuhl, 82 ha could be brought under irrigation.

Table showing Net Irrigated Area of District Solan by source (in hectares)

Table showing Net Irrigated Area of Solan by source (in Hectares)						
Year	Canals	Tanks	Other Wells	Tube Wells	Others Source	Total
2010-11	…	…	633	3354	8291	12278
2011-12	…	…	783	3455	7722	11960
2016-17	2	…	…	3186	6484	9672

Source: Directorate of Land Records, HP



	Canals	Tanks	Other Wells	Tube Wells	Others Source	Total
2010-11	0	0	633	3354	8291	12278
2011-12	0	0	783	3455	7722	11960
2016-17	2	0	0	3186	6484	9672

Graph showing Net Irrigated Area of District Solan by source (in hectares)

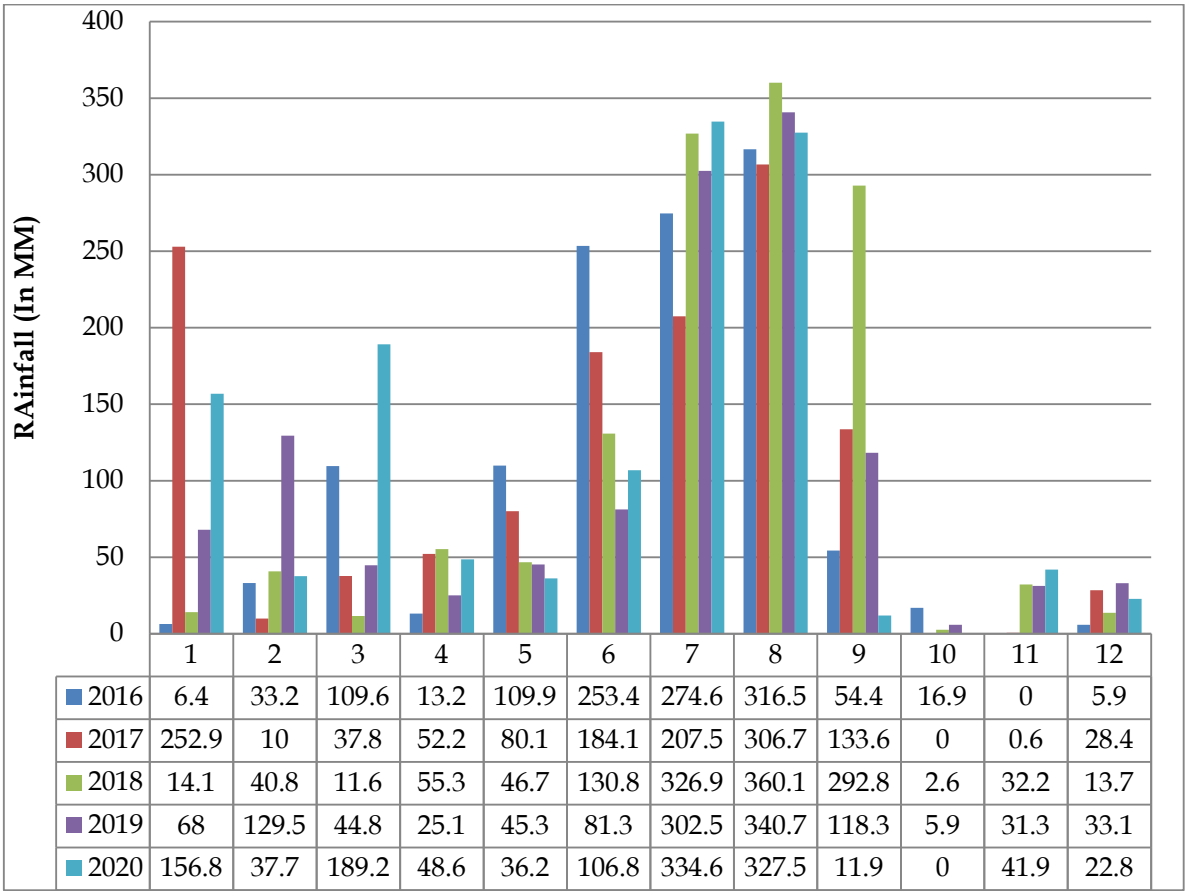
8 RAINFALL OF THE DISTRICT AND CLIMATIC CONDITIONS:-

(8.1) Rainfall:

Rainfall varies significantly with the altitude of the area. The catchment area receives rainfall due to western disturbances that pass over the north-western part of the country during the winter months. Significant precipitation in 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 2016 to 2020 in the district as per IMD.

Table showing annual rainfall data of District Solan

SOLAN DISTRICT RAINFALL IN MILLIMETERS (R/F)												
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F
2016	6.4	33.2	109.6	13.2	110	253.4	274.6	316.5	54.4	16.9	0	5.9
2017	252.9	10	37.8	52.2	80.1	184.1	207.5	306.7	133.6	0	0.6	28.4
2018	14.1	40.8	11.6	55.3	46.7	130.8	326.9	360.1	292.8	2.6	32.2	13.7
2019	68	129.5	44.8	25.1	45.3	81.3	302.5	340.7	118.3	5.9	31.3	33.1
2020	156.8	37.7	189.2	48.6	36.2	106.8	334.6	327.5	11.9	0	41.9	22.8



	1	2	3	4	5	6	7	8	9	10	11	12
2016	6.4	33.2	109.6	13.2	109.9	253.4	274.6	316.5	54.4	16.9	0	5.9
2017	252.9	10	37.8	52.2	80.1	184.1	207.5	306.7	133.6	0	0.6	28.4
2018	14.1	40.8	11.6	55.3	46.7	130.8	326.9	360.1	292.8	2.6	32.2	13.7
2019	68	129.5	44.8	25.1	45.3	81.3	302.5	340.7	118.3	5.9	31.3	33.1
2020	156.8	37.7	189.2	48.6	36.2	106.8	334.6	327.5	11.9	0	41.9	22.8

Average monthly rainfall data of the district Sirmaur from the year 2016 to 2020

(8.2) Climate of the Area

The region has three distinct seasons. The area experiences severe winter from October to Mid March followed by a summer season lasting from March to June. The area receives rainfall under the influence of the southwest monsoon from July to September end followed by the post-monsoon season lasting up to November.

The climate of the district is sub-tropical to temperate depending upon the elevation. Three major seasons are the winter season extending from Nov to Mid-March; the summer season from Mid March to June followed by the monsoon period extending from July to September end. Maximum precipitation in the form of rain occurs from July to September. The average annual rainfall in the district is about 3100 mm, out of which 90% occurs during the monsoon season. In the non-monsoon season, precipitation as snowfall also occurs in the higher reaches above 1500 m above MSL. During the winter period, rainfall also occurs in lower hills and valley parts. Mean maximum and minimum temperatures of 38°C and 1°C respectively.

Humidity is generally low throughout the year. During the summer season, humidity is lowest at 36%. During monsoon months, it goes as high as 80-90%. The highest levels of humidity are observed in the month of August. The average humidity during synoptic hours is 53% and 62% respectively. Snowfall is received in the higher reaches of the Dhauladhar ranges. The average minimum and maximum temperatures are 2°C and 45°C. The temperature in the area varies between maximum reaching 39 – 40 degrees Celsius in May – June and minimum being recorded at 2-5 degrees Celsius in December – January.

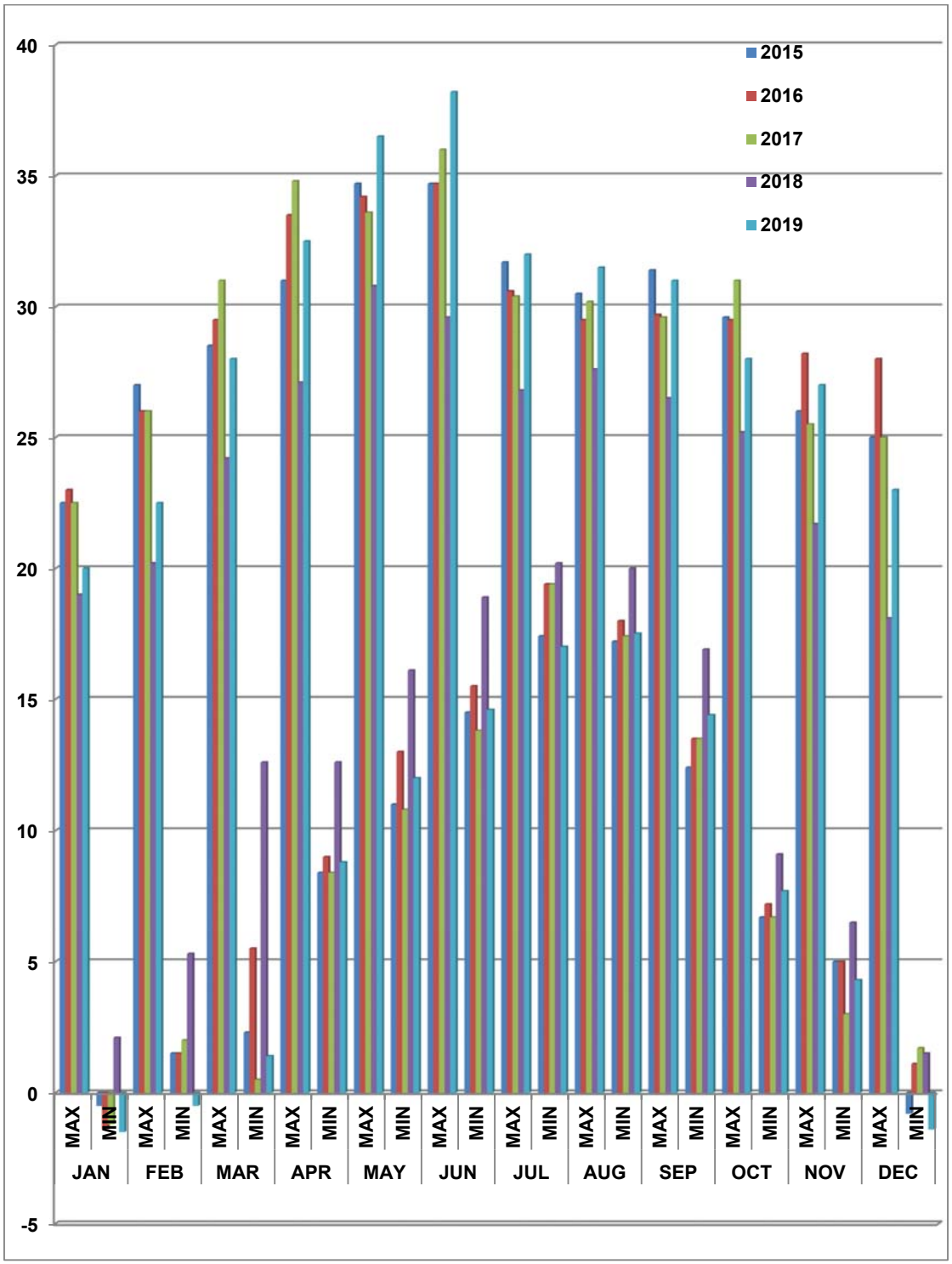
Table showing the climate of the district

Table showing Maximum & Minimum Temperature of District Solan
(Meteorological Centre-Nauni)

Month	Year	2015	2016	2017	2018	2019
JAN	MAX	22.5	23	22.5	19	20
	MIN	-0.5	-1.4	-1.2	2.1	-1.5
FEB	MAX	27	26	26	20.2	22.5
	MIN	1.5	1.5	2	5.3	-0.5
MAR	MAX	28.5	29.5	31	24.2	28
	MIN	2.3	5.5	0.5	12.6	1.4
APR	MAX	31	33.5	34.8	27.1	32.5
	MIN	8.4	9	8.4	12.6	8.8
MAY	MAX	34.7	34.2	33.6	30.8	36.5
	MIN	11	13	10.8	16.1	12
JUN	MAX	34.7	34.7	36	29.6	38.2
	MIN	14.5	15.5	13.8	18.9	14.6
JUL	MAX	31.7	30.6	30.4	26.8	32
	MIN	17.4	19.4	19.4	20.2	17
AUG	MAX	30.5	29.5	30.2	27.6	31.5

	MIN	17.2	18	17.4	20	17.5
SEP	MAX	31.4	29.7	29.6	26.5	31
	MIN	12.4	13.5	13.5	16.9	14.4
OCT	MAX	29.6	29.5	31	25.2	28
	MIN	6.7	7.2	6.7	9.1	7.7
NOV	MAX	26	28.2	25.5	21.7	27
	MIN	5	5	3	6.5	4.3
DEC	MAX	25	28	25	18.1	23
	MIN	-0.8	1.1	1.7	1.5	-1.4

Source: Meteorological Department, Govt. of India



Average monthly temperature of the district Solan from the year 2015 to 2019

9 DETAILS OF THE MINING LEASES IN THE DISTRICT:

Table showing list of mining leases granted

Sr. No.	Name and Address of Leases	Khasra No./ Location (in Mauza/ Mohal)	Area (Hectare / Bighas)	Type of (River Bed/Hill Slope)	Period in Years	Purpose (Open sale/ Stone Crusher)	Geo-Coordinates	Approved Quantity Per Annum in MT
1	Shri Hari Krishan Sharma S/o Shri Laxmi Dutt Sharma, Village Tikkar, P.O. Salogra, Tehsil & District Solan	205, 206, 217/2, 218/2 and 220 (Deothi)	5-14 bighas	Hill Slope	05.07.2019 to 04.07.2024	Open Sale	Longitude 77^0 0' 34" E Latitude 30^0 56' 17" N	1954 During the first year and 2205 MT in the last year
2	Shri Dev Raj S/o Late Shri Sita Ram, Village Khadoli, P.O. Garkhal, Tehsil Kasauli, District Solan	32 (Sherla Kaneta)	09-18 bighas	Hill Slope	22.06.2019 to 21.06.2024	Open Sale	Longitude 76^0 53' 45.8" E Latitude 31^0 57' 02" N	8134
3	Shri Amit Sharma S/o Shri Heera Nand Sharma, Village Korron, P.O. Kumarhatti, Tehsil & District Solan	331 and 332 (Korron)	15-04 bighas	Hill Slope	16.09.2019 to 15.09.2024	Open Sale	Longitude 77^0 03' 42.05" E Latitude 30^0 56' 10.4" N	15990
4	Shri Amit Bindal, Prop. M/s Deothal Sand Mine,Tehsil & District Solan	130, 131 and 132 (Deothi)	09-13 bighas	Hill Slope	20.07.2020 to 19.07.2025	Open Sale	Longitude 77^0 02' 34.9" E Latitude 30^0 56'10.4" N	18509

5	Shri Ramesh Mehta, Village Kothi, P.O. Ghatti, Tehsil & District Solan (H.P.)	132/4 and 164/46 (Lavi-Khurd)	07-14 bighas	Hill Slope	06.05.2020 to 05.05.2025	Open Sale	Longitude 77^0 4' 30.02" E Latitude 30^0 54' 57.28" N	13680
6	Shri Praveen Thakur, Village Dharon-Ki-Dhar, P.O. Kotla, Tehsil & District Solan (H.P.)	132/4 and 164/46 (Kadhari-Kalan)	08-09 bighas	Hill Slope	06.05.2020 to 05.05.2025	Open Sale	Longitude 77^0 09' 59.7" E Latitude 30^0 54' 41.9" N	14810
7	Shri Devender Singh S/o Shri Krishan Lal, Village Shilly, P.O. Damkari, Tehsil & District Solan (H.P.)	43 and 44 (Bajhlog)	06-01 bighas	Hill Slope	27.08.2021 to 26.08.2026	Open Sale	Longitude 77^0 08' 10.2" E Latitude 30^0 54' 55.1" N	113157
8	Shri Dalip Singh, Village and P.O. Basal, Tehsil & District Solan (H.P.)	86, 89 and 93 (Jokhari)	07-14 bighas	Hill Slope	27.08.2021 to 26.08.2026	Open Sale	Longitude 77^0 07' 41.64" E Latitude 30^0 57' 32.67" N	20519
9	Shri Vinod Thakur, Village and P.O. Basal, Tehsil & District Solan (H.P.)	291/1 and 298/1 (Basal Patti Jarash)	08-07 bighas	Hill Slope	17.07.2021 to 16.07.2026	Open Sale	Longitude 77^0 6' 0.45" E Latitude 30^0 55' 41.74" N	11960
10	Shri Lokesh Thakur (GPA holder)	10/1 (Rangah)	06-04 bighas	Hill Slope	10.09.2021 to 09.09.2026	Open Sale	Longitude 77^0 9' 51.10" E Latitude 30^0 52'	9063

	Shri Bhim Singh, Village Rangah, P.O. Oachghat, Tehsil & District Solan (H.P.)						10.20" N	
11	Shri Amit Bindal, Prop. M/s Shoolini Sand Mines, R/o Bindal Colony, Solan	12, 13 and 74/7 (Sihawala)	08-07 bighas	Hill Slope	18.09.2021 to 17.09.2026	Open Sale	Longitude 77^0 8' 8.40" E Latitude 30^0 56'5.82" N	10835
12	Shri Sushil Kumar, Prop. M/s Sharma Stone Provider, Village and P.O. Kakkarhatti, Tehsil & District Solan	197/111/88 (Raipur)	16-13 bighas	Hill Slope	11.11.2021 to 10.11.2026	Open Sale	Longitude 77^0 00' 57.28" Latitude 30^0 57' 08.54" N	65000
13	Shri Chatter Singh S/o Shri Daulat Ram, Village Top-Ki-Ber, P.O. Deothi, Tehsil and District Solan	256/208/1, 312/206/3/1/2 and 257/208/2 (Top-Ki-Ber)	09-02 bighas	Hill Slope	11.11.2021 to 10.11.2026	Open Sale	Longitude 77^0 02' 31.35" E Latitude 30^0 56' 9.79"N	17870
14	Shri Amit Bindal, Prop. M/s Bijeshwar Yellow Sand, R/o Bindal Colony, Solan	78 min and 78 min (Jokhari)	13-06 bighas	Hill Slope	12.12.2022 to 11.12.2027	Open Sale	Longitude 77^0 7' 43.42" E Latitude 30^0 56' 56.61" N	29686
15	Shri Virender Kumar, Village	309/1 and 310/1 (Kunhi)	07-14 bighas	Hill Slope	10.11.2021 to 09.11.2026	Open Sale	Longitude 76^0 56' 06.3" E Latitude	8000

	Kunhi, P.O. Ghanaghu ghat, Tehsil Arki, District Solan						31^0 11' 34.0" N	
16	Shri Naresh Kumar S/o Shri Puran Chand, Village Bawasi, P.O. Maan, Tehsil Arki, District Solan (H.P.)	203/70/1 (Bawasi)	13-00 bighas	Hill Slope	20.02.2023 to 19.02.2028	Open Sale	Longitude 76^0 54' 12.26" E Latitude 31^0 5'40.57" N	28838
17	Shri Naresh Kumar S/o Late Shri Tulsi Ram, Village Rachakra, P.O. Hanuman Barog, Tehsil Arki, District Solan (H.P.)	26/5/1 and 26/5/2 (Rachhakra)	06-00 bighas	Hill Slope	27.05.2023 to 26.05.2028	Open Sale	Longitude 76^0 55' 56.18" E Latitude 31^0 12' 50.68" N	10077
18	Smt. Ranjit Kaur D/o Shri Ranbir Singh, Vilage Saned, P.O. Bhattian, Tehsil Nalagarh, District Solan	358 and 364/2 (Aduwal Jandori)	16-06 bighas	Hill Slope	15.09.2020 to 14.09.2025	Open Sale	Longitude 76^0 41' 25.48" E Latitude 31^0 6' 53.82" N	27649
19	Smt. Veena Sharma W/o Shri Sandeep Sharma, Village Banoi Ram Singh,	93/5	02-50-18 bighas	Hill Slope	12.09.2023 to 11.09.2028	Open Sale	Longitude 76^0 55' 51.18" E Latitude 30^0 53' 30.53" N	215818

	P.O. Kot-beja, Tehsil Kasauli, District Solan (H.P.)							
20	Shri Ganesh Dutt Sharma, Prop. M/s Sharma stone crusher, Village Talona, P.O. Kakkarhatti, Solan	4 and 5 (Bughar Kaneta)	26-15 bighas	Hill Slope	03.11.2016 to 02.11.2026	Stone crusher	Longitude 76^0 55' 58.6" E Latitude 31^0 02' 21.5" N	16328
21	Kumar Rajinder, Prop. M/s Guru Parmeshwar Stone crusher, Village Gunai, P.O. Kot-beja, Tehsil Kasauli, District Solan	115/111/3 (Banoi Ram Singh)	50-00 bighas	Hill Slope	28.08.2015 to 27.08.2030	Stone crusher	Longitude 76^0 55' 08" E Latitude 30^0 53' 58" N	41384
22	Shri Ganesh Dutt Sharma, Prop. M/s Sharma stone crusher, Village Talona, P.O. Kakkarhatti, Solan	86 and 87/2 (Dhandu)	11-05 bighas	Hill Slope	11.11.2021 to 10.11.2026	Stone crusher	Longitude 76^0 46' 43" E Latitude 31^0 02' 00" N	113513
23	Shri Liaq Ram S/o Shri Matu Ram, Partner M/s Laxmi stone crusher,	33/2, 34/2. 125/35, 126/35, 36 and 37 (Badog)	35-13 bighas	Hill Slope	03.10.2017 to 02.10.2027	Stone crusher	Longitude 77^0 01' 47.7" E Latitude 30^0 46' 29.1" N	96000

	Village Manakpur, P.O. Majra, Tehsil Baddi, Solan							
24	Shri Pratap Thakur S/o Late Shri T.R. Thakur, Village and P.O. Kaba-kalan, Tehsil & District Solan (H.P.)	224/22 and 244 (Kaba-Dharguda)	15-05 bighas	Hill Slope	03.05.2021 to 02.05.2026	Stone crusher	Longitude 77^0 04' 15" E Latitude 30^0 50' 35" N	15822
25	Shri Balbir Mehta, Partner M/s Shri Krishna stone crusher, Village and P.O. Bhaguri, Tehsil Kasauli, District Solan (H.P.)	155 and 156 (Kotla)	07-8-16 bighas	Hill Slope	10.03.2022 to 09.03.2027	Stone crusher	Longitude 76^0 55' 24.60" E Latitude 30^0 56' 43.86" N	4632
26	Shri Mohan Lal Mehta, Prop. M/s Vishawkarma Hard stone crusher, Village Khali, P.O. Kumarhatti, Tehsil & District Solan (H.P.)	1 and 96/3 (Bayla Balau)	21-11 bighas	River bed	24.06.2022 to 23.06.2027	Stone crusher	Longitude 77^0 00' 23.4" E Latitude 30^0 51' 07.5" N	8100
27	Smt. Ranjana Kalia, Prop. M/s Shiva stone	41 (Kayal Manjhali)	31-19 bighas	Hill Slope	13.12.2022 to 12.12.2037	Stone crusher	Longitude 76^0 55' 58.39" E Latitude 31^0 03' 08.44" N	38810

	crusher, Ward No. 1 Arki, Tehsil Arki, District Solan (H.P.)							
28	Sh. Tarsem Bharti, Prop. M/s Jagdamba stone crusher Unit-II, VPO Shoghi, Tehsil & Distt. Shimla (H.P.)	134/106/2 (Chund)	27-00 bighas	Hill Slope	08.08.2014 to 07.08.2024	Stone crusher	Longitude 77^0 04' 18.9" E Latitude 31^0 01' 48.6" N	44000
29	Shri Hamender Chandel, Prop. M/s Bajrang stone crusher, R/o Pawan Kunj, Village Lachog, P.O. Anji Brahmana, Tehsil Kandaghat, Solan	589/1 (Neri)	0.9933 Hectare	Hill Slope	23.11.2016 to 22.11.2031	Stone crusher	Longitude 77^0 02' 18.5" E Latitude 31^0 01' 59.9" N	21071
30	Smt. Suman Chandel, Prop. M/s Lakshmi stone crusher, Village Lachog, P.O. Anji Brahmana, Tehsil Kandaghat, Solan	443/147/1 (Lacchog)	24-09 bighas	Hill Slope	03.08.2017 to 02.08.2032	Stone crusher	Longitude 77^0 05' 37.0" E Latitude 31^0 01' 54.2" N	31000
31	Shri Ramesh Chand, Prop. M/s Ramesh	191/97/2 (Barghyana)	25-11 bihas	Hill Slope	01.03.2018 to 28.02.2028	Stone crusher	Longitude 77^0 01' 27.97" E Latitude 31^0 01'	20365

	stone crusher, Village Kathar, P.O. Basal, Tehsil and District Solan						23.20" N	
32	Shri Meena Ram Thakur, S/o Shri Ram Lal, Village Majhoti, P.O. Bharti, Tehsil and District Solan (H.P.)	163/83/3 (Kayasu)	14-00 bighas	Hill Slope	27.01.2022 to 26.01.2032	Stone crusher	Longitude 77^0 01' 00.34" E Latitude 31^0 01' 55.68" N	13000
33	Sh. Vinod Sharma, Prop. M/s Ambey stone crusher, V.P.O. Bhumti, Tehsil Arki, Solan	3 and 4 (Iqua-Kaneta)	14-19 bigha	Hill Slope	18.02.2010 to 17.02.2025	Stone crusher	Longitude 76^0 55' 25" E Latitude 31^0 06' 35" N	8387
34	Smt. Ranjana Kalia, Prop. M/s Shiva stone crusher, Ward No. 1 Arki, Tehsil Arki, District Solan (H.P.)	`1/1 (Chhoi)	24-02 bighas	River bed	15.06.2009 to 14.06.2024	Stone crusher	Longitude 76^0 56' 03.2" E Latitude 31^0 04' 00.1" N	32258
35	Shri Ramesh Thakur S/o Shri Nathu Ram, Village Deothal, P.O. Kunhar Tehsil Arki	26/2 and 27/2 (Devthal)	23-08 bighas	Hill Slope	11.11.2016 to 10.11.2031	Stone crusher	Longitude 76^0 53' 47.4" E Latitude 31^0 11' 14.1" N	17324

36	Smt. Kuldeep Kaur, Prop. M/s Bharat stone crusher, Village Khanalag, P.O. Manjhu, Tehsil Arki, District Solan	195/155/127/2/1 and 195/155/127/2/2 (Khanalag)	07-08 bighas	Hill Slope	05.07.2019 to 04.07.2024	Stone crusher	Longitude 77^0 00' 28.8" E Latitude 31^0 08' 01.3" N	12375
37	Shri Devender Singh S/o Shri Harbhajan Singh, R/o Bothwell Lodge, IGMC Shimla	2, 3, 4, 5 7/2, 9 and 11 (Bhiali Nichli)	107-12 bighas	Hill Slope	05.07.2019 to 04.07.2034	Stone crusher	Longitude 76^0 51' 55.7" E Latitude 31^0 11' 38.8" N	5605
38	Shri Naresh Kumar S/o Shri Dhanu Ram, Village Dhart, P.O. Saryanj, Tehsil Arki, District Solan	59/3 (Dharth)	17-02 bighas	Hill Slope	10.10.2019 to 09.10.2024	Stone crusher	Longitude 76^0 53' 39.19" E Latitude 31^0 13'10.5" N	18800
39	Shri Naresh Kumar S/o Shri Dhanu Ram, Village Dhart, P.O. Saryanj, Tehsil Arki, District Solan	72/122 and 72/1/3 (Dharth)	13-05 bighas	Hill Slope	10.10.2019 to 09.10.2024	Stone crusher	Longitude 76^0 53' 31.9" E Latitude 31^0 12' 53.4" N	17520
40	Shri Vinod Sharma, Prop. M/s Ambey stone crusher,	22, 23 and 24 (Nanto)	01-98-07 Hectares	Hill Slope	18.08.2021 to 17.08.2036	Stone crusher	Longitude 76^0 55' 33.46" E Latitude 31^0 6' 2.35" N	48105

	Village & P.O. Batal, Tehsil Arki, District Solan (H.P.)							
41	Shri Brij Mohan Sharma, Prop. M/s Sharma stone crusher, Village & P.O. Bhumti, Tehsil Arki, District Solan (H.P.)	29/1 (Basantpur)	15-12 bighas	Hill Slope	21.09.2022 to 20.09.2027	Stone crusher	Longitude 76^0 54' 50.20" E Latitude 31^0 9' 53.42" N	22049
42	Shri Arun Thakur, Prop. M/s Shiva stone crusher, Village Khanalag, P.O. Manjhu, Tehsil Arki, District Solan (H.P.)	134/2 (Khanalag)	13-18 bighas	Hill Slope	31.01.2023 to 30.01.2028	Stone crusher	Longitude 77^0 00' 23.5" E Latitude 31^0 07' 52.0" N	15878
43	Smt. Kuldeep Kaur, Prop. M/s Bharat stone crusher, Village Khanalag, P.O. Manjhu, Tehsil Arki, District Solan	126 (Khanalag)	08-18 bighas	Hill Slope	14.06.2023 to 13.06.2028	Stone crusher	Longitude 77^0 0' 28.71" E Latitude 31^0 7'58.47" N	5826
44	Sh. Navdesh Passi, Partner M/s Himachal Grit Udyog,	95 and 96/2 (Vidhi)	13 bigha	Hill Slope	09.06.2011 to 08.06.2026	Stone crusher	Longitude 76^0 55' 9.40" E Latitude 30^0 54' 40.74" N	38250

	Village Sansiwala, P.O. Barotiwala							
45	Shri Jitender Singh, Prop. M/s Singh stone crusher, Village Katha, P.O. & Tehsil Baddi, District Solan	721/3 and 641/2 (Tipra)	16-13 bighas	Hill Slope	04.08.2017 to 03.08.2027	Stone crusher	Longitude 76^0 52' 26.00" E Latitude $30^0$55'0.00" N	60750
46	Shri Anil Bansal, Prop. M/s Shiv stone crusher, Village Kattiwala, P.O. Mandhala, Tehsil Baddi, District Solan (H.P.)	336, 337/1, 339 and 340 (Dhauler)	16-17 bighas	Hill Slope	16.08.2017 to 15.08.2032	Stone crusher	Longitude 76^0 54' 16.56" E Latitude 30^0 54' 18.12" N	56330
47	Shri Anil Bansal, Prop. M/s Shiv stone crusher, Village Kattiwala, P.O. Mandhala, Tehsil Baddi, District Solan (H.P.)	73/2, 3, 4, 6, 7, 8, 9, 10 and 11/2 (Gurdasspura)	18-12 bighas	Hill Slope	04.09.2017 to 03.09.2032	Stone crusher	Longitude 76^0 53' 27.06" E Latitude 30^0 54' 32.70" N	26000
48	Shri Gurmeet Singh, Prop. M/s Gurmeet stone crusher, Village Sauri Bhumia,	679, 742 and 932 (Reru Uperla)	55-00 bighas	River bed	21.06.2019 to 20.06.2024	Stone crusher	Longitude 76^0 42' 19.33" E Latitude 31^0 04' 05.57" N	50625

	P.O. & Tehsil Nalagarh							
49	Shri Lachmi Chand, Prop. M/s Naina stone crusher, Village Raipur Jakholi, P.O. Lodhimajra, Tehsil Nalagarh, District Solan (H.P.)	873, 874, 892/1, 1 min and 1 (Tikkari, Bohri and Amb-Da-Har)	224-00 bighas	River bed	18.10.2019 to 17.10.2024	Stone crusher	Longitude 76^0 38' 27" E Latitude 31^0 12' 37" N	68796
50	Shri Mohan Singh, Prop. M/s Jai Mata stone crusher, Village Nawangram, P.O. Jhajra, Tehsil Nalagarh, District Solan (H.P.)	45, 46, 47, 48 and 49 (Chak)	16-15 bighas	Hill Slope	11.08.2020 to 10.08.2025	Stone crusher	Longitude 76^0 37' 19.5" E Latitude 31^0 09' 56.2" N	29628
51	Smt. Neelam Chandel, Prop. M/s Changer stone crusher, Village Androla Uperla, P.O. Panjhera, Tehsil Nalagarh, District Solan (H.P.)	112/104/9 and 8 (Plasra Kalu)	14-11 bighas	Hill Slope	11.08.2020 to 10.08.2025	Stone crusher	Longitude 76^0 43' 53.5" E Latitude 31^0 04' 23.1" N	52063
52	Smt. Roshani Devi, Prop.	353, 354, 355, 356, 358, 359 and 360 (Deoli)	39-12 bighas	Hill Slope	13.08.2020 to 12.08.2	Stone crusher	Longitude 76^0 37' 35.7"	43300

	M/s Thakar Rohani stone crusher, Village Nawangram, P.O. Jhajra, Tehsil Nalagarh, District Solan (H.P.)				025		Latitude 31^0 09' 24.2"	
53	Shri Gaurav Kumar, GPA holder of Smt. Shashi Adlakha, Prop. M/s Jai Naina Devi stone crusher, Village Berson, P.O. Manjholi, Tehsil Nalagarh, District Solan (H.P.)	795/736/308 (Beli-Khol)	53-00 bighas	River bed	22.12.2020 to 21.12.2025	Stone crusher	Longitude 76^0 36' 48.7" E Latitude 30^0 02' 58.7" N	250000
54	Smt. Madhuri Saini, Prop. M/s Manjholi stone crusher, Village Berson, P.O. Manjholi, Nalagarh, Solan	266/205/1, 266/205/2, 322/5, 6, 261, 274, 278, 280, 44/2/2, 189/1, 190, 191, 192/2, 195/1, 186, 187/1, 193/1 and 13/2 (Bella, Mandyarpur, Dandi Harnam, Naharsingh, Kheri)	682-06	River bed	19.02.2021 to 18.02.2026	Stone crusher	Longitude 76^0 40' 10.2" E Latitude 31^0 01' 34.9" N	15636
55	Shri Navdesh Passi, Jitender Singh, Prop. M/s Himachal Grit	1496, 1497, 1498, 1499, 1502, 1503, 1507, 1511, 1513, 1514, 1515, 1516, 1517, 1519, 1520, 1521 and 1525 (Kalyanpur)	24-19 bighas	River bed	01.03.2021 to 29.02.2036	Stone crusher	Longitude 76^0 50' 06.1" E Latitude 30^0 56' 21.4" N	38250

	Udyog, M/s Singh stone crusher, Village Sansiwala, P.O. Barotiwala, Tehsil Baddi, District Solan (H.P.)							
56	Shri Surjeet Singh, Navdesh Passi, Jitender Singh, Partner M/s Gupta stone crusher, M/s Himachal Grit Udyog, M/s Singh stone crusher, Village Haripur Sandholi, P.O. and Tehsil Baddi, District Solan (H.P.)	185, 188, 189, 190, 191, 192, 193, 194, 195, 196, 198, 200 and 201 (Bhatoli-Kalan)	25-07 bighas	River bed	09.08.2021 to 08.08.2036	Stone crusher	Longitude 76^0 46' 42.7" E Latitude 30^0 55' 45.1" N	41625
57	Shri Bidhi Chand, Prop. M/s Nalagarh stone crusher & M/s R.P. Enterprises, Village Nayagram, P.O. Jhajra, Tehsil Nalagarh, District Solan	130/2/2/2/2 min, 130/2/2/2/2 min, 535, 580, 772/636, 85 min, 85 min, 41/4, 42/4, 35 min and 35 min (Taprian, Baghlehar and Baniala and Kharuni)	1054-00 bighas	River bed	01.10.2021 to 30.09.2026	Stone crusher	Longitude 76^0 40' 58.9" E Latitude 31^0 09' 33.6" N	522000

	(H.P.)							
58	Shri Ram Kumar, Prop. M/s Rama and M/s Kundlas stone crusher, Village and P.O. Haripur Sandholi, Tehsil Baddi, Solan	160/1, 160/2, 493/1, 493/2, 98/1, 98/2, 1458/99/1 and 99/2 to 6/1, 1458/99/2 and 99/2 to 6/2, 102/2, 1296/1190/474/1 and 1296/1190/474/2 (Daso Majra, Khol, Bhud and Malpur)	704-05 bighas	River bed	01.10.2021 to 30.09.2026	Stone crusher	Longitude 76^0 46' 29.85" E Latitude 30^0 56' 35.47" N	69120
59	Shri Himanshu Sharma, Prop. M/s Lakhwinder stone crusher, Village Bhogpur, P.O. Dolowal, Tehsil Nalagarh, District Solan	180/2 (Aduwal Jandori)	30-02 bighas	River bed	15.02.2022 to 14.02.2027	Stone crusher	Longitude 76^0 41' 00.21" E Latitude 31^0 06' 43.34" N	20000
60	Smt. Ranjit Kaur, Prop. M/s Tripti stone crusher, Village Nayagram, P.O. Jhajra, Tehsil Nalagarh, District Solan (H.P.)	1/2 and 89 (Behali)	47-05 bighas	River bed	10.01.2022 to 09.01.2027	Stone crusher	Longitude 76^0 38' 2.8" E Latitude 31^0 09' 54.8" N	19320
61	Smt. Asha Rani Dang, Partner M/s Shri Krishan stone crusher, Village Swaraj Majra,	349/49 min, 131, 349/49/2 min, 1227/1228/1106/225/2/2/2/2, 1227/1228/1106/225 min, 1155/648/2, 63/2, 203/2, 905/500 (Kenduwal, Baddi-Sheetalpur, Landewal and Kalyanpur)	896-07 bighas	River bed	03.02.2022 to 02.02.2027	Stone crusher	Longitude 76^0 47' 27.4" E Latitude $30^0$54' 48.4" N	132750

	P.O. & Tehsil Baddi, District Solan (H.P.)							
62	Shri Rahul Sharma, Prop. M/s Babaji stone crusher, Village Saned, P.O. & Tehsil Ramshegar, District Solan (H.P.)	42/1 (Radog)	45-14 bighas	River bed	22.04.2022 to 21.04.2027	Stone crusher	Longitude 76^0 52' 15.0" E Latitude 31^0 07' 41.7" N	65700
63	Shri Sunil Garg, Prop. M/s Shiv Bhawani stone crusher, VPO Dabhota, Tehsil Nalagarh	1923/1/1, 2265/1539/2, 1804/2, 904/843/3/1, 856/180/1 and 199/1 (Ratyod and Bhangla)	270-02 bighas	River bed	09.05.2022 to 08.05.2027	Stone crusher	Longitude 76^0 39' 37.20" E Latitude 31^0 06' 22.54" N	57000
64	Smt. Bhupender Kaur, Village and P.O. Haripur Sandholi, Tehsil Baddi, District Solan (H.P.)	924, 925, 926, 927, 928, 931, 932, 933 and 936 (Malpur)	07-10 bighas	Hill Slope	06.09.2022 to 05.09.2027	Stone crusher	Longitude 76^0 47' 04.9" E Latitude 30^0 56' 33.8" N	15995
65	Shri Kulwant Singh, Partner M/s Saini Grit Udyog, Village Nayagram, P.O. Panjhera, Tehsil Nalagarh,	328/1, 391/328/2, 226/152/1/1, 152/1/2, 22, 207/43, 44, 21/2 and 212/45 (Seri, Bhimia and Souri)	352-09 bighas	River bed	13.09.2022 to 12.09.2027	Stone crusher	Longitude 76^0 42' 22.8" E Latitude 31^0 03' 58.8" N	216000

	District Solan (H.P.)							
66	Shri Gurcharan Singh, Prop. M/s Shiv Bhole stone crusher, Village and P.O. Haripur Sandholi, Tehsil Baddi, District Solan (H.P.)	2558/2024/2 (Kishanpura)	317-08 bighas	River bed	10.10.2022 to 09.10.2027	Stone crusher	Longitude 76^0 45' 04" E Latitude 30^0 57'59" N	113400
67	Shri Avtar Singh, Prop. M/s Saini stone crusher, Village Berson, P.O. Manjholi, Tehsil Nalagarh, District Solan	2, 6, 557/1 and 586/1 (Rampur)	315-06 bighas	River bed	10.10.2022 to 09.10.2027	Stone crusher	Longitude 76^0 37' 2.39" E Latitude 31^0 2' 54.71" N	120710
68	Shri Anchit Thakur, Prop. M/s Thakar Rohani stone crusher, Village Androla Uperla, P.O. Panjhera, Tehsil Nalagarh, District Solan (H.P.)	189/1 and 60 (Jhadian)	127-00 bighas	River bed	10.10.2022 to 09.10.2027	Stone crusher	Longitude 76^0 43' 12.5" E Latitude 31^0 03' 57.4" N	43300
69	Shri Rajesh Verma, Partner M/s Manpura stone	2250, 2251, 2245, 2246, 2248 and 2249 (Kishanpura)	15-09 bighas	Hill Slope	22.03.2023 to 21.03.2028	Stone crusher	Longitude 76^0 44' 11.0" E Latitude 30^0 58' 33.2" N	69158

	crusher, Village and P.O. Manpura, Tehsil Baddi, District Solan (H.P.)							
70	Shri Puneet Kaushal, Prop. M/s Shiwalik stone crusher, Village Gulabpura, P.O. Panjhera, Tehsil Nalagarh, District Solan (H.P.)	338, 339, 334, 340, 341, 337, 336, 364, 357 and 360 (Dhalathon)	17-04 bighas	Hill Slope	27.03.2023 to 26.03.2028	Stone crusher	Longitude 76.69883 Latitude 31.18267	21706
71	Shri Mohan Singh, Prop. M/s Jai Mata stone crusher, Village Nawangram, P.O. Jhajra, Tehsil Nalagarh, District Solan (H.P.)	43/1 (Dhalathon)	165-09 bighas	River bed	28.04.2023 to 27.04.2028	Stone crusher	Longitude 76^0 41' 21.5" E Latitude 31^0 10' 18.5" N	29628
72	Smt. Bimla Devi and Smt. Neelam Kumari, Prop. M/s Neelam stone crusher, Village Dhaulpur, P.O. Mandhala, Tehsil Baddi,	429 (Lakhanpur)	10-17 bighas	Hill Slope	29.05.2023 to 28.05.2028	Stone crusher	Longitude 76^0 40' 36.15" E Latitude 31^0 58' 46.31" N	15096

	District Solan (H.P.)							
73	Shri Rajinder Kumar, Prop. M/s Shubh stone crusher Screening Plant, Village Buranwala , P.O. Barotiwala, Tehsil Baddi, District Solan (H.P.)	33/2, 35/2 and 36 (Jungle-Silah)	58-14 bighas	Hill Slope	03.08.2023 to 02.08.2028	Stone crusher	Longitude 76^0 42' 32.92" E Latitude $31^0$10'40.01" N	85000
74	Shri Naveen Goyal, Partner M/s Ramsons stone crusher, Village and P.O. Manpura, Tehsil Baddi, District Solan	1560/364/1 (Manpura)	58-01 bighas	River bed	09.10.2023 to 08.10.2028	Stone crusher	Longitude 76^0 44' 49.40" E Latitude 30^0 58'57.12" N	4950
75	Shri Jitender Singh, Prop. M/s Singh stone crusher, Village Katha, P.O. & Tehsil Baddi, District Solan	1668/1, 1669/1 and 1714./1 (Bhatoli-Kalan)	61-06 bighas	River bed	09.10.2023 to 08.10.2028	Stone crusher	Longitude 76^0 49' 39.30" E Latitude 30^0 56'4.50" N	60750
76	Smt. Sonal Sood, Prop. M/s Tashkent stone crusher,	116/71/17/1 (Barog)	24-04 bighas	Hill Slope	05.12.2023 to 04.12.2033	Stone crusher	Longitude 77^0 02' 10.16" E Latitude 30^0 46' 17.64" N	134000

	Village Narayani, P.O. Pratha, Tehsil Kasauli, District Solan							
77	Shri Amandeep Singh, Partner M/s Rana stone crusher, Village Kotla Kalan, P.O. Jhajra, Tehsil Nalagarh, District Solan (H.P.)	79/2 and 80 (Koti-Kalan)	12-18 bighas	Hill Slope	03.11.2023 to 02.11.2028	Stone crusher	Longitude 76^0 40' 49.21" E Latitude 31^0 11' 18.41" N	35705
78	Shri Mehar Singh Verma, Village and P.O. Manghu, Tehsil Arki, District Solan (H.P.)	1033/1,1046/1,1043 and 1044 Bhel	08-00 bighas	Hill Slope	19.12.2023 to 18.12.2028	Stone crusher	Longitude 76^0 54' 51.93" E Latitude 31^0 10' 28.50" N	8930
79	M/s Ambuja Cements Ltd., P.O. Darlaghat, Tehsil Arki, District Solan	Kashlog, Chakru, Serwala, Banjan, Patti, Banli, Badog, Banog, Rathoh, Mangoo, Chola, Gyana, Rauri, Sangoi, Serjeri and Ghamaru	488-08 Hectares	Hill Slope	28.05.1992 to 27.05.2012 Renewed for further term of 20 years i.e. upto 27.05.2032. Extension upto 27.05.2042	Limestone & Shale	Longitude 76^0 57' 47.51" E Latitude 31^0 15' 12.59" N	Limestone =7.59MTPA Shale=0.75 MTPA
80	M/s UltraTech Cement Ltd.,	Bagga, Bhalag, Samtyari & Sehnai	331-424 Hectares	Hill Slope	29.09.2007 to 28.09.2037.	Limestone & Shale	Longitude 76^0 53' 10.80" E Latitude	Lime stone =4.725 MTPA Shale

	Village Baga, P.O. Kandhar, Tehsil Arki, District Solan (H.P.)				Extension upto 28.09.2057		31^0 19' 8.38" N	=0.525 MTPA

10 DETAIL OF ROYALTY OR REVENUE RECEIVED IN DISTRICT SOLAN

In earlier times, the houses/ buildings were constructed in form of small dwellings with walls made up of mud plaster, stone and interlocking provided with wooden frames. There were negligible commercial as well as developmental activities resulting in less demand of building material. However with the passage of time, construction techniques changed and new vistas of developmental activities were started with modern construction techniques. As such the demand of minor minerals in the District started an increasing trend. Mainly three types of minor mineral constituents such as sand, stone and bajri are required for the modern construction/developmental activities apart from other material like cement and steel. In order to meet the requirement of raw material for construction, the extraction of sand, stone and bajri is being carried out exclusively from the river beds. The demand of sand is mainly met through by river borne sand whereas the demand of bajri/grit is either met through river borne collection or through manufactured grit by stone crushers. The demand of dressed or undressed stone is met through the broken rock material from the hill slope. The royalty received from major and minor minerals since 2019-20 onwards is tabulated in the following table.

Details of royalty or revenue received

S. No.	Year	Royalty in Crores
1	2019-20	75.87
2	2020-21	72.64
3	2021-22	84.85
4	2022-23	77.95

11 DETAIL OF PRODUCTION OF MINERALS

Mainly three types of minor mineral constituents such as sand, stone and bajri are required for the modern construction/developmental activities apart from other material like cement and steel. In order to meet the requirement of raw material for construction, the extraction of sand, stone and bajri is being carried out exclusively from the river beds. The demand of sand is mainly met through by river borne sand whereas the demand of bajri/grit is either met through river borne collection or through manufactured grit by stone crushers. The demand of dressed or undressed stone is met through the broken rock material from the hill slope. The production of the minor minerals since 2019-20 onwards is tabulated in the following table.

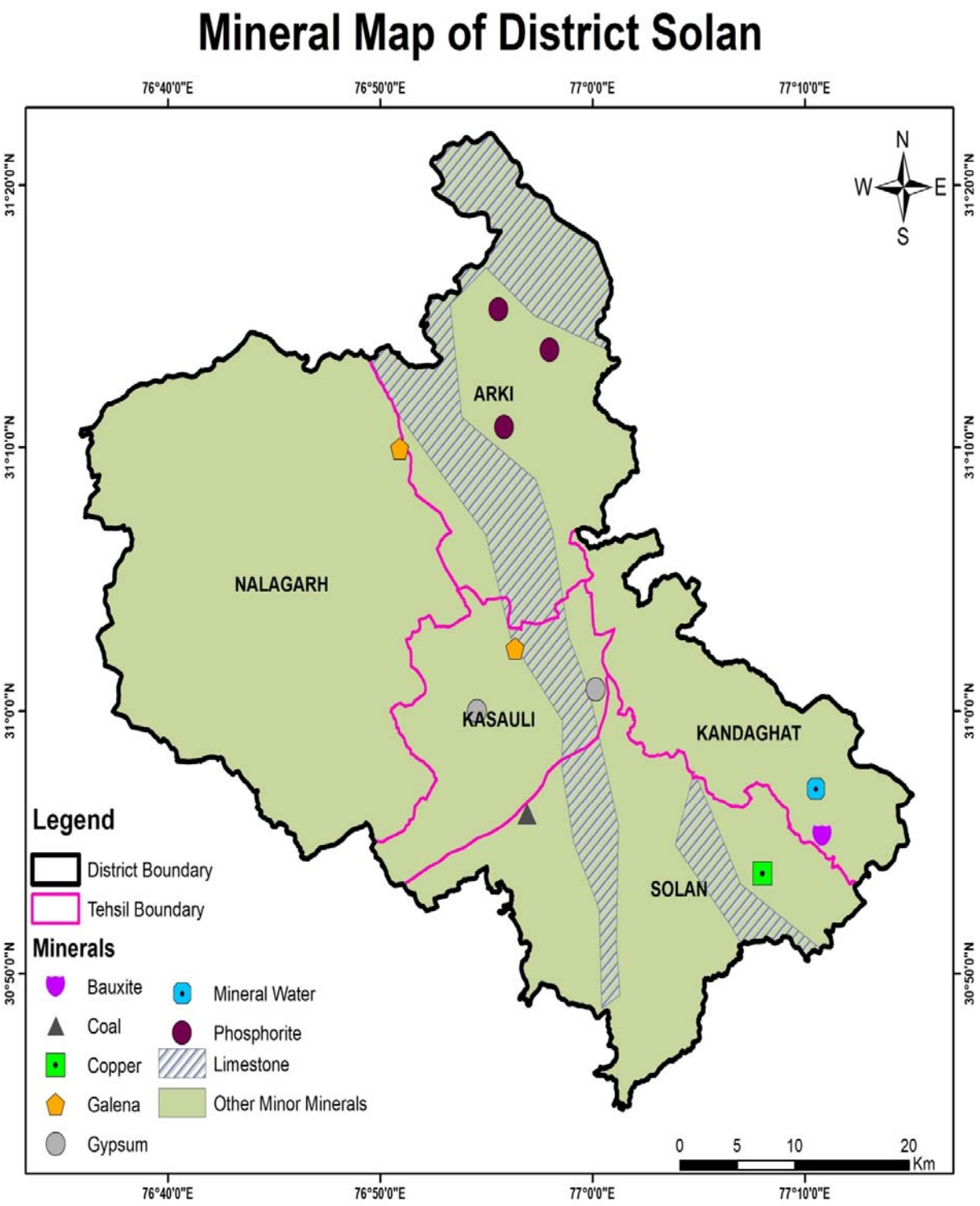
Details of Production of minor mineral

S. No.	Year	Production of Minor Mineral (in tonnes)
1	2019-20	577922
2	2020-21	720977
3	2021-22	1013321
4	2022-23	1299960

Details of Production of major mineral

S. No.	Year	Production of Major Mineral (in tonnes)
1	2019-20	8704528
2	2020-21	9057511
3	2021-22	9577897
4	2022-23	8791328

12 MINERAL MAP OF DISTRICT



13 LIST OF LETTER OF INTENT (LOI) HOLDERS IN DISTRICT SOLAN WITH VALIDITY

It is submitted that the department grants 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.

14 TOTAL MINERAL RESERVES AVAILABLE IN DISTRICT

The total limestone reserve of Solan district (as per Geological Survey of India) is about 1650 million tonnes. Apart from above, the all the other minor minerals are extracted in the district from the riverbeds as well as hill slopes. The riverbed deposits are always replenishable and the reserves vary depending upon many factors like rainfall, deposition of mineral etc. It is important to mention here that 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 applied for grant of mineral concessions 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 as such, the letter of intents are issued only after recommendations of the Joint Inspection Committee.

Further, the mineral potential is site specific and is calculated and year wise planning is done while preparing the mining plan of the area.

15 QUALITY /GRADE OF MINERAL AVAILABLE IN THE DISTRICT

(a) Bauxite:

In District Solan the Bauxite has been reported in Deothal area (30^0 51' : 77^0 10'). The Bauxite occurs as pisolitic ore having a thickness of 1 to 5 metres traceable for about 1.5 Km

.

(b) Barytes:

The Barrytes have been reported in District Solan near Subathu (30^0 58' : 76^0 59'), Haripur (31^0 01' : 76^0 59') and Sair (31^0 05' : 77^0 03'). The Barrytes occurs in lenticular bands.

(c) Copper:

An old Copper mine was in existence near Solan (30^0 55' : $77^0$07') in Shimla Group of formation.

(d) Gypsum:

Gypsum occurs in Eocne rocks about 3 Km to the South-East of Subathu (30^0 58' : 76^0 59'). Pockets of Gypsum occur in the area and in the nallas draining into Kuthar River from the western ridge 5 Kms. South-West of Subathu. The purple indurated clay of Dagshai near Dubrughat contains pockets of gypsum along the Bhakalag ($30^0$00' : 76^0 57') - Dhundan ($30^0$14' : 75^0 54') road.

(e) Mineral Water:

There are altogether 5 springs at Jaoni (31^0 32' : 77^0 50') the temperature of water is 55^0 C and water is clear with disagreeable sline and deposits ferruginous matter.

(f) Rock Phosphate:

The rock phosphate in Dati Deeb (30^0 12' 30" : 76^0 56' 30") occurs as pellets in the green facies rocks of Subathu Formation. The sandstone and limestone of A Formation of the Krol Group are found to be phosphatic in Deoria (30^0 50' 30" : 77^0 11' 15") area.

In Patta (31^0 21' 45" : 76^0 55' 45") and Rakhalong Dedo (31^0 10' 00" : 76^0 56' 40") areas, phosphatic nodules occur in the brown shales of Subathu Formation. The nodule varies in size upto 26 cm and contains 32% P_2O_5.

(g) Limestone:

(i) Arki Limestone Deposit:

The limestone belt of Arki is about 2Kms. NNW of Arki town, which is the Tehsil headquarter of Solan District, Arki is 39Kms. From Shimla via Shalaghat the State Headquarter & 58 Kms. from Solan via Subathu. It is lies between longitude 76^0 58' 02" and 76^0 56' 24" E and Latitudes 31^0 11' 15" and 31^0 9' 36"N.

Nature of deposit:

Limestone deposit of Arki area belongs to Basantpur formations of Shimla group of rocks & predominantly it is composed of limestone, dolomite and shales & siltstone.

Reserves:

Total mine able reserves of steel grade limestone have been proved to the tune of 119.06 million tones. The said deposite has been leasedout to NMDC for exploitation of the said reserves for further supply to Steel authority.

Quality: Average grade of limestone up to the depth of 146 mtrs. is as below:

Ca0	MG0	$Si0_2$	Fe_20_3	$A1_20^3$	L.O.I
53.46%	1.48%	0.50%	0.35%	0.27%	53.46%

(ii) Bagha-Bhalag Limestone deposit:

The deposit lies on the border of District Bilaspur and Solan. The Majority of limestone is exposed around village Bagha, tehsil Arki, Distt. Solan, H.P. and is located at a distance of 6 Kms. from Kharsi Falling on Darla Mor-Beri Road. Kharsi is 16Kms. away from Darla Mor towards Beri which onwards falls on National Highway No. 88 i.e. Shimla-Hamirpur-Mataur.

Nature of Deposit:

The limestone belongs to Sorgharwari Member of Shali formation comprises of pink and grey with thin shale partings. The rock units exposed in Bagha area forms a plunging syncline in which pink and grey limestone is refolded into minor syncline and anticline thereby increases the thickness of the deposits. The limestone overlies the dolomites of Khatpul member and is well bedded and laminated with Shale partings.

Average Chemical Analysis of the Limestone is as under:-

Pink Limestone

Ca0	MG0	$Si0_2$	Fe_20_3	$A1_20^3$	L.O.I
46.81%	2.44%	9.00%	0.55%	1.17%	38.02%

Grey Limestone

Ca0	MG0	$Si0_2$	Fe_20_3	$A1_20^3$	L.O.I
40.00%	1.75%	20.00%	1.20%	2.80%	33.00%

Reserves:

The grey and pink limestone in the area rises from 1020 mtrs. to 1640mtrs. R.L. from the M.S.L. The total reserves inferred in the area are to the tune of 295 million tones out of which 95 million tones have been proved by drilling up to 1300 mtrs. R.L. from the M.S.L.

On the said deposits mining leases has been granted in favour of M/S Jay Pee Cements and company has established factory of 2.45 Million Tonn per annum at Bagha

(iii) Kashlog-Mangu Limestone Deposit:

The deposit is at a distance of 10 Kms. From Kararaghat falling on Shimla- Bilaspur road at a distance of nearly 40Kms. From Shimla.

Nature of Deposits:

Limestone exposed in the area belongs to Basantpur formation of Shimla group of rocks. It is light grey, dark grey & blackish in colour. Hard compact & crises-crossed by calcite veins. General trend of rocks in the area is NW-SE dipping NE form 22^0 to 54^0 in amount.

Total Reserves:

Total reserves proved by drilling upto a depth of 100 mtrs. are to the tune of 130 million tonnes whereas estimated reserves are to the tune of 200 million tonnes.

Quality: Average chemical analysis of limestone is as under:

Ca0%	$Mg0^2$%	$Si0^2$%,	R^20^3%,	Total carbonate
48.7	0.93	10.47	1.54	Varies from 76% to 97%

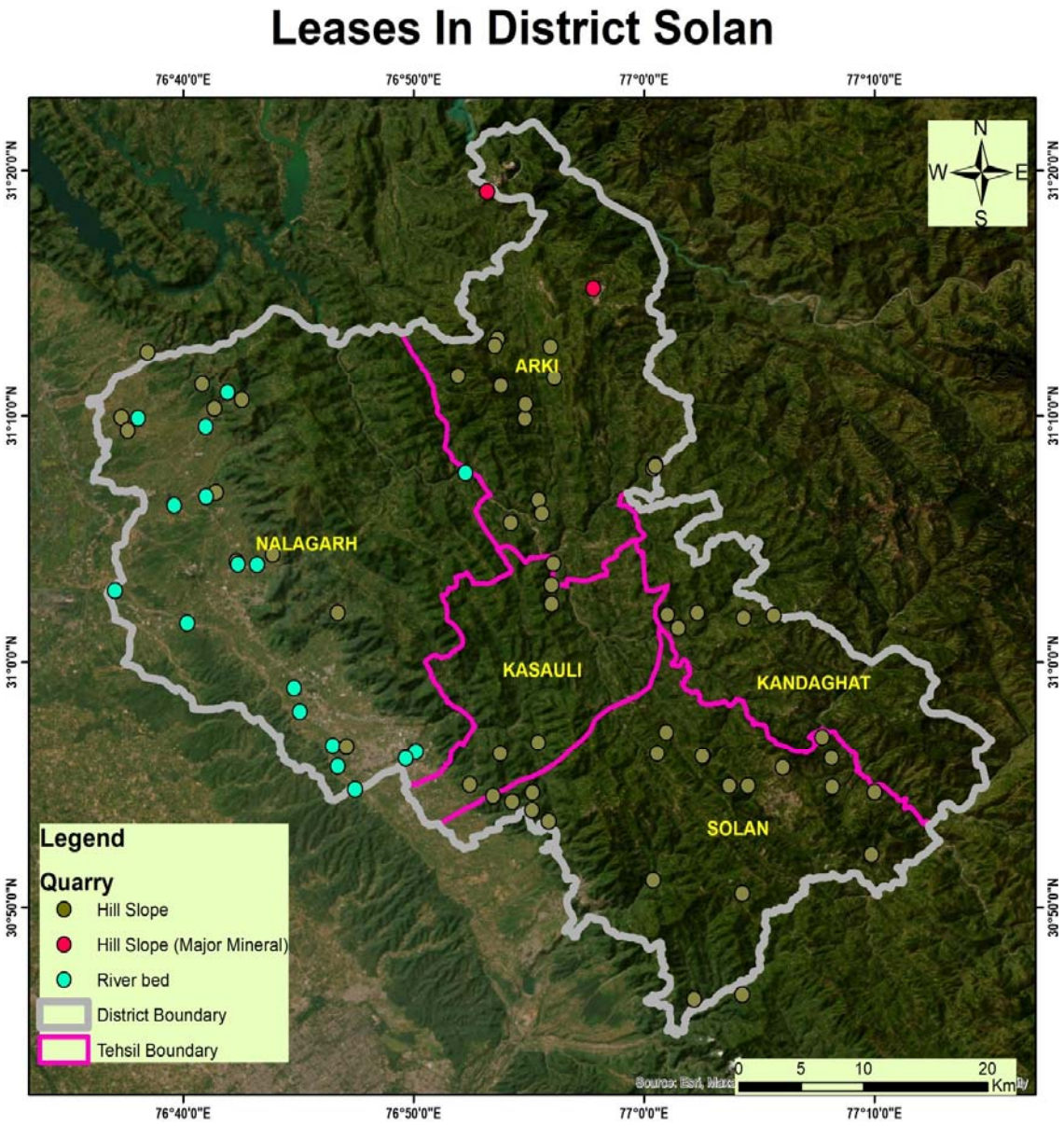
16 USE OF MINERAL

Limestone, dolomitic- limestone, shale, brick earth, minor minerals like sand, stone & bajri. The mining activities in district can basically be categorized under large sector and in small sector. The large sector comprises of major limestone projects for cement manufacture and the small mining sector comprises mining of minor minerals like sand, stone, bajri, slates, shale, clay etc. which are basically building material required to meet the infra-structural development of the district. The Cement plant of M/s UltraTech Cements is located Bagga, Tehsil Arki, Distt. Solana and M/s Ambuja Cements Ltd. is located at Tehsil Darlaghat in Solan district of Himachal Pradesh with approved quantity of limestone extraction of 4.725 & 7.59 MTPA respectively.

17 DEMAND AND SUPPLY OF THE MINERAL IN THE LAST THREE YEARS

The demand is huge as constructions activity grows with faster growth of country as well as state. Cement manufacturer make cement as per market demand of both local and out of district and the minor minerals are basically building material required to meet the infra-structural development of the district.

18 MINING LEASES MARKED ON THE MAP OF THE DISTRICT



19 DETAILS OF THE AREA OF WHERE THERE IS A CLUSTER OF MINING LEASES VIZ. NUMBER OF MINING LEASES, LOCATION (LATITUDE AND LONGITUDE):

The details of all the mining leases granted in the district alongwith the Geo-Cordinates is already provided at 9 and have also been marked on the distrcit map at 18.

20 DETAILS OF ECO-SENSITIVE AREA, IF ANY, IN THE DISTRICT:

None

21 IMPACT ON THE ENVIRONMENT (AIR, WATER, NOISE, SOIL, FLORA & FAUNA, LAND USE, AGRICULTURE, FOREST ETC.) DUE TO MINING ACTIVITY;

Generally, the environment impact can be categorized as either primary or secondary. Primary impacts are those which are attributing directly by the project. Secondary impacts are those which are indirectly include the associate investment and change pattern of social and economic activities by the proposed action.

The impact has been ascertained for the project assuming that the pollution due to mining activity has been completely spelled out under the base line environmental status for entire ROM which is proposed to be exploited from the mines.

The major air pollutants due to mining activity include

AIR ENVIRONMENT

Dust is emitted to air mainly due to vehicular movement on the un-metal led road and such pollution is seen mainly during summer and winter seasons.

As far as air pollution is concerned, fugitive dust (SPM) pollution will be predominant over the others such as NOx, SO2 etc. Mining unit operation such as excavation, loading & unloading, movement of truck/tippers on the kuchha roads, no doubt, will generate the fugitive dusts.

WATER ENVIRONMENT

Some time the mining activity leads to the water table causing ground water depletion. Due to the interference with surface water sources like river.
Strata water gets disturbed and contaminated in case of intersection of ground water table.
Natural water table of the area gets disturbed.
Contamination of surface water bodies due to the discharge of mine water and surface runoff workshop effluent.

NOISE LEVELS

The source of noise will be due to the deployment of machines in the lease area.
Operation of drilling machines, blasting, excavation, loading & unloading of mineral etc. such high level of noise can cause health effects, poor work performance and disturbances to human and wild life and constant source of disturbance.

LAND ENVIRONMENT
The topography of the area will change certain changes due to mining activity which may cause some alteration to the entire eco system. Mining causes various land disturbances/degradation due to change in land use pattern.

Removal of forest covers which causes loss to flora and fauna and take many years to get back similar forest cover if the mining area is properly reclaimed. Removal of top soil and overburden causes loss on agriculture.

IMPACT ON FLORA & FAUNA
The impact on biodiversity is difficult to quantify because of its diverse and dynamic characteristics. Mining activity generally result in the deforestation ,land degradation, water, air & noise pollution which

directly or indirectly affect the faunal and flora status of the project area. However, occurrence and magnitude of these impact are entirely dependent upon the project location, mode of operation and technology involved.

22 REMEDIAL MEASURES TO MITIGATE THE IMPACT OF MINING ON THE ENVIRONMENT

MITIGATION MEASURES

The following mitigation measures are being/ will be adopted to mitigate air pollution generated due to the mining activities:

- During Drilling Operation

Dust generation is reduced by using sharp teeth of shovels.
Providing dust extractors to drilling units.
Personal protective equipment's is being provided to drill operators and his helpers.

- During Blasting Operation

Proper stemming in blast holes.
Avoiding blasting during unfavourable condition.
Use of Rock Breaker to avoid blasting in ridges.

- During loading operation

Latest generation loading equipment's like hydraulic excavators is being/ will be used and operated by skilled operators to load dumpers.
Water tanker arranged for water sprinkling on haul roads and Loading Point.
Propagation of this dust is/ will be confined to loading point only and does not affect any person nearby. Both the operators of excavator and dumpers present at that point operate the machine from a closed cabin.

- During Crushing

Crusher hoppers & conveyor systems to be totally enclosed and provided with water sprayers.
Completely covered stacker and reclaimed shed are provided at crusher.
Water sprinkling system has been installed at crusher.

- During Transport operation

Water tanker has been in operation for regular water sprinkling on haul roads for dust suppression.
To control the gaseous emission, all mine machineries are maintained in proper order/as per OEM through routine checklist.
Strict speed limit (20-25 km/hr) of vehicles is /will be implemented.
Proper covering of transported material and stored raw material.
Regular maintenance of HEMMs & transportation vehicles.
Measures will be taken to reduce the diesel consumption during transportation.

- Plantation work

Local forest trees (Acacia catechu, Acacia nilotica, Acacia Senegal, Aegle marmelos, Albizia amara, Albizia lebbeck, Albizia odoratissima, Albizia procera, Alstonia scholaris, Anogeissus latifolia, Azadirachta indica, etc..) has been used for plantation/greenbelt.

- Safety Measures for Water Reservoir at Conceptual Stage

Construction of wire fencing along the periphery of the reservoir.

Plantation will be done between the mining pits and the periphery of lease.
Conduct geo-technical stability studies involving expert agencies.
Management of Waste Water generated at mine site
No waste water is being/ will be discharged outside lease boundary.
Domestic waste water generated is being/ will be disposed off in Soak pit.
Workshop waste water is treated and reuse for washing purpose by installing gravity separation method to separate water & oil.

NOISE & VIBRATION AND MITIGATION MEASURES

- The following control measures is being/ will be adopted to keep the ambient noise levels within the limits:-

When conventional drilling, use of sharp drill bits to achieve optimum drilling performance and to reduce noise generation at source.
Avoiding the secondary blasting.
Adoption of control blasting with proper spacing, burden and stemming.
Blasting is to be carried out during favorable atmospheric conditions and low human activity timing.
Use of proper designed machinery, maintained properly.
Crusher is totally enclosed in a covered building to minimize sound propagation.
Sound insulated chambers for the workers deployed on the machineries producing higher level of noise like dozers, drills etc.
Regular maintenance, oiling and greasing of machines at regular intervals is being/ will be done to reduce generation of noise.
All employees and operators has been/ will be provided with protective equipment, earmuffs and earplugs as a protective measure from the high noise level generated near the machinery.
Noise Monitoring is carried out in core zone and buffer zone by NABL accredited laboratory.

23 RECLAMATION OF MINED OUT AREA (BEST PRACTICE ALREADY IMPLEMENTED IN THE DISTRICT, REQUIREMENT AS PER RULES AND REGULATION, PROPOSED RECLAMATION PLAN):

As per status all mines are to be closed before final closure of mine.
Reclamation of exhausted mines are planned to be undertaken in below three possible manner

1-if, sustainable amount of waste is there, the exhausted quarry can be fully or partly backfilled using the store waste. the backfilled area to be brought under plantation of local species.
2-if the generation of waste is much less and depth is less then plantation on broken up surface.
3-convert to water reservoir after stabilization of slope if the exhausted quarry continue much below the surrounding surface level. it is preferred to cordon the water reservoir either throw wire fencing or retaining wall with plantation from the safety point of view.
Most of the mine lease areas are yet to be exhausted from ore point of view. Hence, reclamations would be taken up only after exhaustion of the ore/mineral from the area.

24 RISK ASSESSMENT & DISASTER MANAGEMENT PLAN;

Risk Assessment

The complete mining operation is being/ will be carried out under the management control and direction of a qualified mine manager holding a First Class Manager's Certificate of competency to manage a metalliferous mine granted by the DGMS, Dhanbad. The DGMS have been regularly issuing standing orders, model standing orders and circulars to be followed by the mine management in case of disaster, if any. Moreover, mining staff is being/ will be sent to refresher courses from time to time to keep them alert. However, following natural/industrial hazards may occur during normal operation.

Natural Hazards

- Landslides;
- Flash floods;
- Damage of life and property;
- Disruption of road & telecommunication facilities; and
- Lightening

Industrial Hazards

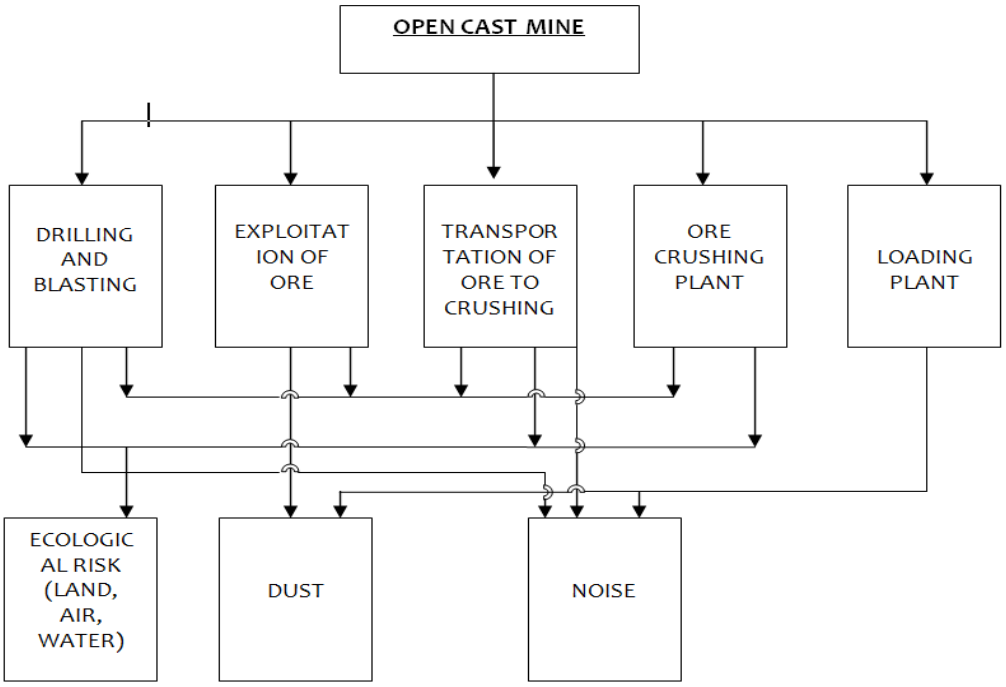
- Accident due to explosives;
- Accident due to heavy mining equipment; and
- Sabotage in case of magazine.

In order to take care of above hazard/disasters, the following control measures are being/ will be adopted:

- All safety precautions and provisions of Mine Act,1952, metalliferous Mines Regulation, 1961 and Mines Rules,1955 will be strictly followed during all mining operations;
- Entry of unauthorized persons is prohibited;
- Firefighting and first-aid provisions in the mines office complex and mining area;
- Provisions of all the safety appliances such as safety boot, helmets, goggles etc. has been made available to the employees and regular check for their use;
- Training and refresher courses for all the employees W in hazardous premises; Under Mines vocational training rules all employees of mines shall have to undergo the training at a regular interval;
- W of mine, as per approved plans and regularly updating the mine plans;
- Cleaning of mine faces is being/ will be regularly done;
- Handling of explosives, charging and blasting is being/ will be carried out by competent persons only;
- Provision of magazine at a safe place with fencing and necessary security arrangement;
- Regular maintenance and testing of all mining equipment as per manufacturer's guidelines;
- Suppression of dust on the haulage roads;
- Adequate safety equipment is being/ will be provided at explosive magazine; and
- Increasing the awareness of safety and disaster through competitions, posters and other similar drives.
- For any type of above disaster, a rescue team has been formed by training the mining staff with specialized training.

Possible hazards in open cast mine

- There are various factors, which can cause disaster in the mines. The mining activity has several disaster prone areas. The identification of various hazards is shown in figure-7.1 and the hazards are discussed below:



Blasting

- Most of the accidents from blasting occur due to the projectiles, as they may sometimes go even beyond the danger zone, mainly due to overcharging of the shot-holes as a result of certain special features of the local ground. Flying rocks are encountered during initial and final blasting operations. Vibrations also lead to displacement of adjoining areas. Dust and noise are also problems commonly encountered during blasting operations. As this region is hilly in nature so there is a possibility of Landslides due to Blasting in the mine.

Overburden

- The overburden dumps may cause landslides. High overburden dumps created at the quarry edge may cause sliding of the overburden dump or may cause failure of the pit slope due to excessive loading, thereby causing loss of life and property. Siltation of surface water may also cause run-off from overburden dumps.

Heavy machinery

- Most of the accidents during operation of dumpers, excavators and dozers and other heavy vehicles are often attributable to mechanical failures and human errors.

Storage of explosives

- Explosive magazine storage facility is located within the existing ML area which will cater to the existing mining activities in the same ML area. For the purpose of transportation of explosives, explosive van is present. The main hazard associated with the storage, transport and handling of explosives is fire and explosion. The rules as per the Indian Explosive Act-1983 and Explosive Rules-2008 should be followed for handling of explosives, which includes transportation, storage and use of explosives.

Fuel storage

- Most of the HEMM will operate on diesel. However, no major storage is envisaged at the ML area.

Waterlogging

- The rainwater would flow down the slope of the hills and also along the natural streams. Rain water Harvesting has been proposed and water is being stored in the pit for use.

Disaster management plan

Objectives of Disaster management plan

- The disaster management plan is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities. For effective implementation of the disaster management plan, it should be widely circulated and personnel training through rehearsals/drills.
- The objective of the Disaster Management Plan is to make use of the combined resources of the mine and the outside services to achieve the following:
- The objective of onsite disaster management plan for the captive mine is to be a state of perceptual readiness through training, development to immediately control and arrest any emergency situations, so as to avert a full-fledged disaster and the consequence of human and property damage. In the event of a disaster still occurring & to manage the same so that the risk of the damage to life and property is minimized.

The salient features are elaborated as below:

- Effect the rescue and medical treatment of casualties;
- Safeguard other people;
- Minimize damage to property and the environment;
- Initially contain and ultimately bring the incident under control;
- Identify any dead;
- Provide for the needs of relatives;
- Provide authoritative information to the news media;
- Secure the safe rehabilitation of affected area; and
- Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the emergency.
- In effect, it is to optimize operational efficiency to rescue rehabilitation and render medical help and to restore normalcy.

EMERGENCY ORGANIZATION

It is recommended to setup an Emergency Organization. (Mine Manager) who has control over the affairs of the mine would be heading the Emergency Organization. He would be designated as Site Controller. As per the General Organization chart, in the mines, the Mines Manager would be designated as the Incident Controller. The Incident Controller would be reporting to the Site Controller.
Each Incident Controller, for himself, organizes a team responsible for controlling the incidence with the personnel under his control. Shift In-charge would be the reporting officer, who would bring the incidence to the notice of the Incidence Controller and Site Controller.

Emergency coordinators would be appointed who would undertake the responsibilities like firefighting, rescue, rehabilitation, transport and provide essential and support services. For this purposes, Security In-charge, Personnel Department, Essential services personnel would be engaged. All these personnel would be designated as key personnel.

In each shift, electrical supervisor, electrical fitters, pump house in-charge and other maintenance staff would be drafted for emergency operations. In the event of power or communication system failure, some of staff members in the mine offices would be drafted and their services would be utilized as messengers for quick passing of communications. All these personnel would be declared as essential personnel.

Following officers of the mines are responsible for co-ordination in case of emergency situation in any section of the mine. All are based at residential colony of the company at a distance of 2 Km from the mine site. Their organizational position and telephone nos. are as follows:

OFF-SITE EMERGENCY PLANNING

INTRODUCTION

The off-site emergency plan is an integral part of any hazard control system. It would be based on those accidents identified by the works management, which could affect people and the environment outside the works. Thus, the off-site plan follows logically from the analysis that took place to provide the basis for the on-site plan and the two plans should, therefore, complement each other. The key feature of a good off-site emergency plan is flexibility in its application to emergencies other than those specifically included in the formation of the plan. The roles of the various parties that may be involved in the implementation of an off-site plan are described below. The responsibility for the off-site plan will be likely to rest either with the works management or with the local authority.

Either way, the plan must identify an emergency coordinating officer who would take overall command of the off-site activities. As with the on-site plan, an emergency control center will be required within which the emergency coordinating officer can operate. An early decision will be required in many cases on the advice to be given to people living “within range” of the accident – in particular whether they will be evacuated or told to go indoors. Consideration of evacuation may include the following factors:

In the case of a major fire but without explosion risk (e.g. an oil storage tank), only houses close to the fire are likely to need evacuation, although a severe smoke hazard may require this to be reviewed periodically.

But if the fire escalates it might be necessary to evacuate people nearby, but only if there is time; if insufficient time exists, people would be advised to stay indoors and shield themselves from the fire while measures are taken by those outside to douse fire.

ASPECTS TO BE INCLUDED IN AN OFF-SITE EMERGENCY PLAN

Some of the aspects to be included in off-site emergency plan are as follows:

a) Organization

Details of command structure, warning systems, implementation procedures, emergency control centers, name and appointments of incident controller, site main controller, their deputies and other key personnel.

b) Communications

Identification of personnel involved, communication center, call signs, network, list of telephone numbers.

c) Special Emergency Equipment

Details of availability and location of heavy lifting gear, bulldozers, specified fire-fighting equipment, fireboats.

d) Voluntary Organizations

Details of organizers, telephone numbers, resources, etc.

e) Meteorological information

Arrangements for obtaining details of weather conditions prevailing at the time and weather forecasts will be made.

f) Humanitarian Arrangements

Transport, evacuation centers, emergency feeding, treatment of injured, first aid, ambulances, temporary mortuaries.

g) Public Information

Arrangements for: -

Dealing with the media-press office

Informing relatives, etc.

h) Assessment

Arrangements for: -

Collecting information on the causes of the emergency

Reviewing the efficiency and effectiveness of all aspects of the emergency plan.

ROLES OF MAJOR HAZARD MANAGEMENTS

Where the local authority has the organization to formulate the plan, the role of management in off-site emergency planning has/ will establish liaison with those preparing the plans and to provide information appropriate to such plans. This will include a description of possible on-site accidents with potential for off-site harm, together with their consequences and an indication of the relative likelihood of the accidents.

Advice should be provided by works managements to all the outside organizations which may become involved in handling the emergency off-site and which will need previously to have familiarized themselves with some of the technical aspects of the works activities, e.g. emergency services, medical departments, etc.

25 DETAILS OF THE OCCUPATIONAL HEALTH ISSUES IN THE DISTRICT. (LAST FIVE-YEAR DATA OF NUMBER OF PATIENTS OF SILICOSIS & TUBERCULOSIS IS ALSO NEEDS TO BE SUBMITTED);

Occupational health should aim at the promotion and maintenance of the highest degree of physical, mental and social well being of workers in all occupations. The prevention among workers of departure from health cause by their W conditions, the protection of workers at there employment from risks resulting from factors adverse to health, the adoption of work to men and each man to his job. in recent years the application of ergonomics has made a significant contribution for reducing industrial accidents and overall health efficiency of workers

OCCUPATIONAL HEALTH

The industrial workers today is placed a highly complicated environment which is getting highly complicated as man becoming ingenious. An industrial worker may be exposed to many types Dieses depending upon the occupation.

Diseases due to physical agent

- Heat –heat hyperpyrexia, heat cramps
- Cold-Trench foot, frost bite, chilblains
- Pressure-caisson disease, air embolism
- Noise-Occupational deafness
- Radiation- Cancer, Leukemia, Pancytopenia
- Mechanical Factor- Injuries, Accident
- Diseases due to chemical agent

- Various toxic gases like carbon dioxide, carbon monoxide causes various type of diseases. Anthracnose, silicosis, siderosis, bagassosis etc.
- Diseases due to biological agentBrucellosis, anthrax, fungal infection etc.
- Diseases of Psychological organs-industrial neurosis, hypertension, pepticulcer etc.

Year	Silicosis	Tuberculosis
2019-20	Nil	1947
2020-21	Nil	1542
2021-22	Nil	1831
2022-23	Nil	1861
2023-24	Nil	1797

26 PLANTATION AND GREEN BELT DEVELOPMENT IN RESPECT OF LEASES ALREADY GRANTED IN THE DISTRICT

Specific conditions are being imposed by the state pollution control board during grant of consent to operate to the mines to developed adequate no. of plantation as per the recommendation made in the approved mining plan during operation period and closure of mining activity. As most of the mines of the district are yet to be exhausted of their mineral content no sort of reclamation measures has been undertaken excluding gap plantation of local species in the peripheral safety zones of the quarries/clusters and in some of the haul road.

27 ANY OTHER INFORMATION.

-NIL-

28 MONITORING & EVALUATION

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

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

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

10. The area not identified for mining due to restriction or otherwise are also to be monitored on a regular basis by the DLTF. Any observations of mining activity from the restricted area shall be reported and corrective measures shall be initiated on an urgent basis by the DLTF.
11. The dispatch routes shall be defined in the Environmental Clearance and shall be avoided through densely habituated area and the increase in the number of vehicle movement on the road shall be in agreement with the IRC guidelines / carrying capacity of the road. The alternate and dedicated route shall be explored and preferred for movement of mining to avoid inconvenience to the local habitat. The mining production capacity, by volume/weight, shall be governed by total permissible dispatch calculated based on the carrying capacity of dispatch link roads and accordingly, the production should be regulated.
12. The movement of minerals shall be reconciled with the data collected from the mines and various Naka/check posts. Other measures may also include a general survey of the potential mineable area in the district which has not been leased/auctioned or permitted for mining due to regulatory or other reasons.
13. The location and number of check post requirement shall be reviewed by DLTF on a regular basis so that appropriate changes in location/number could be made as per the requirement. Such review shall be carried out on a regular basis for the district on inter-state boundary or district providing multiple passages between two districts of different states.
14. The district administration shall compile the information from their district of the permitted and legal mined out minerals and other details and share such information and intelligence with the officials of the adjoining district (Inter or/and Intra State) for reconciliation. The information shall include the area of operation, permissible quantity, mined out minerals (production) the permitted route etc., and other observations, especially where the mine lease boundary is congruent with the district boundary. Such coordination meeting shall be held on a quarterly basis, alternatively in two district headquarters or any other site in two districts decided mutually by the District Magistrate.
15. The in-situ and ex-situ environmental mitigative measures stipulated as EMP, CER, CSR and other environmental and safety conditions in mines including the welfare of labours shall properly reflect in the audit report.

29 COMMENTS/ SUGGESTIONS:

HPSEIAA in its 69th meeting on dated 18th June, 2024 approved the DSR of district Solan and decided to upload the DSR on public domain/ official websites of Department of Industries and Department of Environment, Science Technology & Climate Change for twenty-one days. The comments, if received, shall be considered and if found fit, shall be incorporated in the final Report. As per the decision of the HPSEIAA the DSR was uploaded on the portal. The suggestions received from the users through e-mail on ms.hpseiaa@gmail.com & remarks of the Industries Department are as under:

#	District	Email dated	Comments	Forwarded to industries	Remarks from Industry Deptt., if any
1.	Solan	17-Jul-24	Please update my lease area details in the District Survey report of Solan District with khasra no. Details of my lease area given below Gopal Dass "Sand, Stone and Bajri Mining Project" Located at Khasra No. 93 Mauza & Mohal: Mahol, Tehsil: Arki, District: Solan, Himachal Pradesh. Proposed Production Capacity: 14,060 TPA (ROM) {Stone Production: 13,312 TPA, Mine Waste:739 TPA, Top Soil: 9 TPA} Mine Lease Area- 08-14 Bighas (0.6546 Ha.)	18-Jul-24	Please see point No. 13 of DSR as well as refer to the email sent on 19.07.2024 sent to ms.hpseiaa@gmail.com
2.	Solan	17-Jul-24	Not included in DSR - Hill Slope mining project for the Extraction of Stone situated in Khasra No. 233/215/202/2 measuring an area 08-00 bighas or 0.6020 (Private Land/Hill Slope) falling in Mauza Dharoi of Tehsil Kandaghat, District Solan H.P, proposed by Rameshwar Dass, Prop. M/s Geeta Industries R/o Village Dharoi, P.O. Kahla, Tehsil Kandaghat, District Solan, H.P,	18-Jul-24	Please see point No. 13 of DSR as well as refer to the email sent on 19.07.2024 sent to ms.hpseiaa@gmail.com
3.	Solan	17-Jul-24	Not included in DSR - Hill Slope mining project for the extraction of stone over an area situated in Khasra No.314/245, 315/245 & 243/5/2/1, measuring an area 19-02 Bighas (Private Land/Hill Slope) falling in Mohal/Mauza Banoh, Tehsil Arki, District	18-Jul-24	Please see point No. 13 of DSR as well as refer to the email sent on 19.07.2024 sent to ms.hpseiaa@gmail.com

			Solan, Himachal Pradesh, proposed by Sh. Roshan Lal, Prop. M/s Bhagwati Stone Crusher, R/Village Banoh, P.O. Kakkarhatti, Tehsil Arki, District Solan, H.P		
4.	Solan	17-Jul-24	Not included in DSR - Extraction of Stone over an area situated in Khasra No. 30/4/3 measuring an area 26-00 Bighas (Private Land/Hill Slope) falling in Mauza Reejeree, Tehsil Arki, District Solan, Himachal Pradesh, proposed by Sh Ghanshyam S/o Sh Hem Raj Sharma, Village Javi & P.O. Darlaghat, Tehsil Arki, District Solan, H.P	18-Jul-24	Please see point No. 13 of DSR as well as refer to the email sent on 19.07.2024 sent to ms.hpseiaa@gmail.com
5.	Solan	17-Jul-24	Not included in DSR - Sh. Rajinder Singh (GPA Holder), M/s Santokh Stone Crusher, is the applicant for the proposed project 'Extraction of sand, stone, and bajri over an area situated in Khasra No. 261, measuring an area of 07-03 Bighas (Private Land, Terrace Deposit) falling in Mauza/Mohal Jhidan, Tehsil Nalagarh, Distt. Solan, Himachal Pradesh.' By Sh. Rajinder Singh (GPA Holder), M/s Santokh Stone Crusher, Village Berson, P.O. Manjholi, Tehsil Nalagarh, District Solan, Himachal Pradesh	18-Jul-24	Please see point No. 13 of DSR as well as refer to the email sent on 19.07.2024 sent to ms.hpseiaa@gmail.com
6.	Solan	17-Jul-24	Not included in DSR - Sh. Raghubir Singh, Proprietor of M/s Berson Stone Crusher, Village Berson, P.O. Manjholi, Tehsil Nalagarh, District Solan, Himachal Pradesh, for the extraction of sand, stone, and bajri over an area situated in Khasra No. 300, measuring 8.01 Bighas (Private Land/Hill Slope) falling in Mauza/Mohal Messa-Tibba, Tehsil Nalagarh, District Solan, Himachal Pradesh	18-Jul-24	Please see point No. 13 of DSR as well as refer to the email sent on 19.07.2024 sent to ms.hpseiaa@gmail.com
7.	Solan	16-Jul-24	As per the district survey report our name and khasra no are not mentioned. But as per Moef	18-Jul-24	Please see point No. 13 of DSR as well as refer to the email sent

			guidelines for preparing District Report the name of lease area with khasra no must be mentioned and the details of that particular area should be included in district survey reports. “Sand, Stone and Bajri Mining Project” Located at Khasra No. 263/1 min and 413 (Private Land) Near: Mauza Berti & Sheel, Tehsil & District: Solan, (Himachal Pradesh) Lease Area: 9-11 Bighas (0.719 Hectare) Ha.		on 19.07.2024 sent to ms.hpseiaa@gmail.com
8.	Solan	16-Jul-24	Not included in DSR - Sand, Stone and Bajri Mining Project” Located at Khasra No. 957, 958, 962, 963, 964, 965, 966, 974, 1812/973 (Private Land) Near: - Mauza /Mohal: Bhatoli Kalan, Tehsil- Baddi District: Solan, (Himachal Pradesh) Lease Area: 1.73 Ha. Proposed Production Capacity: 77,435 TPA (ROM) [Silty Sand: 11,615 TPA, Stone: 30,974 TPA, Bajri: 34,846 TPA]	18-Jul-24	Please see point No. 13 of DSR as well as refer to the email sent on 19.07.2024 sent to ms.hpseiaa@gmail.com
9.	Solan	16-Jul-24	Not included in DSR - Smt. Ambika Verma W/o Capt. Ashwin Verma R /o House No. 1074, Sector- 43B, Chandigarh, Sand & Stone Mining Project” Located at Khasra No. 66/32/1/3 Near: - Mauza Dalehan, Tehsil: - Solan District: Solan, (Himachal Pradesh) Lease Area: 10-06 bighas (0.7751 Hectare) (Pvt. Land/Hill Slope) Category: B2 Production Capacity: 8,471	18-Jul-24	Please see point No. 13 as well as refer to the email sent on 19.07.2024 sent to ms.hpseiaa@gmail.com
10.	Solan	4th July 2024	Not included in DSR - our mining site namely Sh. Harbhajan Singh, Prop. M/s Shiv Om Stone Crusher located at Khasra no. 2619/2579/2204/1, having an area of 500-00 Bighas (42-14-65 Ha), Government land- river bed, Mauza/Mohal Kishanpura, Tehsil Baddi, District- Solan, Himachal Pradesh.	08-Jul-24	Please check point no. 13 it is mentioned as:- 13. List of Letter of Intent (LoI) Holders in District Solan with validity:- It is submitted that the department grants 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. Geologist (Zone-III) 8 July 2024 Now, please see point No. 13 of DSR as well as refer to the email sent on 19.07.2024 sent to ms.hpseiaa@gmail.com
11.	Solan	4th July 2024	Not included in DSR - Sh. Amarjit Singh Prop: M/s Sarsa Stone Crusher for Extraction of Stone & Sand located at 592, 593, 1556/590, 591, 1557/590 & 1558/590 (Private Land-Hill slope) having an area of 7-14 Bighas, Mauza/Mohal Kishanpura, Tehsil Baddi, District- Solan, Himachal Pradesh.	08-Jul-24	-do-
12.	Solan	4th July 2024	Not included in DSR - Sh. Narinder Kumar Bhalla Prop: M/s Shiva Stone Crusher for Extraction of Sand, Stone & Bajri located at 700/681/272 & 788/702/684/286 (Private Land-River bed) having an area of 36-11 Bighas, Mauza/Mohal Beli Khol, Tehsil Baddi, District-Solan, Himachal Pradesh.	08-Jul-24	-do-

The Deptt. of Industries vide email dated 19th July, 2024 informed that the Department grants mineral concessions by two modes, one through auction and another through mining leases. In both the 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 letter of intent is in-principle approval to obtain the required clearances for the grant of mineral concession. The applicant has to complete the codal formalities like preparation of a mining plan and has to obtain environmental 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 intent 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 either extended or withdrawn.

So, the list of letters of intents cannot be provided at this stage as these are dynamic in nature and only the information of granted mineral concessions is provided in the updated DSR.