Himachal Pradesh Himalaya

India

Inventory of Glaciers and Glacial Lakes and the Identification of Potential Glacial Lake Outburst Floods (GLOFs) Affected by Global Warming in the Mountains of Himalayan Region

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Foreword

The monsoonal climate of the Hindu Kush-Himalayas has two distinct seasons – Wet and dry. Dry season needs of water are not less than the wet season. The glaciers of the Hindu Kush-Himalayas (HKH) are nature's renewable storehouse of fresh water from which hundreds of millions of people downstream benefit just when it is most needed – in the dry hot season before the monsoon. While the total number of glaciers in the region is still unknown, this study has for the first time documented that there are 2554 glaciers in Himachal Pradesh. Covering an area of 4160.5 Square kilometers, these high frozen reservoirs release their water at the top of the watersheds. These perennial glaciers plus the seasonal snow cover serve as the perennial sources of rivers that wind their way through grazing, agricultural and forest and are used as renewable sources of irrigation, drinking water, energy and industry.

However, these glaciers are retreating in the face of accelerated global warming. They are particularly vulnerable to climate change and the resultant long-term loss of natural fresh water storage will have as yet uncalculated effects on communities downstream. More immediately, as glaciers retreat, glacial lakes form behind some of the now exposed terminal moraines. Rapid accumulation of water in glacial lakes form behind some of the now exposed terminal moraines. Rapid accumulation of water in glacial lakes particularly in those adjacent to receding glaciers, can lead to a sudden breaching of the unstable dam behind which they have formed. The resultant discharges of huge amounts of water and debris – a glacial lake outburst flood or GLOF – often have catastrophic effects downstream.

Many glacial lakes are known to have formed in the HKH in the last half century and a number of GLOFs have been reported in the region, including in Himachal Pradesh, in the last few decades, these GLOFs have resulted in many deaths, as well as the destruction of houses, bridges, fields, forests and roads. The lakes at risk, however, are situated in remote and inaccessible areas. When they burst, the local communities may have been devastated, while those in far away cities were largely unaware of the event.

In Himachal Pradesh, the catastrophic flood events in the Satluj basin in the last few years raised awareness of the problem considerably. Despite some studies of individual cases, there is still no detailed inventory of glaciers and glacial lakes, of GLOF events or of potential GLOF sites, in Himachal Pradesh – let alone of their impact on downstream populations and investments. This publication, along with similar publications made for the studies conducted in Nepal and Bhutan, are designed to fulfill this pressing need. The research upon which it is based started in 1999, when the United Nations Environment Programme Regional Resource Centre for Asia and the Pacific (UNEP/RRC-AP) provided ICIMOD with the opportunity of using its expertise in the area of geographic information system (GIS) to create a comprehensive inventory and GIS database of glaciers and glacial lakes in Nepal and Bhutan using available maps, satellite images, aerial photographs, reports and field data on different scales. It built on ICIMOD's experience and longstanding concern with collecting and distributing material on the means to identify and mitigate mountain disasters and safeguard the livelihoods of vulnerable mountain people and their downstream neighbors.

One of the major objectives of the study was to identify areas where GLOFs events had occurred and lakes that could pose a potential threat of a GLOF in the near future. Out of a surprisingly large total of 229 lakes, the researchers found 22 lakes that are potentially dangerous in Himachal Pradesh. These results thus provide the basis for development of a monitoring and early warning system and for the planning and prioritization of disaster mitigation efforts that could save many lives and properties situated downstream, as well as guide infrastructure *planning. In addition, it is anticipated that this study will provide useful information for many of those concerned with water resources and land use planning.*

As a presentation of the results of the APN-START/UNEP supported study, this report also includes a description of the methods used to identify glaciers, glacial lakes and glacial lakes outburst floods that may pose a threat; as well as an inventory (and maps) of the glaciers and glacial lakes in Himachal Pradesh. It includes a summary of the results of various glacial lakes, and a brief review of the causes and effects of known GLOF events in Himachal Pradesh. The database and analysis are the first to cover the whole of the state of Himachal Pradesh on a large scale.

We are thus confident that this comprehensive report and digital database will be of service to scientists, planners and decision makers in many areas. Through their informed actions, we hope it will contribute to improving the lives of those living in the mountains and help safeguard future investments for the benefit of many people in the region.

We would like to congratulate the project team members for successful completion of this report in short time. We are also pleased that this project has enabled us to strengthen our collaborative work as well as the capacity building and cooperation between ICIMOD, CSKHPAU, APN, START, UNEP.

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Acronyms

ADB	Asian Development Bank
ADRG	ARC digitized raster graphics
AP	Aerial Photograph
AP	Asia and the Pacific
APN	Asia-Pacific Network
APT	Automatic Picture Transmission
bcm	billion cubic metre
C	Centigrade
CSKHPAU	Chaudhary Sarwan Kumar Himachal Pradesh Agricultural University
CIDA	Canadian International Development Agency
CSO	Chief Scientific Officer
DEM	Digital Elevation Model
DHM	Department of Hydrology and Meteorology
DMA	Defense Mapping Agency
EESL	Electrowatt Engineering Service Ltd
EMS	Electromagnetic Spectrum
ERTS	Earth Resources Technology Satellite
ETH	Swiss Federal Institute of Technology
ETM	Enhanced Thematic Mapper
FCC	False Color Composite
FFC	Federal Flood Commission
FFD	Flood Forecasting Division
F.F.S	Flood Forecasting System
FPSP	Flood Protection Sector Project
FWC	Flood Warning Centre
GDP	Gross Domestic Product
GIS	Geographic Information System
GI	Glacial Lake
GLOF	Glacial Lake Outburst Flood
Gr	Glacier
Ha.	Hectares
H.F	High Frequency
HKH	Hindu Kush – Himalaya
HRPT	High Resolution Picture Transmission
HRV	High Resolution Visible (SPOT)
HYCOS	Hydrological Observing System
ICIMOD	International Centre for Integrated Mountain Development
ILWIS	Integrated Land and Water Information Systems
IR	Infrared
IIR	First infrared

IRS	Indian Remote Sensing Satellite series
IRS1D	Indian Remote Sensing Satellite series 1D
IUCN	International Union for Conservation of Natural Resources
LANDSAT	Land Resources Satellite
Lat/Lon	Longitude/Latitude
LIGG	Lanzhou Institute of Glaciology and Geocryology
LISS	Linear Imaging and Self Scanning Sensor (IRS)
M	Million
masl	metre above sea level
MENRIS	Mountain Environment and Natural Resources' Information
System	
MESSR	Multispectral Electronic Self Scanning Radiometer
Met	Meteorology
mg L –1	miligram/litre
MSS	Multi Spectral Scanner
N.A.	Not Available
NEA	Nepal Electricity Authority
NIR	Near infrared
NIMA	National Imagery and Mapping Agency
NOAA	National Oceanic and Atmospheric Administration
NRD	Natural Resources Division
PAN	Panchromatic Mode Sensor System (SPOT)
RECA	Rapid Environmental Change Assessment
RGB	Red Green Blue
RRC	Regional Resources Centre
RS	Remote Sensing
SPOT	Système Probatoire d' Observation de la Terre / Satellite Pour l'Observation de la Terre
START	global change SysTem for Analysis, Research, and Training
SWIR	Short Wave Infra Red (JERS)
TM	Thematic Mapper (LANDSAT)
TDS	Total Dissolved Substance
THIR	Thermal infrared
TPC	Tactical Pilotage Chart
TTS	Temporary Technical Secretary
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
VNIR	Visible and Near Infra Red instrument

WAA	Water Apportionment Accord
WAPDA	Water and Power Development Authority
WECS	Water and Energy Commission Secretariat
WGI	World Glacier Inventory
WGS	World Geographic/Global System
WGMS	World Glacier Monitoring Service
WHYCOS	World Hydrological Observing System
WMO	World Meteorological Organization
WRRP	Water Resources Research Programme
XS	Multispectral Mode Sensor System (SPOT)

Chapter 1

Introduction to the Inventory of Glaciers and Glacial Lakes

1.1 INTRODUCTION

Himachal Pradesh is a mountain province in the Indian Himalayas covering an area of over 50 thousand sq. km, where mountains and hills occupy most of the land. It extends from the Shivalik hills in the south to the Great Himalayan range including a slice of Trans-Himalayas in the north. Goegraphically, the state of Himachal Pradesh is situated between 30°22’44’’ and 33°12’40’’ N latitude, and 75°45’55’’ to 79°04’20’’E longitude.

The state is vulnerable to various hazards due to fragile geological conditions, great elevation differences, and steep sloping terrain. Apart from landslides and river erosion, the mountainous region is also quite susceptible to disastrous hazards due to glacial lake outburst floods (GLOFs). The GLOF is the most devastating flood-producing phenomenon, which occurs in the Himalayan region from time to time. In general, the area above an elevation of 4,000 masl is mostly covered by snow and ice throughout the year. The glaciers, some of which consist of a huge amount of perpetual snow and ice, create many glacial lakes. These glaciers, as well as the glacial lakes, are the sources of the headwaters of many great rivers in the region. Most of these lakes are located in the down valleys close to the glaciers. GLOF refers to the sudden outburst of lakes, dammed by glacier ice or moraines, producing flows of water that are often of an order of magnitude greater than normal rain-derived peak flows and may travel tens of kilometers downstream, transporting colossal amounts of debris. The occurrence of GLOF in high mountains poses many problems for inhabitants and their infrastructure. First the loss of human life is extremely high, second agricultural crops and land are washed away on a large scale, third hydroelectric projects and roads are totally destroyed or damaged, then rock-fill dams may be breached if the inflow of the torrent of debris cannot be accommodated over the spillway, and lastly large reservoirs are rapidly filled with sediment.

The bursting of moraine-dammed lakes is often due to the breaching of the dam by the erosion of the dam material as a result of overtopping by surging water or piping of dam material. Earthquakes leading to the slumping of dam material may also cause the bursting of the lake. The drainage of ice-dammed lakes may be due to: flotation of the ice dam, pressure deformation, melting of tunnels through or under the ice, and drainage associated with tectonic activity.

The propagation of GLOF surges provokes landslides and bank erosion that temporarily block the surge waves and result in a series of surges as the landslide dams breach. The flood surge can propagate hundreds of kilometres below the glacier lake. Several empirical relationships have been developed from approximate computations of peak release discharges and they indicate that the moraine-dammed lakes may cause peak discharges, which are 10 times higher than the ice-dammed lakes. The damage and constraints are similar to those as in the case of landslide dam bursts.

In the last half-century, several glacial lakes have developed in the Hindu Kush-Himalayas and Tibetan Himalayas. This may be attributed to the effect of recent global warming. The glacial lakes are formed on the glacier terminus due to the recent retreating processes of the glaciers. The majority of these glacial lakes are dammed by unstable moraines, which were formed by the glaciations of the Little Ice Age. Occasionally, the lake happens to burst and suddenly releases an enormous amount of its stored water, which causes serious floods downstream along the river channel. This phenomenon, generally known as glacial lake outburst flood (GLOF), is recognised to be a common problem in Hindu Kush-Himalayan countries such as Nepal, India, Pakistan, Bhutan, and China (Tibet).

In Himachal Pradesh, the sources of its major rivers and the bulk of its freshwater resources are locked up in ice and snow. During the last few decades there has been a rapid retreat of glaciers creating many dangerous moraine-dammed lakes. The formation of such lakes could be dangerous as these lakes may contain a large quantity of water and lakes can cause flash floods in the downstream areas. There are quite a few number of such lakes in Himachal Pradesh, which is divided into four major river basins viz., Beas, Ravi, Chenab and Satluj and four sub basins, having the area ranging between 0.1 and 1.25 sq. km. One such lake located at the snout of the Geopang Gath Glacier in the Chandra basin has been studied in detail for assessing the volume of water. This lake also exists in the survey of India toposheets and its area is 0.27 sq km as per topographical map of 1976. It has been estimated that within a span of 22 years, the aerial extent of the lake was observed as 0.42 and 0.5 sq. km (Depth of the lake was estimated by taking the average of maximum and minimum height of moraine dam and the average depth of the lake is estimated as 18 m). The height was taken from Survey of India toposheets. By considering the average depth, the volume of the lake water was estimated as 9.0 million m^3 in 1998. The instantaneous discharge in the lake is estimated as 326.89-m^3/ sec. This discharge is much more than the summer discharge calculated for chhota shigri nala, which is 10 m^3/sec. If this lake bursts, there will be a sudden increase in its discharge, which may create large damage in the downstream area. Thus in order to assess the possible hazards from such lakes, it has become essential to have the systematic inventory of all such lakes formed at the high altitudes. Besides making a temporal inventory, a close monitoring of these lakes is required to assess the change in their behaviour.

Another desiccated glacial lake and the old terminal moraine are visible from the Rohtang Pass in Chenab Basin. The desiccated lake, about 2.5 km in length, is a narrow meandering plain following the contours of bounding slopes and consists of such fluvio-glacial deposits as mud, fine sand, pebbles and angular gravels, through which the glacier stream runs. The associated Sonapani glacier is about 11 km long. The Bara shigri glacier in Lahaul-Spiti is receding at an alarming rate of 10 metres a year. This is the second largest glacier in the world. Three artificial lakes have been created on the hills on top of the strategic Pangi valley road, which are threatening it in case these burst and their waters came down swirling. Such lakes are considered unsafe as these contain a sufficient quantity of water for causing floods downstream. Rupturing of moraine dammed lakes can cause floods in the valleys. Environmentalists have warned that the low lying areas might be devastated by flashfloods in case the process of melting of glaciers continued in the present manner. The study indicates that the aerial size of the lake created by the Geopang Gath glacier was 0.27 sq. km in 1976 which increased to 0.47 sq. km in 1998. The size of the lake near another glacier was 0.30 sq. km in 1972 and has now grown to 1.22 sq. km. Another glacial lake on the Sissu Nullah was 0.27 sq. km in 1976 and it increased to 0.47 sq. km in 1998. The recent flashflood in the Sutlej, which claimed about 170 lives, is feared to have been caused either due to a cloud burst or breach of lake in the upper reaches. The Manali and Kulu areas suffered widespread damage due to a flashflood in the Beas river and its tributaries a few years ago when the headquarters of the Snow and Avalanche Study Establishment (SASE), which predicts such disasters, was itself devastated.

In many other glaciers as well, small isolated lakes/ponds have been formed. They are increasing in size at a very fast rate. It has been observed that some of the glaciers in Himachal Pradesh are retreating by about 20–30m in a year.

One should be fully aware of the dangerous nature of large glacial lakes, especially if they happen to exist at the headwaters of rivers that flow through inhabited valleys or are harnessed for the generation of hydropower and/or for other purposes. It is an utter necessity to identify such lakes initially from the study of satellite images (and aerial photographs if available) and to assess their field conditions without delay. Some of these lakes may need only regular monitoring whereas a few may really need structural counter measures to reduce the inherent hazards they pose.

ICIMOD and UNEP/RRC-AP from 1999 to 2001 inventoried 3,252 glaciers and 2,323 glacial lakes in Nepal and 677 glaciers and 2,674 glacial lakes in Bhutan. The study also identified 20 glacial lakes in Nepal and 24 glacial lakes in Bhutan as potential glacial lake outburst flood. In addition to this at least 20 catastrophic outburst events have been documented in Bhutan, Nepal and China over the past 50 years Comparable information from India and Pakistan is virtually non-existent. To fulfill the gap, ICIMOD in collaboration with APN, START and partner institutes continued the study in 2002. A beginning has been made to document glaciers, glacial lakes and potentially dangerous glacial lakes in the HKH region from which valuable knowledge and lessons are being learned. The study will expand the glacial lake and GLOF knowledge base of HKH region. Taken together, the database development will greatly enhance the ability of global and regional climate researchers, national policy makers and water resource planners, as well as the general public, to understand and mitigate GLOF-associated hazards.

The programme of APN is extended in 2003 to continue the inventories of glaciers and glacial lakes in Pakistan, India and China as a second phase of APN project. This report describes the Himachal Pradesh, India part only.

For the mapping and inventory of the glaciers and glacial lakes, the methodology used in this study is based on the research study of the Temporary Technical Secretary for the World Glacier Inventory of the Swiss Federal Institute of Technology (ETH), Zurich (Muller et al. 1977; World Glacier Monitoring Service (WGMS) 1989).

1.2 Objectives

- To understand the GLOF phenomenon by creating an inventory of existing glacial lakes and monitoring the GLOF events on a regular basis
- To establish an effective early warning mechanism to monitor GLOF hazards using RS and GIS in the Hindu Kush-Himalayan region
- To develop the capacity building of national institutions to assess and monitor the GLOF phenomenon
- To disseminate the results and outputs to the relevant organisations in the region that could make use of this information for GLOF hazard prevention and mitigation planning

1.3 Outputs

- An inventory of glaciers and glacial lakes of Himachal Pradesh
- Identification of potential risk lakes
- Recommendations for the establishment of a system for monitoring potential risk lakes using RS and GIS
- Strengthening of capabilities of the national institutions to implement an early warning system for GLOF hazard monitoring
- Dissemination of the results and outputs to relevant institutions

1.4 Activities

a) Glacier and glacial lake inventory

- Acquisition of Land Observation Satellite (LANDSAT) Thematic Mapper (TM), IRS LISS 3 images for 2000 covering the state of Himachal Pradesh.
- Collection of GIS data layers including digital elevation models (DEM), geology, soils, hydrology (rivers), land use, infrastructure (roads), settlements, forest, administrative boundaries (districts and villages), urban areas, and tourist SPOTs on a scale of 1:50,000
- Data analysis and report writing.

b) Monitoring potential risk lakes

- Acquisition of LANDSAT TM/Système Probatoire Pour l'Observation de la Terre (SPOT)/RS images of 1990 and 1995 for glacial lakes.
- Acquisition of time series satellite images for 1990 and 1995
- Field checking and validation of results.
- Report writing

c) Establishment of an early warning system

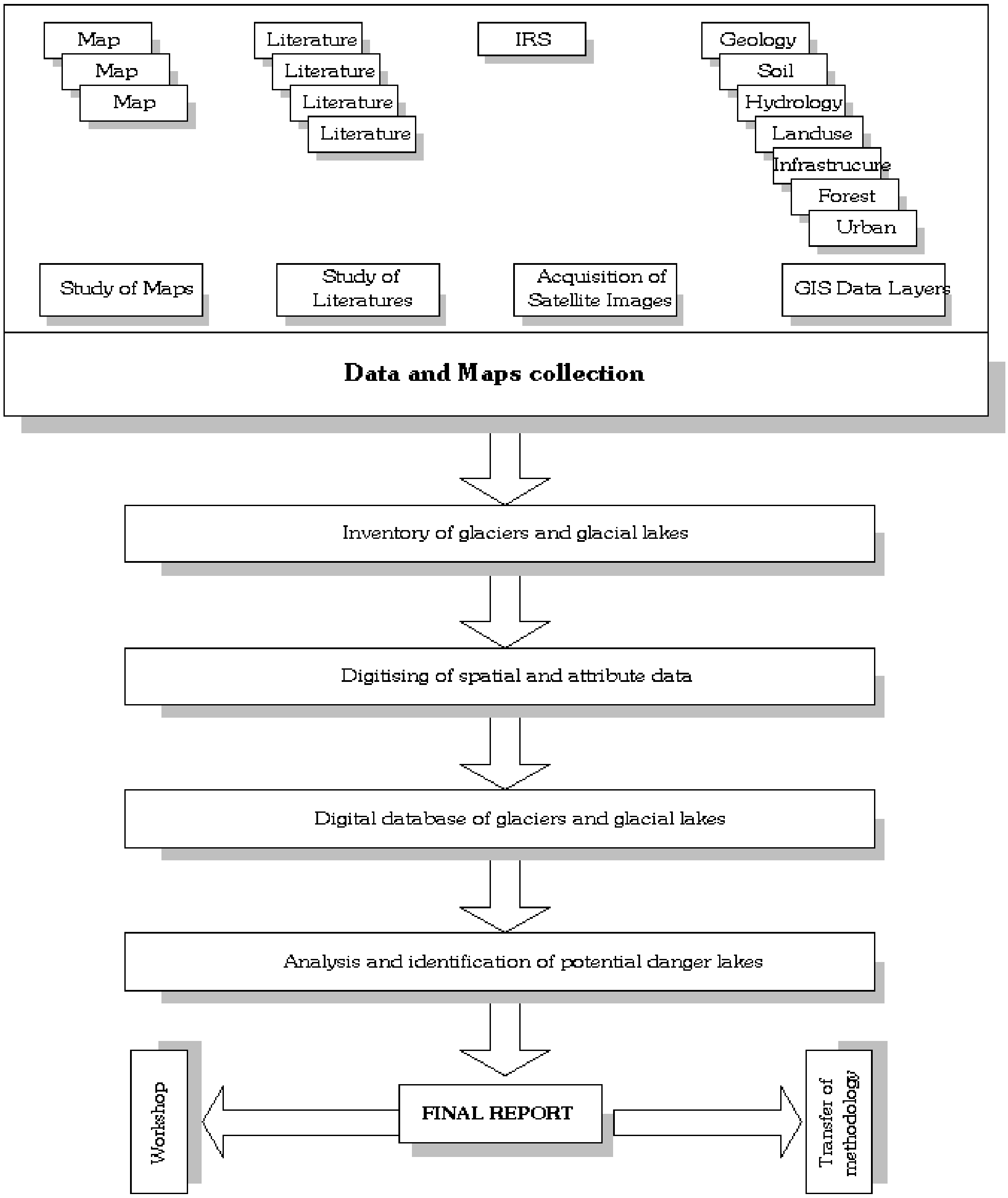
- Developing the methodology using RS and GIS techniques for the inventory of glaciers and glacial lakes and for the GLOF monitoring and early warning system
- Training two participants from Himachal Pradesh

d) Results dissemination/publication

- Publication of a comprehensive report including (1) to (3) above
  Dissemination of results and outputs in the form of reports, on CD, and through the Internet.

- Organisation of a workshop to release the results and outputs.

1.5 FLOW CHART



Chapter 2

General Characteristics of the Himachal Pradesh

Himachal Pradesh, situated in the lap of Western Himalayas, has majestic mountains, fertile valleys, perennial rivers, precious forests, invaluable flora and fauna, tremendous wealth of resources, minerals, very rich culture and diverse customs and manners. The state of Himachal Pradesh is situated between 30° 22' 44" and 33° 12' 40" N latitude, and 75° 45'55" to 79°04'20" E longitude, and occupies an area of 5.57 million ha. Himachal Pradesh is a hilly state with a general increase in elevation from west to east and south to north ranging from 350 m to 7000 m (Kayastha, 1971). Its one-third areas remain snow covered for about seven months in a year. This snowy part of the State is the source of three major rivers – Beas, Ravi, and Chenab while Satluj and Yamuna Rivers originate from Tibet and Yamnotri, respectively. Its climatic conditions vary from extremely hot to severe cold regions like Chamba, Kinnaur and Lahaul Spiti. Dharamsala and Palampur in Kangra district receive the highest precipitation only next to Chirapunji (highest rainfall in the world), while areas like Spiti almost have no rainfall during the winter season .

2.1 Geomorphology

Physiographically the Himachal Pradesh have been identified into four divisions (Marh, 2000) and are described briefly below:

Outer Himalaya or the Shivaliks

This division consists of low hills of Shivalik zone with an elevation of up to 600 m. Shivalik hills are made of monoclinal hills dipping gently southward, steep scraps facing north and structural valleys called *duns* to the north of them. This zone represents the youngest part of the Himalaya and the strata here consist of sandstone, conglomerate and shale. These are prone to erosion and this zone has a highly dissected and rugged terrain. The seasonal streams called *choes* have dissected deeply into the unconsolidated understream. This zone is about 50 km wide in the west, becomes about 80 km wide in Kangra valley and tapers to smaller width in Nalagarh and Kyarda Duns in east. Main ranges in this division are Hathi Dhar, Sikandar Dhar, Chaumukhi range, Solasinghi Dhar, Ramgarh Dhar, Naina Devi Dhar and Dharti Dhar.

Lesser Himalaya or Central Zone

This zone mainly includes the Dhauladhar and Pir Panjal ranges. The Dhauladhar and Pir Panjal ranges are conspicuous and quite distinct in the west and form the southern and northern watershed of Ravi Basin. Dhauladhar extends further east into the Beas valley and crosses the Satluj river near Rampur. Pir Panjal forming the southern watershed of the Chandrabhaga in Chamba and Lahaul Spiti districts joins the Great Himalayan range north of Deo Tibba and Rupi Valley (Parbati River). Some minor ranges of lesser Himalaya are Dagni Dhar, Mani Mahesh and Dhog Dhar in the Ravi valley; Jalori Dhar and Shikari Dhar in Beas and Satluj basins and Nagtibba range. Mussourie range and Shimla hills in the Yamuna basin east of the great Himalayan Divide.

Great Himalaya or Central Zone
The great Himalaya range forms the northern watershed of the Chandrabhaga (Chenab) basin and separates it from Spiti basin and further east it forms watershed between Spiti and Beas basins. It is cut across by Satluj before it enters the Utter Pradesh Himalaya with extension to Badrinath/Kedarnath. The elevation of the great Himalaya ranges between 5000 and 6000 m, and it has several passes having elevations between 4500 m.

Zanskar range
The easternmost range of Himachal Pradesh is the Zanskar range. It forms the northern watershed of the Spiti and Sangla valleys in Kinnaur and roughly forms the Indo-Tibetian boarder. Satluj cuts across the Zanskar range forming a deep gorge. In the south-eastern part of Kinnaur, one prominent range comes out of it towards west-northeast in the form of Kinner Kailash range. Himachal Pradesh displays extensive areas with present day and past glaciers. Almost whole of the state has been either directly or indirectly affected by glaciers. Modern glaciers are merely the shrunken remnants of the much more extensive alpine glaciers of the Pleistocene ice age. Large part of Zanskar, Great Himalaya and Pir Panjal are currently being glaciated and display features of glacial topography while other areas have features of extensive past glaciations. Garwood (1924) has suggested that in Kangra valley glaciers came down to as low as 610 m. On the basis of analysis of deposits found in the Kangra valley, Sharma (1977) has suggested that this area has experienced three major glacial periods. This kind of extension of glaciers to low elevations has also been suggested in the Ravi valley near Chamba town (Marh, 1996). Evidences indicting the presence of glaciers in the past like different kind of morains, ice-transported blocks, smoothened and striated rock surfaces, U-shaped valleys, hanging valleys, glacial lakes and glacial-fluvial deposits are found in different parts of the state (Sharma, 1977; Marh, 1986; Marh et al., 1994).

2.2 GEOLOGY

The state of the Himachal Pradesh comprises the most complicated geological regions in the Himalaya. The Region falls into four major stratigraphical zones (Singh and Bhandari, 2000) as described below:

Outer or sub-Himalayan Zone
This zone also called Shivaliks, consists mainly of tertiary formations, extending from north-west to south-east. This system comprises great thickness of detrital rocks, clays and conglomerates.

Lower Himalayan range
This zone is mainly comprised of granite and other crystalline rocks of unfossiliferrous sediments. The Karol belt separates this region from Shivalik system. The rocks of the Shimla-Karol belt are of dark unaltered slates and micaceous sandstones. Metamorphosed rocks are overthurst on the Shimla slates. The overlying deposits of the Karol belt have a) Karol limestones and b) Tal quartzites.

High Himalayan Zone

The rocks of this zone lack fossils. The granite rocks and granitic gneisses exist in south of Spiti region and also along the Satluj. In this zone, severe tectonics have affected the crystalline rocks and led to the formation of the crystalline klipen as in the Shimla area.

Tibetan or Tethys Himalayan zone

This zone mainly consists of the wide basin covering the Spiti valley. A nearly complete sequence of fossiliferrous Paleozoic and Mesozoic strata is laid bare in this zone. The youngest Mesozoic formations are obviously composed in the central part of the basin. The base of the sedimentary column is formed by argilacious metamorphics where mica schist rich in Kyanite, staurolite and garnets are predominant. The rusty ferruginous slates are also present at many places.

2.3 SOILS

The soils of the state have not been classified properly so far because of lack of information and a great deal of heterogeneity (Singh and Bhandari, 2000). According to Raychaudhary and Govinda Rajan (1971), these soils have been shown as brown hill soils in the old system of classification. These soils have been termed as Cambisols as a broad soil region in FAO-UNESCO soil map of the world, vol II (Anonymous, 177). However, based on their development and physico-chemical properties, the soils of the state can be broadly divided into nine groups (Yadava and Thakur, 1972; Verma 1979; Verma and Tripathi, 1982; Verma et al. 1985; Singh, 1987; Singh et al. 1996) as shown below:

Alluvial soils

These soils are characterized by the incipient profile development and usually exhibit AC profiles and occasionally B2 horizon. Such soils are found in Una (Una district), Indora (Kangra district) and Poanta (Sirmaur district) areas where floodplain is a dominant physiography. These soils correspond to Udifluvents and Eutrochrepts in accordance with Soil Taxonomy of USDA (Soil Survey Staff, 1990). These are generally coarse textured soils comprising loamy sand and sandy loam and occasionally loam to sandy clay loam. These are low in organic matter and neutral (pH >6.5) in reaction. The soils are somewhat calcareous in nature in which calcium carbonate varies from 2.0 to 4.5 per cent.

Brown hill soils

These soils are found in Nahan (Sirmaur district) and Solan (Solan district) areas. Generally the soils have ABC profiles in which process of illuviation has given rise to the development of cambic or argillic horizons. These soils are medium to high in organic matter and neutral to slightly acidic in reaction. Sandy loam to clay loam texture is usually encountered. According to the soil taxonomy the soils are classified as Hapludols, Hapludalfs and Udorthents.

Non-Calcic Brown soils

These soils are generally found in parts of Hamirpur, Bilaspur and Mandi districts besides Dehra Gopipur (Kangra district) areas. These soils show moderate development leading to ABC profiles. Depending upon the physiography, these are characterized by the presence of argillic horizons whereas in certain locations, cambic horizon is of common occurrence. Soil reaction is neutral in most cases and rarely acidic. The texture varies from loamy sand to clay loam. Organic matter content varies from low to medium. These soils are equivalent to Eutrochrepts and hapludalfs according to Soil Taxonomy of USDA.

Brown Forest soils

These soils are found in parts of Chamba districts where the forest vegetation has resulted in the formation of dark A horizon. The soils are further characterized by B horizon which invariably shows alluvial clay as evidenced by clay argillans on ped surfaces. These have moderately deep to deep solum. The soils are sandy loam to clay loam in texture and slightly acidic to neutral in reaction. The soils belong to Hapludalf, Hapludolls and Eutrochrepts groups in order of their occurrence.

Grey Wooded or Brown Podzolic Soils

Grey wooded soils are commonly developed in parts of Shimla and Kullu districts and Karsog area of Mandi district. The soils are mainly developed under varying magnitude of podzolization. B horizon shows illuviation of free sesquioxides and clay. A horizon is generally characterized by darker colours containing high organic matter. ABC profiles are generally found on stable physiography. Soil reaction ranges from slightly to strongly acidic and the textures are sandy loam to clay loam. The soils belong to Hapludolls and hapludalfs groups.

Grey Brown Podzolic soils

These soils are commonly found in parts of Kangra district and Jogindernagar area of Mandi district. The soils have well developed B2 horizon marked by iluvial clay on ped surfaces and are moderately to well developed. The dominant process of soil formation is podzolization. In adition, B2 horizon is characterized by stronger matrix colours of redder hues, high values and chromas and are accompanied by Fe-Mn concretions. Thick argillic horizon underlying ochric epipedon is generally seen. Heavy texture of clay loam silt loam and silty clay soils are often found. They are distinctly acidic in reaction. In soil taxonomy these soils are classified as Paleudalf, Hapludalf and Haplorthods.

Planosolic Soils

These soils are found in Balh valley of Mandi district, Ghumarwin of Bilaspur district, Nagwain area of Kullu district and Saproon valley of Solan district. The soils are imperfectly drained. Gleyed horizon often shows Fe-Mn concretions, mottling and grey matrix colours which qualify for cambic diagnostic horizon for moderately developed soil profiles whereas argillic horizon is invariably found indicating marked illuviation of clay. Soils are medium to fine textured i.e. sandy loam to sandy clay loam and clay loam and are neutral in reaction. Organic matter is usually medium to high whereas available phosphorus and potassium are rated under medium categories. These soils are placed in Ochraqualfs, Hapludalfs and Haplaquepts groups under soil taxonomy.

Humus and Iron Podzols

These soils are mainly confined to parts of Shimla, Dalhousie and Manali regions. The soils are predominantly formed under the process of podzolisation. While dark coloured A horizon is enriched with organic matter, the reddish brown to yellowish brown B2 horizon contains free iron and aluminum accompanied by organic matter. Typical ashy grey albic (A2 horizon) is rather uncommon in such podzols. Profiles are marked by distinct spodic horizon underlying Mollic or Umbric epipedon. Soils are acidic in reaction and contain high amounts of organic matter. Sandy loam, sandy clay loam and clay loam textures are common. They are low in available phosphorus and high in potassium. As per soil taxonomy, these soils qualify for Haplorthods, Argiudolls and Hapludolls.

Alpine Humus Mountain Skeletal Soils

These soils are found in the Himalayan highlands constituting the districts of Kinnaur, Lahaul-Spiti and Pangi tehsil of Chamba district where the precipitation is low and temperature regimes may be frigid to mesic. Mollic or ochric epipedons are overlying cambic horizon in moderately developed soil profiles only over stable physiographic situations. Soils are gravelly loamy sand to loam, usually high in organic matter and neutral in reaction. Available phosphorus and potassium are generally medium to high. On the basis of soil taxonomy, these soils can be classified as Hapludolls, Eutrochrepts and Udorthents (Sehgal, 1973; Negi, 1976; Verma, 1979; Sharma and Singh, 1991).

2.4 MOUNTAIN PASSES

Himachal Pradesh being a hilly state is bound on many sides by high hills and there are several inhabited valleys enclosed around by high mountains. The approach to these valleys is through difficult mountain passes, some of which are given below (Attri, 2000): *Kundi ki jot*: This pass lies between Kaniara and Chinota. This pass is said to have been one of the earliest and much used in old times by the Gaddies (nomads) of Chamba district. *Bohar pass*: This pass lies between Boh in Kangra and Basu or Bakan in Chamba. It is low and easy to cross. *Indrar pass*: The location of this pass is between Dharamsala (Kangra district) and Chinota. The frozen snow is rather steep, otherwise it is an easy pass to cross over. *Satnalo pass*: This is a difficult pass, which lies between Bandla (Kangra district) and Bara Bauao. *Talang pass*: The pass lies from the head of Bangana river, between Narwana or Jiya (Kangra district) and Traita. Although this is very high pass, but not difficult one. The height of this pass is about 16, 000 feet above mean sea level. Kuronw and Sultanpur passes: These passes fall in the mountain ranges of Lahaul and Kullu district. *Bara Lacha passes*: Its height is estimated to be between 16221 and 16500 feet above mean sea level lying between Zingzingbar and Lingti encamping grounds. This pass is generally open to traffic from June to October. During winter months it remains hermetically sealed. *Kugti pass*: This pass is a gateway to Bara Bhangal another tribal area in Himachal Pradesh and is approximately 17000 feet high. *Kwagpur pass*: It lies between the villages of Sungra in Kinnaur and Teri in Spiti and occurs on the line from Dhunkar to Shimla. Its height is between 14000 and 15000 feet above mean sea level. *Manirung pass*: This pass lies in between village of Mani on one side and Robuk in Kinnaur on the other side. The height of this pass is approximately 18889 feet above mean sea level. This pass is used by traders from Spiti, Bushahr and Kinnaur. *Takling pass*: It strikes off from Spiti at the height of17000 feet above mean sea level. It enters Ladakh and is rarely used. *Babeh pass*: It rises from Satluj at the Wangtu bridge ascending to the valley of Gutaon in Kinnaur, the first village in Spiti, after passing Modh in the pin valley. This is used by people living in Bushehar, Kinnaur and Spiti. *Parung pass*: This pass lies at a height of 18, 508 feet above mean sea level. This pas lies between the village of Kiber in Spiti and Ladakh This is used by traders of Spiti, Bushahr and Ladakh and tourists proceedings from Shimla to Leh on the Pangong Lake. *Humta pass*: The Humta pass lies between Preenee in the upper Beas valley and Chaitroo in Chandra valley It is estimated to be 15000 feet high. The pass is open most part of the year.

Rohtang pass: The pass lies at a height of 13, 325 feet above mean sea level and lies between Rahla in Kullu valley and Khoksar in Lahaul valley.This pass is a gateway to Lahaul. The river Beas originates from Rohtang pass.

Rohtang pass (Photo by R.M. Bhagat)

Kunzum pass: This pass lies at a height of 14 900 feet above mean sea level. It is between Upper Chandra valley and Losar in Spiti valley.

Kunzum pass (Photo by R.M. Bhagat)

Malana pass: It lies at a height of 12, 000 feet and is situated between the villages of Naggar and Malana in Kullu district and the ascent on both sides is very fatiguing. *Bubboo pass*: This pass lies at a height of 10, 000 feet and is a boundary between Mandi and Kullu district. *Bajaura pass*: This pass lies at a height of 7000 feet and is between Kamand in Beas valley and Bajaura in Kullu valley. *Jalouri pass*: This pass lies between Manglore and Kot in Seraj in Kullu district. This pass has a big forest on either side. *Basloh pass:* This pass lies at a height of 11, 000 feet above mean sea level and lies along Plach and Nirmand in Seraj.

2.5 EROSION HAZARDS

Several kinds of erosion are taking place in Himachal Pradesh. Some of these are sheet erosion, Rill and gully erosion, stream and river bank erosion, Road construction erosion, land slide erosion and glacier erosion. Sharma and Singh, (1991) has described in detail these erosions taking place in Himachal.

Land slides along NH-22 Khadra Dhank (now abandoned – the road is rerouted and this stretch is avoided due to frequent landslides) in Kinnaur district (Photo by R.M. Bhagat)

Erosion along Spiti river in cold desert area (Photo by R.M. Bhagat)

Glacier erosion: Sharma and Singh (1991) has explained that whenever there is a movement of large mass of ice down the slopes, it brings alongwith huge debris causing lot of soil erosion. Glacial erosion is characterized by furrowing, cutting, ploughing and scouring action on the land mass. The flash floods due to enormous snowmelt transport the debris down into the river system after having inflicted lot of damage to the bed and to the sides of gullies. These authors have further shown evidence of such occurrence near Jangi village in Kinnaur district, where lakhs of tones of debris have been brought by glaciers few years back and dumped into the bed of Tidong rivulet and Satluj river where it drains. In Kinnaur and Lahaul and Spiti districts there are many conspicuous glacier paths devoid of vegetation that directly dump debris into the river beds.

2.6 HYDRO POWER POTENTIAL

India has total hydro-power potential of 80,044 MW. Himachal Pradesh has a vast Hydel potential and preliminary hydrological, topographical and geographical investigations has estimated that there is about 21,332 MW potential in this state. Most of the projects already producing electricity are under the control of outside agencies like Bhakhra Beas management Board, Punjab State electricity Board

Sector wise power consumption in H.P.

S.No.	End user during 1997-98	Million K watt.	Percentages of total
1.	Domestic	473.372	24.33
2.	Commercial	134.898	6.93
3.	Industrial	1182.454	60.78
4.	Agriculture	10.532	0.54
5.	Public lightening	6.049	0.31
6.	Miscellaneous	138.241	7.11
	Total	1945.545	100

The above pattern shows that Industrial composition in HP alone accounts for about 61 per cent of total consumption.

Details of identified/unidentified hydro potential of HP.

Yamuna Basin		
	Project under operation	**Mega Watt**
1.	Andhra	16.95
2.	Giri	60
3.	Yamuna Project	537.37
4.	Gumma	3
Satluj basin		
1.	Rong Tong	2
2.	Rukti	1.5
3.	Chaba	1.75
4.	Bhakhra Dam	1200
5.	SVP Bhaba	120
6.	Nogli Stage I	2.5
Beas basin		
1.	Beas Satluj Project	990
2.	Uhl Stage I	110
3.	Uhl Stage II	60
4.	Binwa	6
5.	Baner	12
6.	Pong Dam	360
Ravi basin		

1.	Gharola	0.05
2.	Bharmour Micro	0.02
3.	Barva Sieul	180
4.	Chemera Stage I	540

Chenab basin		
	Project under operation	**Mega Watt**
1.	SISSU	0.1
2.	Billing	0.2
3.	Killar	0.3
4.	Therot	4.5
Project under Construction		**Mega Watt**
Yamuna basin		
1.	Gumma SHP	3
Satluj basin		
1.	Bhaba AUG Scheme	3
2.	Nathpa Jhakri	1500
3.	Ghanvi	22.5
4.	Rampur	680
Beas basin		
1.	Largi	126
2.	Uhl Stage II	60
Ravi basin		
1.	Holi	3
2.	Sal II	2
3.	Chemera Stage II	300

Projects under Private and Joint Sectors

	Project under operation	**Mega Watt**
1.	Dhamwari Sunda (Yamuna)	70
2.	Baspa Stage II (Satluj)	300
3.	Karcham Wangtoo (Satluj)	1000
4.	Kol Dam (Satluj)	800
5.	Uhl Stage III (Beas)	100
6.	Malana (Beas)	86
7.	Budhil (Ravi)	70
8.	Hibra (Ravi)	231

Brief details of the projects in Himachal Pradesh

1. Baner Hydel Project (12 MW) It has been built on the Baner ‘Khad’ which is a tributary of river Beas and originated from the southern slopes of Dhauladhar range. The project is located in Distt. Kangra The project was commissioned on May 13, 1996.

2. Gaj Hydel Project (10.5 MW): This project with an installed capacity of 10.5 MW during a mean year, is a run of the river scheme, utilizing the
3. water of Gaj and Leond ‘Khad’. The project is located in Distt. Kangra at a distance of 40 km from Kangra Town. The project was commissioned on April 22, 1996.
4. Bhaba Augmentation Scheme (3MW): It is being created primarily to augment the water availability in the Bhaba Khad;, during the winter season. The discharge in the Bhaba Khad is reduced to a great extent during winter when entire catchment area is covered with snow, thereby reducing the firm power capacity of emitting 120 MW SVP.
5. Bassi (60 MW): The maximum demand recorded in this power house during 1996-1997 was 60 MW. The main transmission line and sub-stations are Bassi-Hamirpur, Bassi-Shana and sub station at Bassi.
6. Binwa (6 MW): Binwa khad is a tributary of the river Beas originating in the southern slopes of Dhauladhar range at an altitude of 4300 m. Binwa khad joins the Beas river after traversing a distance of about 100 km. Binwa project with 2 Unit of 3 MW each is located near Baijnath in Palampur tehsil of Kangra District.
7. Kol Dam (800 MW): The Kol Dam site is very easily approachable from Slapper bridge on the national highway 21. Beas-Satluj project is 5-6 km away from the site of Kol Dam. The Government of HP took a decision during Oct, 1995 to invite global offers for the equity participation of Himachal Govt. is to be 25 % and private party 75 %. Now, it has been decided to hand over the project to NTPC.
8. Bhaba Project (120 MW): This power house with 3 units of 40 MW each is located at Bhabanagar in the Kinnaur district. The intake site of the project is across river Bhaba, a tributary of Satluj river. Bhaba project is popularly known as Sanjay Vidyut Pariyojna.
9. Bhakhra Dam (1200 MW): The location of the Bhakhra Dam is near Bhakhra Village in Bilaspur district. The purpose for the construction of this dam was irrigation and hydro power. The catchment area of Bhakhra dam is 56,876 km. Flanked on both sides by two gigantic power plants, the 225 m high Bhakhra dam is one of the highest straight gravity dam in the world.
10. Beas - Satluj Project (990 MW): The Beas project is located in Mandi district with the capacity of 990 MW. A fall of 335 m has been created with the cost of Rs. 260 million Beas Satluj link project. The Beas river has been diverted at Pandoh. There are in all six units of 165 MW each at Dehar close to the meeting point of the two rivers.
11. Baspa Project II: this Project located in Kinnour has been considered for execution with the private sector. The project has been techno-economically cleared by CEA and the firm has started infra-structure works. The project is expected to be commissioned by 2001.
12. Pong Dam (360 MW): The location of the dam is in Kangra district. It is on river Beas and the catchment area is 12562 km. The construction of this dam was started as early as in 1960 and completed in 1974. The height of the dam is 133 m.
13. Shanan Electricity House: The oldest hydel project is located near Jogindernagar. The project is brain child of Col. Betti. The main attraction of the shaman power house is the diversion of Uhl and Lamba tributaries of Beas rivers flowing at 1800

m above mean sea level in Mandi district. This power house is known for its Engineering feet which was the first electric project in the Himalayas in 1930.

14. Neugal Hydel Project (15 MW): This project is located in district Kangra and has been considered for execution.
15. Chemera II Project (300 MW): The project is located in Chamba district on river Ravi and the first stage is in operation
16. Nathpa Jakhri project (1500 MW): The project envisages the construction of pick up dam on Satluj river at Nathpa about 3 miles down stream of Wangtoo. Installed capacity of this project will be 1500 MW and estimated revised cost will be Rs. 7208 crores. From this project HP will get 12 % free electricity as royalty. This project is already facing time delay and its first unit is to be commissioned by 2001. The length of the tunnel of Nathpa Jhakri is approximately 26 km.

2.7 IRRIGATION PROJECTS

Himachal Pradesh does not have a very well developed irrigation system, however, there are some irrigation projects, which are now operational in the state:

Shah Nehar project: This is the only major irrigation project in Himachal Pradesh and is in Kangra district on the river Beas. After fully commissioning the project it will irrigate15, 287 hectares of land and about 93 villages will be benefited by the project. There are some medium and small irrigation projects, which are listed below:

Balh valley project: This project is constructed in Mandi district and utilizes the water of Baggi channel of Beas Satluj Link project. The existing potential of the Balh valley project is 2410 hectares.

Bhabour project: Bhabour Sahib project utilizes the water of Nangal dam reservoir and will irrigate an area of 2640 hectares. The work on phase II of this project is still being constructed and will irrigate 2440 hectares.

Giri irrigation project: This is in Sirmour district and will irrigate an estimate area of 5263 hectares.

Sidhata project: The Sidhata scheme is situated in Jawali tehsil of Kangra district. The total irrigation potential of this project will be 3150 hectares.
The following projects are proposed to be brought under irrigation facilities Attri (2000):

1. Bara Solda Nagrota Surian project in Kangra district
2. Hatli Sagrangra Batauha in Mandi district
3. Dhaneta Barsar in Hamirpur district
4. Tikker dam in Hamirpur district
5. Pandol Chauntra project in Mandi district
6. Mehran Dharwabon in Mandi district
7. Rela Bhen-Kher Badhel in Mandi district
8. Phina Singh project in Kangra district
9. Bason Garli Glori Shah Talai project in Hamirpur district
10. Sarwari in Kullu district
11. Changer area in Bilaspur district

12. Beet Illaqa project in Una district
13. Churu project in Hamirpur district
14. Sakral project in Hamirpur district
15. Jangle Beri project in Hamirpur district
16. Kandror, Harkhan, Panoh Dajari project in Bilaspur district

2.8 MINERAL RESOURCES

Himachal Pradesh is endowed with several important minerals like limestone, high grade limestone, quartzite, gold, pyrites, copper, rock salt, natural oil and gas, mica, iron ore etc. Himachal Pradesh is the only state in India where rock salt is mined.

Limestone: Commonly known as Chuna-ka –pathar is one of the most important minerals used in many industries like cement, calcium carbide, lime, fertilizer, steel, sugar, textiles, paper and leather. It is available in Gagal (Kangra district) and Barmana (Bilaspur district). The reserves of these places are estimated to be 150 million tones.

Gypsum: It is found in Kurga and Bharli areas of Sirmour district. About 4 million tones of reserves are estimated in these areas. Gypsum is also found in varying amounts in Solan, Chamba, Kinnaur and Lahaul-Spiti districts.

Rock salt: It is being mined in Gumma and Darang areas of Mandi districts.
Friable Quartzites: boulders and pebbles are found in small rivulets of Una district, while white quartzite is found in Bilaspur district.

Iron ore is found in Kangra, Kullu, Kinnaur, and Mandi districts, Copper in Chamba, Kullu, Kinnaur, Sirmour, and Lahaul-spiti districts, Pyrites in Shimla and Chamba districts, *Nickel, Cobalt* and *Silica* in Kullu district and *antimony* is found in Lahaul-spiti district.

Nearly 232 *slate* quarries are producing states in Mandi, Chamba, Sirmour and Kangra districts, which are used for primarily roofing purpose.

2.9 FOREST RESOURCES

In the mountainous regions, such as Himachal Pradesh, natural resources constitute the basic support system for life. The rural population depends on forest resources for their requirements of fodder, fuel wood, timber, herbs and medicinal plants. In many areas, particularly where much of the population is landless, forest resources are one of few resources, which are freely available to rural dwellers.

The total geographical area of the state as reported in the village papers was 2906 thousand ha in 1966-67 which increased to 2987 thousand ha in 1979-80. Forests constitute an important natural resource of the state, which provide timber, fuel, fodder, wood, etc. The forests contribute 1/3 of the total revenue of the state and also provide employment to a sizable population.

The forests of the state can be broadly classified into coniferous forests and broad leaved forests. Distribution of various species follow a fairly regular attitudinal stratification except where the micro-climate changes due to aspect, exposure and local changes in the rock and soil brings in vegetation inversion. The vegetation varies from dry scrub forests at lower altitude to alpine pasture at higher attitude. In between these two extremes, distinct vegetational zones of mixed deciduous forests, chir, ban oak, pure or mixed coniferous and kharsu oak forests are found.

The forests of Himachal Pradesh are rich in biodiversity, forming the conspicuous vegetation cover. Out of total 45,000 species of plants found in the country, as many as 3,295 species have been reported in the state. The forests of the state can be classified as reserved, demarcated, unprotected demarcated, unclassed forests based on legal classification; whereas on attitudinal basis these are named as tower mountain, middle mountain, temperate and alpine forests.

In Himachal Pradesh, total area under forest is 37,591 km with total growing stock of 10.25 crore m whereas per capita forest area is 0.73 ha. Annual prescribed yield from forests is 5 57 727 m.

Major timber resources of Himachal Pradesh are conifers viz. *Cedrus deodara*, *Pinus roxburghi*: *P wallichiana Picea smithiana Abies pindrow A spectabilis Cupressus torulosa, Juniperus excelsa and J. sequamata*. Among broad leaved species, *Shorea robusta, Quercus leucotricophora, Q. floribunda, Q. dilatata, Aesculus indica, Acer* spp., *Juglans regia, Acacia catechu, Dalbergia sissoo, Toona ciliata, Alnus nepalensis* etc. are important wood resources. Average annual removal of conifers has been estimated to be 3,59,085 m whereas from broad leaved species, removal is 1,91,89 m The fodder and fuel wood yielding species are *Grewia optiva, Morus alba, Bauhinia variegata, Celtis australis, bamboos, Albizia chinensis, A. lebbeck and Robinia pseudocacia.*

Wood resources have a great bearing on the economy of the state as people are dependent upon these resources for meeting multifarious demands Major uses of wood are in the form of firewood, house construction, packaging of the horticultural produce and in agricultural implements. Annual fuel wood requirement of the state is 32 lac tonnes which is increasing day by day due to increase in population. The demand for fuel wood in rural area is usually met by lopping and small twigs collected from common lands including culturable wastelands and fallows other than current fallows. The increase in demand of fuel wood is the major cause of deforestation.

The state also has valuable possessions of non wood forest resources. These products specifically include grasses, fruits, leaves, bark, animal products, soil and minerals. These also include bamboo, canes, grasses fibers, flosses, essential oils, fixed oils, waxes, dyes and tans, medicinal plants, gums and resins, drug yield specifies, poisons, insecticides and miscellaneous forest produce (lac, honey, tandu leaves).

2.10 FLORA AND FAUNA

As has been seen above Himachal Pradesh presents a varied climate, topography and geology resulting into diversified flora. Climate is the main factor which determines the composition of the flora of any area. The variety of economically important trees, herbs and shrubs found naturally growing in three altitudinal belts i.e. (i) 1200 ft to 4000 ft (ii) 4000 ft to 8000 ft and (iii) 8000 ft to 11000 ft. The following are the important flora found in Himachal Pradesh:

***Trees*:** The commonly found trees in Himachal Pradesh are, Akoria (*Rhus*), Akash bel (*Cusevta refles*), Akrot (*vugulans regia*), Amaltas (*Cassia fistula*), Bargad (*Ficus benghalensis*), Chil (*Pinus longifolia*), Haldia (*Adina cardilolia*), Harar (*Terminalia chebule*), Kachnar (*Bauhinia variegate*), Kakare (*Pistacia integerrime*), Semal (*Salmalia malabarica*), Simbal (*Bombax malabaricum*, Seriphal (*Acgle marmelos*) and kaiphal (*Myrica nagi*) beside several other trees like varios species of pines, fodder trees, acacia spp. etc.

Shrubs: The commonly found shrubs in Himachal Pradesh are, Bhatindu (*Cissampelos pareira*), Dhai (*Woodfordia fncticosa*), Kamal (*Man philippinensis*) Kural (*Medua helix*), Thuna (*Taxus baccata*) and Tut (*Morus alba*)

Herbs: Himachal Pradesh is home to various herbs of high economic importance, some of which are, Bhang (Cannabis sativa), Ritha (Sapindus trifoliayus), Toon (Toona ciliate), Mehndu (Dodonaca viscas) and Tunga (Rhus cotinus)

Wild life: Amongst the animals the most common wild animals are, Musk deer, Barking deer, Himalayan Thar, Himalayan ibax, Blue sheep, Snow leopard, Common leopard, Himalayan black bear, Common palm civet, Ghoral, Indian porcupine, Indian Hare, Red fox, Indian fox, common langur and Jackal. Amongst the commonly found birds are Tragopan, Monal, Cheer koklas, Kalij and Snow cock. Amongst the commonly found fish in the river waters of Himachal Pradesh are, Mrigal, Grass carp, Mirror carp, Beta Kuni, Rohu, Ticto, Sarena, Gungli, trout and and Mahaseer.
Special emphasis is laid on to develop, protect and scientifically manage the wild life in protected areas in Himachal Pradesh. The major wild life sanctuaries in Himachal Pradesh are, Great Himalayan National Park, Kullu district, Bandli sanctuary, Mandi district, Govind sagar sanctuary, Bilaspur, Kanwar sanctuary, Kullu, manali sanctuary, Kullu district, Pong dam sanctuary, Kangra district and Shilli sanctuary, solan district. Special arrangement is made for captive breeding and rehabilitation of endangered species.

2.11 ECONOMY

Over the years, the economy of the state has kept pace with the economic environment in the country as well as across the globe. It registered a growth rate of more than 6.00 per cent per annum in the Gross State Domestic Product (GSDP) between 1994-95 and 1999-2000 at constant prices which was higher than the growth rate achieved at the national level. During the past decade of 90s, structural composition of the state economy has witnessed significant metamorphosis. The share of primary sector consisting of agriculture, forestry, fishing and mining & quarrying has declined from 35.1 per cent in 1990-91 to 27.4 per cent in 2000-01. Within primary sector, though the share of agriculture including horticulture and animal husbandry in GSDP declined from 26.5 per cent in 1990-91 to 22.5 per cent in 2000-01, yet these activities continue to be the mainstay of majority of the population as they provide direct sustenance to about 70 per cent of the working population. On the other hand the contribution of secondary sector got jacked up from 26.5 to 32.5 per cent during the same period. Within this sector, the share of electricity, gas and water supply went up from 4.7 to 6.1 per cent. In consonance with the world economic trends, the share of tertiary sector (i.e. trade, transport, communications, banking, real estate and business, community and & personal services) increased from 38.4 per cent in 1990-91 to 40.1 per cent in 2000-01

Table 1. Gross domestic product at factor cost at constant prices

Year	Agriculture, forestry, logging, fishing, mining & quarrying	Manufacturing, construction, electricity, gas & water supply	Transport, communication & trade	Banking & insurance, real estate & ownership of dwelling business services	Public administration, defence & services	Gross domestic product at factor cost
1994-95	1590 (1.2)	1686 (28.4)	625 (9.9)	532 (5.9)	811 (-2.5)	5244 (9.6)
1995-96	1622 (2.0)	1856 (10.1)	669 (7.1)	535 (0.5)	886 (9.3)	5568 (6.2)
1996-97	1646 (1.5)	2084 (12.3)	712 (6.5)	578 (8.0)	935 (5.5)	5955 (6.9)
1997-98	1673 (1.6)	2179 (4.5)	791 (10.9)	597 (3.3)	1095 (17.1)	6335 (6.4)
1998-99	1692 (1.2)	2324 (6.6)	867 (9.6)	631 (5.7)	1278 (16.6)	6792 (7.2)
1999-00	1601 (-5.4)	2519 (8.4)	881 (1.6)	706 (11.9)	1499 (17.3)	7206 (6.1)
2000-01	1755 (9.6)	2657 (5.4)	928 (5.4)	717 (1.5)	1578 (5.3)	7635 (6.0)

Figures within parenthesis are the annual growth rate (%) of gross domestic product at constant prices
(Source: Economic survey of Himachal Pradesh, 2002)

Chapter 3

Hydro-Meteorology


River Beas in Kullu valley


River Satluj near Rampur district

3.1 RIVERS

Greater Himalayas may not compete with the plain regions for agricultural purposes, but it is the perennial source of five rivers, which flow through Himachal Pradesh and provide abundance of water to the Indus river basin. Further, the rivers in Himachal Pradesh have slanting flow and so are useful for hydro-electric power generation, the other unique distinction of Himachal Pradesh is that it provides water both to the Indus and Ganga basins.

Major Rivers and Tributaries:

i. ***Yamuna:*** Yamuna is the eastern-most river of Himachal Pradesh. It rises from "Yamnotri" in Gharwal hills and forms the eastern boundry with Uttar Pradesh. Its famous tributaries are Tons, Pabar and Giri or Gir Ganga. The Gir Ganga rises from near "Kupar peak" just above Jubbal town in Shimla District, Tons from Yamnotri and Pabar from Chandra Nahan lake near the "Chanshal peak" in Rohru tehsil of Shimla district. It leaves the state near 'Tajewala' and enters into the Haryana State. Its total catchment area in Himachal is 2,320 km.

ii. ***Satluj:*** Satluj rises beyond Indian borders in the Southern slopes of the Kailash Mountain from 'Mansarovar lake' (in Tibet) is largest among the five rivers of Himachal Pradesh. It enters Himachal at "Shipki" (altitude 6,608 m) and flows in the south-westerly direction through Kinnaur, Shimla, Solan, Mandi and Bilaspur district. Its course in Himachal Pradesh is 320 km from

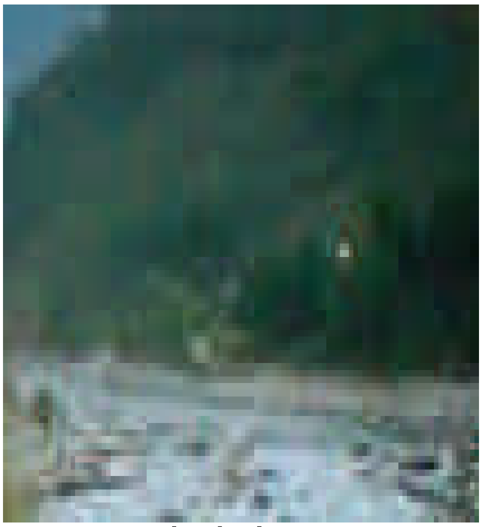
"Rakastal", with famous tributaries viz., the Spiti, the Ropa, the Taiti, the Kashang, the Mulgaon, the Yola, the Wanger, the Theog and the Rupi as right bank tributaries, whereas, the Tirong, the Gayanthing, the Baspa, the Duling and the Soldong are left bank tributaries. It leaves Himachal Pradesh to enter the plains of Punjab at "Bhakhra", where Worlds highest gravity dam has been constructed on this river.

iii. ***Beas:*** The world famous "Rohtang Pass" (altitude 3,978 m) is the birth place of river Beas. It originates from 'Beas Kund'. Its main tributaries are; the Parbati, the Spin and the Malwa Nala in the east, and the Solang, the Manalsu, the Sujoin, the Phojal and the Sarvari streams in the West. In Kangra, it is joined by Binwa, Neugal, Banganga, Gaj, Dehr and Chakki from North, and Kunal, Masch, Khairan and 'Man' from the south. The Beas enters Kangra District at Sandhol and leaves it near Moorthal. At Bajaura, it enters Mandi District. The Northern and Eastern tributaries of the Beas are perennial and snow fed, while Southern are seasonal. Its flow is maximum during monsoon months. At Pundoh, in Mandi District, the water of the Beas has been diverted through a big tunnel to join the Satluj. It flows for 256 km in Himachal Pradesh.

iv. ***Chenab:*** Two streams namely 'Chandra' and 'Bhaga' rise on the opposite side of the Baralacha Pass (altitude 4,891 m) and meet at Tandi (altitude 2,286 m) to form the river Chenab. The Chandra rises from the south east and Bhaga from the north west of the Baralacha Pass. It enter Pangi valley of Chamba District near "Bhujnal" and leaves the district at 'Sansari nala' to enter Podar valley of Kashmir with its total length of 1,200 km. It has a catchment area of 61,000 sq km out of which 7,500 sq km lie in Himachal Pradesh. It is the longest river of Himachal Pradesh in terms of volume of waters.

River Chenab entering the Pangi valley
(Photo adapted by permission from 'Travels to highlands of Himanchal' by K.R. Bharti)

v. ***Ravi:*** Ravi rises from 'Bara Bhangal' – a branch of Dhaula Dhar as a joint stream formed by the glacier fed Badal and Tant Guri. The right bank tributaries of Ravi are the Budhil, Tundaha, Beljedi, Saho and Siul; and its left bank tributary is Chirchind nala. Ravi flows by the foot of Dalhousie hill, through the famous Chamba Valley. It has a catchment area of about 5,451 sq km. As the Ravi flows down from the heights, it passes hill sides with terraced fields. Ravi first flows westward through a reparatory in the 'Pir Panjal' from Dhauladhar range and then turns southward, cutting the deep gorge through the Dhauladhar range. It flows nearly 130 km in Chamba region, before leaving it finally at Kheri.



River Ravi in Chamba district

Chandra Tal: It is situated near the Palmo Pass at an elevation of 14, 000 feet above mean sea level. The length and breadth of this lake is around 1500 meters and 500 metes respectively. The water of this lake drains in Chandra River.

Chandra Tal Lake
(Photo adapted by permission from 'Travels to highlands of Himanchal' by K.R. Bharti)

Ghadarsu lake: It is in Chamba district situated at a distance of 25 kilometers from Tissa. The height of this place is about 11, 500 feet above mean sea level. This is a circular lake and is about one kilometer in circumference.

Lama Dal lake: This lake is situated at a distance of about 47 kilometers from Chamba and lies on the inner slope of Dhauladhar range. Its elevation is about 12, 000 feet above mean sea level. The circumference of this lake is about 2.5 kilometers.

Gobind sagar lake: This is one of the largest manmade reservoir in India. This was made by impounding the water of Satluj River. The area of the Gobind Sagar lake is about 100 km^2. The water of this reservoir is used to irrigate thousands of hectares of land in Punjab and Rajasthan.

Maha Kali dal Lake: This lake is situated in Churah Tehsil of Chamba district.

Mani Mahesh lake: This lake is situated at a height of 13, 000 feet, near the base peak in Mani Mahesh range commonly called the Mani Mahesh kailash in the Budhil Valley in Chamba district.

Mani Mahesh Lake
(Photo adapted by permission from 'Travels to highlands of Himanchal' by K.R. Bharti)

Kali ka dull: This lake is in Churah Tehsil in Chamba district and is a famous pilgrimage centre.

Parasar lake This lake is situated in Mandi district and is about 31 kilometers from Mandi town. There is a floating island in the lake.

Rewalsar lake: This lake is situated in Mandi district at a distance of 24 kilometers from Mandi town. The lake is associated with snake worship and is a famous worship place.

Nako lake: This lake is situated at a height of 2950 meters above mean sea level in Hangrang valley of Kinnaur district on Hindustan –Tibet road.

Renuka Lake: This lake has a circumference of about 2.4 kilometers and is situated in the Sirmour district.

Khajjiar lake: This lake lies in the Chamba and Dalhousie in Chamba district. It is a small lake and is situated in the oval shaped valley in Khajjiar and is a famous tourist destination.

3.3 GLACIERS

A glacier is a natural body of large dimension made up of crystalline ice formed on the earth surface as a result of accumulation of snow. Glaciers are responsible for making the Himalayan rivers perennial. Himalayan rivers are an important ever renewing source of fresh water for the millions of people living in the plains of northern and eastern India. Some of the important glaciers of Himachal Pradesh are (Chauhan 1998):

Bara Shigri: The Bara Shigri glacier is the largest glacier in the Chandra valley of Lahaul and Spiti district and is difficult to be trekked. It is tenanted in a cirque on the middle slopes of the main Himalayan range. High mountains cover it from three sides. It is about 3 km wide and 25 km long. The entire tract is devoid of vegetation. The other main glaciers of Chandra valley In Lahaul are Chhota Shigri, Kulti, Pacha, Tapu, Milang and Bolunag. The Gyephang glacier is named after the supreme deity of Lahaul valley which had temple of Shashan.

Bara Shigri Glacier

Chandra: This glacier is responsible for forming Chandratal lake and has originally separated from Bara Shigri glacier. It is tenanted in a cirque of the towering peak. It gives water to form Chandra River which joins Bhaga to form Chenab. Thick deposits of moraines are found in this tract.

The Lady of Keylong: This glacier is situated at an altitude of about 6061 m which can be seen from Keylong and is popular among visitors to the valley. It was named by Lady Elashainghday about a century ago during British period. Although it is always snow covered, but in the middle of it is seen a dark bare patch that looks like the figure of women walking with a load on her back.

Bhaga: This glacier is tenanted in an amphitheatre in Lahaul area of the main Himalayan range. It is the source of Bhaga river water and later merges with Chandra waters to form Chenab after Tandi. It has carved small depressions and pot holes on the valley bottom. Moraines have been found along the flanks and the tongue of this glacier.

Sonapani: This glacier was surveyed by Walker and Pascoe in 1906. It is only five and a half kilometer from the confluence of Kulti Nala
Perad: The perad glacier is a small easily accessible near Putiruni, which in local dialect means brken rock, that has a nice cave too.

Mukkila and *Miyar*: Mukkila and Miyar glaciers located in the Lahaul area are about 12 kilometer in length and these pour water in Bhaga and Miyar rivulets, respectively. These are situated at a height of about 6478 m.

Trilokinath: The glacier is visible from Trilokinath temple area and drains water towards Chenab river.

Hanging glacier near Triliokinath in Lahaul Valley (Photo by R.M. Bhagat)

A Conglomerate of Glaciers draining in Chenab river, small glacial lakes are visible in the foreground (Photo by R.M. Bhagat)

Beas Kund: This glacier is located on the south facing slopes of the towering Pir Panjal range near the conspicuous Rohtang Pass in Manali region of Himachal Pradesh. This glacier is tenanted in a cirque on the upper reach near the summit of the high peaks of Pir Panjal range. Alpine and sub Alpine meadows come up in the cirque of this glacier during summer.

Chandra Nahan: This glacier is located in a small amphitheatre on the south-eastern slopes of the main Himalayan range in the area north west of Rohru in Himachal Pradesh. The glacier feeds Pabbar river – a tributary of the river Tons. This glacier is encroached by towering peaks at an altitude of about 6000 m. The Chandra Nahan glacier bears both recent and old glacial debris which includes huge boulders. It has formed striations on the valley floor. It can be approached via Rohru area in Shimla district.

Some of the glaciers in the Satluj basin are Gara, Gor Gorang, Shaune Gorang and Nagpo Tokpo

Gondhala glacier (Photo by R.M. Bhagat)

3.4 CLIMATE

Himachal Pradesh can broadly be divided into three zones for rainfall purposes (Attri, 2000). These are Himalayas, inner Himalayas and Alpine zone. Annual average rainfall varies from 1500 mm to 1750 mm in the first zone and from 750 to 1000 mm in the second zone. The alpine zone above 11000 ft remains snow bound for about five to six months in a year. The general climate remains intensely cold during winter in the alpine zone, but turns cool during May to September period. In the state there are four seasons during the year namely winter, pre monsoon, monsoon and post monsoon. The winter season extends from January to February, pre-monsoon from March to May, monsoon from June to September and post monsoon from October to December. As in other parts of country, nearly half of the total rainfall is received during monsoon season, spread over June to September and the remaining precipitation is distributed among other seasons. The highest rainfall is received in Kangra district and the lowest in Lahaul and Spiti district.

The temperature in Himachal Pradesh varies according to the altitudinal variability i.e. from very hot in the low-lying areas to zero and even sub-zero at highest altitudes (figure 3.1). The low winter temperature starts increasing by the end of February, and becomes highest in the month of June – the hottest month of the year. It is also true that even summer is comparatively milder in the mid hill areas than in the plains. With the onset of monsoons, the temperature starts falling until December-January which are the colder months. However, the period between 15th December and 15th February is the coldest period in the state. At many places in the higher altitude areas the temperature falls even to sub-zero levels (figure 3.2).

Altitudinal Agroclimatic Zones

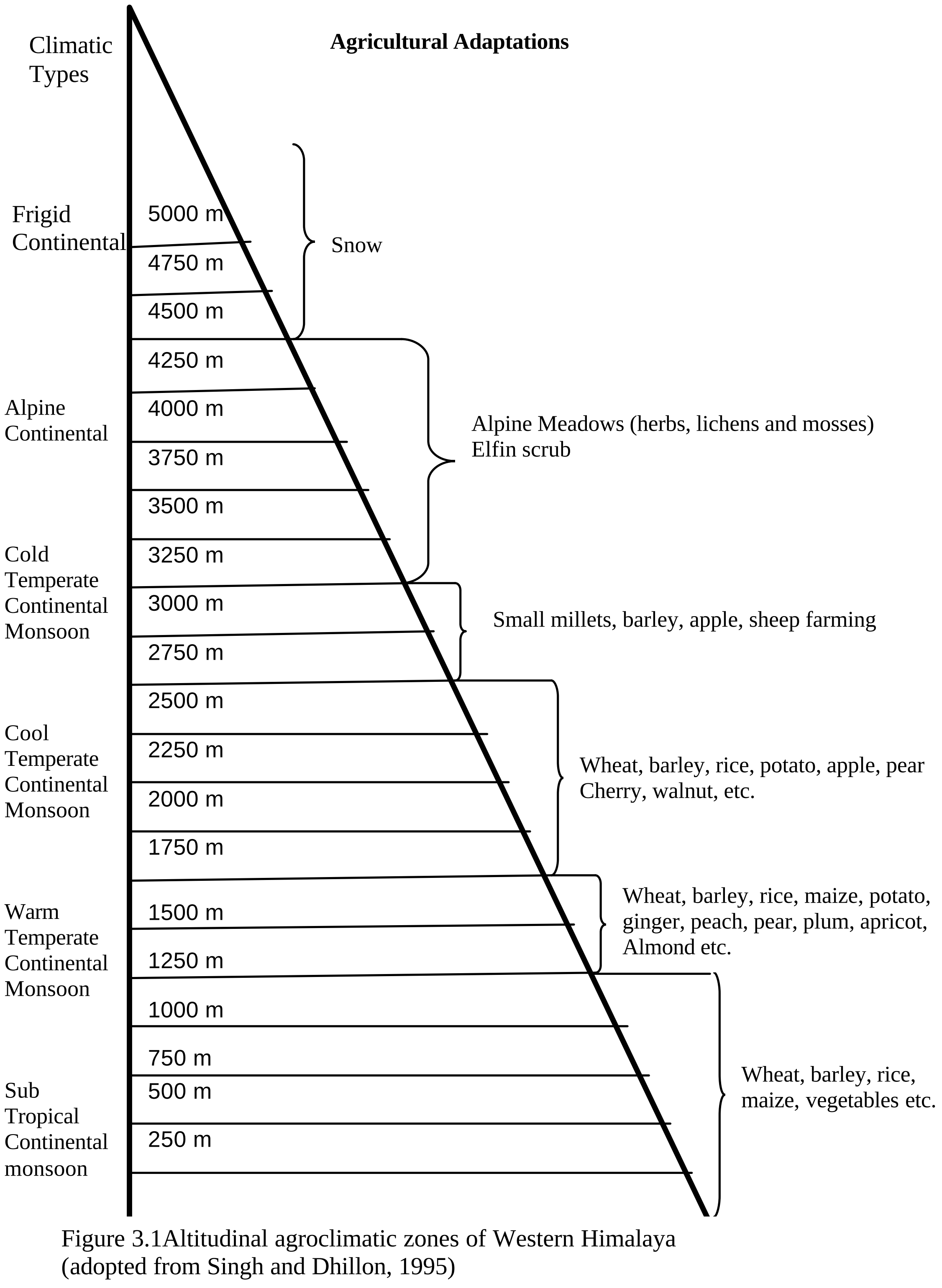


Figure 3.1Altitudinal agroclimatic zones of Western Himalaya (adopted from Singh and Dhillon, 1995)

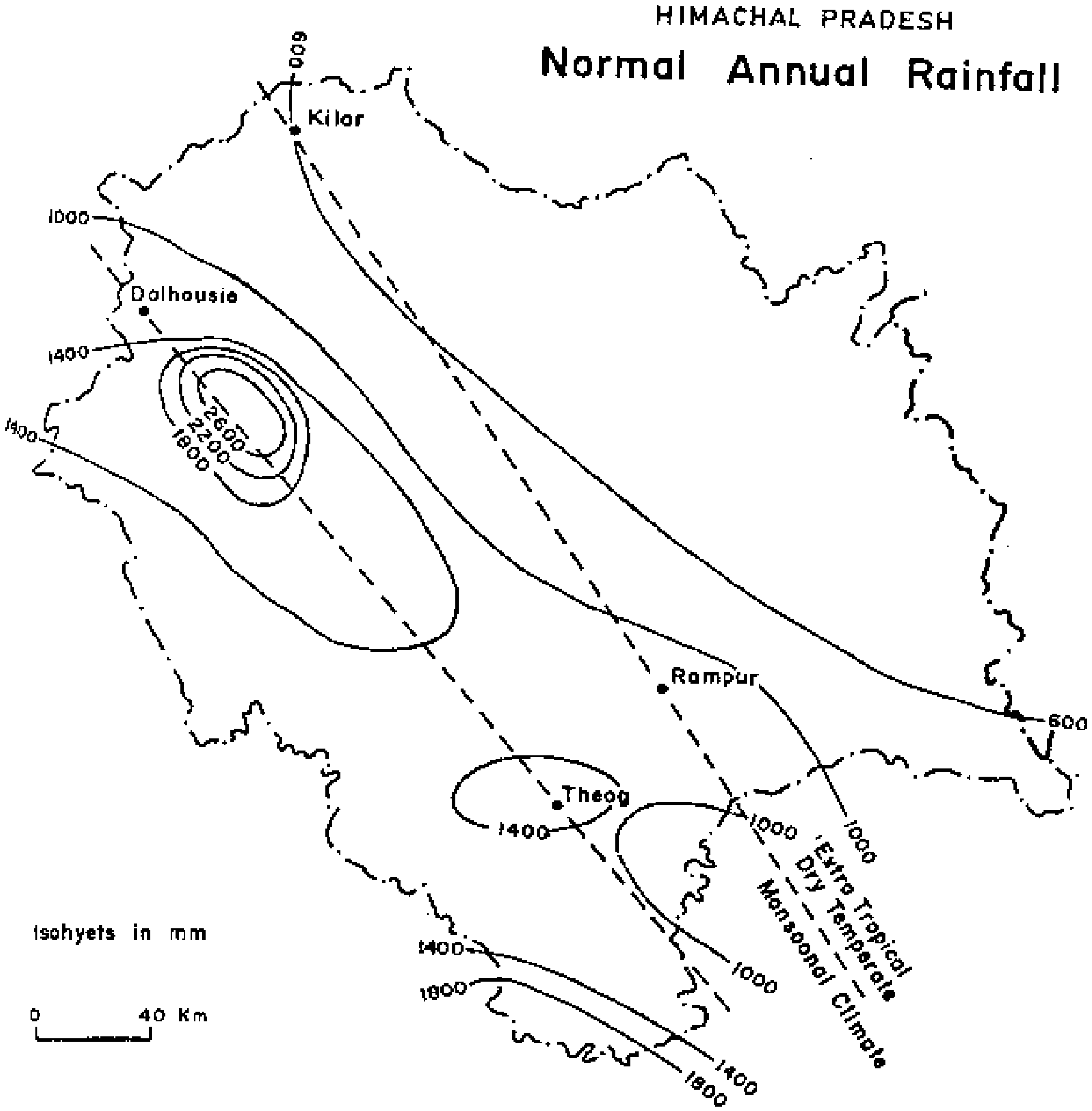


Figure 3.2 Normal Annual Rainfall in Himachal Pradesh

Chapter 4

Materials and Methods

The basic materials required for the compilation of an inventory of glaciers and glacial lakes are large-scale topographic maps and aerial photographs. Remote sensing data like those from the Indian Remote Sensing satellite series 1D (IRS1D) Linear Imaging and Self Scanning Sensor (LISS3), and the Système Probatoire Pour l'Observation de la Terre (SPOT) multispectral (XS) for different dates are also used to study the activity of glaciers and for the identification of potentially dangerous glacial lakes. The combination of digital satellite data and the digital elevation model (DEM) of the area is also used for better and more accurate results for the inventory of glaciers and glacial lakes.

4.1 Topographic Maps

Glaciers and glacial lakes are mostly concentrated in the north-eastern part of Himachal Pradesh. The spatial distribution of glaciers and glacial lakes was identified from topographic maps and verified by satellite images for the activity of the glaciers and glacial lakes. The topographic maps used were published by survey of India in the period from the 1960s-1970s on a scale of 1:50,000.

The coordinate system parameters for the maps of the Himachal are as follows:

• Projection**:**	Albers Equal Area Conic
• Ellipsoid**:**	WGS 84
• Datum:	WGS 1984
• False easting**:**	0.0000000
• False northing**:**	0.0000000
• Central meridian**:**	82° 30'E
• Central parallel**:**	0° 0' N
• Latitude of first parallel	20° N
• Latitude of second parallel	35° N

Altogether 110 topographic map sheets cover the whole of Himachal (Figure 4.1). The maps required for the study of the glaciers and glacial lakes fall within 60 sheets (Table 4.1). The topographic maps of the same scale i.e. 1:50,000 for some of the glacier and glacial lake area were not available however; maps of the larger scales (1:250,000) did serve the purpose to some extent. The digital topographic map (ARC digitized Raster Graphics (ADRG) published in January 1996 by the National Imagery and Mapping Agency (NIMA) and Defense Mapping Agency (DMA) of the U.S. Government at the scale of 1:500,000 with same projection parameter as mentioned above are used in the geo-reference of the satellite images and DEM generation.

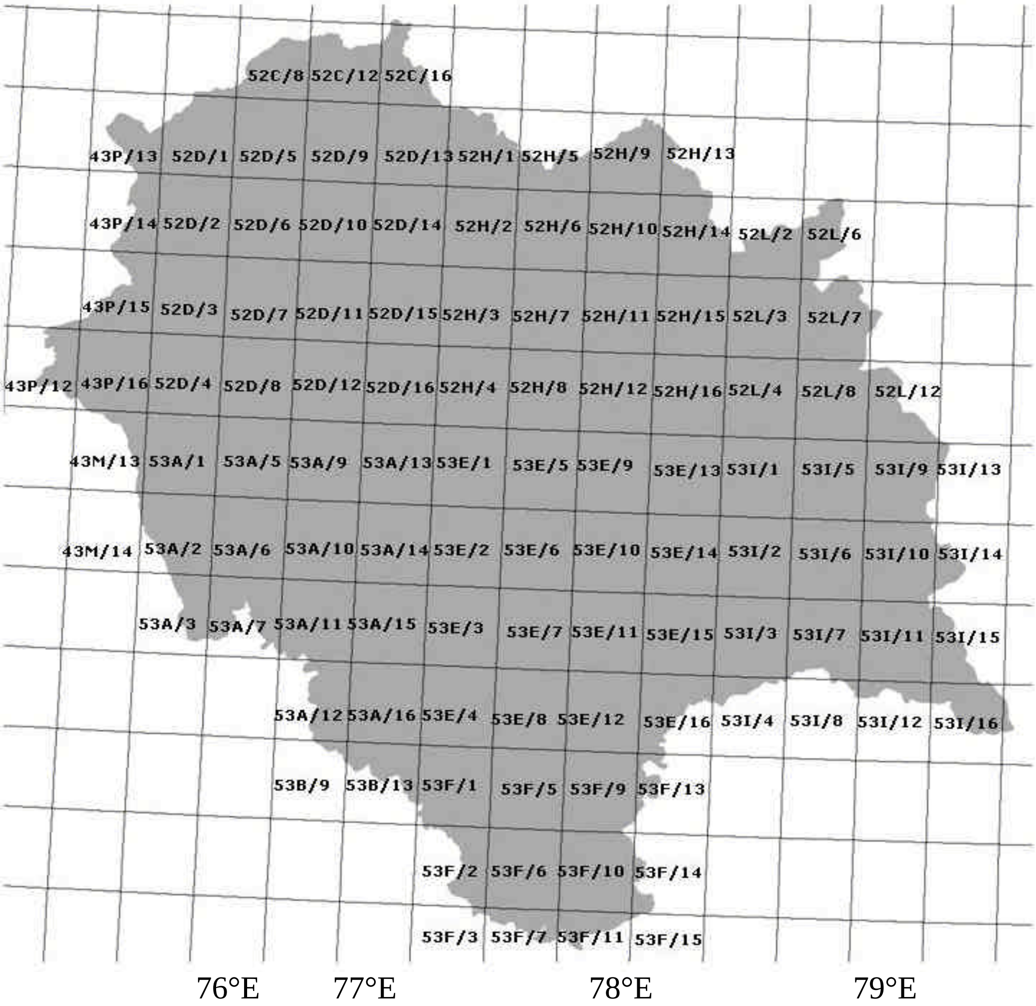


Figure 4.1: Index map for the 1:50,000 scale topographic maps of Himachal Pradesh

Table 4.1: List of topographic maps of Himachal Pradesh.		
Grid number	Sheet No.	Remarks
43P	12, 13, 14, 15 and 16	Available original map sheets (1:50,000)
44M	13 and 14	
52C	8,12 and 16	
52D	1, 2 and 9	
52H	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15 and 16	
52L	2,3,4, and 8	
53A	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15 and 16	
53B	9 and 13	
53E	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15 and 16	
53F	1,2,3, 5,6,7,9,10,11,13,14, and 15	
53I	1,2,3,4,5,6,7,8, 12 and 16	
43 P		Available original map sheets (1:250,000)
44M		
52C		
52 G		
52H		
53A		
53B		
53E		
53F		

4.2 Aerial Photographs

Aerial photographs of Himachal Pradesh were not available for the present study.

4.3 Satellite Images

The satellite images of IRS1D LISS3 and SPOT as given below were also acquired.

IRS1D LISS3 images

Due to time constraints and relative costs in acquiring cloud free data, instead of LANDSAT TM, IRS1D LISS3 images of 1999–2000 with least cloud cover were acquired. Seven scenes cover all the northern parts and the glaciated area of Himachal (Table 4.2). The images acquired are given in Table 4.2.

Table 4.2: IRS1D LISS3 satellite images of Himachal Pradesh			
S. No.	Path	Row	Date
1	094	047	19 October 1999
2	095	047	19 September 1999
3	094	048	19 October 2001
4	095	048	06 October 2000
5	096	048	03 October 2001
6	095	049	06 October 2000
7	096	049	03 October 2000

SPOT images

Spot images of Himachal Pradesh were not available for the present study..

4.4 INVENTORY METHOD

The methodology for the mapping and inventory of the glaciers is similar to the inventory of glaciers and glacial lakes carried out in Nepal and Bhutan by Mool et. al, 2001 and based on instructions for compilation and assemblage of data for the World Glacier Inventory (WGI), developed by the Temporary Technical Secretary (TTS) at the Swiss Federal Institute of Technology, Zurich (Muller et al. 1977) and the methodology for the inventory of glacial lakes is based on that developed by the Lanzhou Institute of Glaciology and Geocryology, the Water and Energy Commission Secretariat, and the Nepal Electricity Authority (LIGG/WECS/NEA 1988). The inventory of glaciers and glacial lakes has been systematically carried out for the drainage basins on the basis of topographic maps and satellite images. Topographic maps on a scale of 1:50,000 published by the Survey of India during the period from the 1960s to the 1990s are used. The following sections describe how the compilation of the inventories for both the glaciers and glacial lakes have been carried out.

4.4.1 Inventory of glaciers

The glacier margins on each map are delineated and compared with satellite images, and the exact boundaries between glaciers and seasonal snow cover are determined. The coding system is based on the subordinate relation and direction of river progression according to the World Glacier Inventory. The description of attributes for the inventory of glaciers are as given below:

Numbering of glaciers

The lettering and numbering start from the mouth of the major stream and proceed clockwise round the basin. The inventory of glaciers is carried out throughout the major and minor river basins of Himachal Pradesh.

Registration of snow and ice masses

All perennial snow and ice masses are registered in the inventory. Measurements of glacier dimensions are made with respect to the carefully delineated drainage area for each ‘ice stream’. Tributaries are included in main streams when they are not differentiated from one another. If no flow takes place between separate parts of a continuous ice mass, they are treated as separate units.

Delineation of visible ice, firn, and snow from rock and debris surfaces for an individual glacier does affect various inventory measurements. Marginal and terminal moraines are also included if they contain ice. The ‘inactive’ ice apron, which is frequently found above the head of the valley glacier, is regarded as part of the valley glacier. Perennial snow patches of large enough size are also included.

Snow line

In the present study, the snow line specially refers to the firn line of a glacier, not the equilibrium line. The elevation of the firn line of most glaciers was not measured directly but estimated by indirect methods. For the regular valley and cirque glaciers from topographical maps, Hoss's method (i.e. studying changes in the shape of the contour lines from convex in the ablation area to concave in the accumulation area) was used to assess the snow line.

Accuracy rating table

The accuracy rating table proposed by Muller et al. 1977 on the basis of actual measurements (Table 4.3) is used in the present study.

Table 4.3 Accuracy rating adopted form Muller et al. (1977)

Index	Area/length (%)	Altitude (m)	Depth (%)
1	0-5	0-25	0-5
2	5-10	25-50	5-10
3	10-15	50-100	10-20
4	15-25	100-200	20-30
5	>25	>200	>30

For the snow line an error range of 50–100 m in altitude is entered as an accuracy rating of '3'. In the glacier inventory, different methods or a combination of methods are usually chosen for comparison with aerial photographs in order to assess the elevation of the firn line for different forms of glacier.

Mean glacier thickness and ice reserves

There are no measurements of glacial ice thickness for the Himachal Himalayas. Measurements of glacial ice thickness in the Tianshan Mountains, China, show that the glacial thickness increases with the increase of its area (LIGG/WECS/NEA 1988). The relationship between ice thickness (H) and glacial area (F) was obtained there as

$$H = -11.32 + 53.21 F^{0.3}$$

This formula has been used to estimate the mean ice thickness in the glacier inventory of the Arun and Bhote-Sunkoshi Basins of Nepal. The same method is also used here to find the ice thickness. The ice reserves are estimated by mean ice thickness multiplied by the glacial area.

Muller et al. 1977 roughly estimated the ice thickness values for Khumbu Valley in Nepal using the relationship between glacier type, form, and area (see Table 4.4). This method was used by WECS to calculate the thickness values for Rolwaling Valley in Nepal. The same method can also be used for the glaciers of the Himachal Himalaya.

According to Muller et al. 1977, mean depth can be estimated with the appropriate model developed for each area by local investigators. For example, the following model was used for the Swiss Alps where is the mean depth, F is the total surface area, and a and b are arbitrary parameters that are empirically determined.

Table 4.4 Relationship between glacier type, form, area and depth given by Muller et al. 1977

Glacier Type	Form	Area (km^2)	Depth (m)
Valley Glacier	Compound basin	1-10	50
		10-20	70
		20-50	100
		50-100	120
	Compound basins	1-5	30
		5-10	60
		10-20	80
		20-50	120
		50-100	120
	Simple basins	1-5	40
		5-10	75
		10-20	100
Mountain Glacier	Cirque	0-1	20
		1-2	30
		2-5	50
		5-10	90
		10-20	120

The measured depth is shown on the data sheet only if the depths of large parts of the glacier bed are known from literature and field measurements.

Area of the glacier

The area of the glacier is divided into accumulation area and ablation area (the area below the firn line). The area is given in square kilometers. The delineated glacier area is digitized in the integrated land and water information systems' (ILWIS) format and the database is used to calculate the total area.

Length of the glacier

The length of the glacier is divided into three columns: total length, length of ablation and the mean length. The total (maximum) length refers to the longest distance of the glacier along the centre line. The mean value of maximum lengths of glacier tributaries (or firn basins) is the mean length.

Mean width

The mean width is calculated by dividing the total area (km^2) by the mean length (km).

Orientation of the glacier

The orientation of accumulation and ablation areas is represented in eight cardinal directions (N, NE, E, SE, S, SW, W, and NW). Some of the glaciers are capping just in the form of an apron on the peak, which is inert and sloping in all directions, is represented as ‘open’. The orientations of both the areas (accumulation and ablation) are the same for most of the glaciers.

Elevation of the glacier

Glacier elevation is divided into **highest elevation** (the highest elevation of the crown of the glacier), **mean elevation** (the arithmetic mean value of the highest glacier elevation and the lowest glacier elevation), and **lowest elevation** (elevation of the glacier tongue).

Morphological classification

The morphological matrix-type classification and description is used in the study. It was proposed by Muller et al. 1977 for the TTS to the WGI. Each glacier is coded as a six-digit number, the six digits being the vertical columns of Table 4.5. The individual numbers for each digit (horizontal row numbers) must be read on the left-hand side. This scheme is a simple key for the classification of all types of glaciers all over the world.

Each glacier can be written as a six-digit number following Table 4.8. For example, ‘520110’ represents ‘5’ for a valley glacier in the primary classification, ‘2’ for compound basins in Digit 2, ‘0’ for normal or miscellaneous in frontal characteristics in Digit 3, ‘1’ for even or regular in longitudinal profile in Digit 4, ‘1’ for snow and/or drift snow in the major source of nourishment in Digit 5, and 0 for uncertain tongue activity in Digit 6.

Table 4.5: Classification and description of glaciers

	Digit 1	**Digit 2**	**Digit 3**	**Digit 4**	**Digit 5**	**Digit 6**
	Primary classification	Form	Frontal characteristic	Longitudinal profile	Major source of nourishment	Activity of tongue
0	Uncertain or miscellaneous	Uncertain or miscellaneous	Normal or miscellaneous	Uncertain or miscellaneous	Uncertain or miscellaneous	Uncertain
1	Continental ice sheet	Compound basins	Piedmont	Even: regular	Snow and/or drift snow	Marked retreat
2	Ice field	Compound basin	Expanded foot	Hanging	Avalanche and/or snow	Slight retreat
3	Ice cap	Simple basins	Lobed	Cascading	Superimposed ice	Stationary
4	Outlet glacier	Cirque	Calving	Ice fall		Slight advance

5	Valley glacier	Niche	Confluent	Interrupted		Marked advance
6	Mountain glacier	Crater				Possible surge
7	Glacieret and snow field	Ice apron				Known surge
8	Ice shelf	Group				Oscillating
9	Rock glacier	Remnant				

The details for the glacier morphological code values according to TTS are explained below.

Digit 1 Primary classification

0. **Miscellaneous:** Any not listed.
1. **Continental ice sheet:** Inundates areas of continental size.
2. **Ice field:** More or less horizontal ice mass of sheet or blanket type of a thickness not sufficient to obscure the sub-surface topography. It varies in size from features just larger than glacierets to those of continental size.
3. **Ice cap:** Dome-shaped ice mass with radial flow.
4. **Outlet glacier:** Drains an ice field or ice cap, usually of valley glacier form; the catchment area may not be clearly delineated (Figure 4.2a).
5. **Valley glacier:** Flows down a valley; the catchment area is in most cases well defined.
6. **Mountain glacier:** Any shape, sometimes similar to a valley glacier, but much smaller; frequently located in a cirque or niche.
7. **Glacieret and snowfield:** A glacieret is a small ice mass of indefinite shape in hollows, river beds, and on protected slopes developed from snow drifting, avalanching and/or especially heavy accumulation in certain years; usually no marked flow pattern is visible, no clear distinction from the snowfield is possible, and it exists for at least two consecutive summers.
8. **Ice shelf:** A floating ice sheet of considerable thickness attached to a coast, nourished by glacier(s), with snow accumulation on its surface or bottom freezing (Figure 4.2b).
9. **Rock glacier:** A glacier-shaped mass of angular rock either with interstitial ice, firn, and snow or covering the remnants of a glacier, moving slowly downslope. If in doubt about the ice content, the frequently present surface firn fields should be classified as 'glacieret and snowfield'.

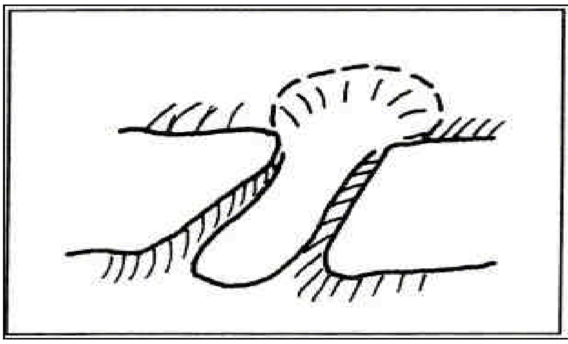


Figure 4.2a: Outlet

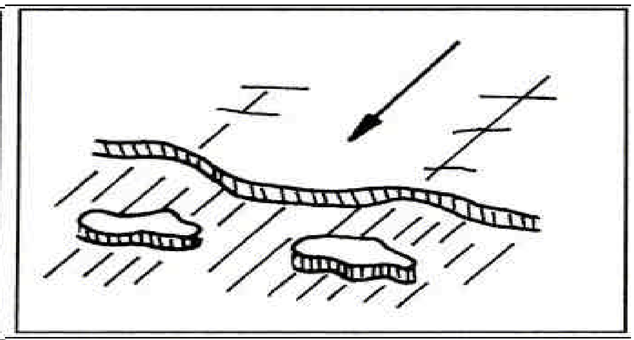


Figure 4.2b: Ice shelf

Digit 2 Form

1. **Compound basins:** Two or more tributaries of a valley glacier, coalescing (Figure 4.3a).
2. **Compound basin:** Two or more accumulation basins feeding one glacier (Figure 4.3b).
3. **Simple basin:** Single accumulation area (Figure 4.3c).
4. **Cirque:** Occupies a separate, rounded, steep-walled recess on a mountain (Figure 4.3d).
5. **Niche:** Small glacier formed in initially a V-shaped gully or depression on a mountain slope (Figure 4.3e).
6. **Crater:** Occurring in and /or on a volcanic crater.
7. **Ice apron:** An irregular, usually thin ice mass plastered along a mountain slope.
8. **Group:** A number of similar ice masses occurring in close proximity and too small to be assessed individually.
9. **Remnant:** An inactive, usually small ice mass left by a receding glacier.

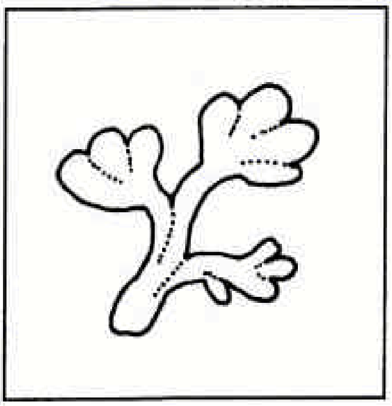


Figure 4.3a: Compound basins

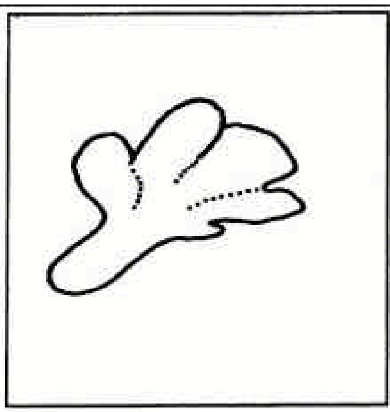


Figure 4.3b: Compound basin

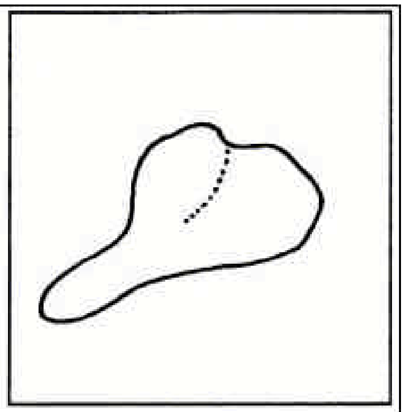


Figure 4.3c: Simple basin

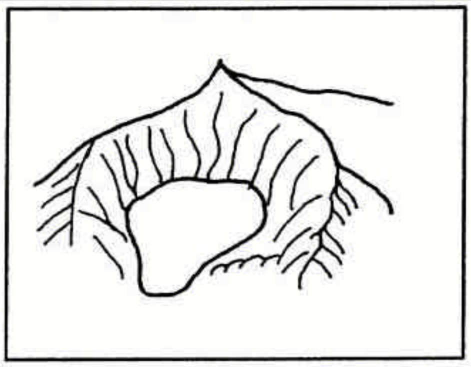
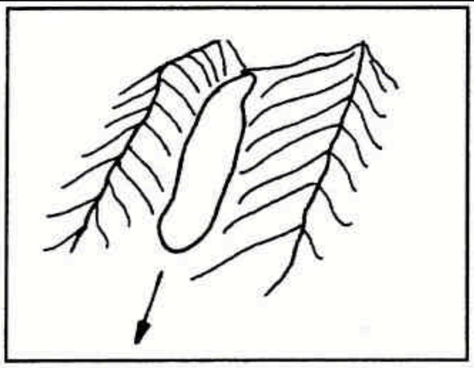



Figure 4.3d: Cirque

Figure 4.3e: Niche

Digit 3 Frontal characteristics

1. **Piedmont:** Ice field formed on low land with the lateral expansion of one or the coalescence of several glaciers (Figure 4.4 a and b).
2. **Expanded foot:** Lobe or fan of ice formed where the lower portion of the glacier leaves the confining wall of a valley and extends on to a less restricted and more level surface. Lateral expansion markedly less than for Piedmont (Figure 4.4c).
3. **Lobed:** Tongue-like form of an ice field or ice cap (see Figure 4.4d).
4. **Calving:** Terminus of glacier sufficiently extending into sea or occasionally lake water to produce icebergs.
5. **Confluent:** Glaciers whose tongues come together and flow in parallel without coalescing (Figure 4.4e).

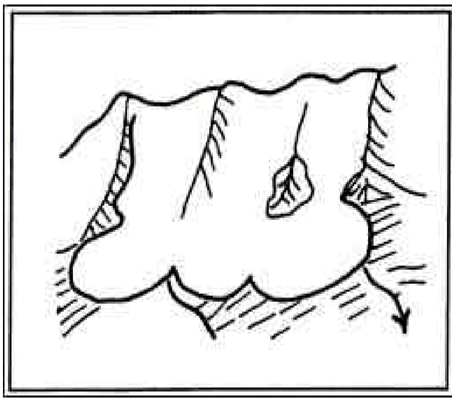
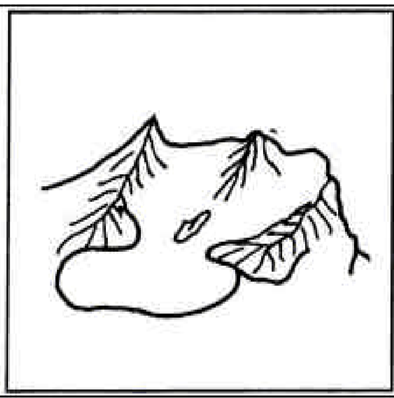
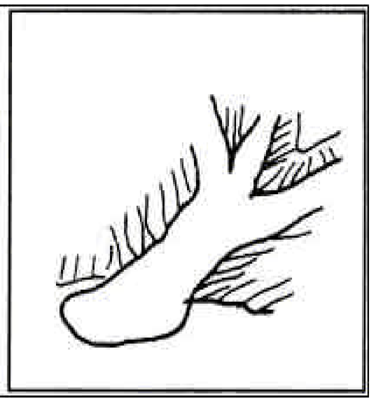




Figure 4.4a: Piedmont

Figure 4.4b: Piedmont

Figure 4.4c: Expanded

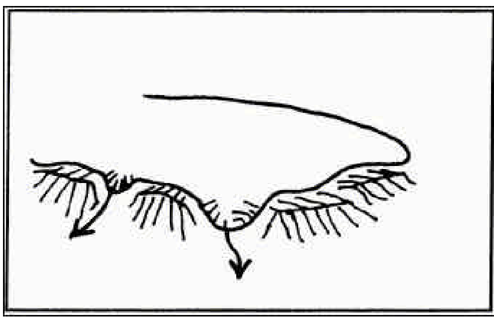
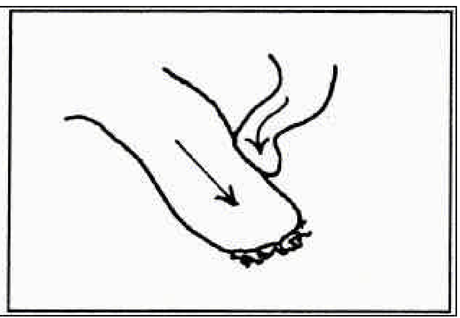



Figure 4.4d: Lobed

Figure 4.4e: Confluent

Digit 4 Longitudinal profile

1. **Even /regular:** Includes the regular or slightly irregular and stepped longitudinal profile.
2. **Hanging:** Perched on a steep mountain slope, or in some cases issuing from a steep hanging valley.
3. **Cascading:** Descending in a series of marked steps with some crevasses and seracs.
4. **Ice fall:** A glacier with a considerable drop in the longitudinal profile at one point causing a heavily broken surface.
5. **Interrupted:** Glacier that breaks off over a cliff and reconstitutes below.

Digit 5 Major source of nourishment

The sources of nourishment could be uncertain or miscellaneous (0), snow and/or drift snow (1), avalanche and/or snow (2), or superimposed ice (3) as indicated in Table 4.8.

Digit 6 Activity of tongue

A simple-point qualitative statement regarding advance or retreat of the glacier tongue in recent years, if made for all glaciers on Earth, would provide the most useful information. The assessment of an individual glacier (strongly or slightly advancing or retreating etc) should be made in terms of the world picture and not just that of the local area; however, it seems very difficult to establish the quantitative basis for the assessment of the tongue activity. A change of frontal position of up to 20 m per year might be classed as ‘slight’ advance or retreat. If the frontal change takes place at a greater rate it would be called ‘marked’. Very strong advances or surges might shift the glacier front by more than 500 m per year. Digit 6 expresses qualitatively the annual tongue activity. If observations are not available on an annual basis then an average annual activity is given.

Moraines: Two digits to be given.
Digit 1: Moraines in contact with present-day glacier.
Digit 2: Moraines further downstream.

0. no moraines
1. terminal moraine
2. lateral and/or medial moraine
3. push moraine
4. combination of 1 and 2
5. combination of 1 and 3
6. combination of 2 and 3
7. combination of 1, 2, and 3
8. debris, uncertain if morainic
9. moraines, type uncertain or not listed.

Remarks: The remarks can, for instance, consist of the following information.

- Critical comments on any of the parameters listed on the data sheet (e.g. how close is the snow line to the firn line, comparison of year concerned with other years).

- Special glacier types and glacier characteristics which, because of the nature of the classification scheme, are not described in sufficient detail (e.g. 'melt structures', glacier-dammed lakes).
- Additional parameters of special interest to the basins concerned (e.g. area of altitudinal zones, inclination etc).
- It is often useful to divide the snow line into several sections (because of different exposition or nourishment). In such cases, the snow line data of each section can be recorded separately.
- Literature on the glacier concerned.
- Any other remarks

The inventory database form (see Annexure I) used for compilation of the inventory of glaciers includes map/satellite codes, aerial photographs, and basin numbers, as well as the glacier parameters described above.

4.4.2 Inventory of glacial lakes

The attributes used for the present inventory and their details are given in the lake inventory form (Annexure II). Similar lake inventories were done in the Pumqu (Arun) and Poiqu (Bhote/Sunkoshi) Basins in Tibet (China) by LIGG/WECS/NEA 1988.

The permanent snow line in the northern belt of the Himalayas is higher than 4,000 masl. All the glacial lake boundaries are demarcated in the topographic maps.

Changes in climatic conditions have had an impact on the high mountain glacial environment. Many of the big glaciers have melted rapidly and given birth to a large number of glacial lakes. Due to the rapid rate of ice and snow melt, possibly caused by global warming, the accumulation of water in these lakes has been increasing rapidly. The isolated lakes above 3,500 masl are assumed to be remnants of the glacial lakes left due to the retreat of the glaciers.

The glacial lake inventory has been systematically compiled for the drainage basins on the basis of topographic maps and satellite images.

Brief descriptions of major attributes for the lake inventory are given below.

Numbering of glacial lakes

The numbering of lakes starts from the outlet of the major stream and proceeds clockwise round the basin.

Longitude and latitude

Reference longitude and latitude are designated for the approximate centre of the glacial lake.

Area

The area of the glacial lake is determined from the digital database after digitisation of the lake from the topographic maps and satellite images.

Length

The length is measured along the long axis of the lake, and estimated to one decimal place in km units (0.1 km).

Width

The width is normally calculated by dividing the area by the length of the lake, down to one decimal place in km units (0.1 km).

Depth

The depth is measured along the axis of the cross section of the lake. On the basis of the depth along the cross section the average depth and maximum depth are estimated. The data are collected from the literature.

Orientation

The drainage direction of the glacial lake is specified as one of eight cardinal directions (N, NE, E, SE, S, SW, W, and NW). For a closed glacial lake, the orientation is specified according to the direction of its longer axis.

Altitude

The altitude is registered by the water surface level of the lake in masl.

Classification of lakes

Genetically glacial lakes can be divided into the following.

- Glacial erosion lakes, including cirque lakes, trough valley lakes, and erosion lakes.
- Moraine-dammed lakes, including end moraine lakes and lateral moraine lakes.
- Blocking lakes formed through glaciers and other factors, including the main glacier blocking the branch valley, the glacier branch blocking the main valley, and the lakes formed through snow avalanche, collapse, and debris flow blockade.
- Ice surface and sub-glacial lakes.

In the glacial lake inventory, end moraine-dammed lakes, lateral moraine lakes, trough valley lakes, glacial erosion lakes, and cirque lakes are represented by the letters M, L, V, E, and C respectively; B represents blocking lakes.

Activity

According to their stability, the glacial lakes are divided into three types: stable, potential danger, and outburst (when there have been previous bursts). The letters S, D, and O represent these types respectively.

Types of water drainage

Glacial lakes are divided into drainage lakes and closed lakes according to the drainage pattern. The former refers to lakes from which water flows to the river and joins the river system. In the latter, water does not flow into the river. Ds and Cs represent those two kinds of glacial lakes respectively.

Chemical properties

This attribute is represented by the degree of mineralization of the water, mg l^{-1}.

Other indices

One important index for evaluating the stability of a glacial lake is its contact relation with the glacier. So an item of distance from the upper edge of the lake to the terminus of the glacier has been added and the code of the corresponding glacier registered. Since an end moraine-dammed lake is related to its originating glacier, this index is only referred to end moraine dammed lakes. As not enough field data exist, the average depth of glacial lakes is difficult to establish in most cases. Based on field data, and as an indication only, the average depth of a glacial lake formed by different causes can be roughly estimated as follows: cirque lake, 10 m; lateral moraine lake, 30m; trough valley lake, 25m; blocking lake and glacier erosion lake, 40m; lateral moraine lake, 20m. The water reserves of different types of glacial lakes can be obtained by multiplying their average depth by their area (LIGG/WECS/NEA 1988).

The inventory database form (see Annexure II) used for compilation of the inventory of glacial lakes includes map/satellite image codes, aerial photographs, and basin numbers, as well as the lake parameters (attributes) described above.

Chapter 5

Spatial Data Input and Attribute Data Handling

One of the main objectives of the present study is to develop a digital database of glaciers and glacial lakes using geographic information systems (GIS). A digital database is necessary for the monitoring of glaciers and glacial lakes and to identify the potentially dangerous lakes. GIS is the most appropriate tool for spatial data input and attribute data handling. It is a computer-based system that provides the following four sets of capabilities to handle geo-referenced data: data input, data management (data storage and retrieval), data manipulation and analysis, and data output can be found in Arnoff (1989).

Any spatial features of the Earth's surface are represented in GIS by the following:

- **Area/polygons:** features which occupy a certain area, e.g. glacier units, lake units, land use units, geological units etc;
- **Lines/segments:** linear features, e.g. drainage lines, contour lines, boundaries of glaciers and lakes etc; and
- **Points:** points define the discrete locations of geographic features, the areas of which are too small to illustrate as Lines or polygons, e.g. mountain peaks or discrete elevation points, sampling points for field observations, identification points for polygon features, centres of glaciers and lakes etc, and attribute data refer to the properties of spatial entities.

The spatial entities described above can be represented in digital form by two data models: vector or raster models. In a vector model the position of each spatial feature is defined by a series of X and Y coordinates. Besides the location, the meaning of the feature is given by a 'code'. In a raster model, spatial data are organized in grid cells or pixels, a term derived for a picture element. Pixels are the basic units for which information is explicitly recorded. Each pixel is assigned only one value.
For the present study, integrated land and water information system (ILWIS) 3.1 for Windows is used for the spatial and attribute database development and analysis. ILWIS for Windows is an object oriented image processing and geographic information system. Analysis and modeling in a GIS requires input of relevant data. The topographic maps of the 1960 (republished 1970) on a scale of 1:50,000 published by the Survey of India were used as the baseline for the spatial data of glaciers and glacial lakes. The list of topographic maps used for the study is given in Chapter 4. Delineation of all the glaciers and glacial lakes was done on the topographic maps. All the glaciers and glacial lakes were numbered and their attributes were noted. The details of the methodology for the delineation and attributes are also given in Chapter 4.

The most common method of entering spatial data is by manual digitizing using a digitizers board. Before starting digitization one should know the map projection system. Map projection defines the relationship between the map coordinates and the geographic coordinates (latitude and longitude). Himachal Pradesh is situated between 30º 15' to 33º

15º 0' E longitude and 75º 45’ to 79º 0’ N latitude. The coordinate system parameters for Himachal Pradesh are as follows.

• Projection:	Albers Equal Area Conic
• Ellipsoid:	WGS 84
• Datum:	WGS 1984
• False easting:	0.0000000
• False northing:	0.0000000
• Central meridian:	82° 30’E
• Central parallel:	0° 0’ N
• Latitude of first parallel	20° N
• Latitude of second parallel	35° N

The minimum and maximum X and Y values required in the above geo-reference system in the Himachal area falling in Grid Zone II B are:

- Min X,Y: -646838.500, 3298325.500
- Max X,Y: -328038.500, 3623225.500

It is always necessary to maintain the details, smoothness, and accuracy of the input spatial data of all the required information as in the maps of the given map scale. They are defined by the snap and tunnel tolerances in the system. The snap and tunnel tolerances in the system are defined by the extent of the minimum and maximum X and Y values. To increase the detail and accuracy, the coordinate system with the required X and Y extents for each one degree area was created to digitize all the topographic maps. These sub-coordinate systems were very useful and made the input and handling of the data easy. After the delineation of the glaciers, glacial lakes, and ridges on the maps the segments were digitized using the following codes.

1	=	lake boundary
2	=	glacier boundary
3	=	ridge line
5	=	basin or international boundary
10	=	dry lake
11	=	drainage line
12	=	lake attached to glacier common boundary
20	=	rock glacier boundary only
23	=	glacier attached to ridge line common boundary
25	=	glacier attached to basin boundary common boundary
100	=	tic points reference lines

The segment code values are necessary for data retrieval and analysis in GIS. All the polygons representing glaciers and glacial lakes are numbered as mentioned in Chapter 4. Points showing the location of glaciers and glacial lakes were digitized. They were used later for identification of the polygons of the glaciers and glacial lakes. After digitization, the segments were checked and the glaciers and glacial lakes were numbered using point identifiers. Basin-wise polygon maps of glaciers and glacial lakes are presented in Chapters 7 and 8.

In an object oriented GIS, polygon maps with identifier domains of the objects have a related attribute table with the same domain. The domain defines the possible contents of a map, a table, or a column in a table (attribute). Some examples of ‘domain’ are class domain (a list of class names), value domain (measured, calculated, or interpolated values), image domain (reflectance values in a satellite image or scanned aerial photograph), identifier domain (a unique code for each item in the map), string domain (columns in a table that contain text), bit domain (value 0 and 1), bool domain (yes or no) etc. An attribute table is linked to a map through its domain. An attribute table can only be linked to maps with a class or identifier domain. An attribute table may contain several columns.

Required attributes of the glaciers and glacial lakes as explained in Chapter 4 were derived or entered in the attribute database in the GIS. Most of the attributes were derived from the topographic maps, aerial photographs, satellite images, reports, field data, etc. Attributes such as area, location (latitude, longitude) etc were derived from the spatial database. If other necessary digital spatial data layers, such as digital elevation models (DEM), are available, it is possible to generate terrain parameters such as elevation, slope, length etc as measuring units for glaciers and glacial lakes. Other attributes such as aspect, mean length, elevation, map code, name, etc, were manually entered in the attribute database. Additional attributes, such as mean elevation, volume etc were derived using logical calculations. For each basin, attribute tables were developed for glaciers and glacial lakes. Some of the attributes were also derived from the results of an aggregation in the same table or from another table using the table joining operations, such as glaciers associated with the glacial lakes, etc.

The criteria for the identification of potentially dangerous glacial lakes are explained in Chapter 11. Using the logical calculation in the GIS, the potentially dangerous glacial lakes were determined. To study the geomorphic characteristics of these potentially dangerous lakes, the available time-series satellite images and topographic maps were also used.

Chapter 6

Application of Remote Sensing

Glaciers and glacial lakes are generally located in remote areas, where access is through tough and difficult terrain. The study of glaciers and glacial lakes, as well as carrying out glacial lake outburst flood (GLOF) inventories and field investigations using conventional methods, requires, extensive time and resources together with undergoing hardship in the field. Creating inventories and monitoring of the glaciers, glacial lakes, and extent of GLOF impact downstream can be done quickly and correctly using satellite images and aerial photographs. Use of these images and photographs for the evaluation of physical conditions of the area provides greater accuracy. The multi-stage approach using remotely sensed data and field investigation increases the ability and accuracy of the work. Visual and digital image analysis techniques integrated with techniques of geographic information systems (GIS) are very useful for the study of glaciers, glacial lakes, and GLOFs.

At first the inventory and evaluation of the glaciers, glacial lakes, and GLOFs were carried out based on topographic maps. The topographic maps of the higher terrain, which houses glaciers and glacial lakes, are not as reliable as those of hills and lowland areas. As a complementary data and tool, various remote sensing techniques and satellite images were used.

Remote sensing is the science and art of acquiring information (spectral, spatial, temporal) about material objects, areas, or phenomena through the analysis of data acquired by a device from measurements made at a distance, without coming into physical contact with the objects, area, or phenomena under investigation.

Remote sensing technology makes use of the wide range of the electro-magnetic spectrum (EMS). Most of the commercially available remote-sensing data are acquired in the visible, infrared, and microwave wavelength portion of the EMS. For the present study, the data acquired within the visible and infrared wavelength ranges were used.

There are different types of commercial satellite data available. Digital data sets of the Land Observation Satellite (LANDSAT) Thematic Mapper (TM) and Indian Remote Sensing Satellite Series 1D (IRS1D) Linear Imaging and Self Scanning Sensor (LISS)3 were used mostly for the present study. Some data sets of Système Probatoire Pour l'Observation de la Terre (SPOT) Multi-Spectral (XS) and SPOT Panchromatic (PAN) were also used. The list of the images relevant to the present study are given in Chapter 4.

A scene of a LANDSAT TM image gives the synoptic view of an area of 185 km by 170 km of the Earth's surface sensed by the American LANDSAT satellite from an altitude of 705 km. There are seven spectral bands of electromagnetic spectrum in LANDSAT TM data, ranging from the blue to far infrared wave length and four bands in LISS 3. The individual bands of LANDSAT TM are 0.45–0.52, 0.53–0.60, 0.62 –0.69, 0.78–0.90, 1.57–1.78, and 2.10–2.35 µm with the spatial resolution of 30m in the visible, near infrared and middle infrared bands, and 10.45–11.66 µm in the far infrared band with

120m resolution. Some of the potential applications of different spectral bands of LANDSAT TM are given in Table 6.1. The TM sensors greatly facilitate the multi-temporal data availability (repeated coverage of 16 days) for studying the temporal changes of glaciers, lakes, and other features.

The SPOT series of French satellites and recent series of IRS satellites have more advantages for the study of glaciers, glacial lakes, and GLOFs due to their stereo data acquisition capacity (±26° off-nadir viewing capability of the system) and higher spatial resolutions of 6 (IRS1C/IRSID PAN data) to 10m (SPOT PAN data).

Table 6.1: Spectral band ranges (µm) used in TM on board LANDSAT's 4 and 5 sensor system and their potential applications

Band number	**Band range (µm)**	Potential applications
1	0.45–0.52	Coastal water mapping; soil/vegetation differentiation; deciduous/coniferous differentiation (sensitive to chlorophyll concentration) etc
2	0.52–0.62	Green reflectance by healthy vegetation etc
3	0.63–0.69	Chlorophyll absorption for plant species' differentiation
4	0.78–0.90	Biomass surveys; water body delineation
5	1.55–1.75	Vegetation moisture measurement; snow/cloud differentiation; snow/ice quality study
6	10.4–12.5	Plant heat stress management; other thermal mapping; soil moisture discrimination
7	2.08–2.35	Hydro-thermal mapping; discrimination of mineral and rock types; snow/cloud differentiation; snow/ice quality study

Table 6.2: Some optical sensor system characteristics of Earth resources satellites used in the study

Satellite system Optical sensor system (Launch dates)	LANDSAT 4/5 MSS (1982 LANDSAT-4) (1985 LANDSAT -5)	LANDSAT 4/5 TM (1982 LANDSAT-4) (1984 LANDSAt-5) (1999 LANDSAT -7)	SPOT XS (1986 SPOT-1) (1990 SPOT-2) (1993 SPOT-3) (1999 SPOT-4)	IRS-1C LISS-III (1995 IRS-1C) (1997 IRS-1D)
Sensor altitude	LANDSAT 1,2,3 = 900 km LANDSAT 4, 5=705 km	705 km	832 km	817 km
Spatial resolution	80m	30m	20m	24m
Temporal resolution (revisit cycle in days)	16	16	20 (nadir)	24 (nadir)
Radiometric resolution (bits per pixel)	6-bit (scaled to 7 or 8-bit during ground processing)	8-bit	8-bit	7-bit
Swath width	185 km scene area = 185*170	185 km scene area = 185*170	60 km	141 km 124*141 133*148
Off-nadir viewing (side-look) capability for PAN mode for stereo image data acquisition (±26° off-nadir viewing)			SPOT PAN (10 m resolution) 0.51–0.73 µm 3 days revisit capability	IRS-1C PAN (6 m resolution) (70 km swath width) 0.50–0.70 µm (6-bit) 3 days revisit capability
Spectral resolution (number of bands)	4	7	3	4

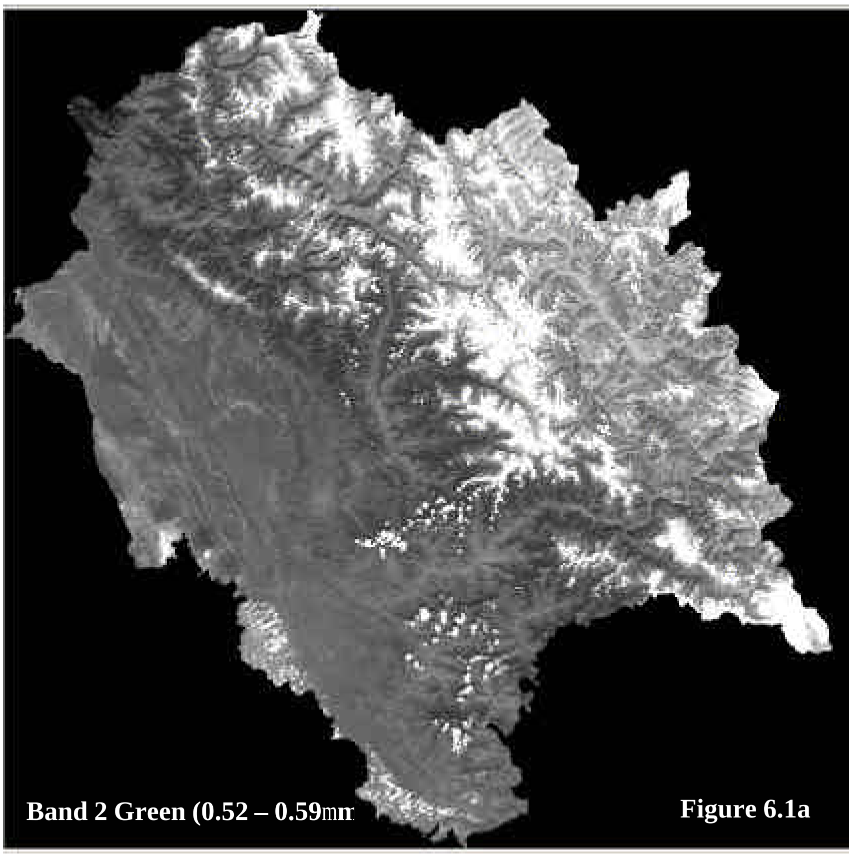
LISS3 sensors on board IRS1C/D satellites provide multi-spectral data collected in four bands of VNIR (visible and the near infrared) and SWIR (short wave infrared) regions (Tables 6.2 and 6.3). LISS3 images cover an area of 124 by 141 km for the VNIR bands (B2, B3, B4) and 133 by 148 km for the SWIR band (B5) sensed from an altitude of 817 km (IRS1C) to 780 km (IRS1D) with repetitive coverage of 25 days. The spatial resolution of VNIR bands is 24m and that of SWIR is 71m. the mosaic of satellite images of different bands of IRS1C LISS3 1D of Himachal Pradesh area is given in Figure 6.1

Table 6.3: Wavelength ranges of the optical sensor system of Earth resources satellites used in the present study

Satellites system **Optical sensor system**	**LANDSAT 4/5** **MSS**	**LANDSAT 4/5** **TM**	**SPOT** **XS**	**IRS-1C/1D** **LISS-III**
Blue		0.45–0.52 µm (B1)		
Green	0.50–0.60 µm (Ch1 or B4)	0.53–0.61 µm (B2)	0.50–0.59 m (XS1)	0.52–0.59 µm (B2)
Red	0.60–0.70 µm (Ch2 or B5)	0.62–0.69 µm (B3)	0.62–0.68 µm (XS3)	0.62–0.68 µm (B3)
NIR	0.70–0.80 µm (Ch3 or B6)	0.78–0.90 µm (B4)	0.78–0.88 µm (XS3)	0.77–0.86 µm (B4)
NIR	0.80–1.10 µm (Ch4 or B7)			
IIR		1.57–1.78 µm (B5)		1.55–1.75 µm (B5)
IIR		2.10–2.35 µm (B7)		
IIR (MIR)				
ThIR		10.45–11.66 µm (B6)		
FIR				

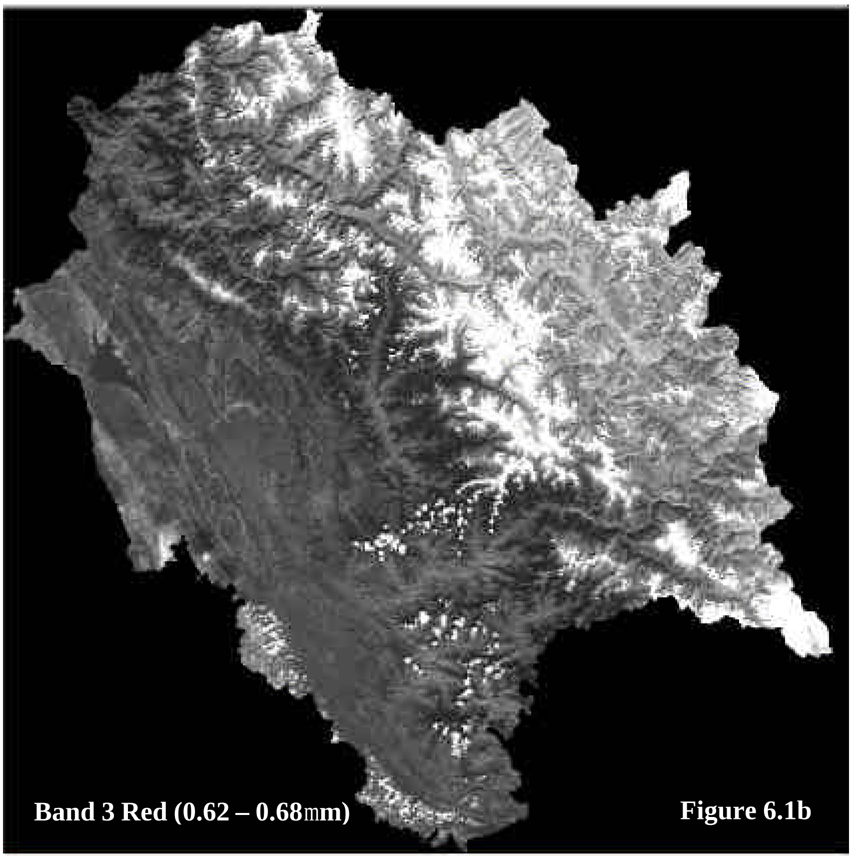
The spatial resolution of LISS3 of the IRS satellite series and XS of the SPOT satellite series are greater than that of LANDSAT TM. With a greater number of spectral bands and spatial resolution of 30 by 30m close to the former two data types, cloud free LANDSAT TM data are equally good for the inventory and evaluation of glaciers, glacial lakes, and GLOFs in the medium scale (1:100,000 to 1:25,000).

When electro-magnetic energy is incident on any given Earth surface feature, three fundamental energy interactions with the feature are possible. Various fractions of energy incident on the element are reflected, absorbed, and/or transmitted. All components of incident, reflected, absorbed, and/or transmitted energy are a function of the wavelength. The proportions of energy reflected, absorbed, and transmitted vary for different Earth



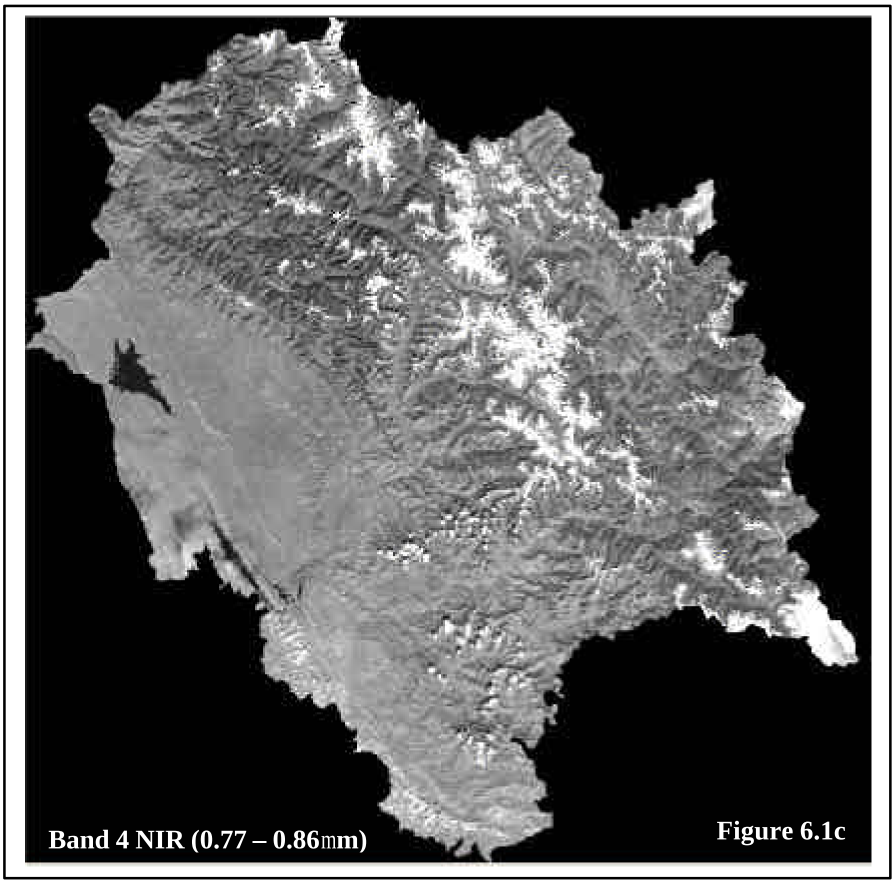
Band 2 Green (0.52 – 0.59mm

Figure 6.1a



Band 3 Red (0.62 – 0.68mm)

Figure 6.1b



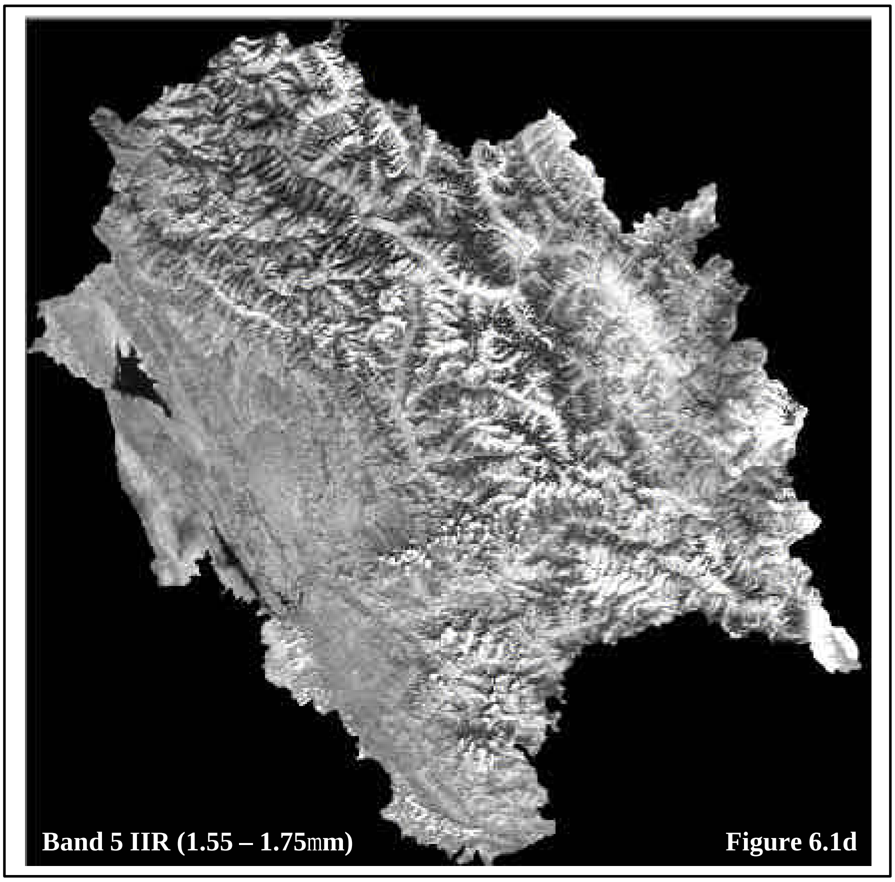


Figure 6.1 Different spectral bands of IRS1D LISS3 of Himachal Pradesh region

features, depending on their material types and conditions. These differences permit us to distinguish different features on an image. Thus, two features may be distinguishable in one spectral range and may be very different on another wavelength band. Within the visible portion of the spectrum, these spectral variations result in the visual effect called **colour**. For example, blue objects reflect highly in the blue portion of the spectrum, likewise green reflects highly in the 'green' spectral region, and so on. Thus, the eye uses spectral variations in the magnitude of reflected energy to discriminate between various objects.

Satellite data are digital records of the spectral reflectance of the Earth's surface features. These digital values of spectral reflectance are used for image processing and image interpretations. A graph of the spectral reflectance of an object as a function of wavelength is called a spectral reflectance curve. The configuration of spectral reflectance curves provides insight into the characteristics of an object and has a strong influence on the choice of wavelength region(s) in which remote-sensing data are acquired for a particular application.

Figure 6.2 shows the typical spectral reflectance curves for three basic types of Earth feature: green vegetation, soil, and water. The lines in this figure represent average reflectance curves compiled by measuring large sample features. It should be noted how distinctive the curves are for each feature. In general, the configuration of these curves is an indicator of the type and condition of the features to which they apply. Although the reflectance of individual features may vary considerably above and below the average, these curves demonstrate some fundamental points concerning spectral reflectance.

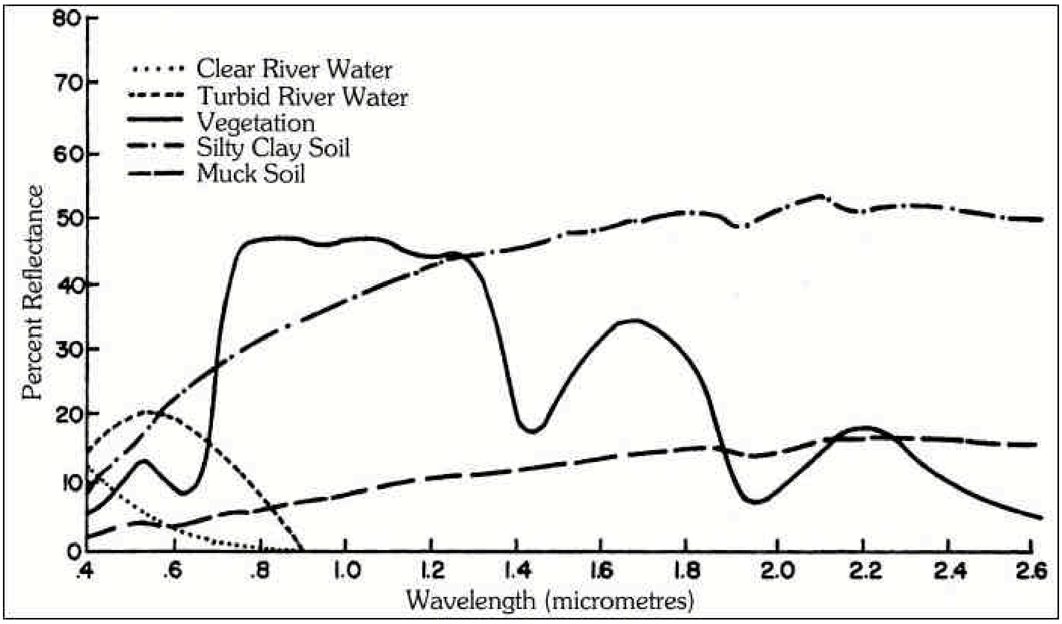


Figure 6.2: Typical spectral reflectance curves for vegetation, soil, and water (after Swain and Davis 1979)

Spectral reflectance curves for vegetation almost always manifest the 'peak-and-valley' configuration (Figure 6.2). Valleys in the different parts of the spectral reflectance curve are the result of the absorption of energy due to plants, leaves, pigments, and chlorophyll content at 0.45 and 0.67 µm wavelength bands and water content at 1.4, 1.9, and 2.7 µm wavelength bands. In near infrared spectrum wavelength bands ranging from about 0.7–

1.3 µm, plants reflect 40–50% of energy incident upon them. The reflectance is due to plant leaf structure and is highly variable among plant species, which permits discrimination between species. Different plant species reflect differently in different portions of wavelength.

The soil curve in Figure 6.2 shows considerably less peak-and-valley variation in reflectance. This is because the factors that influence soil reflectance act over less specific spectral bands. Some of the factors affecting soil reflectance are moisture content, soil texture (proportion of sand, silt, and clay), surface roughness, presence of iron oxide, and organic matter content. These factors are complex, variable, and inter-related. For example, the presence of moisture in soil will decrease its reflectance. As with vegetation, this effect is greatest in the water absorption bands at about 1.4, 1.9, and 2.7 µm (clay soils also have hydroxyl absorption bands at about 1.4 and 2.2 µm). Soil moisture content is strongly related to soil texture; coarse and sandy soils are usually well drained, resulting in low moisture content and relatively high reflectance; poorly drained and fine-textured soils will generally have lower reflectance. In the absence of water, however, the soil may exhibit the reverse tendency, that is, coarse-textured soils may appear darker than fine-textured soils. Thus, the reflectance properties of soil are consistent only within a particular range of conditions. Two other factors that reduce soil reflectance are surface roughness and organic matter content. Soil reflectance normally decreases when surface roughness and organic matter content increases. The presence of iron oxide in soil also significantly decreases reflectance, at least in the visible wavelengths. In any case, it is essential that the analyst be familiar with the existing conditions.

When considering the spectral reflectance of water, probably the most distinctive characteristic is the energy absorption at near infrared wavelengths. Water absorbs energy in these wavelengths, whether considering water features per se (such as lakes and streams) or water contained in vegetation or soil. Locating and delineating water bodies with remote-sensing data are carried out easily in near infrared wavelengths because of this absorption property. However, various conditions of water bodies manifest themselves primarily in visible wavelengths. The energy/matter interactions at these wavelengths are very complex and depend on a number of inter-related factors. For example, the reflectance from a water body can stem from an interaction with the water surface (specula reflection), with material suspended in the water, or with the bottom of the water body. Even in deep water where bottom effects are negligible, the reflectance properties of a water body are not only a function of the water per se but also of the material in the water.

Clear water absorbs relatively little energy with wavelengths of less than about 0.6 µm. High transmittance typifies these wavelengths with a maximum in the blue-green portion of the spectrum. However, as the turbidity of water changes (because of the presence of organic or inorganic materials), transmittance, and therefore reflectance, changes dramatically. This is true in the case of water bodies in the same geographic area. Spectral reflectance increases as the turbidity of water increases. Likewise, the reflectance of water depends on the concentration of chlorophyll. Increases in chlorophyll concentration tend to decrease water reflectance in blue wavelengths and increase it in green wavelengths. Many important water characteristics, such as dissolved oxygen concentration, pH, and salt concentration, cannot be observed directly through changes in water reflectance. However, such parameters sometimes correlate with observed reflectance. In short, there are many complex inter-relationships between the spectral reflectance of water and its particular characteristics. One must use appropriate reference data to correctly interpret reflectance measurements made over water.

Snow and ice are the frozen state of water. Early work with satellite data indicated that snow and ice could not be reliably mapped because of the similarity in spectral response between snow and clouds due to limitations in the then available data set. Today satellite remote sensing systems' data are available in more spectral bands (e.g. LANDSAT TM in seven bands). It is now possible to differentiate snow and cloud easily in the middle infrared portion of the spectrum, particularly in the 1.55–1.75 and 2.10–2.35 µm wavelength bands (bands 5 and 7 of LANDSAT TM). As shown in Figure 6.3, in these wavelengths, the clouds have a very high reflectance and appear white on the image, while the snow has a very low reflectance and appears black on the image. In the visible, near infrared, and thermal infrared bands, spectral discrimination between snow and clouds is not possible, while in the middle infrared it is. The reflectance of snow is

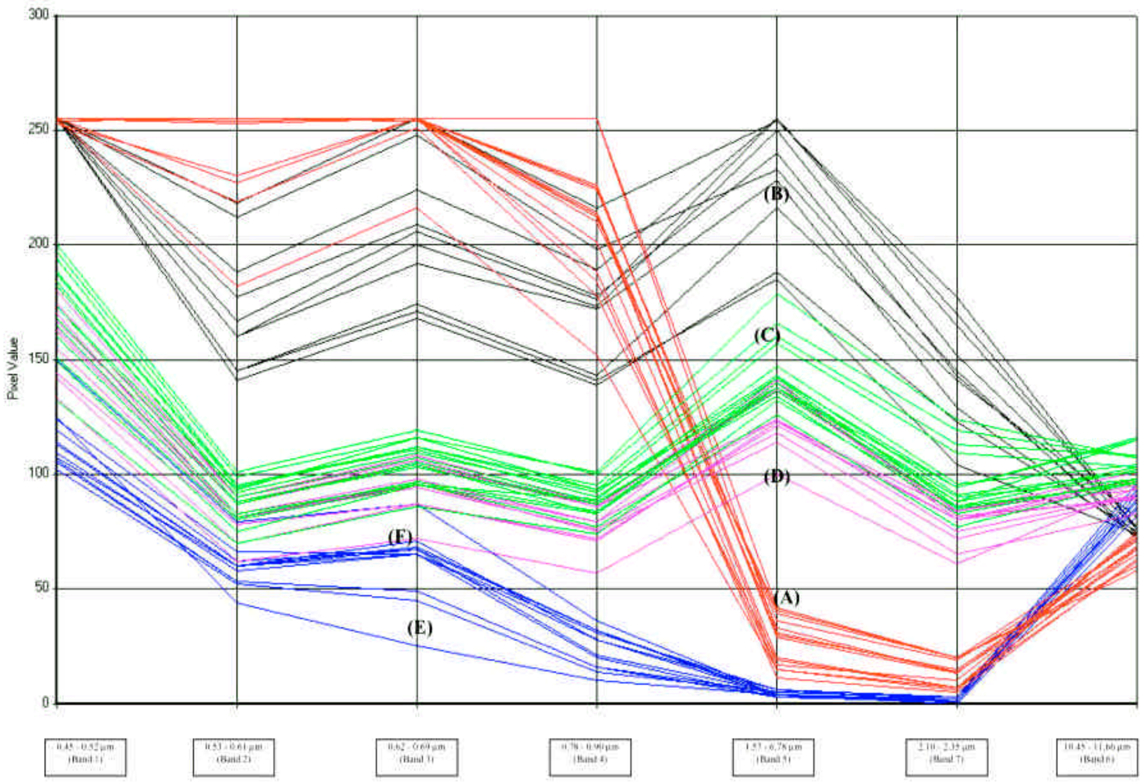


Figure 6.3: Spectral reflectance characteristics in terms of pixel value based on a September 22, 1992, Landsat TM seven-band data set of the Tama Koshi and Dudh Koshi areas of Nepal.
Red lines—clean glaciers and fresh snow (A); Black lines—clouds (B);
Green lines—recent debris from GLOFs (C); Maroon lines—debris covered glacier (D);
Blue lines—clean/melted (E) and silty and/or partly frozen water (lake) (F)

generally very high in the visible portions and decreases throughout the reflective infrared portions of the spectrum. The reflectance of old snow and ice is always lower than that of fresh snow and clean/fresh glacier in all the visible and reflective infrared portions of the spectrum. Compared to clean glacier and snow (fresh as well as old), debris covered glacier and very old/dirty snow have much lower reflectance in the visible portions of the spectrum and higher in the middle infrared portions of spectrum.

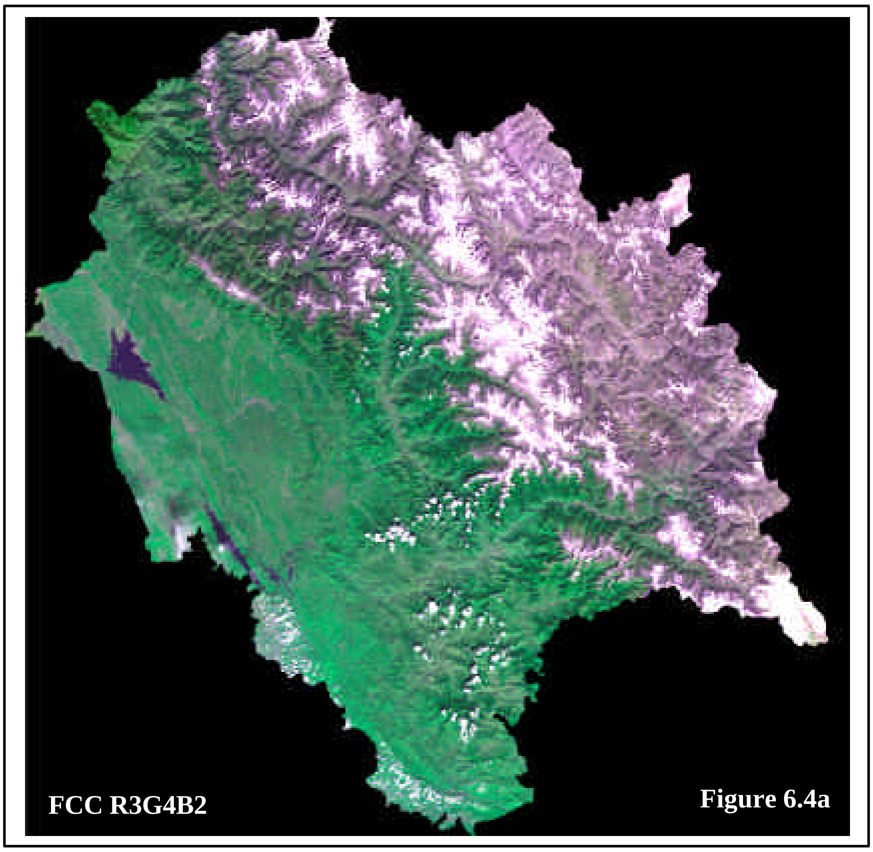
To identify the individual glaciers and glacial lakes, different image enhancement techniques are useful. However, complemented by the visual interpretation method (visual pattern recognition), with the knowledge and experience of the terrain conditions, glacier and glacial lake inventories and monitoring can be done. With different spectral band combinations in false colour composite (FCC) and in individual spectral bands, glaciers and glacial lakes can be identified and studied using the knowledge of image interpretation keys: colour, tone, texture, pattern, association, shape, shadow etc. Combinations of different bands can be used to prepare FCC. Different colour composite images highlight different land-cover features.

Figure 6.4 shows colour composite images R3G4B2 (red to band 3, green to band 4, blue to band 2) and R4G3B2 of an IRS1D LISS3 of 19 September 1999 to 19 October 2001 of the Himachal Pradesh. In the colour composite images of Figure 6.4 one can identify different types of land cover, glaciers and glacial lakes. The Figure 6.5 is the FCC of R5G3B2 and FCC of R5G4B3 of Himachal Pradesh of date 19 September 1999 to 19 October 2001. These type of FCC are useful to identify the rock types and different types of landsforms. Colours in the colour composite images and tones in the individual band images are the outcome of the reflectance values. Glaciers appear white (in individual bands and colour composite) to light blue (in colour composite) colour of variable sizes, with linear and regular shape having fine to medium texture, whereas, in the thermal band, they appear grey to black. The distinct linear and dendritic pattern associated with slopes and valley floors of the high mountains covered with seasonal snow can be distinguished in the glaciers in the mountains.

The lake water in colour composite images ranges in appearance from light blue to blue to black. In the case of frozen lakes, it appears white. Sizes are generally small, having circular, semi-circular, or elongated shapes with very fine texture and are generally associated with glaciers in the case of high lying areas, or rivers in the case of low lying areas. In general, erosion lakes and some cirque lakes are not necessarily associated with glaciers or rivers at present. The debris flow path along the drainage channel gives a white to light grey and bright tone. The sample FCC of the subset of study area is given in Figure 6.6, in which one can easily identify the fresh snow, glacier ice, debris cover glacier, glacial lake, river valley etc.

For glacier and glacial lake identification from satellite images, the images should be with least snow cover and cloud free. Least snow cover in the Himalayas occurs generally in the summer season (May–September). But during this season, monsoon clouds will block the views. If snow precipitation is late in the year, winter images are also suitable except for the problem of long relief shadows in the high mountain regions. For the present study, most of the images are of the winter season under conditions of least seasonal snow cover and cloud free.

Knowledge of the physical characteristics of the glaciers, lakes, and their associated features is always necessary for the interpretation of the images. For example, the end



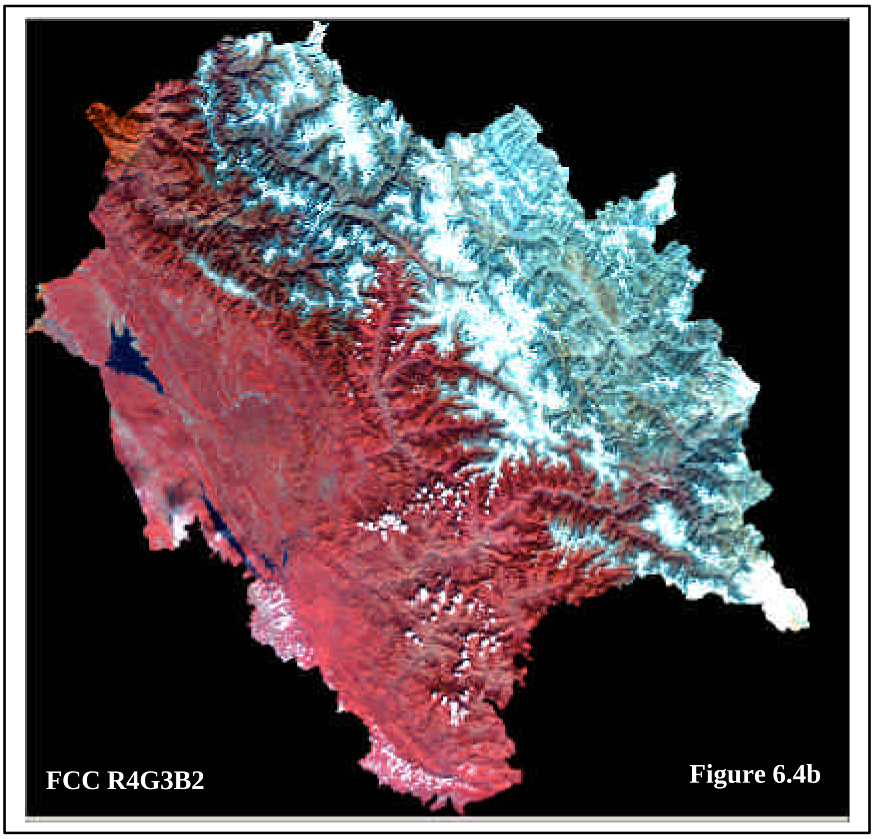
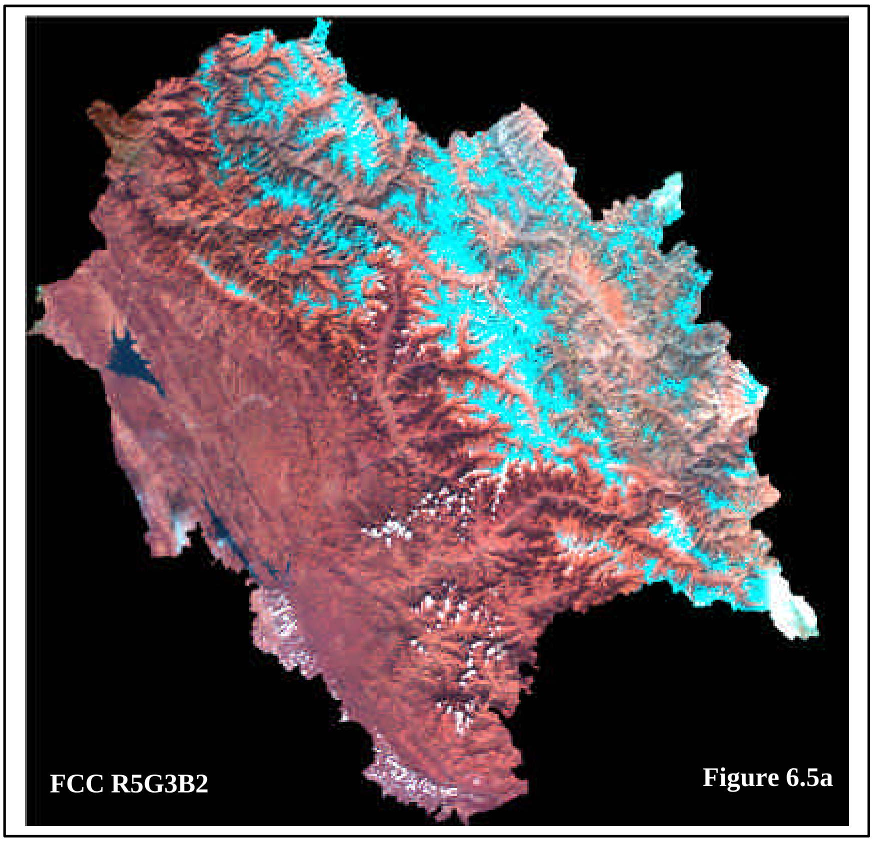


Figure 6.4 False Color Composite (FCC) of different spectral bands of IRS1D LISS3 of Himachal Pradesh region



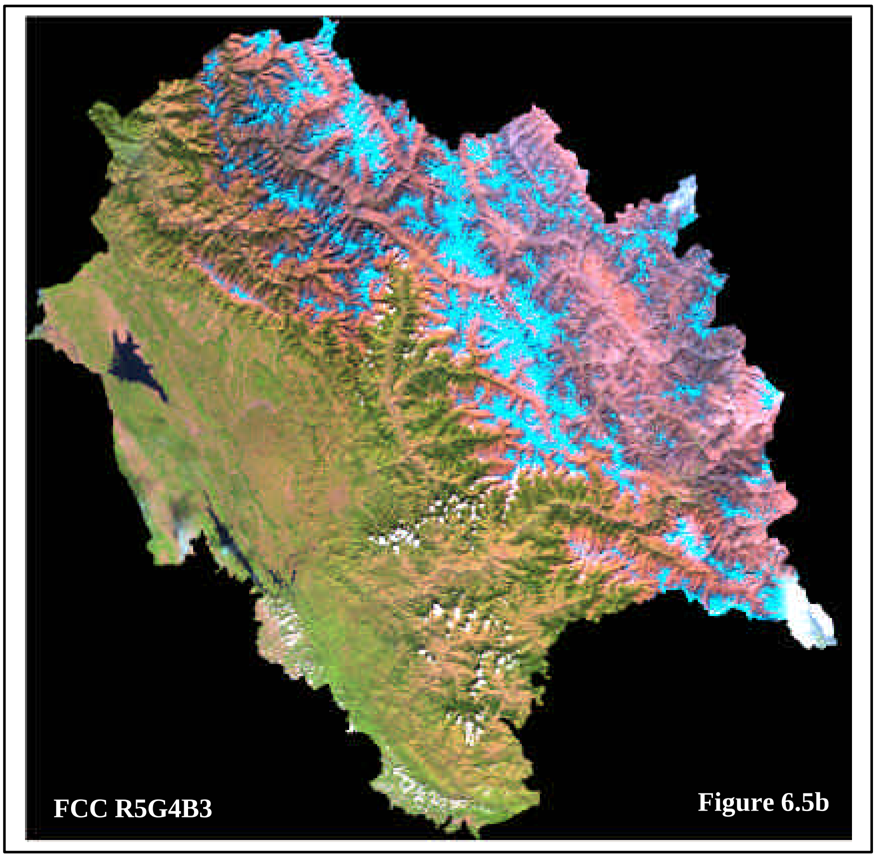


Figure 6.5 False Color Composite (FCC) of different spectral bands of IRS1D LISS3 of Himachal Pradesh region

moraine damming the lake may range from a regular curved shape to a semi-circular crescent shape. The frozen lake and glacier ice field may have the same reflectance, but the frozen lake always has a level surface and is generally situated in the ablation areas of glaciers or at the toe of the glacier tongue, and there is greater possibility of association with drainage features downstream.

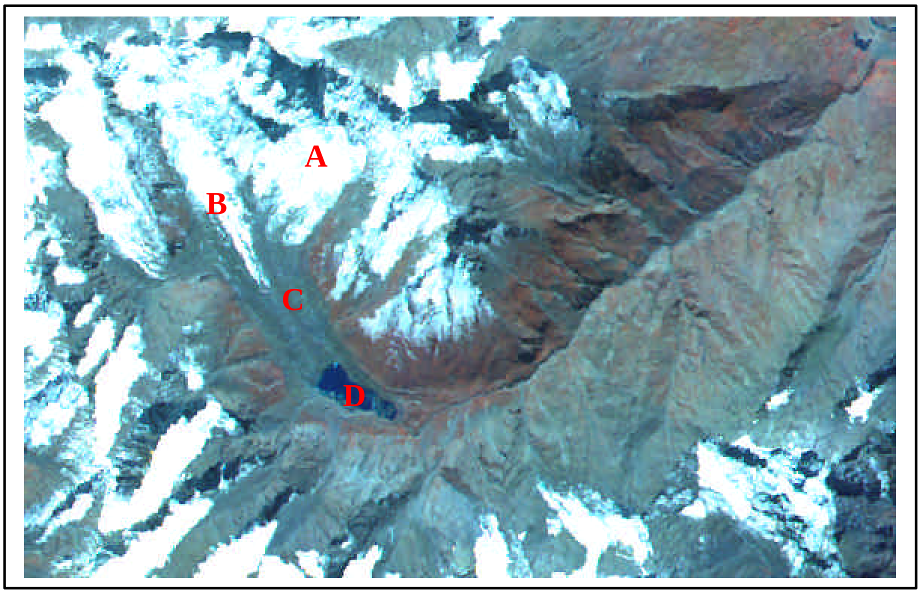


Figure 6.6 False color composite (FCC) of Red (5) Green(4) Blue(3) indicating Fresh snow (A), glacier Ice (B), Debris covered Glacier (C) and Glacial Lake (D). Subset of the study area of IRS 1D LISS3

The technique of digital image analysis facilitates image enhancement and spectral classification of the ground features and, hence, greatly helps in the study of glaciers and lakes. Monitoring of the lakes and glaciers can be done visually as well as digitally. In both the visual interpretation and digital feature extraction techniques, the analyst's experience and adequate field knowledge are necessary. The satellite images have to be geometrically rectified based on the appropriate geo-reference system and cell sizes. The same geo-reference system is required for the integration and analysis of the remote sensing satellite data in the GIS database. The image resolutions and geo-reference system should be the same for better results.

Coarse spatial resolution images have limitations when distinguishing smaller lakes and small stream paths. However, such small objects will show up in the coarse spatial resolution images averaged with reflectance values of their surrounding objects.

The technique of integrating remote sensing data with GIS does help a lot with identification and monitoring of lakes and glaciers. The DEM of an area generated either using stereo satellite images, aerial photographs, or digitisation of topographic map data can play a big role in deciding the rules for discrimination of features and land cover types in GIS techniques and for better perspective viewing and presentations (Figure 6.7). DEM itself can be used to create various data sets of the area (e.g. slope, aspect). For example, even though glacial lakes are covered by snow, the lake surfaces are flat, and glaciers, snow, and ice create slope angles. In this case, decision rules for integrated analysis in GIS can be assigned, that is, if the slope is not too pronounced and the texture smooth, then such areas are recognised as frozen glacial lakes. DEM generated from satellite images, aerial photographs, or topographic maps should be compatible with and of reliable quality to other data sets. The satellite images or orthophotos can be draped over the DEM for interpretation or presentation. Figures 6.8 and 6.9 show some examples of the use of DEM draped by satellite images.

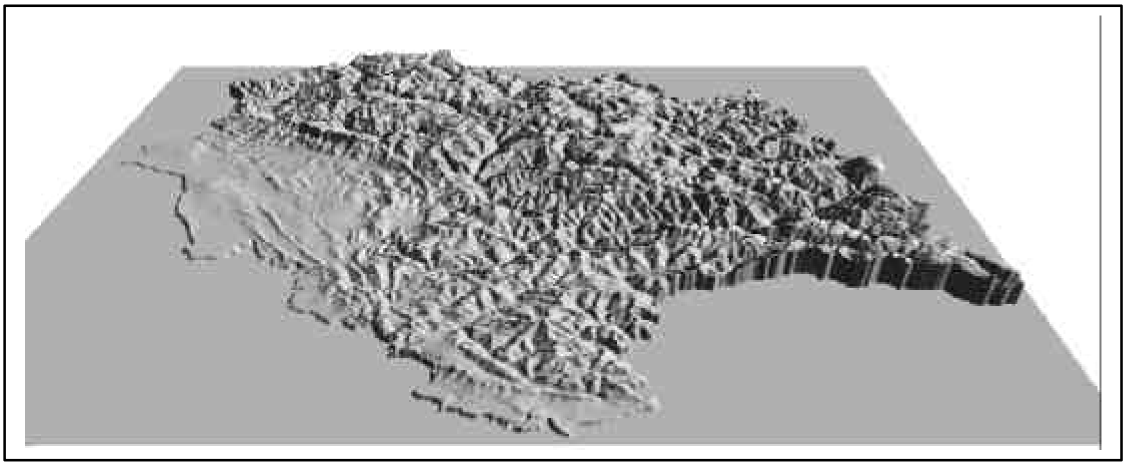


Figure 6.7 DEM of Himachal Pradesh generated from the digitization of topographic maps

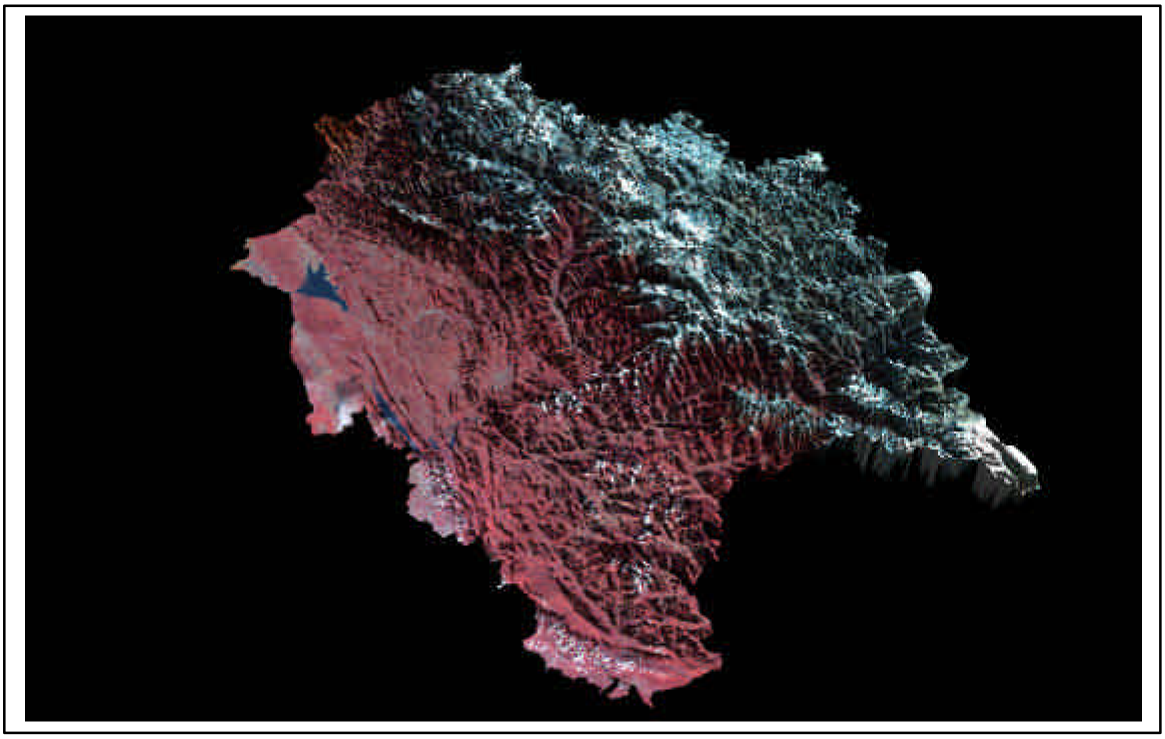


Figure 6.8 IRS1D LISS 3 R5G3B2 drapped over the DEM of Himachal Pradesh

Based on different criteria, actively retreating glaciers and potentially dangerous lakes can be determined using the developed spatial and attribute database complemented by multi-temporal remote-sensing data sets. Once the activity of glaciers and the potentially dangerous status of lakes are determined, the use of medium- to large-scale aerial photographs provides the best tool for detailed geomorphic studies and other evaluation. The photograph image characteristics, shape, shadow, tone, colour, texture, pattern, and relation to surrounding objects were used for aerial photo interpretation. Geomorphic features and processes of the area are very distinctive in their appearance on aerial photographs. Physical parameters of glaciers, glacial lakes, and associated moraines can easily be estimated by stereoscopic viewing.

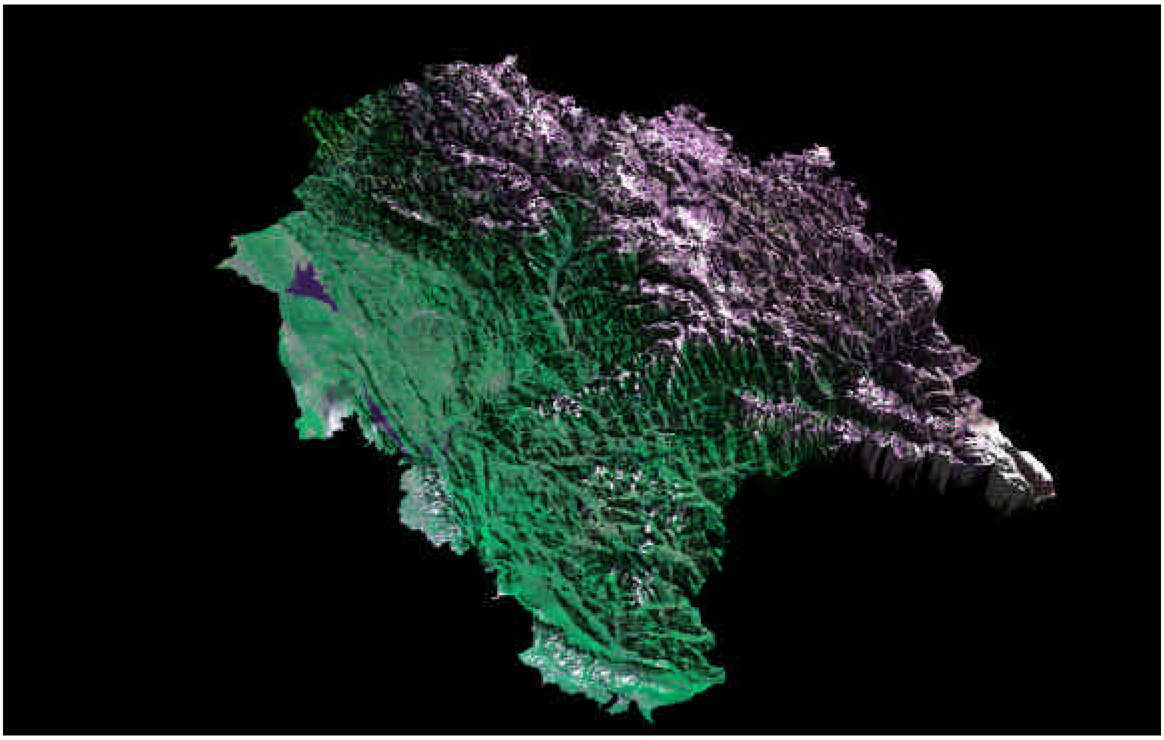


Figure 6.9 IRS1D LISS 3 R5G4B3 drapped over the DEM of Himachal Pradesh

Chapter 7

Inventory of Glaciers

7.1 Brief Description Of Glacier Inventory

The inventory of glaciers has been based on topographic maps and satellite images. Glaciers were digitized on the satellite image and the identification, classification, and determination of stages of glaciers was accomplished by referring topographic maps of the glaciated regions of Himachal Pradesh. The spatial inventory is based entirely on topographic maps on a scale of 1: 50,000 published in the 1960s to 1970s by the Survey of India. All the projection parameters of the topographic maps are incorporated in the images to make the prints compatible with the topographic maps.

For the inventory of glaciers, the area is divided into major rivers basins. The aerial extension of the glaciers is found with the help of geographic information systems (GIS). To estimate the ice reserves, it is an utmost necessity to have the mean thickness of the glaciers. Since the mean glacier thickness data are not available, this is estimated from the equation developed for the Tianshan Mountains (Chaohai Liu and Liangfu 1986)

$$H = -11.32 + 53.21F^{0.3}$$

Where H = mean ice thickness (m) and F = area of glacier (km^2)

The ice reserves were estimated by multiplying the mean thickness by the area of the glacier.

7.2 Types Of Glacier

The classification of glaciers is adopted from the morphological classification of glaciers by the World Glacier Monitoring Service (WGMS) (Muller et al. 1977). Details of the classification are mentioned in Chapter 4. The classified glaciers are divided into different types, combining Digit 1 of ‘primary classification’ and Digit 2 of ‘form’. Generally, seven types of glacier are observed in the Himachal Pradesh - mountain glaciers, mountain basin glacier, valley glaciers, cirque glaciers, niche glaciers, ice caps, and ice aprons. Mountain glaciers are dominant in quantity and the profile shows a hanging nature. Other glaciers, except for valley glaciers, generally fall into the category of mountain glaciers but the thickness of ice is comparatively low. The number of valley glaciers is comparatively low but the corresponding areas and ice reserves are higher than those of mountain glaciers. The area and ice reserves of the valley glaciers are generally large owing to the fact that the ice thickness increases with increase in the area of the glacier.

Mountain glaciers are uncertain or miscellaneous, compound basins, compound basin, or simple basin in the form of a hanging glacier. The major source of nourishment is snow and/or drift snow. Ice caps, cirque glaciers, niche glaciers, and ice aprons are other types of hanging mountain glaciers, but they are considered to be a different type due to their significance in size, shape, form, and ice thickness. The most significant valley type glaciers are fewer in number and characterised by compound basins, compound basin, and simple basin. They are mainly nourished by snow and drift snow at the headwater and by snow and ice avalanche at the lower valley. The adjoining part of the valley glacier at the headwaters is characteristically a mountain glacier, but due to its continuation into a valley glacier, the whole ice mass will be considered to be a valley glacier. Hence, the area of the valley glacier is higher than that of the mountain glaciers.

The longitudinal profile of the valley glacier from crown to toe shows an even or regular shape. As the headwater is steeper and has a gentle slope in the lower reaches, the profile makes the curve concave upwards. Due to the gentle slope at the lower reaches and the accumulation of debris derived from the headwater, glacial lakes develop in a supra glacial and moraine dammed form. Generally, the stability of glacial lakes is poor and there is always the chance of avalanches from mountain glaciers, which may break the damming material and cause glacial lake outburst floods (GLOFs).

7.3 GENERAL CHARACTERISTICS OF GLACIATION

The occurrence of glaciers has always been linked to climatic conditions. Climate is of fundamental importance to the inception and growth of glaciers. The form of the landscape dictates the threshold conditions for glacier occurrence and determines glacier morphology. In certain climatic conditions for glaciation, glaciers of different shapes and sizes are formed depending on the landscape. Mountain glacier regions are associated with climatic fronts, zones of maximum precipitation.

The general characteristics of glaciation in Himachal Pradesh are not well studied.

7.4 GLACIERS OF HIMACHAL PRADESH

To create a comprehensive inventory and GIS database of glaciers present in the state, the state boundary of Himachal Pradesh was divided in to four major river basins viz., Beas, Ravi, Satluj and Chenab and four more sub-basins which are not covered under these major river coverages. All the basins contained a significant number of glaciers. Basin wise distribution of glaciers including their number, area constituted and Ice reserve is shown in Table 7.1.

Table 7.1. Distribution of glaciers in Himachal Pradesh.

S.No.	Basin	Glacier Number	Area (km^2)	Ice reserve (km^3)
1	Beas	358	758.18	76.4
2	Ravi	198	235.21	16.88
3	Chenab	681	1704.7	187.66
4	Satluj	945	1217.7	94.45
5	Sub basin 1 (Tsarap Chu)	250	163.33	7.96
6	Sub basin 2 (Taklingla)	55	32.04	1.38
7	Sub basin 3 (Bhagirathi)	43	43.06	2.43
8	Sub basin 4 (Pabbar)	24	6.36	0.19
	Total	2554	4160.58	387.35

The majority of the glaciers in Himachal Pradesh fall into the primary classification of mountain glaciers with simple basins with their major source of recharge being from snow or avalanches with a marked rate of retreat. Glaciers in this region generally occur above the elevation of 4,000 masl. It has been estimated that there are 2554 glaciers altogether inventoried within the territory of Himachal Pradesh, covering an area of 4160.58 sq. km with an ice reserves of 387.35 km^3 (Table 7.1 and Figure 7.1). The highest number of glaciers lies in Satluj river basin and the lowest number of glaciers in the sub basin 4 (Pabbar). The details of the glacier inventory for all the sub-basins are given in Annex.

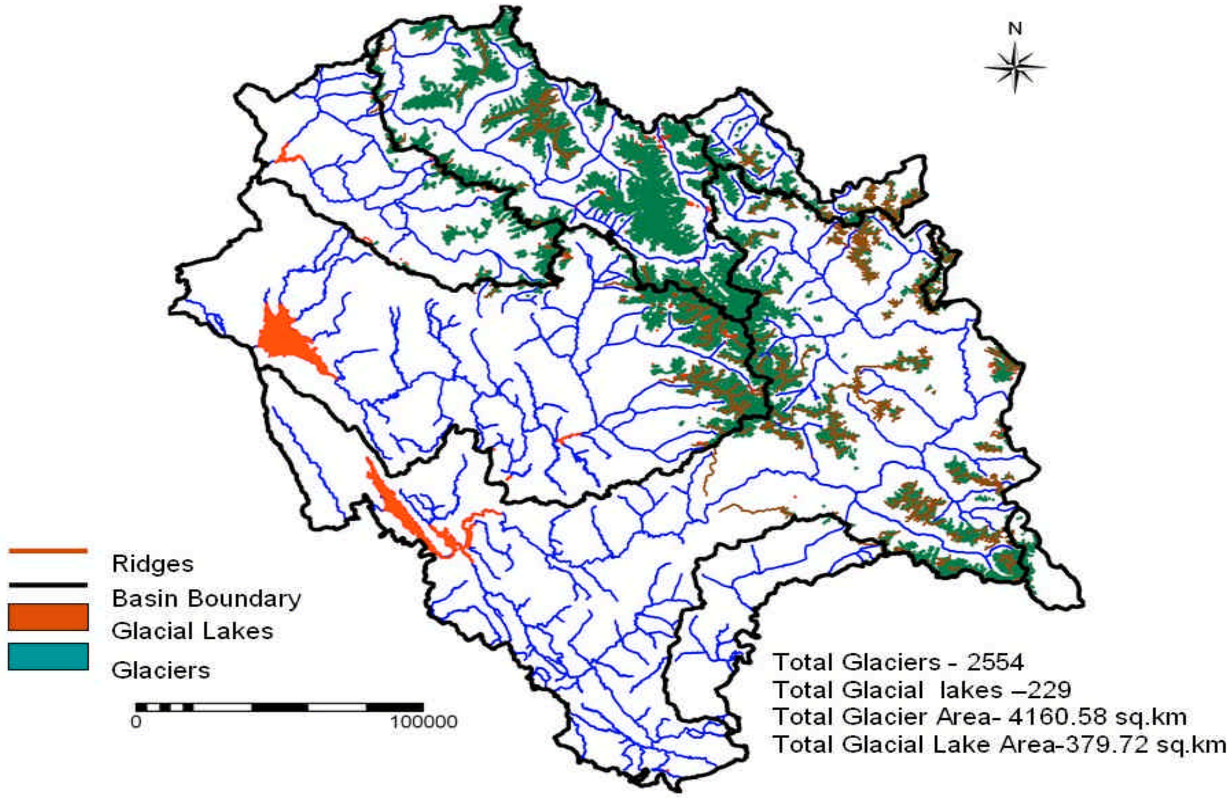


Fig. 7.1 Inventory of Glaciers and Glacial lakes in Himachal Pradesh.

7.4.1 Beas River Basin

The western part of Himachal Pradesh is occupied by the Beas river basin. It lies between 31°24' N - 32° 36' N latitude and 75° 36' E -77°.52' E longitude. The Beas river network comprises Parbati, Binwa, Neugal, Banganga, Gaj, Dehr and Chakki Kunal, Masch, Khairan rivers. The main river flows from east to west. Glaciers are confined to the extreme north eastern part of the basin.

The Beas river basin has a total of 358 glaciers and covers an area of 758.18 sq. km with ice reserves of 76.42 km^3 (Table 7.2). The two largest glaciers in the basin are Beas_gr 128 and Beas_gr 230. Both of them are valley glaciers and have area coverage of 63.18 and 65.68 sq. km, respectively. Glacier Beas_gr 128 is 18.3 km long and Beas_gr 230 is 16.3 km (Figure 7.2).

The highest numbers of glaciers is distributed in the southern aspect, whereas the lowest number of glaciers are distributed in the east and west aspects (Table 7.2).

Table 7.2 Summary of glaciers in the Beas basin with respect to aspect.

Aspect	E	N	NE	NW	S	SE	SW	W
Number of glacier	25	52	44	58	68	34	49	28
Area (km^2)	19.02	129.58	77.46	132.04	143.99	40.12	112.86	103.11
Area(%)	2.5	17.1	10.2	17.4	19	5.3	14.9	13.6
Maximum Area (km^2)	2.21	65.68	15.58	28.62	63.18	6.57	43.53	41.7
Minimum Area (km^2)	0.08	0.06	0.12	0.06	0.05	0.07	0.05	0.07
Maximum length (m)	3094	5024	9165	6730	7931	4708	7735	3788
Minimum Length (m)	455	248	337	350	222	292	279	438
Ice reserve (km^3)	0.84	15.11	5.88	11.17	16.72	2.25	11.82	12.61

There are seven types of glacier in the Beas basin—Cirque, Ice-apron, Ice cap, Mountain, Mountain basin and Valley glaciers. The mountain type of glaciers is predominant in number as 134 out of 281 total are the mountain glaciers followed by mountain basins (105). However, 12 valley glaciers in the basin constitute 48 per cent of the total area and 70.2 per cent of the total ice reserves (Table 7.3). The least of the area is covered by ice caps (0.2 %) and cirques (0.3 %).

Table 7.3 Distribution of glaciers by type in Beas basin

	Number		**Area**				**Ice reserve**	
Glacier Type	Count	%	km^2	%	of largest glacier	of smallest glacier	Km^3	%
Cirque	12	3.4	2.49	0.3	0.61	0.05	0.06	0.1
Ice Apron	60	16.8	41.47	5.5	3.91	0.07	1.76	2.3
Ice Cap	9	2.5	1.32	0.2	0.36	0.05	0.03	0
Mountain	134	37.4	156.43	20.6	8.44	0.05	8.61	11.3
Mountain basin	105	29.3	186.82	24.6	15.2	0.16	12.15	15.9
Niche	26	7.3	5.41	0.7	0.69	0.05	0.13	0.2
Valley glacier	12	3.4	364.24	48	65.68	9.23	53.67	70.2

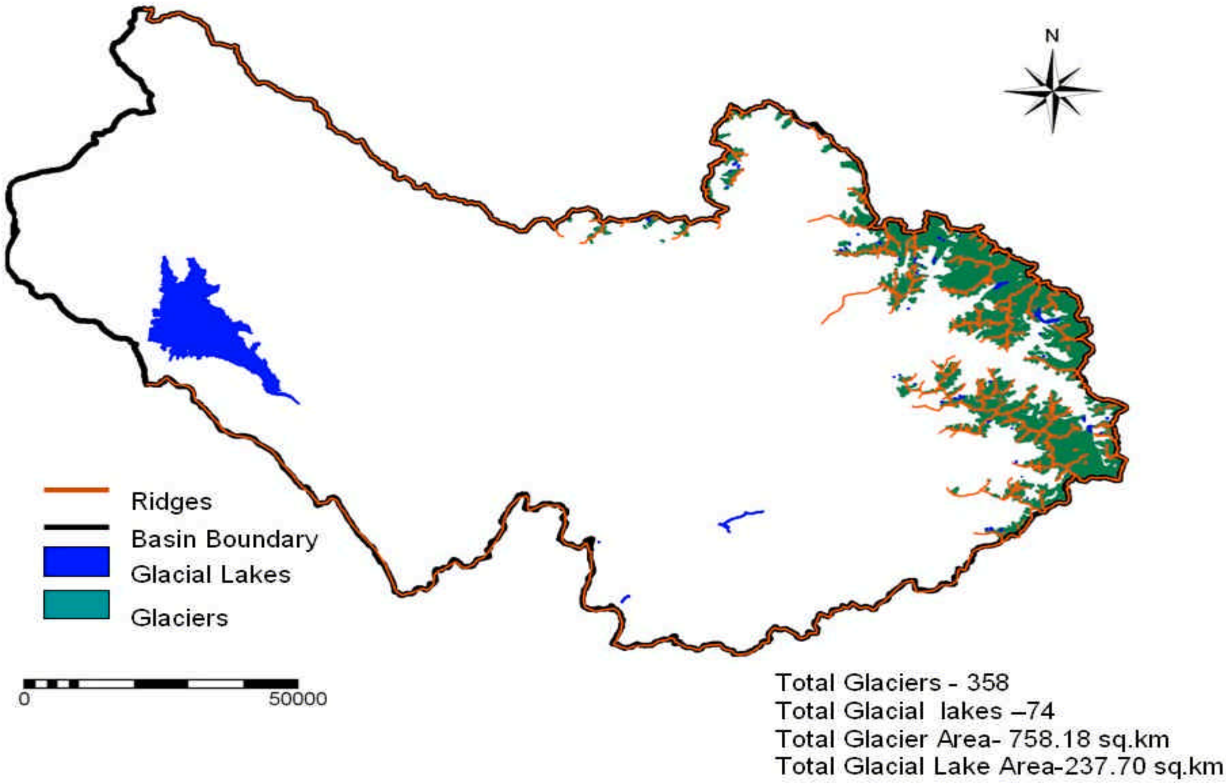


Figure 7.2 Glaciers and Glacial lakes of Beas basin.

7.4.2 Ravi River Basin

The Ravi river basin extend from 32º 13’ N to 33º 03’ N latitude to 75° 46’ E to 77° 01’ E longitude. It is the smallest of Himachal’s four major river basins. The Ravi basin comprises of 198 glaciers. The total area covered by these glaciers is 235.21 sq. km with an ice reserve of 14.58 km^3. The distribution of glaciers in this basin is shown in Figure 7.3.

The maximum number of glaciers is found to be either oriented towards South (43) followed by North West (31) and North east (29) (Table 7.4). The largest glacier, Ravi_gr 121, has an area of 18.65 sq. km and is located at 32° 25' 15.27" N latitude, and 77° 00' 10.61" E longitude.

Table 7.4 Summary of glaciers in the Ravi basin with respect to aspect.

Aspect	E	N	NE	NW	S	SE	SW	W
Number of glacier	13	27	29	31	43	8	32	15
Area (km^2)	3.97	17.36	13.33	64.02	19.01	4.92	85.00	27.61
Area(%)	1.7	7.4	5.7	27.2	8.1	2.1	36.1	11.7
Maximum Area (km^2)	1.61	2.30	2.62	18.16	2.21	2.30	18.65	10.36
Minimum Area (km^2)	0.05	0.03	0.04	0.04	0.01	0.07	0.06	0.08
Maximum length (m)	4335	3236	7184	8247	9412	5972	8941	7597
Minimum Length (m)	231	314	224	181	168	433	184	251
Ice reserve (km^3)	0.14	0.73	0.53	5.23	0.74	0.22	4.93	2.05

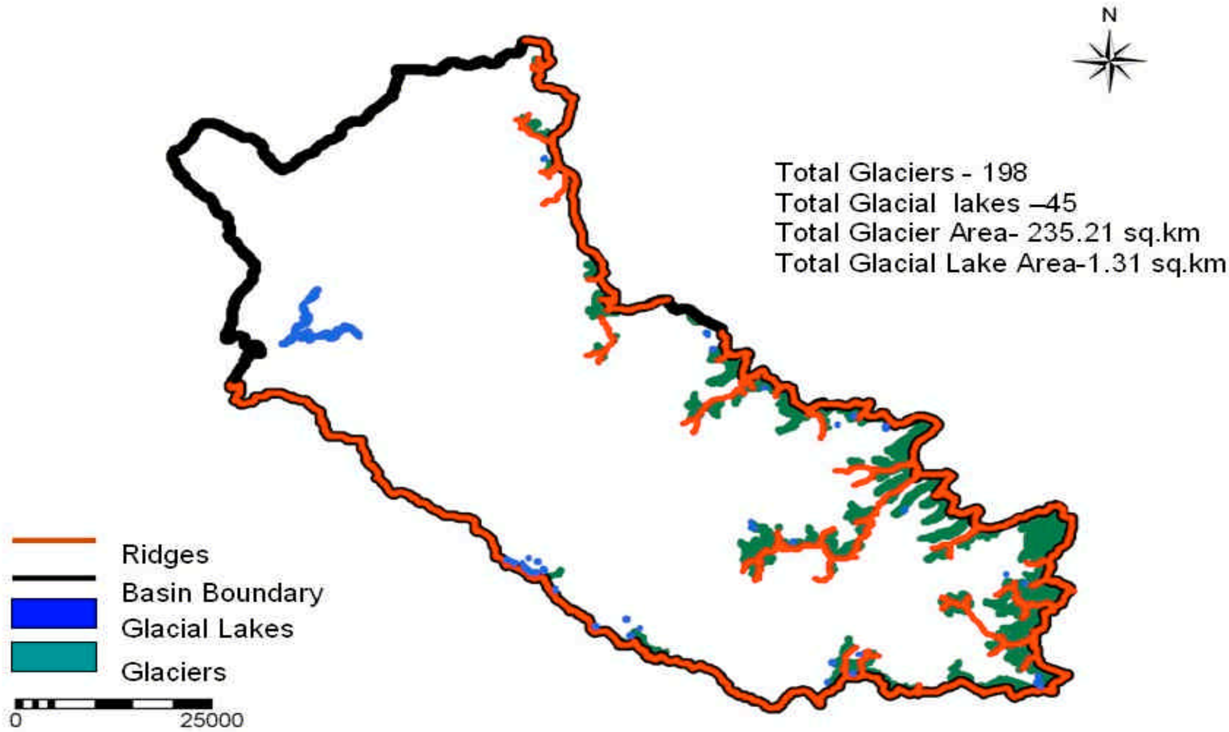


Figure 7.3 Glaciers and lakes of Ravi basin.

The glaciers in the Ravi river basin are classified mainly into mountain and mountain basin glaciers, out of which mountain glaciers are dominant in terms of number. There are 98 mountain glaciers and 39 mountain basin glaciers (Table 7.5, Figure 7.3). Of the total ice reserves in the basin the mountain glaciers and mountain basin contain 29.77 and 43.98% respectively (Table 7.5). Only 7 valley glaciers are present in the Ravi basin.

Table 7.5 Distribution of glaciers by type in Ravi basin

	Number		**Area**				**Ice reserve**	
Glacier Type	Count	%	km^2	%	of largest glacier	of smallest glacier	Km^3	%
Cirque	14	7.07	1.98	0.84	0.04	0.50	0.04	0.24
Ice Apron	18	9.09	7.76	3.30	0.01	1.78	0.33	1.97
Ice Cap	6	3.03	0.69	0.29	0.06	0.19	0.01	0.07
Mountain	98	49.49	70.02	29.77	0.03	7.34	3.52	20.82
Mountain basin	39	19.70	103.44	43.98	0.21	18.65	8.57	50.75
Niche	16	8.08	3.11	1.32	0.04	0.57	0.08	0.46
Valley glacier	7	3.54	48.22	20.50	4.61	10.49	4.34	25.69

7.4.3 Chenab River Basin

The Chandra and the Bhaga rivers are the main drainage lines of Chenab basin. After their, confluence at Tandi, their combined waters constitute the Chandrabhaga or the Chenab river. It has a catchment area of 61,000 sq km out of which 7,500 sq km lie in

Himachal Pradesh. It is the longest river of Himachal Pradesh in terms of volume of waters. The river is fed by numerous glaciers distributed throughout the basin.

As many as 681 glaciers have been identified which feed Chenab river (Figure 7.4). They cover an area of 1704.70 sq. km and an ice reserves of 187.66 Km^3 (Table 1). The basin has also the credit of possessing the largest glacier of the state. The largest glacier, Bara Shigri glacier (Chenab_gr 585), is located at the south eastern end of the basin at latitude 32° 14' 58.83" N and longitude 77° 36' 52.13" E. It is valley glacier about 34.24 km in length, constitutes an area of 180.26 sq. km and ice reserve of 43.53 km^3. There is another gigantic glacier (Chenab_gr 467) about 24 km long, swathe an area of 106.07 sq km and ice reserves of 21.58 km^3 (Figure 7.4).

The most dominant aspects of the glaciers are northeast followed by south and northwest. The west aspect glaciers are fewest in number (Table 7.6). Northeastern and northwestern aspects of glaciers collectively signify about 52 per cent of the glaciers.

Table 7.6 Summary of glaciers in the Chenab basin with respect to aspect.

Aspect	E	N	NE	NW	S	SE	SW	W
Number of glacier	65	78	121	92	103	1	80	89
Area (km^2)	98.03	153.67	423.1	439.24	149.85	2.19	186.87	174.77
Area(%)	5.8	9	24.8	25.8	8.8	0.1	11	10.3
Max. Area (km^2)	20.32	27.89	30.11	180.26	24.43	2.19	106.07	35.9
Min .Area (km^2)	0.03	0.03	0.02	0.03	0.03	2.19	0.03	0.05
Max. length (m)	10835.3	15758.7	12494.7	34237.2	8790.9	1885.1	24003	9833.1
Min.Length (m)	171.8	253	288.9	201.8	251	1885.1	191.1	338.3
Ice reserve (km^3)	7.93	12.05	40.38	66.71	11.95	0.12	26.88	15.80

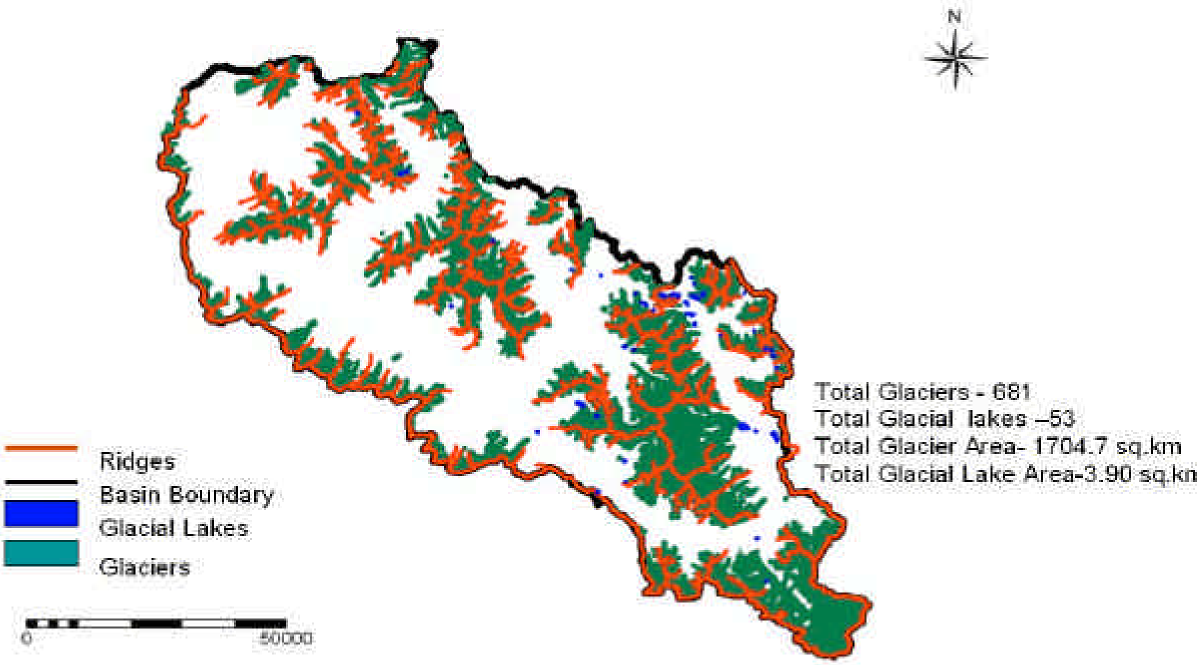


Figure 7.4 Glaciers and lakes of Chenab basin

Seven types of glacier have been recognized in this basin, out of which mountain glaciers are dominant in terms of number (278) followed by mountain basin (222) with 92 niche glaciers, 38 cirque glaciers and 34 valley glaciers (Figure 7.4). Areas occupied by mountain and mountain basin glaciers are 269.65 and 656.63 sq. km, respectively. The valley glaciers occupy a 41.5% area and 60.6% ice reserves. (Table 7.7).

Table 7.7 Distribution of glaciers by type in Chenab basin

	Number		**Area**				**Ice reserve**	
Glacier Type	Count	%	km^2	%	of largest glacier	of smallest glacier	Km^3	%
Cirque	38	5.6	6.08	0.4	0.49	0.02	0.13	0.10
Ice Apron	12	1.8	13.35	0.8	7.15	0.18	0.84	0.50
Ice Cap	5	0.7	0.73	0	0.35	0.05	0.02	0.00
Mountain	278	40.8	269.65	15.8	7.71	0.03	15.20	8.10
Mountain basin	222	32.6	656.63	38.5	24.43	0.03	53.04	28.30
Niche	92	13.5	51.46	3	30.11	0.03	4.75	2.50
Valley glacier	34	5	706.8	41.5	180.26	0.8	113.68	60.60

7.4.4 Satluj River Basin

Satluj is the longest and largest river traversing the Pradesh from east to west and plausibly, Satluj river basin is largest among five basins of the State. It spreads over 30° 22'to 32° 42' N latitude and 76° to 79° E longitude horizontally. Eighty percent of its catchment is snow fed. It consists of 945 glaciers with a cumulative area of 1217.70 sq. km and an estimated ice reserve of 94.45 km^3 (Table 7.1, Figure 7.5). Although the number of glaciers in Satluj basin is comparatively high, the ice reserve and the area occupied is less than the Chenab basin. Usually a higher number of valley glaciers indicate a larger ice reserves and a higher number of mountain, glaciers, ice caps and ice aprons indicates a smaller ice reserves. Therefore smaller ice reserve in the Satluj basin indicates that there are fewer valley glaciers (only 12 in number) as compared to Chenab basin which has 34 valley glacier hence more reserves of ice.

Table 7.8 Summary of glaciers in the Satluj basin with respect to aspect.

Aspect	E	N	NE	NW	S	SE	SW	W
Number of glacier	59	143	195	155	114	150	83	46
Area (km^2)	46.38	299.86	314.22	230.08	89.83	123.19	62.22	51.92
Area(%)	3.8	24.6	25.8	18.9	7.4	10.1	5.1	4.3
Maximum Area (km^2)	9.77	39.26	25.14	63.79	12.3	16.24	9.41	17.42
Minimum Area (km^2)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Maximum length (m)	6975.9	20218.2	11005	19181.9	7311.6	7592.9	7084.7	7452
Minimum Length (m)	377.9	267.9	251.9	213.3	133.8	223.8	232.1	354.7
Ice reserve (km^3)	2.66	25.40	24.84	21.31	4.94	7.84	3.49	3.97

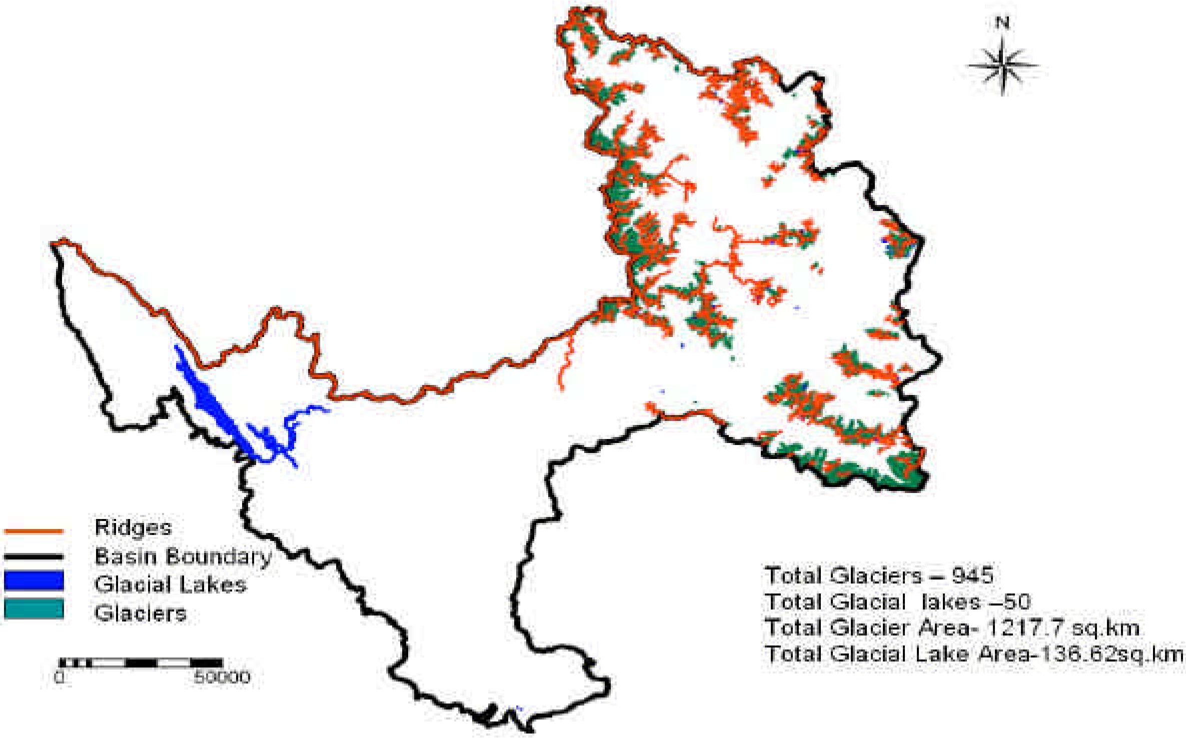


Figure 7.5 Glaciers and lakes of Satluj basin.

The aspect of the glaciers is distributed in all directions. The highest number (195) of glaciers is distributed in the northeast aspect followed by the northwest (155) and southeast (150) (Table 7.8 and Figure 7.5).

Table 7.9 Distribution of glaciers by type in Satluj basin

	Number		**Area**				**Ice reserve**	
Glacier Type	Count	%	km^2	%	of largest glacier	of smallest glacier	Km^3	%
Cirque	65	6.9	9.6	0.8	0.49	0.03	0.21	0.2
Ice Apron	82	8.7	43.1	3.5	9.77	0.03	2.14	2.3
Ice Cap	57	6	12.86	1.1	1.12	0.02	0.37	0.4
Mountain	260	27.5	173.44	14.2	6.84	0.06	8.17	8.7
Mountain basin	416	44	697.51	57.3	17.42	0.06	47.26	50
Niche	52	5.5	8.43	0.7	0.84	0.02	0.19	0.2
Valley glacier	13	1.4	272.76	22.4	63.79	7.88	36.11	38.2

Seven types of glaciers have been recognized, out of which mountain basins glaciers are dominant in terms of number. There are 416 mountain glaciers, 260 mountain glaciers and 13 valley glaciers (Figure 7.5). Areas occupied by these glaciers are 697.51, 173.44 and 272.76 sq. km, respectively. Out of the total ice reserves in the basin, the mountain basin and valley glaciers contain 50.0 and 38.2 per cent, respectively (Table 7.9). The maximum length of the glaciers is 2.02 km and the minimum length is about 0.1782 km.

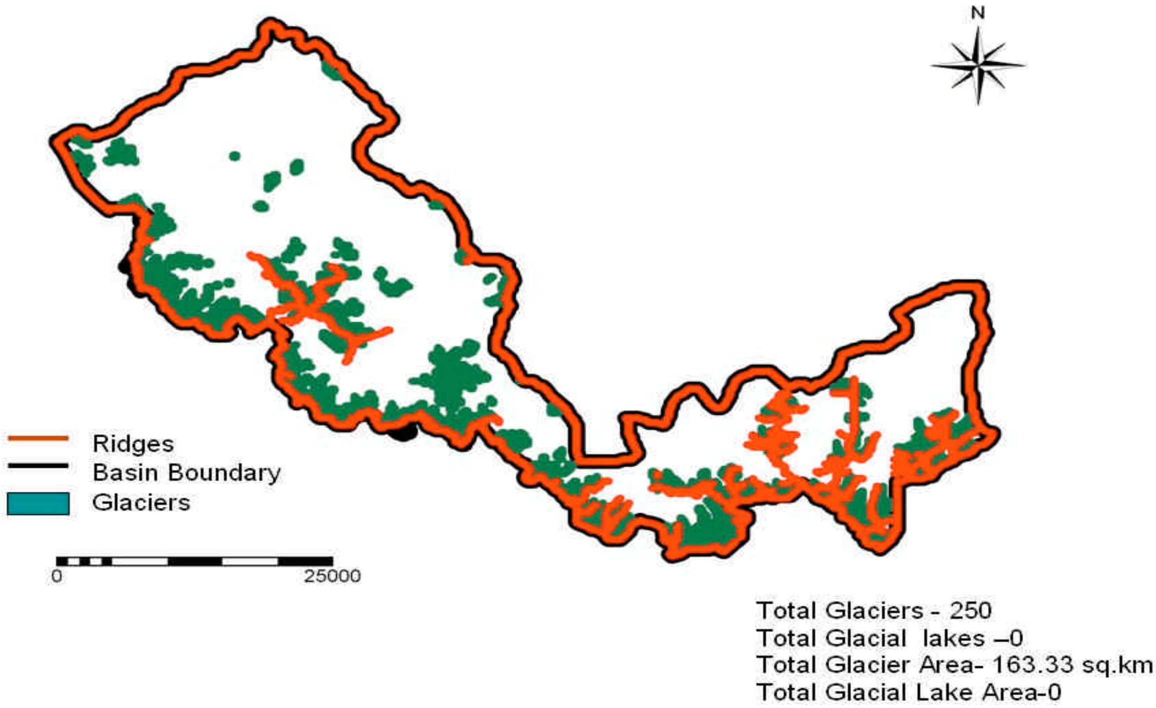


Figure 7.6 Glaciers and lakes of Sub basin 1(Tsarap Chhu).

The largest glacier in Satluj basin is Satluj_gr 898 which lies in the extreme south eastern corner of the state border, occupies an area of 63.79 sq.km and ice reserve of 11.04 km^3 The longest glacier is Saluj_gr 913 which is about 20 km long although it is one half to Satluj_gr 898 in terms of area and ice reserves.

7.4.5 The Sub Basins

Beside the major identified basins there are other four sub-basin.

Sub Basin 1 (Tsarap Chu)

The sub-basin 1 lies between 32° 29' - 32° 59' N latitude and 77° 28' - 78° 24' E longitude, has a total of 250 glaciers occupying an area of 163.33 sq. km. (Figure 7.6). The northern aspect of glaciers was dominant, a total of 165 glaciers i.e. 82.7 per cent are found in the north, northeast and northwest aspect (Table 7.10).

Table 7.10 Summary of glaciers in the sub basin 1 (Tsarap Chu) with respect to aspect.

Aspect	E	N	NE	NW	S	SE	SW	W
Number of glacier	16	57	54	53	13	34	14	8
Area (km^2)	7.87	45.07	49.98	40.04	2.14	12.9	2.93	2.35
Area(%)	4.8	27.6	30.6	24.5	1.3	7.9	1.8	1.4
Maximum Area (km^2)	3.05	4.84	4.54	5.41	0.58	1.76	0.62	1.2
Minimum Area (km^2)	0.49	0.79	0.93	0.76	0.16	0.38	0.21	0.29
Maximum length (m)	3968.6	5365.2	5244.9	5963.3	1959.5	3802.3	1337	2048.1
Minimum Length (m)	317.8	320.6	196.1	324.1	245.6	242.9	208.1	193.3
Ice reserve (km^3)	0.38	2.12	2.68	2.08	0.05	0.50	0.07	0.08

The majority of the glaciers are mountain glaciers (Table 7.11). The largest glacier recognized in this sub-basin is sub_basin 81. This is the largest glacier of the sub-basin with a length of 5.96 km and an area of 5. 41 sq. km. The second largest sub_basin 87 is 4.86 km long, occupies an area of 5. 24 sq. km.

Table 7.11 Distribution of glaciers by type in Sub basin 1 (Tsarap Chu)								
	Number		**Area**				**Ice reserve**	
Glacier Type	Count	%	km^2	%	of largest glacier	of smallest glacier	Km^3	%
Cirque	13	5.2	1.77	1.1	0.36	0.06	0.04	0.4
Ice Apron	4	1.6	1.02	0.6	0.67	0.05	0.03	0.4
Ice Cap	31	12.4	3.75	2.3	0.62	0.02	0.08	1
Mountain	104	41.6	40.55	24.8	3.05	0.03	1.47	18.5
Mountain basin	83	33.2	104.18	63.8	4.84	0.09	5.50	69.1
Niche	13	5.2	1.41	0.9	0.5	0.02	0.03	0.4
Valley glacier	2	0.8	10.65	6.5	5.41	5.24	0.81	10.2

Sub Basin 2 (Taklingla)

Sub basin 2 (Taklingla) lies between 32° 11’ N – 32° 29’ N latitude and 78° 23’ E – 78° 32’ E longitude. Sub-basin 2 (Taklingla) consists of 55 glaciers, covering an area of 34.04 sq. km and ice reserves of 1.38 km^3 on the whole. The largest glacier sub_basin 2_gr 52 lies in the 32°24'36.16" longitude and 78°27'25.39" latitude, is 4.7 km in length and occupies and area of 3.60 sq. km (Figure 7.7).

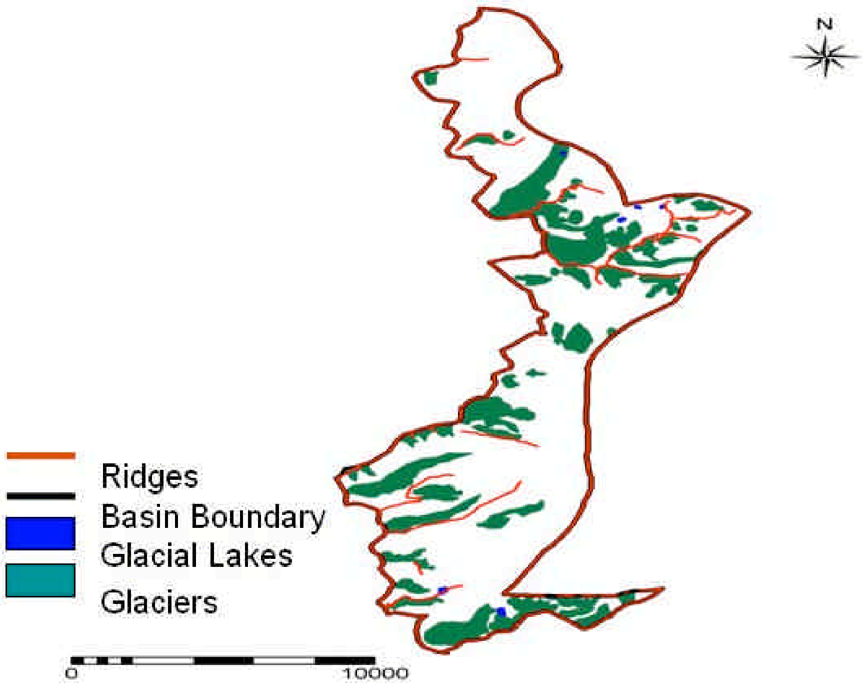


Figure 7.7 Glaciers and lakes of Sub basin 2 (Taklingla)

The maximum number of glaciers (20) is in the north eastern aspect followed by south eastern (18). The former alone covers about 60 per cent of the area whereas southeastern oriented glaciers occupy only 18.57 per cent of the area. The lowest number of glaciers (4) are east oriented, however, western aspect was completely absent in the sub_basin 2 glaciers (Taklingla) (Table 7.12). Only mountain glaciers are present in this basin (Table 7.13).

Table 7.12 Summary of glaciers in the sub basin 2 (Taklingla) with respect to aspect.

Aspect	E	N	NE	S	SE
Number of glacier	4	6	20	7	18
Area (km^2)	1.32	3.46	19.24	2.07	5.95
Area(%)	4.1	10.8	60.1	6.5	18.6
Maximum Area (km^2)	0.79	0.88	3.6	0.87	1.86
Minimum Area (km^2)	0.07	0.24	0.07	0.07	0.04
Maximum length (m)	1734	1695.8	4706.4	1861	2949.9
Minimum Length (m)	566.9	655.9	391.6	608.4	284.8
Ice reserve (km^3)	0.04	0.12	0.98	0.06	0.18

Table 7.13 Distribution of glaciers by type in Sub basin 2 (Taklingla)								
	Number		**Area**				**Ice reserve**	
Glacier Type	Count	%	km^2	%	of largest glacier	of smallest glacier	Km^3	%
Cirque	3	5.5	0.31	1	0.2	0.04	0	0
Ice Cap	1	1.8	0.07	0.2	0.07	0.07	0	0
Mountain	39	70.9	13.03	40.7	0.94	0.07	0.37	26.8
Mountain basin	10	18.2	14.96	46.7	2.92	0.47	0.77	55.8
Niche	1	1.8	0.07	0.2	0.07	0.07	0	0
Valley glacier	1	1.8	3.6	11.2	3.6	3.6	0.24	17.4

Sub Basin 3 (Bhagirathi)

The Sub basin 3 (Bhagirathi) lies between 31° 05' E- 31° 27' N latitude and 78° 44' E – 79° 02' E. There are 43 glaciers that have been identified within sub-basin 3 (Bhagirathi). They occupy a surface area of 43.06 km (Table 7.1, Figure 7.8). In terms of number northeast and southeast oriented glaciers are more dominant (Table 7.14). Southeastern glaciers, however, occupy almost 48.7 per of the total area enclosed in the sub basin, whereas southwestern aspect is completely missing in the basin.

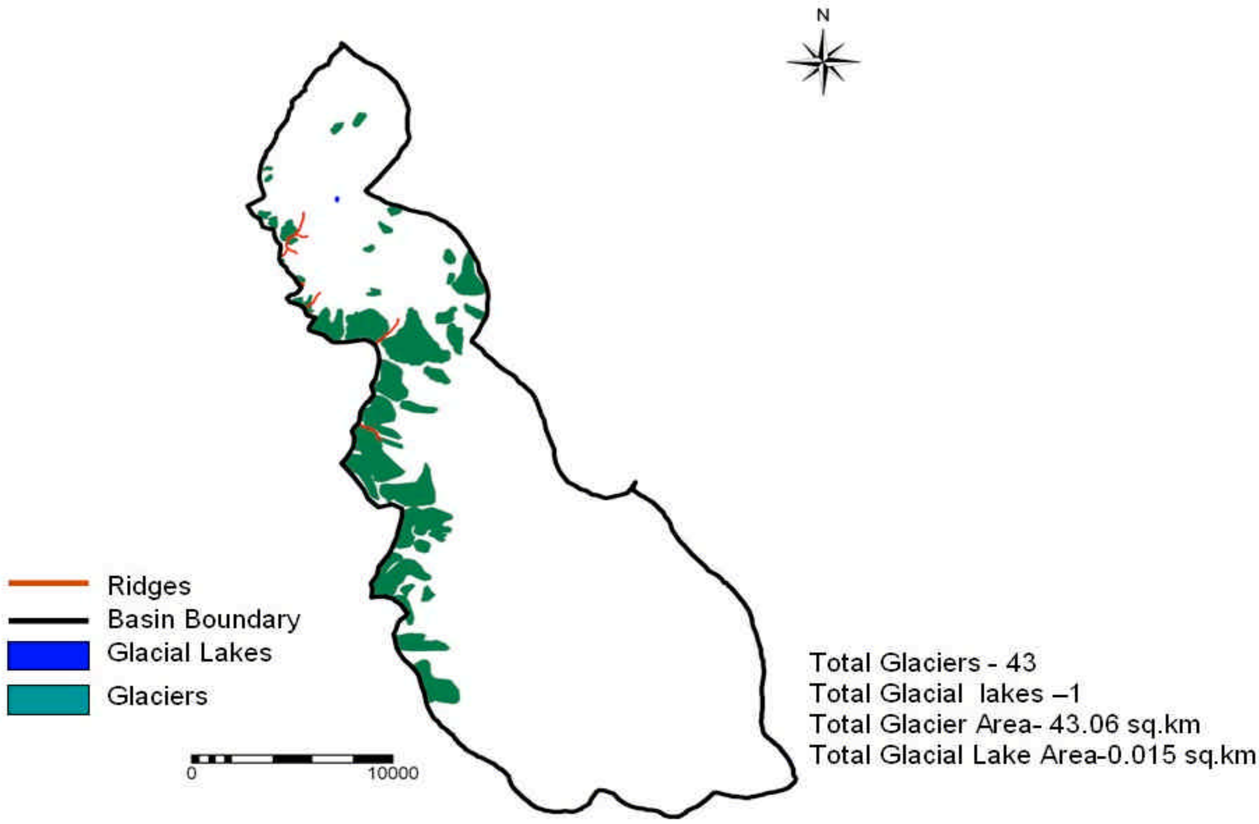


Figure 7.8 Glaciers and Glacial lakes of Sub basin 3 (Bhagirathi)

Table 7.14 Summary of glaciers in the sub basin 3 (Bhagirathi) with respect to aspect.							
Aspect	E	N	NE	NW	S	SE	W
Number of glacier	6	8	12	3	1	12	1
Area (km^2)	2.29	10.12	8.06	0.67	0.8	20.98	0.14
Area(%)	5.3	23.5	18.7	1.6	1.9	48.7	0.3
Maximum Area (km^2)	1.7	5.05	3.06	0.41	0.8	5.05	0.14
Minimum Area (km^2)	0.04	0.11	0.03	0.1	0.8	0.21	0.14
Maximum length (m)	2672.5	3965.3	3482.2	1278.8	1714.7	4173.9	660.9
Minimum Length (m)	442.6	563.6	191.2	490.5	1714.7	774.8	660.9
Ice reserve (km^3)	0.10	0.61	0.41	0.02	0.03	1.26	0.00

The sub basin has only 5 types of glaciers i.e. cirque, ice cap, mountain, mountain basin and niche (Table 7.15). The mountain glaciers are dominant constituting about 53.5 per cent in terms of number and 61.2 per cent in terms of area occupied. The second highest types of glaciers are mountain basin counting 25.6 per cent of glacier number and 35.8 per cent of the total area covered by glaciers in the basin. Valley glaciers are not found in the sub basin.

Table 7.15 Distribution of glaciers by type in Sub basin 3 (Bhagirathi)								
	Number		**Area**				**Ice reserve**	
Glacier Type	Count	%	km^2	%	of largest glacier	of smallest glacier	Km^3	%
Cirque	2	4.7	0.37	0.9	0.34	0.03	0.01	0.9
Ice Cap	4	9.3	0.75	1.7	0.27	0.1	0.02	1.7
Mountain	23	53.5	26.33	61.2	5.05	0.11	1.50	61.2
Mountain basin	11	25.6	15.4	35.8	5.05	0.13	0.90	35.8
Niche	3	7	0.21	0.5	0.11	0.04	0.00	0.5

Sub Basin 4 (Pabbar)

The Sub basin 4 (Pabbar) lies between 36° 36’ E to 31°25’ N latitude and 77° 30’ E to 78° 18’ E Sub basin 4 (Pabbar) is the smallest basin that contain only 24 glaciers. These glaciers occupy an area of 6.36 sq km area and ice reserves of 0.19 Km^3 (Figure 7.9). The glaciers are small in size with maximum area of 1.005 sq km is being covered by Sub_basin 4_gr 5, the length of this glacier is 0.36 km. The majority of the glaciers are south oriented (Table 7.16) however, the area occupied by the south west oriented glaciers is maximum (32% of the total area).

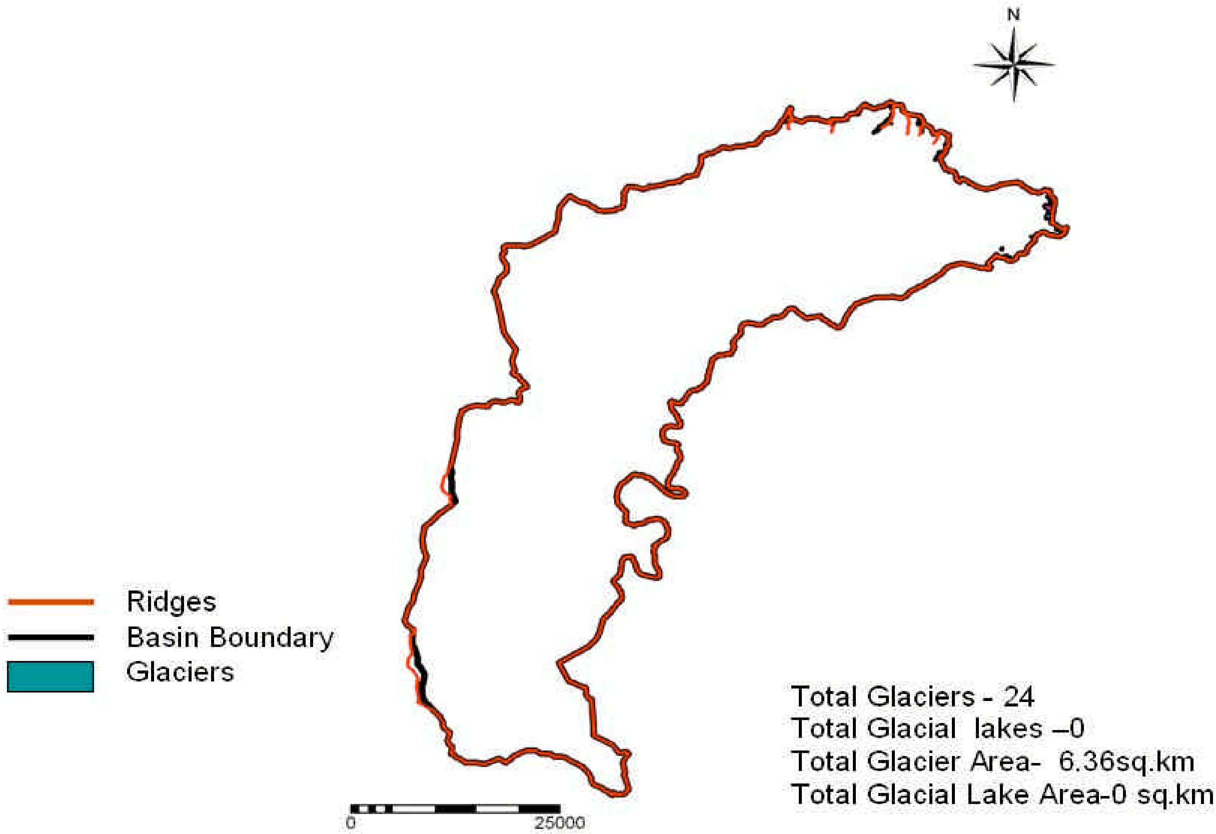


Figure 7.9 Glaciers and lakes of Sub basin 4 (Pabbar)

Table 7.16 Summary of glaciers in the sub basin 4 (Pabbar) with respect to aspect.						
Aspect	N	NW	S	SE	SW	W
Number of glacier	3	2	11	1	3	4
Area (km^2)	0.30	0.54	1.69	0.05	2.04	1.75
Area(%)	4.6	8.4	26.6	0.8	32	27.5
Maximum Area (km^2)	0.13	0.33	0.56	0.05	1.01	0.88
Minimum Area (km^2)	0.06	0.21	0.04	0.05	0.28	0.09
Maximum length (m)	567.2	652.5	1735.2	271.2	3588.8	1296.2
Minimum Length (m)	305.4	529.6	328.1	271.2	574.8	458
Ice reserve (km^3)	0.00	0.01	0.04	0.00	0.08	0.06

Three types of glaciers are observed in the sub basin viz,. cirque, ice cap and mountain wherein mountain glaciers are more in number i.e. 54.2 per cent of the total glaciers present in the sub basin (Table 7.17).

Table 7.17Distribution of glaciers by type in Sub basin 3 (Pabbar)								
	Number		**Area**				**Ice reserve**	
Glacier Type	Count	%	km^2	%	of largest glacier	of smallest glacier	Km^3	%
Cirque	8	33.3	1.116	17.5	0.562	0.041	0.03	14
Ice Cap	3	12.5	2.03	31.9	1.005	0.269	0.08	39.5
Mountain	13	54.2	3.217	50.6	0.881	0.051	0.09	46.6

Chapter 8
Inventory of Glacial Lakes

8.1 Brief Description Of Glacial Lake Inventory

The inventory of glacial lakes has been systematically carried out using topographic maps. For the identification, classification, and evaluation of the dangerous stage of glacial lakes, a LISS3 satellite image has been used. The spatial inventory is based entirely on the topographic maps on a scale of 1:50,000 published in the 1960s–1970s by the Survey of India. The spatial distribution and aerial extension of the glacial lakes were obtained with the help of geographic information systems (GIS).

8.2 Glacial Lakes - Their Numbering, Type, And Characteristics

A glacial lake is defined as a water mass existing in a sufficient amount and extending with a free surface in, under, beside and/or in front of a glacier and originated by glacier activities such as the retreating processes of a glacier.

For the purpose of the inventory, the numbering of the lakes started from the outlet of the major stream and proceeded clockwise round the basin.

It is obvious to note that the lakes associated with perennial snow and ice, originate from glaciers. But the isolated lakes found in the mountains and valleys far from the glaciers may not have a glacial origin. Due to the rapid rate of ice and snow melt, possibly caused by global warming, accumulation of water in these lakes has been increasing rapidly. The isolated lakes above 3,500 masl are considered to be the remnants of the glacial lakes left due to the retreat of the glaciers.

The lakes are classified into erosion lakes, valley trough lakes, cirque lakes, blocked lakes, lateral and end moraine-dammed lakes, and supraglacial lakes.

Erosion lakes

Glacial erosion lakes are the water bodies formed in a depression after the glaciers have retreated leaving the lakes isolated from the glaciers (Figure 8.1). They may be cirque type and trough valley type lakes and are generally stable lakes.

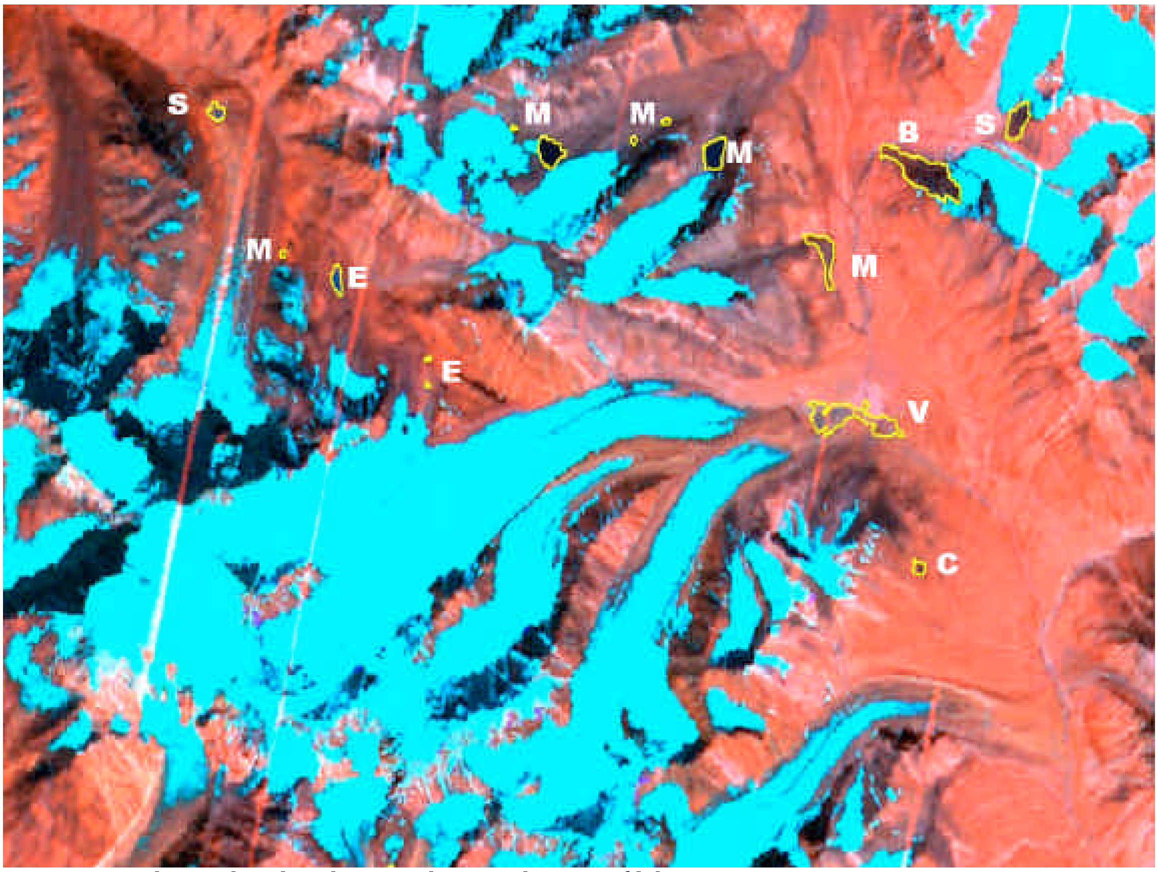


Figure. 8.1 Lakes in the Chenab Basin showing the type of lakes.
S-Supraglacial lake, M-Moraine Dammed lake, E-Erosion lake, B-Blocked lake, C-Cirque lake.

Supraglacial lakes

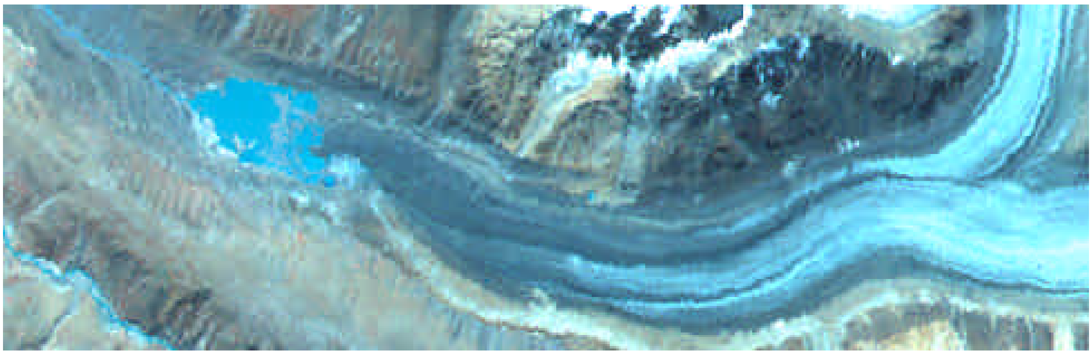
The supraglacial lakes are small and change their position in the glacier. The Lanzhou Institute of Glaciology and Geocryology (LIGG)/ the Water and Energy Commission Secretariat (WECS)/ the Nepal Electricity Authority (NEA) study (LIGG/WECS/NEA 1988) did not consider such lakes in their classifications. However, the history of past glacial lake outburst flood (GLOF) events of moraine-dammed lakes indicates that they are initially derived from supraglacial lakes. As the target of the project is to identify and monitor the potentially dangerous glacial lakes with the help of time series' satellite images, aerial photographs, and topographic maps, it will be helpful to know the activity of supraglacial lakes. If supraglacial lakes are situated at the tongue of a valley glacier, larger in size, or grouping rapidly to expand their size, then they are potentially dangerous and may burst out in the near future.

These lakes develop within the ice mass away from the moraine with dimensions from 50 to 100m. These lakes may develop in any position of the glacier but the extension of the lake is less than half the diameter of the valley glacier. Shifting, merging and draining of the lakes characterise the supraglacial lakes. The merging of lakes results in expansion of the lake area and storage of a huge volume of water with a high potential energy. The tendency of a glacial lake towards merging and expanding indicates the danger level of the GLOF. Most of the potentially dangerous lakes are advanced forms of supraglacial lakes.

Moraine-dammed lakes

In the retreating process of a glacier, glacier ice tends to melt in the lowest part of the glacier surrounded by lateral and end moraines. As a result, many supraglacial ponds are formed on the glacier tongue. These ponds sometimes enlarge to become a large lake by interconnecting with each other, a moraine-dammed lake is thus born. The lake is filled with melt water and rainwater from the drainage area behind the lake and starts flowing from the outlet of the lake even in the winter season when the flow is minimum.

There are two kinds of moraine-dammed lakes, end moraine-dammed lakes and lateral moraine-dammed lakes, depending on the position and morphology of the damming conditions (Figure 8.1). The moraine material may be ice-cored or ice-free. Before the ice body of the glacier completely melts away, glacier ice exists in the moraine and beneath the lake bottom. The ice bodies cored in the moraine and beneath the lake are sometimes called **dead ice** or **fossil ice**. As glacier ice continues to melt, the lake becomes deeper and wider. Finally when ice contained in the moraines and beneath the lake completely melts away, the container of lake water consists of only the bedrock and the moraines.



An ice-dammed lake is produced on the side(s) of a glacier, when an advancing glacier happens to intercept a tributary/tributaries pouring into a main glacier valley. Since the glaciers in the Himachal Himalayas produce relatively rich debris, thick lateral moraines are deposited on both sides of the glacier tongue. As such an ice core-dammed lake is usually small in size and does not come into contact with glacier ice. This type of lake is less susceptible to GLOF than a moraine-dammed lake.

A glacial lake is formed and maintained only up to a certain stage of glacier fluctuation. If one follows the lifespan of an individual glacier, it is found that the moraine-dammed glacial lakes build up and disappear with a lapse of time. The moraine-dammed lakes disappear once they are fully destroyed or when debris fills the lakes completely or the mother glacier advances again to lower altitudes beyond the moraine dam position. Such glacial lakes are essentially ephemeral and are not stable from the point of view of the life of glaciers.

8.3 Glacial Lakes of Himachal Pradesh

As in the inventory of glaciers, the inventory of glacial lakes was carried out by dividing the State into four basins and four sub basins constituted by the four major rivers and their tributaries. The basins are Beas, Ravi, Chenab, Satluj and Sub basins which are four in number.

Altogether 229 lakes have been identified, with a cumulative area of 379.72 sq. km (Table 8.1 and Figure 8.2). The details of the lake inventory database are given in Annex II.

Table 8.1 Distribution of lakes in the basins of Himachal Pradesh.			
S.No.	Basin	Lake Number	Area (km^2)
1	Beas	74	237.70
2	Ravi	45	1.32
3	Chenab	53	3.90
4	Satluj	50	136.62
5	Sub basin 1 (Tsarap Chu)	0	-
6	Sub basin 2 (Takling la)	6	0.16
7	Sub basin 3 (Bhagirathi)	1	0.02
8	Sub basin 4 (Pabbar)	0	-
	Total	229	379.72

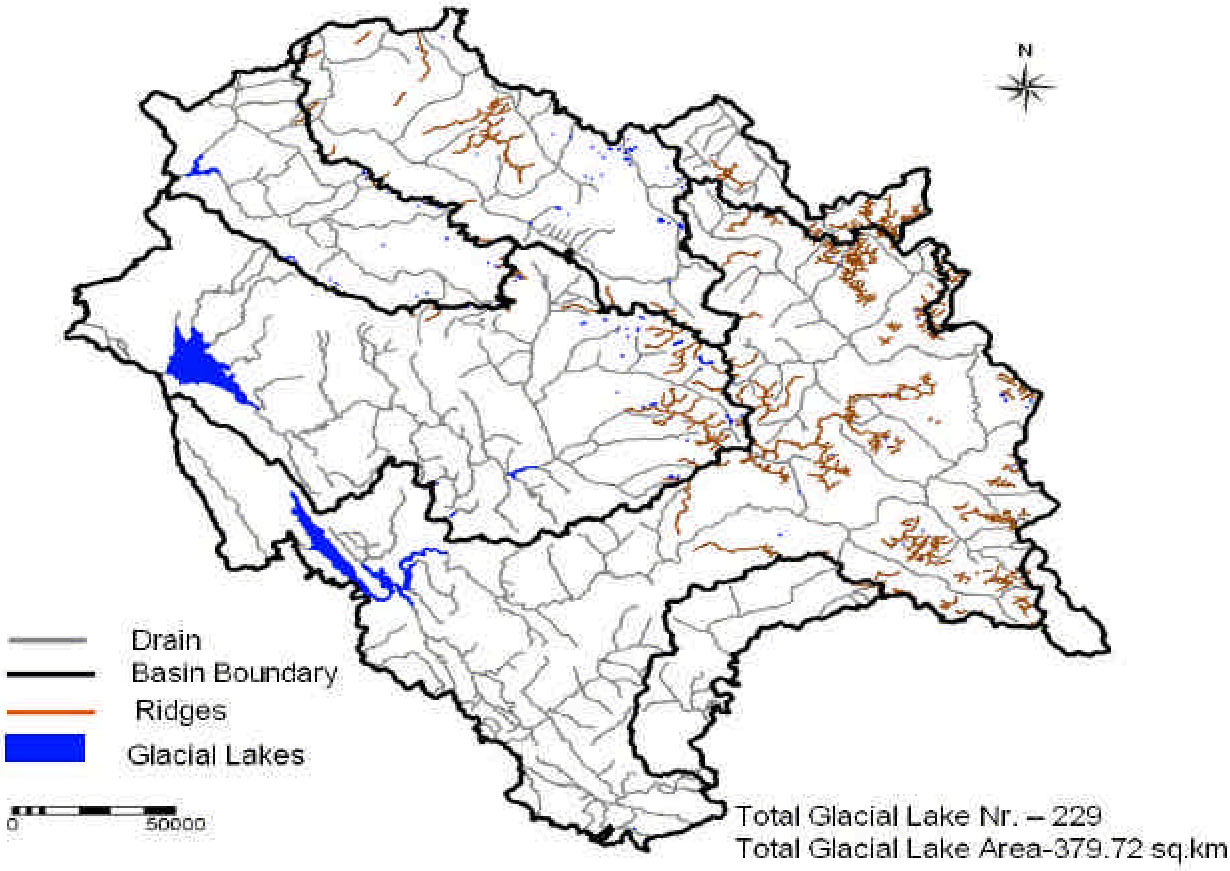


Fig. 8.2 Lakes of Himachal Pradesh

8.3.1 The Beas basin

The Beas river basin is situated in the western part of Himachal Pradesh. It consists of highest number of lakes. In the Beas basin a total of 74 lakes have been identified covering an area of 237.7 sq. km. Most of the lakes (67) are found to be associated with glaciers (Figure 8.3).

The lakes in this region have been classified into seven types: erosion, cirque, valley, blocked, lateral moraine, moraine dammed and supraglacial lakes (Table 8.2). There are 15 erosion lakes, 2, cirque, 4 blocked, 3 lateral moraine, 25 moraine dammed, 16 supraglacial and 9 valley lakes. The cumulative surface area of the lakes in the basin is 2.37 sq km. The erosion lakes, cirque lakes and valley lakes are not potentially dangerous as they are isolated and not associated with any hanging glaciers. In general erosion and valley lakes are higher in number but, this basin has 25 moriane dammed, 4 blocked lakes which falls in the category of potentially more dangerous lakes. More than 33 per cent of the area is occupied by moraine dammed lakes. Lakes that are not associated with any glacier even if they are large in size do not pose any danger of GLOF. It is those lakes that are associated with large glaciers that pose a threat of flooding as they have the potential to grow in size as the glaciers recedes.

Table 8.2 Types of lakes in Beas basin

Type	Number		Area (m^2)		Area of largest lake
	Number	%	Area	%	
Blocked	4	5.4	116285	0.1	61977.49
Cirque	2	2.7	33084.14	0	19549.07
Erosion	15	20.3	178852.9	0.1	41404.02
Lateral moraine	3	4	83066.65	0	51859.75
Moraine dammed	25	33.8	533924.7	0.2	70094.87
Supraglacial	16	21.6	1626641	0.7	502366
Valley	9	12.2	2.35E+08	98.9	2.33E+08

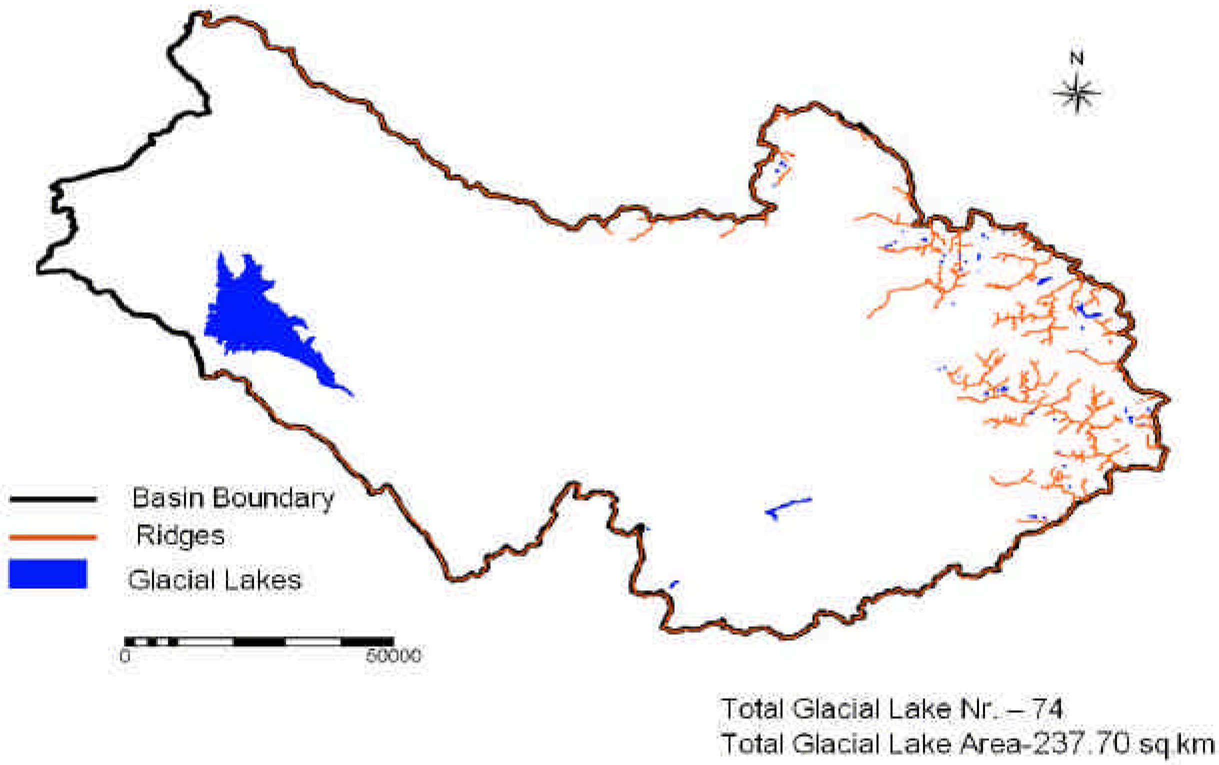


Fig. 8.3 Lakes of Beas Basin

8.3.2 The Ravi Basin

The Ravi river basin is smaller in aerial extension and has a less number of lakes than other basins. A total of 45 lakes have been identified in the Ravi basin (Table 8.3 and Figure 8.4) and 30 of them are associated with glaciers. Ravi_gl 2 is the largest lake with an area of 0.059 sq.km and has an average length of 520m. It is classified as an erosion, it is linked directly to the Ravi_gr 25. The majority of the lakes (25) in ravi basin are of erosion type. Besides 9 valley lakes there are 6 cirque, 2 lakes each of moraine dammed and blocked type and one supraglacial lake.

Table 8.3 Types of lakes in Ravi basin

Type	Number		Area (m^2)		Area of largest lake
	Number	%	Area	%	
Blocked	2	4.4	46787.3	0.5	24244.74
Cirque	6	13.3	109210.3	1.1	37105.78
Erosion	25	55.6	703627.7	7.1	246566.40
Lateral moraine	2	4.4	12158.3	0.1	7197.40
Moraine dammed	1	2.2	19798.1	0.2	19798.10
Supraglacial	9	20.0	8977397.0	91	8849821.00
Valley	2	4.4	46787.3	0.5	24244.74

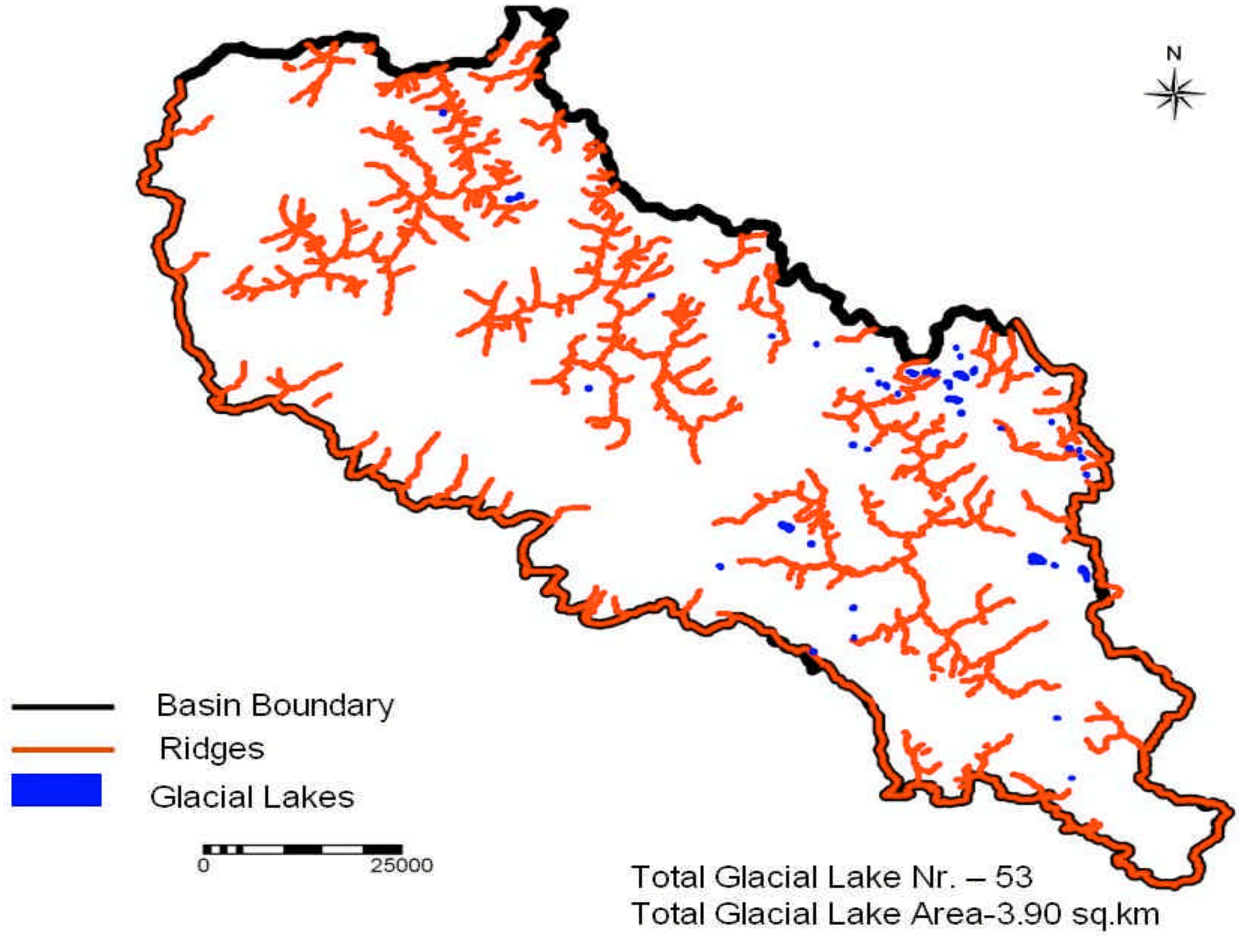


Fig. 8.5 Glacial of Chenab Basin

8.3.3 The Chenab basin

The Chenab basin contained 53 lakes covering an area of 3.90 sq km, out of these 49 lakes that could be classified as glacial lakes. The distribution of lakes in accordance with the types of lakes is presented in Table 8.4, and with the glaciers is shown in Figure 8.5. The highest number of lakes is of moraine dammed type, followed by supraglacial lakes. Besides this, there are seven erosion and six blocked lakes. Chenab_gl 26 is the largest moraine dammed glacial lake which is about 2 km long constituting an area of 0.91 sq km. Another moraine dammed lake in the basin is Chenab_gl 20 occupying an area of 564939.98 m^2 and is 1461.7 m long (Figure 8.6). This lake is associated with Geopang gath glacier. This lake located at the snout of the Geopang Gath Glacier in the Chandra basin has been identified as dangerous as it can cause flash floods in the downstream areas. This lake also exists in the survey of India toposheets and its area is 0.27 sq km as per topographical map of 1976. The average area of lakes ranged from 0.001 to 0.91 sq km.

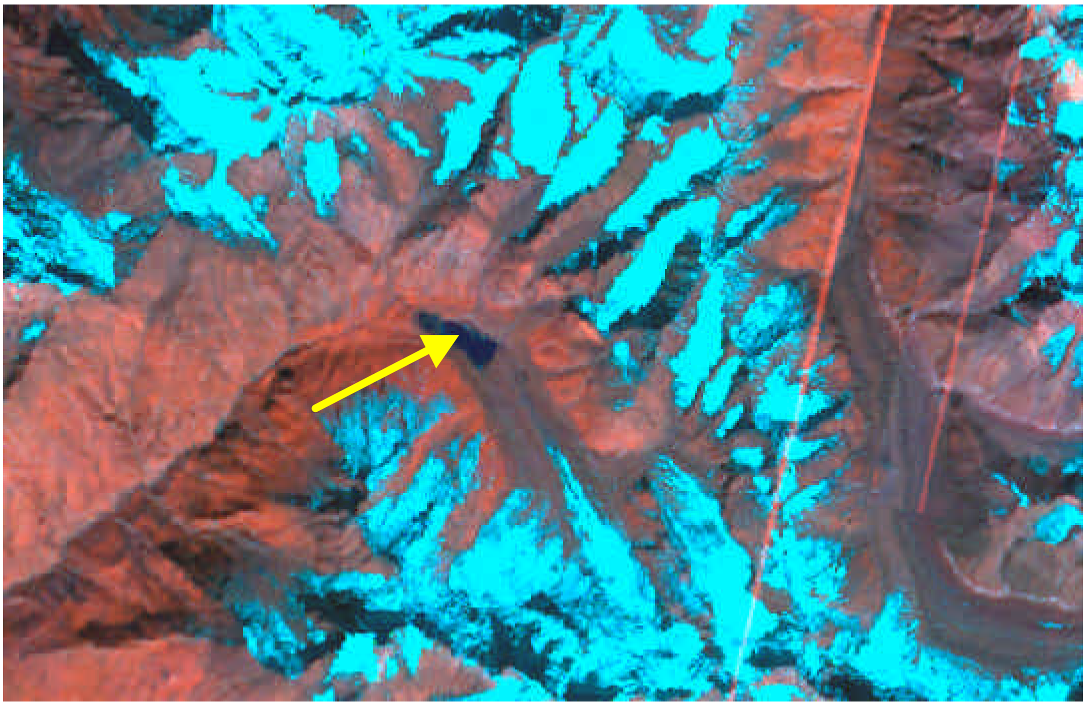


Figure 8.6 Moraine dammed (Chenab_gl 20) lake in the Chenab basin

Table 8.4 Types of lakes in Chenab basin					
Type	Number		Area (m^2)		Area of largest lake
	Number	%	Area	%	
Blocked	6	11.3	986162.1	25.3	518301.9
Cirque	2	3.8	44588.5	1.1	30255.86
Erosion	7	13.2	103461	2.6	51777.44
Lateral moraine	23	43.4	1919593	49.2	911042.6
Moraine dammed	11	20.8	316957.3	8.1	129218.5
Supraglacial	4	7.6	534168.6	13.7	349673.8
Valley	6	11.3	986162.1	25.3	518301.9

8.3.4 The Satluj basin

There are 50 lakes in total listed in this basin with an area of 136.60 sq km (Table 8.1, Figure 8.7). Most of the lakes are small in size and about 42 are found to be associated with glaciers. At present these lakes do not pose any danger from GLOF. There are maximum number of moraine dammed lakes (24), followed by supraglacial and erosion (7 each) followed by valley lakes (6) and cirque and blocked lakes (3 each). Moraine dammed lakes dominate in number, however, valley lakes constitutes 99.5 per cent of the area covered by the lakes as Satluj_gl 50 alone covers 135.8 sq km area and 77 km in length (Table 8.5).

Table 8.5 Types of lakes in Satluj basin					
Type	Number		Area (m^2)		Area of largest lake
	Number	%	Area	%	
Blocked	3	6	24507	0	124
Cirque	3	6	55017	0	404
Erosion	7	14	170226.2	0.1	527
Lateral moraine	24	48	421125.4	0.3	586
Moraine dammed	7	14	5722	0	169
Supraglacial	6	12	135896433.2	99.5	135794074.5
Valley	3	6	24507	0	124

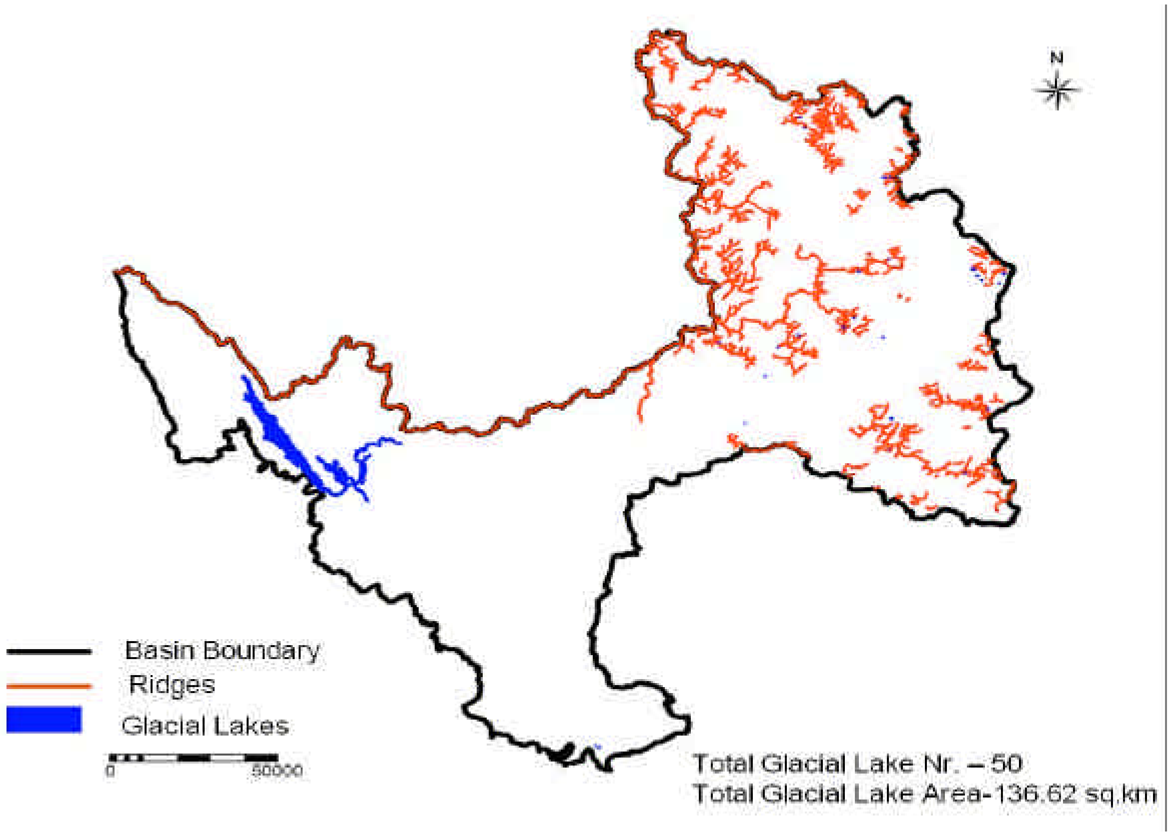


Fig. 8.7 Lakes of Satluj Basin

8.3.5 The Sub-basins

The Sub Basin 1 (Tsarap Chu)

Sub-basin 1 has no lakes.

The Sub Basin 2 (Takling la)

There are only 6 lakes in the sub-basin 2 (Takling la) covering an area of 0.162 sq. km and 5 are linked to glaciers hence could be termed as glacial lakes (Figure 8.8). These lakes fall in the category of moraine dammed, supraglacial and blocked lakes. Out of the total six, 3 have been designated as moraine dammed and collectively constitutes about 72 per cent of the area (Table 8.6). Blocked lakes numbering two are also small lakes and only one of them is associated with glaciers.   All these lakes are small in size with largest about 0.052 sq. km.

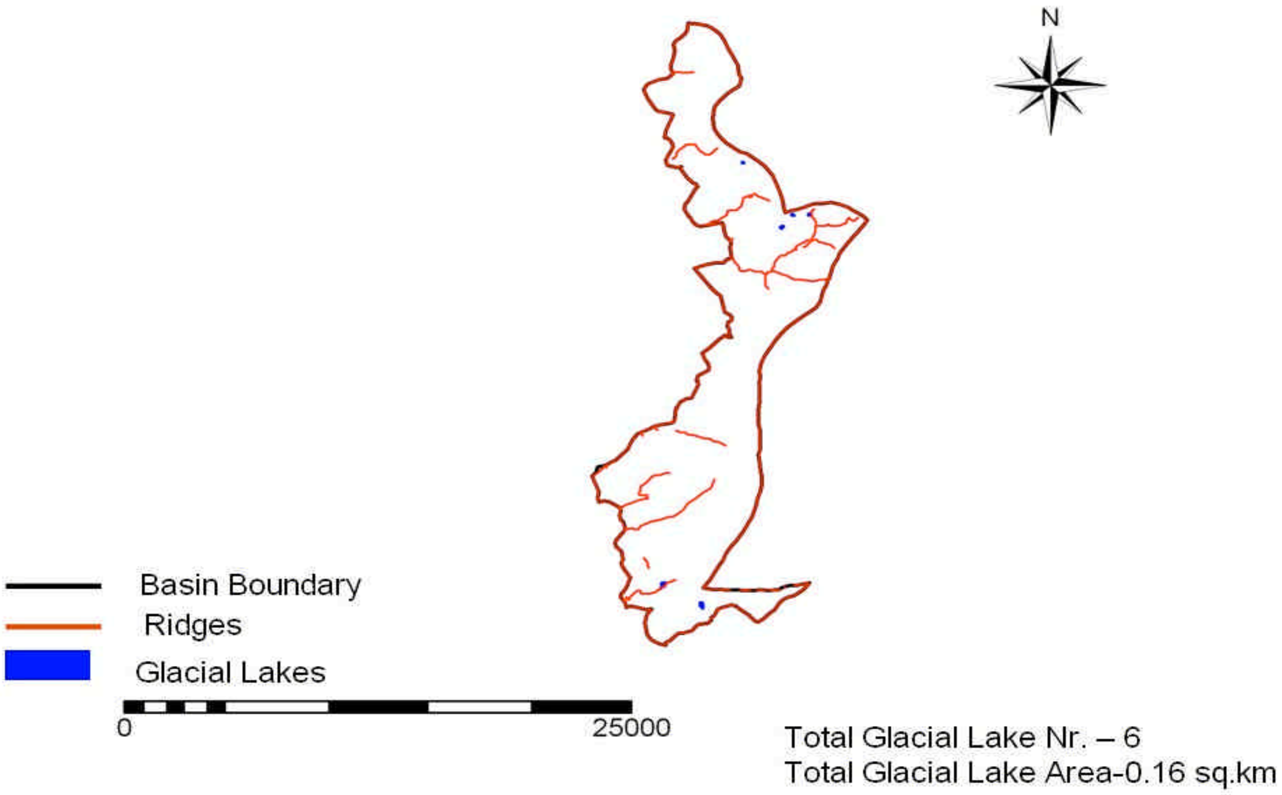


Fig. 8.8 Lakes of Subbasin 2 (Takling la)

Table 8.6 Types of lakes in Sub basin 1 (Tsarap Chu)

Type	Number		Area (m^2)		Area of largest lake
	Number	%	Area	%	
Blocked	2	33.3	36021.27	22.2	23171.68
Moraine dammed	3	50	116612.2	72	52793.46
Supraglacial	1	16.7	9382.09	5.8	9382.09

The Sub Basin 3 (Bhagirathi)

Only one glacial lake could be located in sub-basin 3 (Bhagirathi) (Table 8.7). It's a valley type of lake constituting an area of 0.015 (Figure 8.9).

Table 8.7 Types of lakes in Sub basin 1 (Tsarap Chu)

Type	Number		Area (m^2)		Area of largest lake
	Number	%	Area	%	

Valley	1	100	15523.52	100	15523.52

The Sub Basin 4 (Pabbar)

There are no lakes present in the Sub Basin 4. (Pabbar)

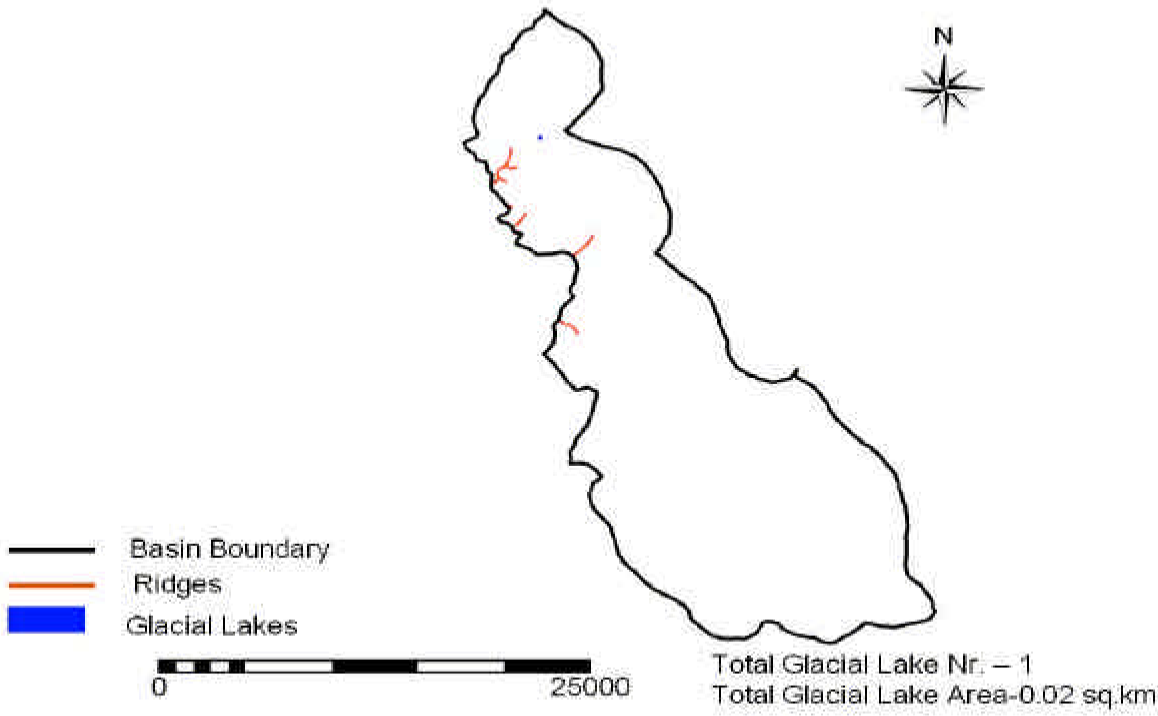


Fig. 8.9 Lakes of Subbasin 3 (Bhagirathi)

Chapter 9

Glacial Lake Outburst Floods and Damage

9.1 INTRODUCTION

Periodic or occasional release of large amounts of stored water in a catastrophic outburst flood is widely referred to as a jokulhlaup (Iceland), a debacle (French), an aluvión (South America), or a Glacial Lake Outburst Flood (GLOF) (Himalayas). A jokulhlaup is an outburst which may be associated with volcanic activity, a debacle is an outburst but from a proglacial lake, an aluvión is a catastrophic flood of liquid mud, irrespective of its cause, generally transporting large boulders, and a GLOF is a catastrophic discharge of water under pressure from a glacier. GLOF events are severe geomorphological hazards and their floodwaters can wreak havoc on all human structures located on their path. Much of the damage created during GLOF events is associated with the large amounts of debris that accompany the floodwaters. Damage to settlements and farmland can take place at very great distances from the outburst source, for example in Pakistan, damage occurred 1,300 km from the outburst source (Water and Energy Commission Secretariat (WECS 1987b).

9.2 CAUSES OF LAKE CREATION

Global warming

There is a concern that human activities may change the climate of the globe. Past and continuing emissions of carbon dioxide (CO_2) and other gases will cause the temperature of the Earth's surface to increase - this is popularly termed 'global warming' or the 'greenhouse effect'. The 'greenhouse effect' gives an extra temperature rise.

Glacier retreat

An important factor in the formation of glacial lakes is the rising global temperature, which causes glaciers to retreat in many mountain regions.

During the so-called 'Little Ice Age' (AD 1550-1850), many glaciers were longer than today. Moraines formed in front of the glaciers at that time nowadays block the lakes. Glaciation and interglaciation are natural processes that have occurred several times during the last 10, 000 years and before.

As a general rule, it can be said that glaciers in the Himalayas have retreated about 1 km since the Little Ice Age, a situation that provides a large space for retaining melt water, leading to the formation of moraine-dammed lakes (LIGG/WECS/NEA 1988). Röthlisberger and Geyh (1985) conclude in their study on 'glacier variations in Himalaya and Karakorum' that a rapid retreat of nearly all glaciers with small oscillation was found in the period from 1860/1900–1980.

Causes of glacial lake water level rise

- The rise in water level in glacial lakes dammed by moraines creates a situation that endangers the lake to reach breaching point. The causes of water level rise in glacial lakes are given below.
- Rapid change in climatic conditions that increase solar radiation causing rapid melting of glacier ice and snow with or without the retreat of the glacier.
- Intensive precipitation events
- Decrease in sufficient seepage across the moraine to balance the inflow because of sedimentation of silt from the glacier runoff, enhanced by the dust flow into the lake.
- Blocking of ice conduits by sedimentation or by enhanced plastic ice flow in the case of a glacial advance.
- Thick layer of glacial ice (dead ice) weighed down by sediment below the lake bottom which stops subsurface infiltration or seepage from the lake bottom.
- Shrinking of the glacier tongue higher up, causing melt water that previously left the glacier somewhere outside the moraine, where it may have continued underground through talus, not to follow the path of the glacier.
- Blocking of an outlet by an advancing tributary glacier.
- Landslide at the inner part of the moraine wall, or from slopes above the lake level.
- Melting of ice from an ice-core moraine wall.
- Melting of ice due to subterranean thermal activities (volcanogenic, tectonic).
- Inter-basin sub-surface flow of water from one lake to another due to height difference and availability of flow path.

9.3 Bursting Mechanisms

Different triggering mechanisms of GLOF events depend on the nature of the damming materials, the position of the lake, the volume of the water, the nature and position of the associated mother glacier, physical and topographical conditions, and other physical conditions of the surroundings.

Mechanism of ice core-dammed lake failure

Ice-core dammed (glacier-dammed) lakes drain mainly in two ways.

- through or underneath the ice
- over the ice

Initiation of opening within or under the ice dam (glacier) occurs in six ways.

- Flotation of the ice dam (a lake can only be drained sub-glacially if it can lift the damming ice barrier sufficiently for the water to find its way underneath).
- Pressure deformation (plastic yielding of the ice dam due to a hydrostatic pressure difference between the lake water and the adjacent less dense ice of the dam; outward progression of cracks or crevasses under shear stress due to a combination of glacier flow and high hydrostatic pressure).
- Melting of a tunnel through or under the ice
- Drainage associated with tectonic activity
- Water overflowing the ice dam generally along the lower margin

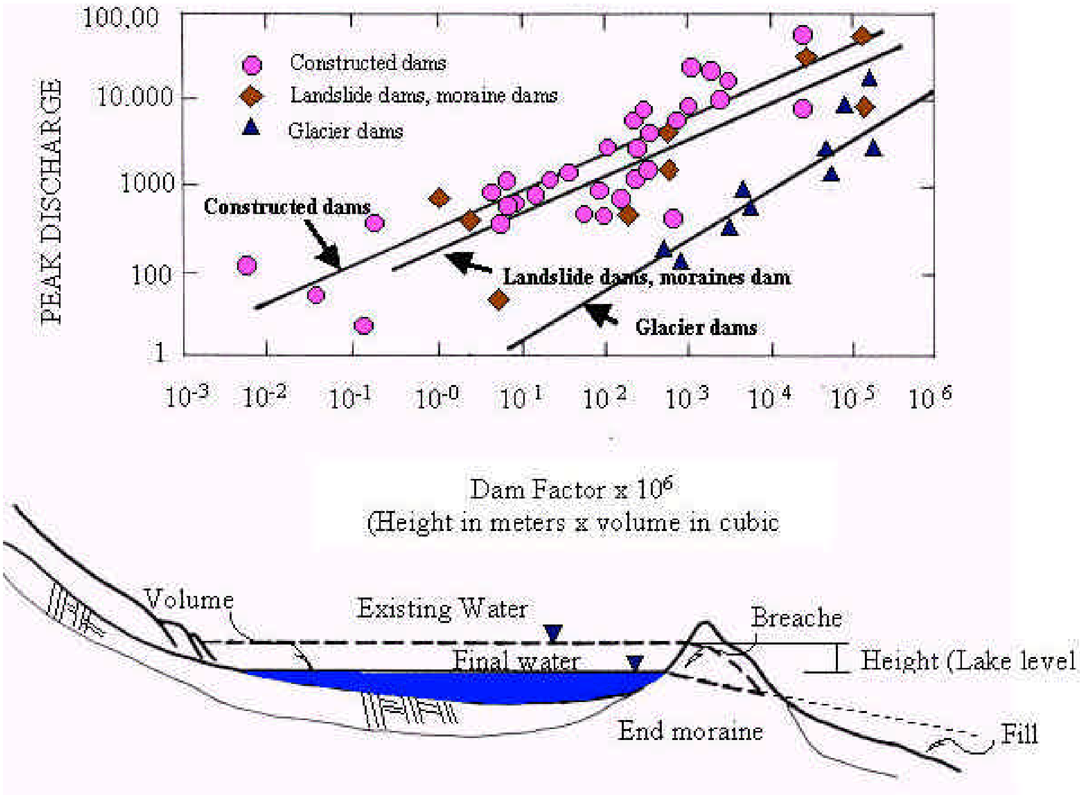
- Sub-glacial melting by volcanic heat

The bursting mechanism for ice core-dammed lakes can be highly complex and involve most or some of the above-stated hypothesis. Marcus (1960) considered ice core-dammed bursting as a set of interdependent processes rather than one hypothesis.

A landslide adjacent to the lake and subsequent partial abrasion on the ice can cause the draining of ice core-moraine-dammed lakes by overtopping as the water flows over, the glacier retreats, and the lake fills rapidly.

Mechanism of moraine-dammed lake failure

Moraine-dammed lakes are generally drained by rapid incision of the sediment barrier by outpouring waters. Once incision begins, the hustling water flowing through the outlet can accelerate erosion and enlargement of the outlet, setting off a catastrophic positive feedback process resulting in the rapid release of huge amounts of sediment-laden water. Peak discharge from breached moraine-damaged lakes just downstream from the moraine can be estimated from an empirical relationship developed by Costa (1985) (Figure 9.1) The onset of rapid incision of the barrier can be triggered by waves generated by glacier calving or ice avalanching, or by an increase in water level associated with glacial advance.



Typical Lake feature to calculate the Dam factor

Figure 9.1: Peak discharge * from breached moraine-dammed lakes can be estimated from an empirical relationship developed by Costa (1985)

Dam failure can occur for the following reasons:

- melting ice core within the moraine dam,
- rock and/or ice avalanche into a dammed lake,
- settlement and/or piping within the moraine dam,
- sub-glacial drainage, and
- engineering works.

Melting ice-core

The impervious ice core within a moraine dam melts, lowering the effective height of the dam, thus allowing lake water to drain over the residual ice core. The discharge increases as the ice core melts, and as greater amounts of water filter through the moraine, carrying fine materials. The resulting regressive erosion of the moraine dam ultimately leads to its failure.

Overtopping by displacement waves

Lake water is displaced by the sudden influx of rock and/or ice avalanche debris. The resultant waves overtop the freeboard of the dam causing regressive and eventual failure.

Settlement and/or piping

Earthquake shocks can cause settlement of the moraine. This reduces the dam freeboard to a point that the lake water drains over the moraine and causes regressive erosion and eventual failure.

Sub-glacial drainage

A receding glacier with a terminus grounded within a proglacial lake can have its volume reduced without its ice front receding up-valley. When the volume of melt water within the lake increases to a point that the formerly grounded glacier floats, an instantaneous sub-glacial drainage occurs. Such drainage can destroy any moraine dam, allowing the lake to discharge until the glacier loses its buoyancy and grounds again.

Engineering works

Artificial measures taken to lower the water levels or to change dam structures may trigger catastrophic discharge events. For example, in Peru in 1953, during the artificial lowering of the water level, an earth slide caused 12m high displacement waves, which poured into a trench, excavated as part of the engineering works and almost led to the total failure of the moraine dam.

9.4 Surge Propagation

As GLOFs pose severe threats to humans, man-made structures, agricultural fields, and natural vegetation it is important to make accurate estimates of the likely magnitude of future floods. Several methods have been devised to predict peak discharges, which are the most erosive and destructive phases of floods. The surge propagation hydrograph depends upon the type of GLOF event, i.e. from moraine-dammed lake or from ice-dammed lake (Figure 9.2). The duration of a surge wave from an ice-dammed lake may last for days to even weeks, while from a moraine-dammed lake the duration is shorter, minutes to hours. The peak discharge from the moraine-dammed lake is usually higher than from ice-dammed lakes.

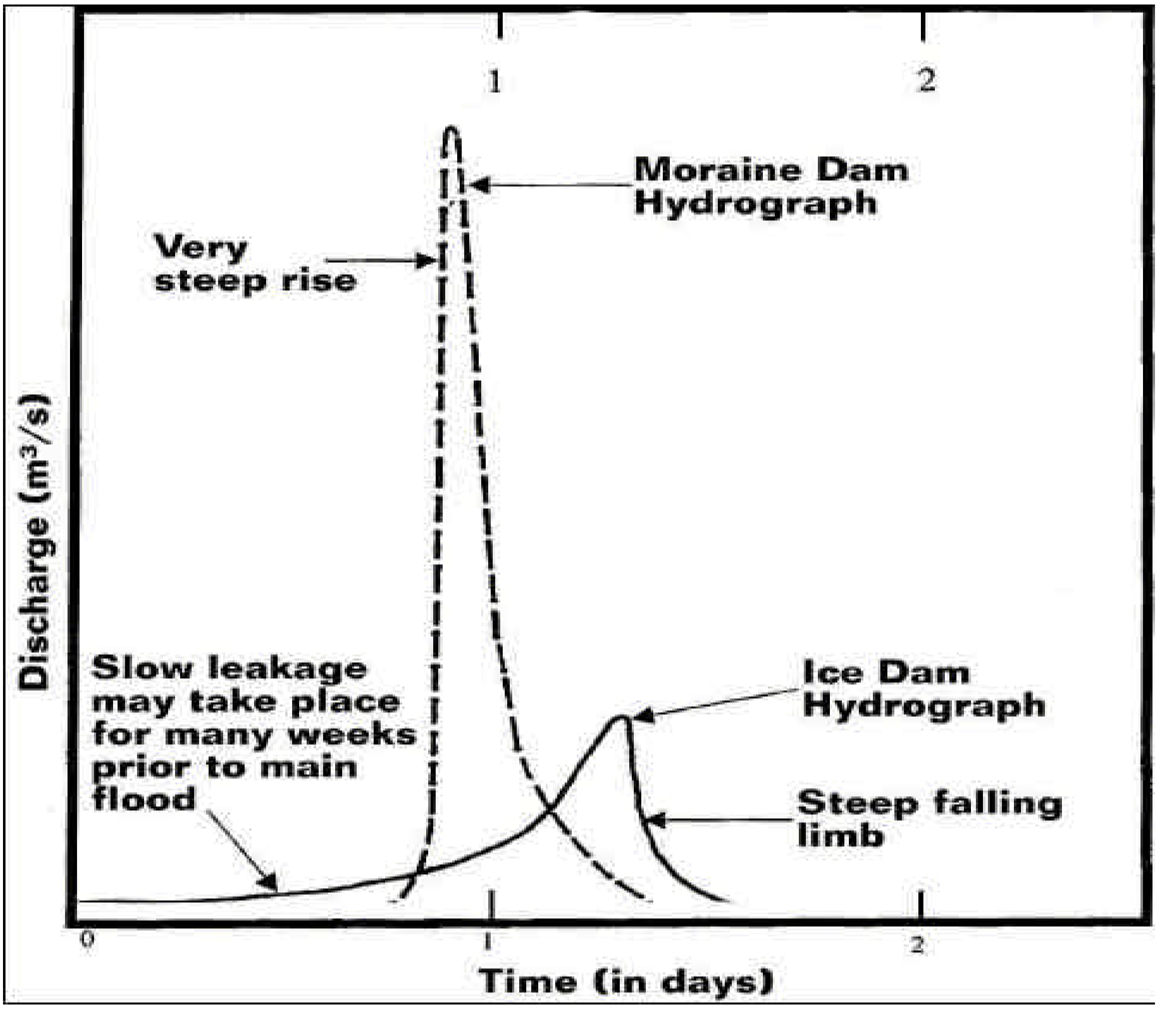


Figure 9.2: Difference in release hydrograph between moraine- and ice-dammed lakes

The following methods have been proposed for estimation of peak discharges.

1) Clague and Mathews formula

Clague and Mathews (1973) were the first to show the relationship between the volume of water released from ice-dammed lakes and peak flood discharges.

$Q_{max} = 75(V_0*10^{-6})^{0.67}$

where
Q_{max} = peak flood discharge ($m^3 s^{-1}$)

V_0 = total volume of water drained out from lake (m^3)

The above relationship was later modified by Costa (1988) as the peak discharge yielded from the equation was higher than that measured for Flood Lake in British Columbia that occurred in August 1979:

$Q_{max} = 113(V_0*10^{-6})^{0.64}$

Later Desloges et al. (1989) proposed:

$Q_{max}=179(V_0*10^{-6})^{0.64}$

This method of discharge prediction is not based on any physical mechanism, but seems to give reasonable results.

2) Mean versus maximum discharge method

If the volume of water released by a flood and the flood duration are known, the mean and peak discharges can be calculated. Generally the flood duration will not be known in advance. Hence, this method cannot be used to determine the magnitude of future floods. Observations of several outburst floods in North America, Iceland, and Scandinavia have shown that peak discharges are between two to six times higher than the mean discharge for the whole event.

3) Slope area method

This method is based on measured physical parameters such as dimensions and slope of channel during peak flood conditions from direct observations or geomorphological evidence.

$Q_{max} = vA$

The peak velocity is calculated by the Gauckler–Manning formula (Williams 1988)

$v = r^{0.67} S^{0.50/n}$

where

v = peak velocity
S = bed slope for a 100m channel reach
n = Manning's roughness coefficient
r = hydraulic radius of the channel
r = A/p

where
A = cross-sectional area of the channel
p = perimeter of the channel under water
For sediment floored channels, bed roughness is mainly a function of bed material, particle size, and bed form or shape and can be estimated from:

$n = 0.038D^{0.167}$

where

D = average intermediate axis of the largest particles on the channel floor.

Desloges et al. (1989) compared the results from all the three methods for a jokulhlaup from the ice-dammed Ape Lake, British Columbia. All the methods gave comparable results.

- The Clague and Mathews method gave a calculated peak discharge of 1680 ± 380 $m^3\ s^{-1}$.
- The mean versus maximum discharge method gave 1080–3240 $m^3\ s^{-1}$.
- The slope area method gave 1,534 and 1,155 $m^3\ s^{-1}$ at a distance of 1 and 12 km from the outlet respectively.

These general relationships are useful for determining the order of magnitude of initial release that may propagate down the system. However, to predict the magnitude of future floods, the first method should be applied, because volume of lake water can be estimated in advance.

Attenuation of a peak discharge of 15,000–20,000m s^{-1} has been reported for the Poiqu River in Tibet (Sun Koshi in Nepal) within a distance of 50 km (XuDaoming 1985).

9.5 Sediment Processes During a Glacial Lake Outburst Flood

During a GLOF, the flow velocity and discharge are exceptionally high and it becomes practically impossible to carry out any measurement. Field observations after a GLOF event have shown a much higher sediment concentration of rivers than before the GLOF event (Electrowatt Engineering Service Ltd 1982; WECS 1995a. WECS 1995a calculated the volume of sediment as $22.5*10^4\ m^3$ after the Chubung GLOF of Nepal in 1991. A high concentration of 350,000 mg^{-1} during a GLOF in the Indus River at Darband in 1962 is reported by Hewitt (1985).

Figure 9.3 gives a hypothetical GLOF illustration showing discharge and variation in sediment concentration (WECS 1987a). The total sediment load is generally accepted as the wash load, which moves through a river system and finally deposits in deltas. In Bhutan, no measurements have been undertaken on total sediment during GLOF events, however, rough estimates of total load during torrents can be made assuming a high sediment concentrations (WECS 1987b). During a GLOF event, stones the size of small houses can be easily moved (WECS 1987b). The relationship between flow velocity and particle diameter can also be used to calculate the size of boulders that can be moved during such events.

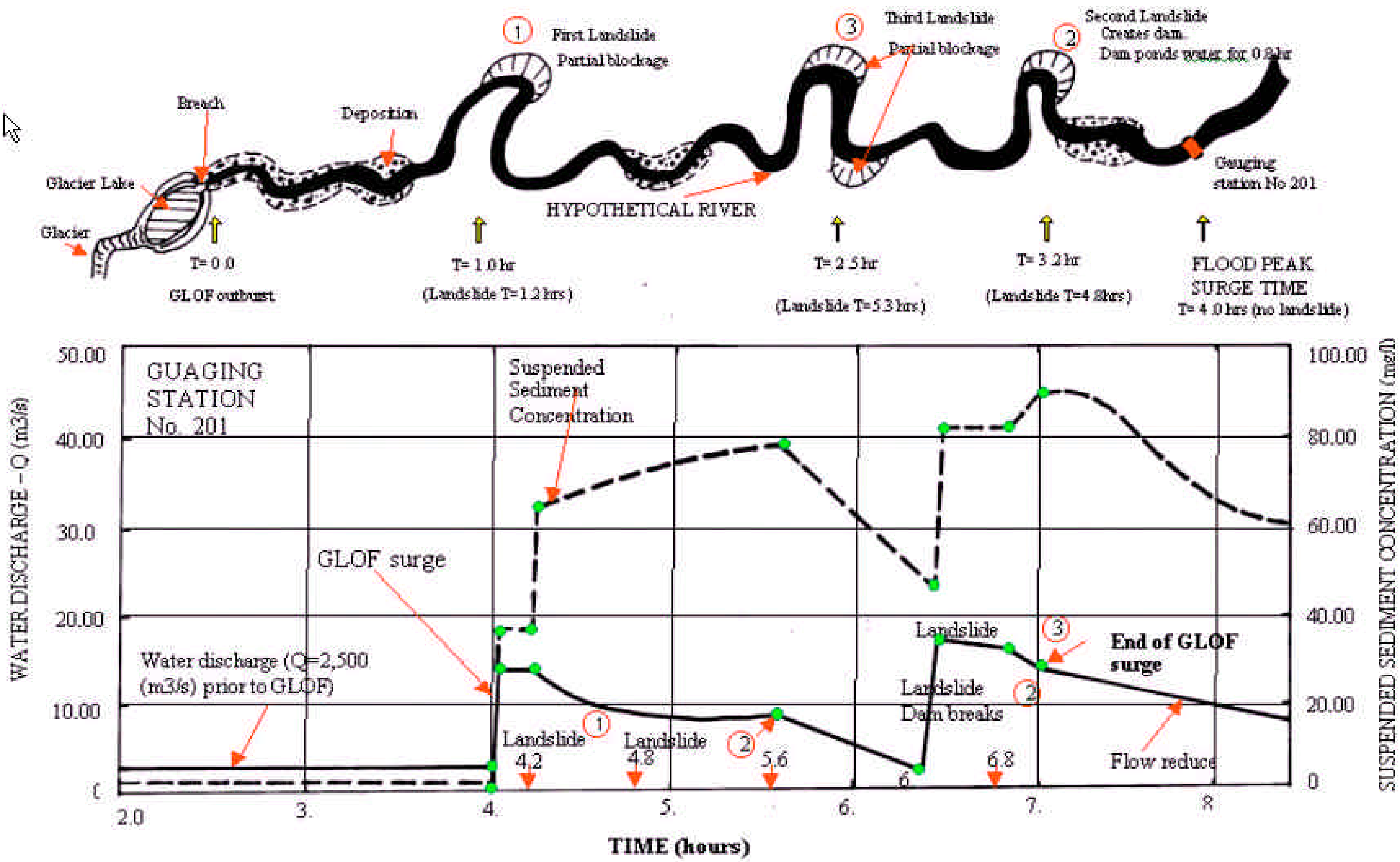


Figure 9.3: Hypothetical GLOF illustration showing discharge and variation in sediment concentration (WECS 1987a)

9.6 SOCIOECONOMIC EFFECTS OF GLACIAL LAKE OUTBURST FLOODS

The impacts of GLOF events downstream are extensive in terms of damage to roads, bridges, trekking trails, villages, agricultural land, natural vegetation, as well as the loss of human lives and infrastructure. The sociological impacts can be direct when human lives are lost or indirect when the agricultural lands are converted to debris filled lands and the village has to be shifted. The records of past GLOF events in the Himalayas show that once every three to ten years, a GLOF has occurred with varying degrees of socioeconomic impact. Therefore, the most appropriate mitigating methods must be applied after conducting a proper hazard assessment study based on possible economic loss evaluation.

Glacial lakes were formed by the retreat of glaciers. Most of these lakes are dammed by moraines. These moraine dams if unstable could fail and give rise to GLOF events, having a devastating effect downstream. During recent decades there has been a rapid retreat of glaciers all over the world. It has been observed that the glaciers in Himachal Pradesh are also retreating but there are no systematic studies made to record the treat of glaciers in Himachal Pradesh. However, recent evidences suggest that the glaciers are melting and are thus retreating while forming glacial lakes at the same time. These lakes are sometimes situated at the headwaters of some of the rivers or their tributaries. If such a lake burst then there may be a flood in the rivers downstream which can cause extensive damage in the down valleys as these rivers flow through the inhabited valleys.

Chapter 10

Potentially Dangerous Glacial Lakes

On the basis of actively retreating glaciers and other criteria, the potentially dangerous glacial lakes can be identified using the spatial and attribute database complemented by multi-temporal, remote–sensing data sets. Medium to large scale aerial photographs are also useful for detailed geomorphic studies and for evaluation of the active glaciers and potentially dangerous lakes.

In general, based on geomorphic characteristics, glacial lakes can be grouped into three types: glacial erosion lakes, glacial Cirque lakes, and moraine-dammed lakes. The former two types of glacial lakes occupy the lowlands or emptying Cirques eroded by ancient glaciers. These glacial lakes are more or less located away from present-day glaciers and the downstream banks are usually made of bedrock or covered with a thinner layer of loose sediment. Both of these glacial lakes do not generally pose an outburst danger. On the other hand, the moraine-dammed glacial lakes have the potential for bursting. A standard index to define a lake that is a source of potential danger because of possible bursting does not exist.

Moraine-dammed glacial lakes, which are still in contact or very near to the glaciers, are usually dangerous. The present study defines all the lakes formed by the activity of glaciers including in the past as **'glacial lakes'**. Moraine-dammed glacial lakes are usually dangerous. These glacial lakes were partly formed between present-day glaciers and Little Ice Age moraine. The depositions of Little Ice Age moraines are usually about 300 years old, form high and narrow arch-shaped ridges usually with a height of 20–150m, and often contain dead glacier ice layers beneath them. These end moraines are loose and unstable in nature. The advance and retreat of the glacier affect the hydrology between the present-day glacier and the lake dammed by the moraines. Sudden natural phenomena with a direct effect on a lake, like ice avalanches or rock and lateral moraine material collapsing on a lake, cause moraine breaches with subsequent lake outburst events. Such phenomena have been well known in the past in several cases of moraine-dammed lakes, although the mechanisms at play are not fully understood.

10.1 CRITERIA FOR IDENTIFICATION

The criteria for identifying the potentially dangerous glacial lakes are based on field observations, processes and records of past events, geomorphic and geotechnical characteristics of the lake and surroundings, and other physical conditions.

Rise in Lake Water Level

In general, the lakes, which have a volume of more than 0.01 km^3 are found to have past events. A lake, which has a larger volume, is deeper, with the deeper part near the dam (lower part of lake) rather than near the glacier tongue, and has rapid increase in lake water volume is an indication that a lake is potentially dangerous.

Activity of Supraglacial Lakes

As time passes, groups of closely spaced supraglacial lakes of smaller size at glacier tongues merge and form bigger lakes. Using temporal satellite images one can identify the successive merging of supraglacial lakes and the formation of a bigger lake. These activities of Supraglacial lakes are indications that the lakes are becoming potentially dangerous.

Position of Lakes

The potentially dangerous lakes are generally at the lower part of the ablation area of the glacier near to the end moraine, and the mother glacier should be sufficiently large to create a potentially dangerous lake environment. Regular monitoring needs to be carried out for such lakes with the help of multi-temporal satellite images, aerial photographs, and field observations.

In general, the potentially dangerous status of moraine-dammed lakes can be defined by the conditions of the damming material and the nature of the mother glacier. The valley lakes with an area bigger than 0.1 km^2 and a distance less than 0.5 km from the mother glacier of considerable size are considered to be potentially dangerous. Cirque lakes even smaller than 0.1 km^2 associated (in contact or distance less than 0.5 km) with steep hanging glaciers are considered to be potentially dangerous. Even the smaller size steep hanging glacier may pose a danger to the lake.

Dam Conditions

The natural conditions of the moraine damming the lake determine the lake stability. The lake stability will be less if the moraine dam has a combination of the following characteristics:

- narrower in the crest area
- no drainage outflow or outlet not well defined
- steeper slope of the moraine walls
- ice cored
- very tall (from toe to crest)
- mass movement or potential mass movement in the inner slope and/or outer slope
- breached and closed in the past and refilled again with water
- seepage flow at moraine walls

A moraine-dammed lake, which has breached and closed subsequently in the past and has refilled again with water, can breach again. Nagma Pokhari Lake in the Tamor basin of Nepal burst out in 1980. The study of recent aerial photographs and satellite images shows a very quick regaining of lake water volume. Zhangzangbo Lake in the Poiqu basin in Tibet (China) burst out in 1964 and again in 1981. Recent satellite images show that the lake has refilled with water and, therefore, could pose danger. Ayaco Lake in the Pumqu basin in Tibet (China) burst out in 1968, 1969, and 1970 and at present it is refilled again with water and poses danger. Similarly in Pakistan in 1884 an ice dam burst in the Shimshal valley, a northern tributary of the Hunza River and led to a three-metre rise in the river level causing considerable devastation at Ganesh and Baltit. This was followed by a similar event in 1893 and then again in 1905. The latter sent a 9 m flood wave down the Hunza, causing landslips. In the following year the Shimshal caused an even bigger flood than that of 1905, raising the Hunza by over 15 m above its normal summer flood level at Chalt. A lake formed again in the Shimshal valley and water began to flow over the top of the icedam on 28 May and breached on 10 June. Regular monitoring of such lakes is necessary using multi-temporal satellite images.

Conditions of Associated Mother Glacier

Generally, the bigger Valley Glaciers with tongues reaching an elevation of below 5,000 masl have well-developed glacial lakes. Even the actively retreating and steep hanging glaciers on the banks of lakes may be a potential cause of danger. The following general characteristics of associated mother glaciers can create danger to moraine-dammed lakes:

- hanging glacier in contact with the lake,
- bigger glacier area,
- fast retreating,
- debris cover at glacier tongue area,
- steep gradient at glacier tongue area,
- presence of crevasses and ponds at glacier tongue area,
- toppling/collapses of glacier masses at the glacier tongue, and
- ice blocks draining to lake.

Physical Conditions of the Surrounding Area

Besides moraines, mother glaciers, and lake conditions, and other physical conditions of the surrounding area as given below may also cause the lake to be potentially dangerous:

- potential rockfall/slide (mass movements) site around the lake which can fall into the lake suddenly,
- snow avalanches of large size around the lake which can fall into the lake suddenly,
- neo-tectonic and earthquake activities around or near the lake area,
- climatic conditions of successive years being a relatively wet and cold year followed by a hot and wet or hot and dry year,
- very recent moraines damming the lake at the tributary glaciers that used to be just a part of a former complex of Valley Glacier middle moraines as a result of the fast retreat of a complex mother Valley Glacier, and
- sudden advance of a glacier towards the lower tributary or the mother glacier having a well-developed lake at its tongue

10.2 MAJOR GLACIAL LAKES AND POTENTIALLY DANGEROUS GLACIAL LAKES

For identification of potentially dangerous glacial lakes, the glacial lakes associated with glaciers such as Supraglacial Valley, Cirque and /or dammed by lateral moraine or end moraine with an area larger than 0.02 km^2 have been considered and they have been defined as major glacial lakes. The details of the major lakes of all the five basins are included in the Annex.

10.2.1 Beas River basin

A total of 28 major glacial lakes of different categories have been identified. The major glacial lake of all these categories has an area of more than 0.2 sq km. The Valley lakes are large in size since the largest lake of this category, is Pang reservoir (beas_gl 74), has an area of about 232.9 sq km. Though it is an artificial lake dammed for the Hydropower and irrigation purpose. The second largest lake is beas_gl 71, which is naturally formed in the valley has an area of 1.66 sq km. Among the major glacial lakes there are altogether eleven moraine dammed lakes, 7 supraglacial lakes, 6 valley lakes and 2 each of erosion and blocked lakes (Table 10.1). The blocked lakes and Erosion lakes are formed due to the glacial erosion and blocking due to debris of little ice age. These lakes are not directly associated with the glaciers in the present day. Rest except the Valley Lakes had association with the parent glaciers at a distance of attached to less than 500m.

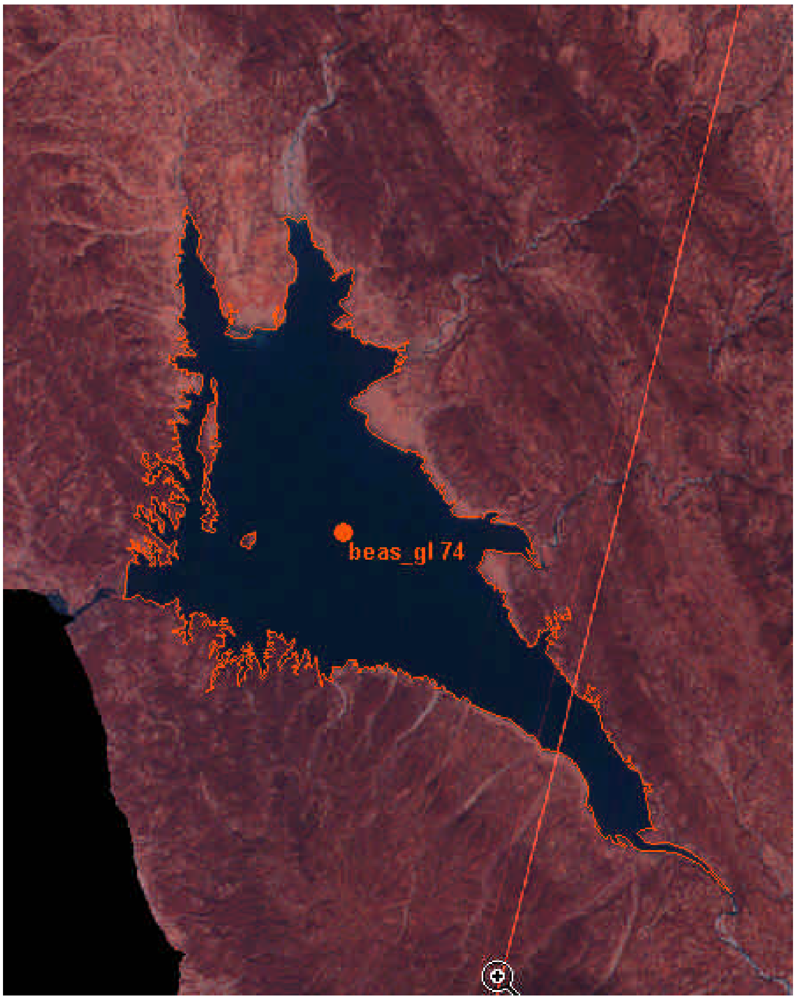


Figure 10.1: Pong Reservoir mapped as Beas_gl 74

Table 10.1: Major glacial lakes of Beas River basin						
S. N	Lake Type	Lake Number	Area (sq m)	Associated Glacier	Distance to Glacier	Remarks
1	Blocked	beas_gl 3	37591	beas_gr 41	149	No hanging glacier, Lake formed due to retreating of the glacier.
2	L M dammed	beas_gl 4	23073	beas_gr 41	0	Very small hanging glacier left due to glacier retreated
3	Valley	beas_gl 7	39812	beas_gr 42	1383	Away from the main chanel
4	Moraine dammed	beas_gl 15	34979	beas_gr 82	108	Hanging glacier is small and the lakes is formed at the base of the slope
5	Moraine dammed	beas_gl 16	62916	beas_gr 84	344	Hanging glacier is small and the lakes is formed at the base of the slope
6	Moraine dammed	beas_gl 21	56963	beas_gr 124	475	Formed due to the glacier retreat, not in the glacier flow path
7	Erosion	beas_gl 24	28843	beas_gr 126	313	Not in the flow path of the glacier
8	L Morainee dammed	beas_gl 25	51860	beas_gr 128	418	Not in the flow path of the glacier
9	Supraglacial	beas_gl 27	165849	beas_gr 128	0	Valley type already indication of outburst and now in the depression
10	Supraglacial	beas_gl 30	375639	beas_gr 146	0	Formed at the tongue of the glacier, indication of outburst and possibility of lake increase due to glacier retreat it might be danger
11	Supraglacial	beas_gl 31	99432	beas_gr 146	0	close to the retreating valley glacier, if it is real lake it might be danger
12	Supraglacial	beas_gl 35	329243	beas_gr 176	0	Valley type close to the retreating valley glacier, if it is real lake it might be danger
13	Supraglacial	beas_gl 36	34511	beas_gr 180	0	The upper lake beas_gl 37 burst out it will have impact on this lake
14	Supraglacial	beas_gl 37	502366	beas_gr 180	0	Valley type close to the retreating valley glacier, if it is real lake it might be danger
15	Valley	beas_gl 40	39921	beas_gr 215	924	In the valley, away from the hanging glacier
16	Supraglacial	beas_gl 46	30967	beas_gr 230	0	In the valley, away from the hanging glacier
17	Valley	beas_gl 47	28298	beas_gr 233	1131	In the valley, away from the hanging glacier
18	Blocked	beas_gl 48	61977	beas_gr 233	1274	In the valley, away from the hanging glacier
19	Moraine dammed	beas_gl 51	20166	beas_gr 273	0	Close to the hanging glacier
20	Moraine dammed	beas_gl 54	22512	beas_gr 273	124	Close to the hanging glacier

21	Moraine dammed	beas_gl 58	70095	beas_gr 294	194	Hanging glacier is very small
22	Moraine dammed	beas_gl 66	43028	beas_gr 354	69	Close to the hanging glacier
23	Moraine dammed	beas_gl 69	24659	beas_gr 356	0	Close to the hanging glacier
24	Moraine dammed	beas_gl 70	27062	beas_gr 357	52	Close to the hanging glacier
25	Valley	beas_gl 71	1664444	?		Away from the glacier
26	Valley	beas_gl 72	422840	?		Away from the glacier
27	Erosion	beas_gl 73	41404	?		Away from the glacier
28	Valley	beas_gl 74	232901223	?		Artificial lake

Out of the 28 major glacial lakes, based on the above-mentioned parameter for the identification of the potential danger glacial lakes, there are altogether 10 potential danger glacial lakes in the Beas River basin (Table 10.2). The lake types in the danger category are of Supraglacial Lakes and Moraine dammed lakes in equal proportion. All these potential danger lakes are situated close to the retreating glacier.

Table 10.2: Potential danger glacial lakes of Beas River basin

S. N	Lake Number	Latitude and Longitude	Area (sq m)	Associated Glacier	Distance to Glacier	Area of the Glacier
1	beas_gl 30	32°08'05.00"N, 77°35'48.80"E	375639	beas_gr 146	0	43532198
2	beas_gl 31	32°07'49.24"N, 77°35'47.49"E	99432	beas_gr 146	0	43532198
3	beas_gl 35	32°04'38.97"N, 77°40'30.09"E	329243	beas_gr 176	0	13278376
5	beas_gl 37	32°04'02.75"N, 77°42'06.00"E	502366	beas_gr 180	0	41699246
6	beas_gl 51	31°55'01.49"N, 77°31'51.84"E	20166	beas_gr 273	0	1840961
7	beas_gl 54	31°54'57.44"N, 77°31'08.62"E	22512	beas_gr 273	124	1840961
8	beas_gl 66	31°40'11.08"N, 77°37'13.93"E	43028	beas_gr 354	69	321135
9	beas_gl 69	31°40'15.43"N, 77°35'57.62"E	24659	beas_gr 356	0	270010
10	beas_gl 70	31°40'16.02"N, 77°35'31.67"E	27062	beas_gr 357	52	252138

All the potential danger supraglacial lakes are situated within the fast retreating Valley glacier and the lakes are rapidly increasing. The details of each potentially dangerous lake are included in table 10.2. These potentially dangerous lakes are located in the central western part and the southeastern part of the basin (Figure 10.1). The potential danger glacial lake of the category Supraglacial lakes are beas_gl 30, beas_gl 31, beas_gl 35, beas_gl 36 and beas_gl 37 associated with the glaciers beas_gr 146, beas_gr 176 and 180. The five potential danger glacial lakes in the catergory of Moraine dammed lakes are beas_gl 51, beas_gl 54, beas_gl 66, beas_gl 69 and beas_gl 70 which are associated with the glaciers beas_gr 273, beas_gr 273, beas_gr 354, beas_gr 356 and beas_gr 357 respectively. All the associated glaciers are characterized in hanging nature close to the glacial lakes.

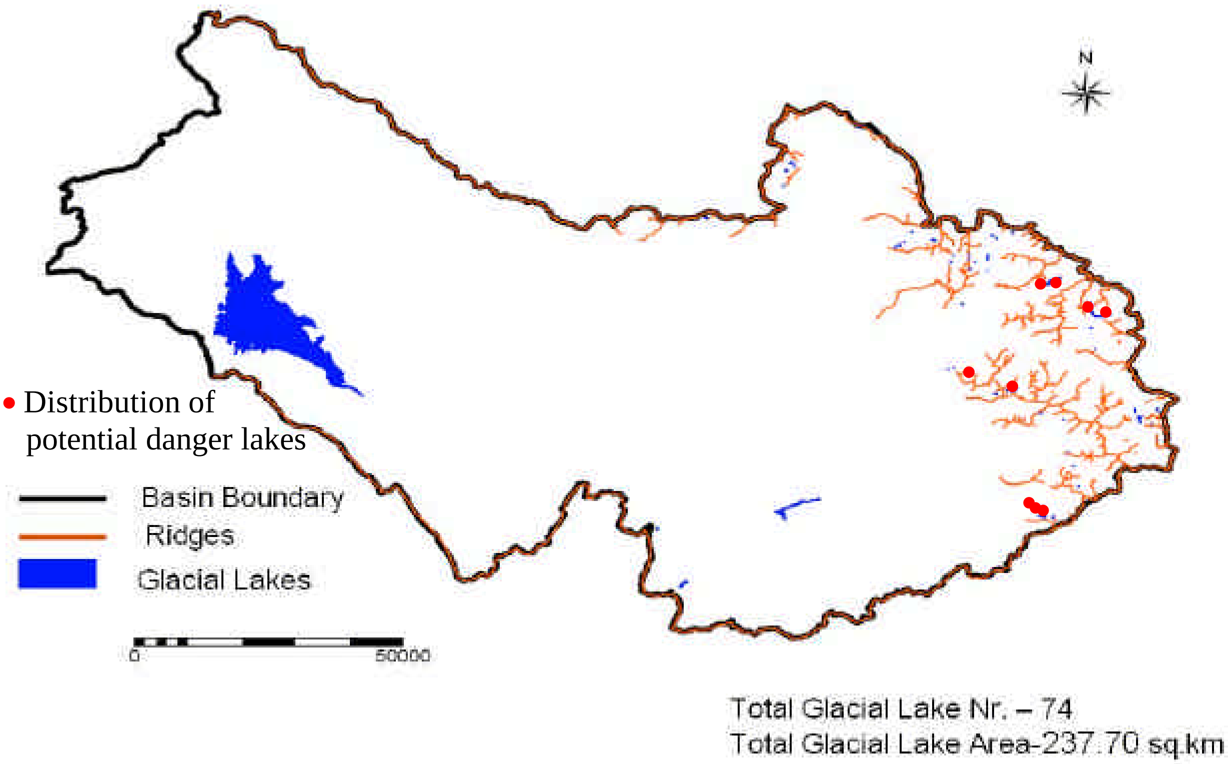


Fig. 10.2 Distribution of potential danger Lakes of Beas River basin

10.2.2 Satluj River basin

Out of 50 glacial lakes of this basin 19 lakes are characterized as major lakes (Table 10.3). The moraine dammed type lakes are maximum (9) followed by Erosion lakes (5) and Valley lakes (4). There is only one cirque lake in the basin. Though the glaciers in the basin are 945 and among them only 13 glaciers are valley type and in these glaciers not a single supraglacial lakes are in the category of major glacial lakes. The largest lake is Satluj_gl 50 has an area of 135.79 sq. km, which is an artificial lake made for the purpose of hydropower and irrigation damming the Satluj river. The largest glacial lake in this basin is 0.058 sq km of Moraine dammed lake. Comparatively the lakes in this basin are not bigger and mostly isolated due to the retreating of the glacier.

Table 10.3: Major glacial lakes of Satluj River basin

S. N	Lake Type	Lake Number	Area (sq m)	Associated Glacier	Distance to Glacier	Remark
1	Valley	Satluj_gl 1	41626			Away from the glacier, situated in the main course of the river
2	M dammed	Satluj_gl 8	27779	satluj_gr 116	571	Formed due to retreat of glacier and chances of expansion
3	Cirque	Satluj_gl 9	40455			Isolated from the glacier due to retreat
4	Erosion	Satluj_gl 11	20031	satluj_gr 151	145	Isolated from the glacier due to retreat
5	M dammed	Satluj_gl 12	30981			Not in the main stream flow so less chances of expansion

6	M dammed	Satluj_gl 13	58659	satluj_gr 183	139	Formed due to retreat of glacier and chances of growing the lake
7	Valley	Satluj_gl 14	26007	satluj_gr 195	924	Isolated from the glacier
8	Erosion	Satluj_gl 18	25010			Isolated from the glacier due to retreat
9	M dammed	Satluj_gl 19	34504	satluj_gr 692	69	Close to the hanging glacier
10	Erosion	Satluj_gl 24	52706	satluj_gr 739	0	Mother glacier is very small
11	M dammed	Satluj_gl 33	23913	satluj_gr 745	1068	Mother glacier is very small
12	M dammed	Satluj_gl 35	29427	satluj_gr 749	0	Isolated from the glacier due to retreat
13	M dammed	Satluj_gl 36	22800	satluj_gr 756	59	Glacier channel is narrow and less chances of ice avalanche
14	M dammed	Satluj_gl 39	28862	satluj_gr 769	920	Away from the main channel and glacier
15	M dammed	Satluj_gl 44	44870	satluj_gr 865	152	Isolated from the glacier due to retreat
16	Valley	Satluj_gl 47	24081	satluj_gr 936	3016	Away from the glacier
17	Erosion	Satluj_gl 48	28200			Isolated from the glacier due to retreat
18	Erosion	Satluj_gl 49	32874			Isolated from the glacier due to retreat
19	Valley	Satluj_gl 50	135794075			Artificial lake

Though the lakes are smaller in size, on the basis of above mentioned criteria in the identification of the potential danger glacial lakes, only three lakes are identified as a potentially dangerous glacial lakes. All those potential danger lakes are of Moraine dammed type at the distance of less than 600m from the associated glaciers. The glacial lake satluj_gl 8 satluj_gl 13 and satluj_gl 19 are associated with the glaciers satluj_gr 116, satluj_gr 183 and satluj_gr 692 respectively (Table 10.4).

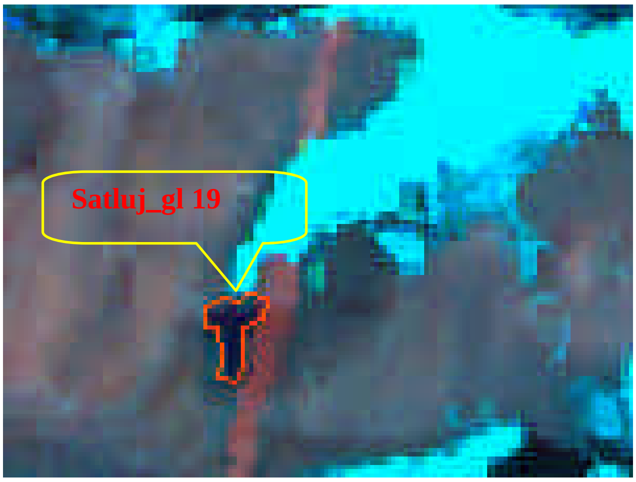


Figure 10.3 Moraine dammed lake attached with the parent glacier in Satluj River basin

Table 10.4: Potentially Dangerous Glacial lakes of Satluj River basin

S. N	Lake Number	Latitude and Longitude	Area (sq m)	Associated Glacier	Distance to Glacier	Area of the Glacier
1	Satluj_gl 8	31°45'44.73"N, 78°06'44.25"E	27779	satluj_gr 116	571	118205
2	Satluj_gl 13	32°00'37.86"N, 78°23'24.62"E	58659	satluj_gr 183	139	1041412
3	Satluj_gl 19	32°15'57.63"N, 78°23'03.14"E	34504	satluj_gr 692	69	795397

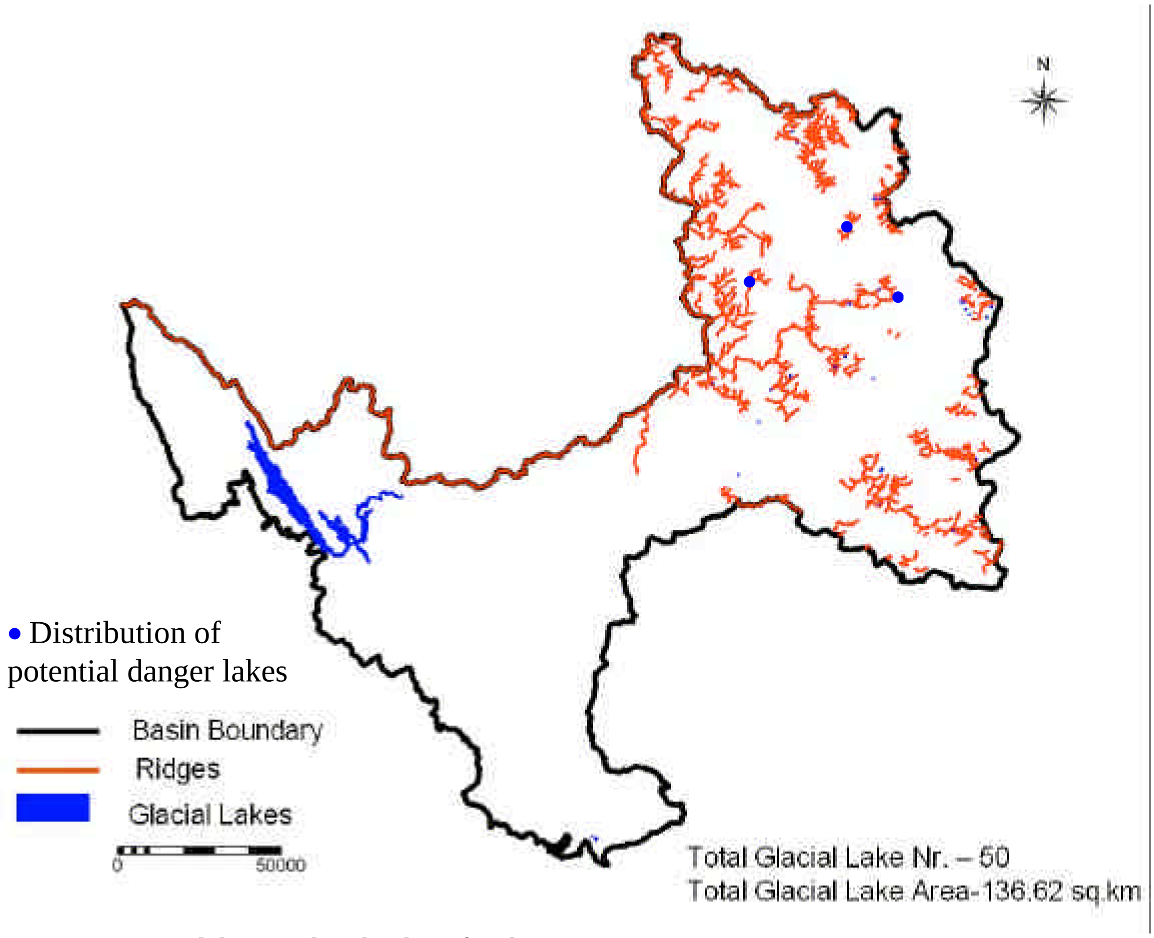


Fig. 10.4: Potential danger Glacial Lakes of Satluj Basin

10.2.3 Ravi River Basin

Out of 45 glacial lakes in the Ravi River basin a total of 16 lakes comes into the major glacial lakes (Table 10.5). Mostly these are Erosion lakes (10). The largest lake in this river basin is ravi_gl 2 of Valley type, which is also a man made dammed lake in the Valley for the purpose of Hydropower and Irrigation. The next largest lake is ravi_gl 40, which has an area of 0.24 sq. km of Erosion type and it is isolated i.e. away from the glacier. Most of the lakes in this basin are away from the main channel of the river flow. Though there are 198 glaciers with 7 Valley type glaciers where only one supraglacial lake is of mapable size.

Table 10.5: Major glacial lakes of Ravi River basin

S N	Lake Type	Lake Number	Area (sq m)	Associated Glacier	Distance to Glacier	Remark
1	Valley	Ravi_gl 2	8849821	?		Away from the glacier and artificial lake
2	Erosion	Ravi_gl 3	59215	Ravi_gr 25	1664.0	Isolated and away from the glacier
3	Erosion	Ravi_gl 14	20712	Ravi_gr 100	98.0	Not in the main course of the channel
4	Blocked	Ravi_gl 16	24245	Ravi_gr 81	0.0	Away from the main ice mass of

						the glacier
5	Blocked	Ravi_gl 20	22543	Ravi_gr 123	0.0	Not in the main course of the channel
6	Erosion	Ravi_gl 23	22750	Ravi_gr 148	1446.0	Parent glacier is very small due to retreat
7	Erosion	Ravi_gl 24	33158	Ravi_gr 149	589.0	Not in the main course of the channel
8	Cirque	Ravi_gl 26	37106	Ravi_gr 177	358.0	Not in the main course of the channel
9	Valley	Ravi_gl 27	57513	Ravi_gr 184	76.0	Lake will be expanding in the course of retreat of glacier
10	Erosion	Ravi_gl 34	44222	?		Isolated due to the retreat of glacier
11	Erosion	Ravi_gl 35	43042	?		Isolated due to the retreat of glacier
12	Erosion	Ravi_gl 36	44659	Ravi_gr 198	485.0	Isolated due to the retreat of glacier
13	Cirque	Ravi_gl 37	22318	?		Isolated due to the retreat of glacier
14	Erosion	Ravi_gl 39	26677	?		Isolated due to the retreat of glacier
15	Erosion	Ravi_gl 40	246566	?		Isolated due to the retreat of glacier
16	Erosion	Ravi_gl 43	25061	?		Isolated due to the retreat of glacier

Out of these 16 major lakes only one lake is characterized as potentially dangerous lake (Table 10.6). The lakes in the Ravi River basin are mostly isolated, away from the glacier and smaller in size. The Ravi_gl 27 lake is the potential danger glacial lake identified in the Ravi River basin. It has the association with the glacier Ravi_gr 184 at a distance of 76m distance (Figure 10.7

Table 10.6 Potentially Dangerous Glacial lakes of Ravi River basin

SN	Lake Number	Latitude and Longitude	Area (sq m)	Associated Glacier	Distance to Glacier	Area of the Glacier
9	Ravi_gl 27	32°15'40.69"N, 76°44'24.84"E	57513	Ravi_gr 184	76.0	498103.77

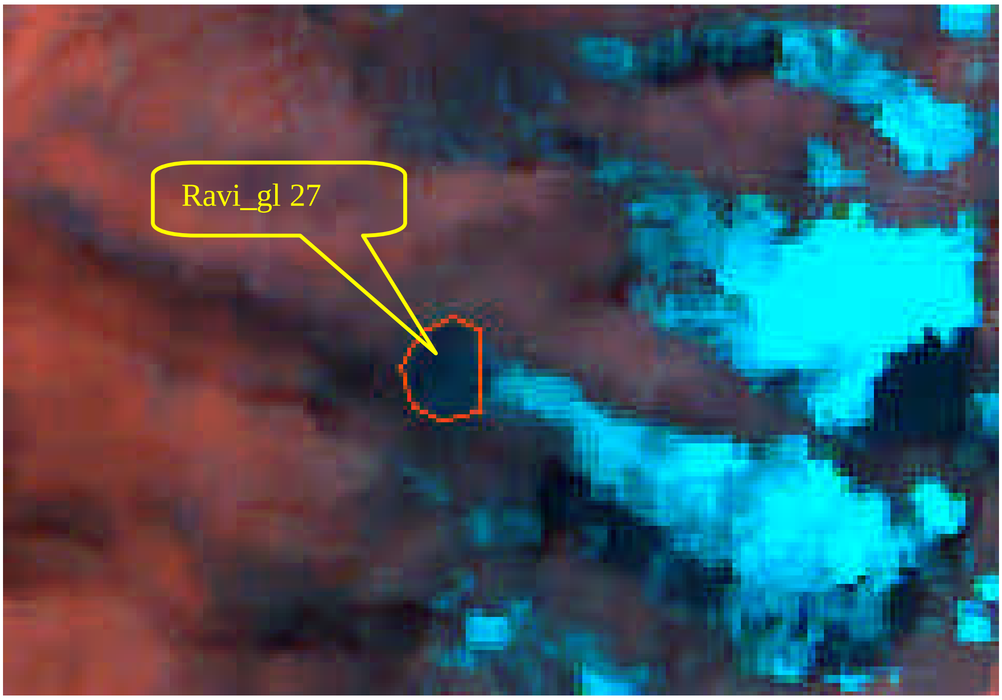


Figure 10.5: Potentially dangerous End Moraine Dammed lakes in Ravi_River basin

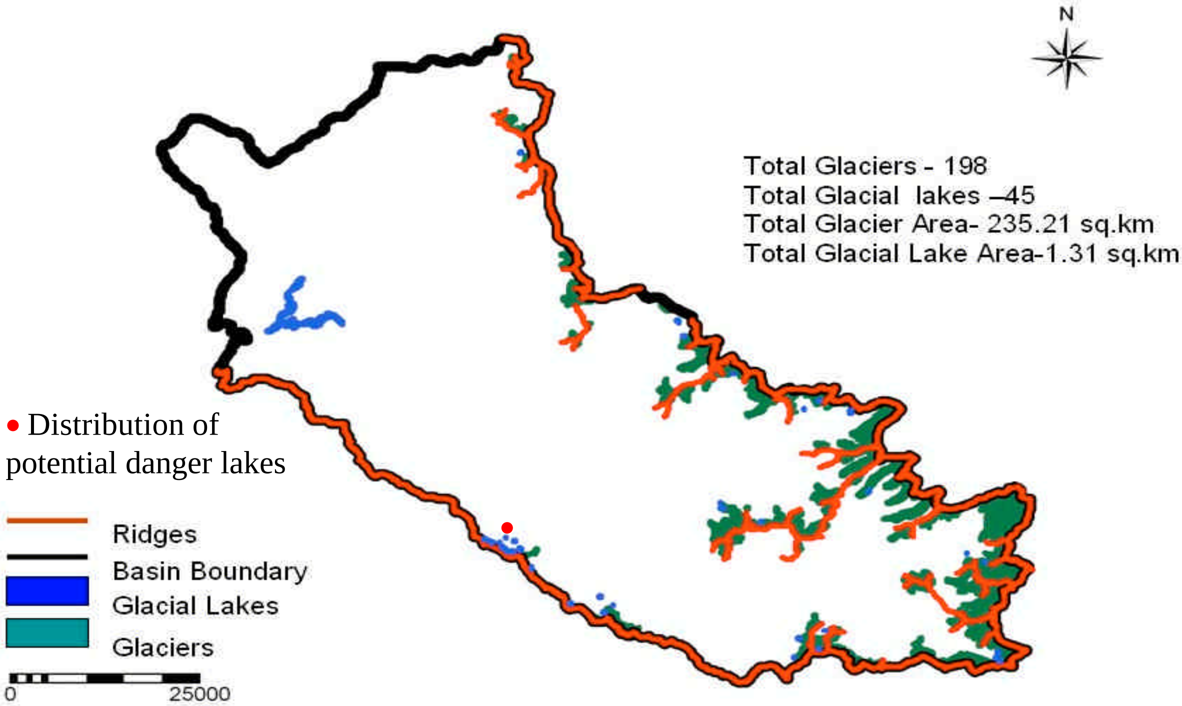


Figure 10.6: Potential danger Glaciers and Glacial lakes of Ravi basin.

10.2.4 Chenab River basin

In the Chenab River basin, since most of the northern part is covered by large ice mass and large sized glaciers so out of 53 glacial lakes, only 18 lakes are characterized as major glacial lakes. There are 6 Moraine dammed lakes, 4 suprglacial lakes, 3 each of Blocked lakes and Valley truough lakes and one each of Erosion lake and Cirque lake. The largest lake in the basin is Chenab_gl 20 with an area coverage of 564940 sq metre. Most of the blocked lake and Supraglacial lakes are situated close to the glaciers. In this area also shows the fast retreat of glaciers and formation of lakes due to retreat of glaciers.

Table 10.7: Major glacial lakes of Chenab River basin

S.N	Lake Type	Lake Number	Area (sq m)	Associated Glacier	Distance ot Glacier	Remarks
1	Morain dammed	chenab_gl 10	32804	Chenab_gr 319	138.0	Left lateral moraine is thin, retreating of glacier indicates that lake will be expanding
2	Erosion	chenab_gl 14	51777	Chenab_gr 335	1674.0	Isolated away from the glacier bounded by hard rock
3	Supraglacial	chenab_gl 16	43984	Chenab_gr 336	0.0	Moraine is very thick compared to the lake, clear indication of outlet from the lake and outburst in the past
4	Supraglacial	chenab_gl 17	45689	Chenab_gr 347	0.0	Moraine is very thick compared to the lake, indication of outburst in the past
5	Morain dammed	chenab_gl 20	564940	Chenab_gr 400	0.0	Outlet is good, at present, high chances of lake expansion due to glacier retreat
6	Supraglacial	chenab_gl 21	25066	Chenab_gr 400	0.0	Downstream also debris covered glacier
7	Valley	chenab_gl 22	38758	?		Away from the main course of the channel
8	Blocked	chenab_gl 25	35862	Chenab_gr 467	2752.0	Away from the main course of the channel
9	Morain dammed	chenab_gl 26	911043	Chenab_gr 467	0.0	Outlet is good, at present, high chances of lake expansion due to glacier retreat
10	Cirque	chenab_gl 27	30256	Chenab_gr 487	951.0	Isolated from the glacier, bounded by hard rock
11	Valley	chenab_gl 28	349674	Chenab_gr 491	950.0	Indication of outburst in the past, wide drainage
12	Valley	chenab_gl 29	138541	Chenab_gr 493	1175.0	Away from the glacier with the wide drainage
13	Morain dammed	chenab_gl 30	119537	Chenab_gr 494	60.0	Indication of outburst in the past, chances of lake expansion due to glacier retreat
14	Morain dammed	chenab_gl 33	124631	Chenab_gr 495	0.0	Indication of outburst in the past, chances of lake

						expansion due to glacier retreat
15	Supraglacial	chenab_gl 38	129219	Chenab_gr 510	0.0	Three side surrounded by glaciers and possibility of blocking of lake from neighboring glacier
16	Blocked	chenab_gl 39	414317	Chenab_gr 510	0.0	Wide drainage outlet
17	Morain dammed	chenab_gl 48	25217	Chenab_gr 549	0.0	Thick moraine with good outlet
18	Blocked	chenab_gl 49	518302	?		Away from the glacier and not the flow path of main channel

Table 10.8: Potential danger glacial lakes of Chenab River basin

	Lake Number	Latitude and Longitude	Area (sq m)	Associated Glacier	Distance to Glacier	Area of the Glacier
	chenab_gl 10		32804	Chenab_gr 319	138.0	
	chenab_gl 20		564940	Chenab_gr 400	0.0	
	chenab_gl 26		911043	Chenab_gr 467	0.0	
	chenab_gl 30		119537	Chenab_gr 494	60.0	
	chenab_gl 33		124631	Chenab_gr 495	0.0	
	chenab_gl 38		129219	Chenab_gr 510	0.0	

There are altogether six glacial lakes are identified as a potential danger. These lakes are chenab_gl 10, chenab_gl 20, chenab_gl 26, chenab_gl 30, chenab_gl 33 and chenab_gl 38 associated with the glaciers Chenab_gr 319, Chenab_gr 400, Chenab_gr 467, Chenab_gr 494, Chenab_gr 495 and Chenab_gr 510 at the distance close to less than 140 m. All the identified potential danger lakes are of Moraine dammed lake except the Chena_gl 38, which is Supraglacial lake.

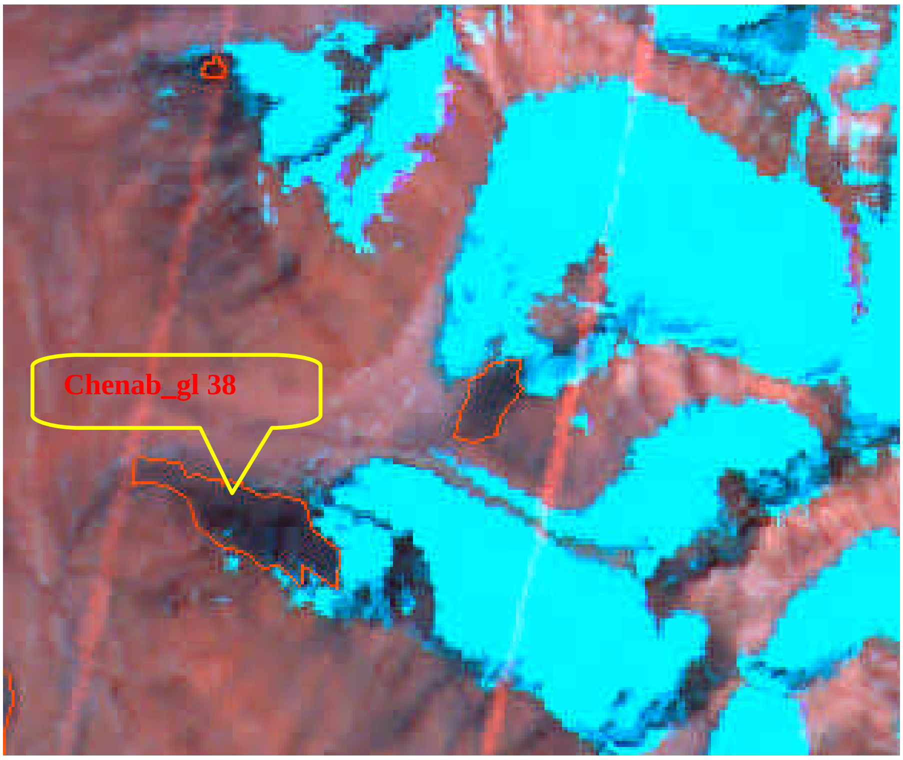


Figure 10.7: potential danger lake in Chenab River basin

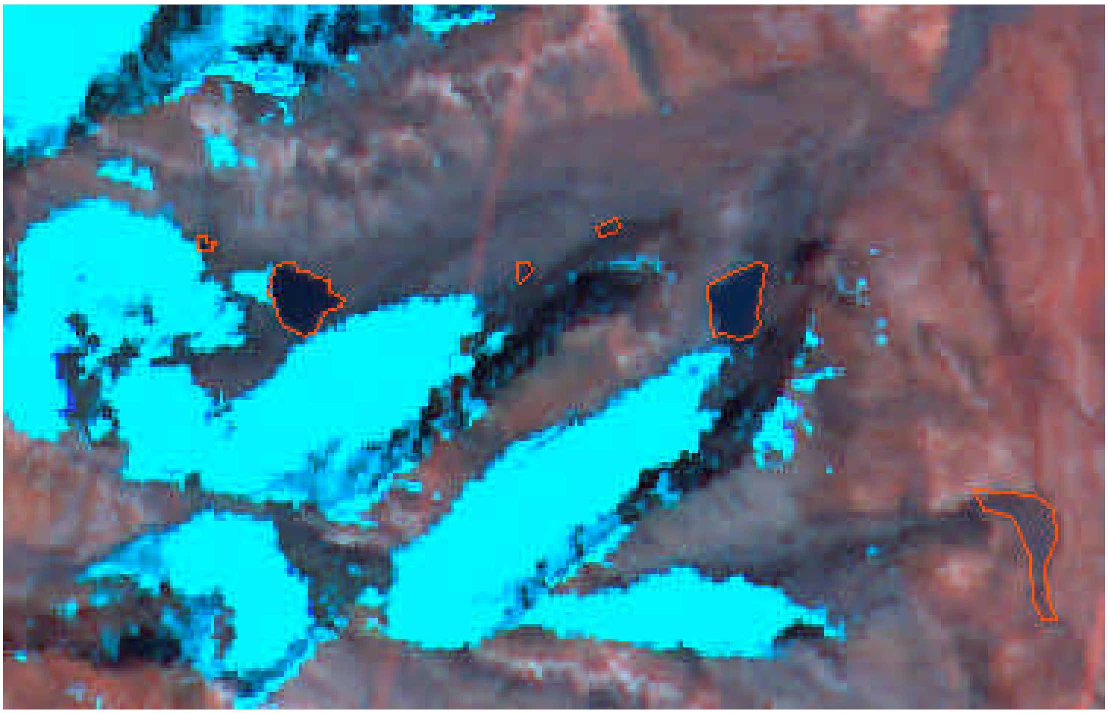


Figure 10.8: potential danger lake in Chenab River basin

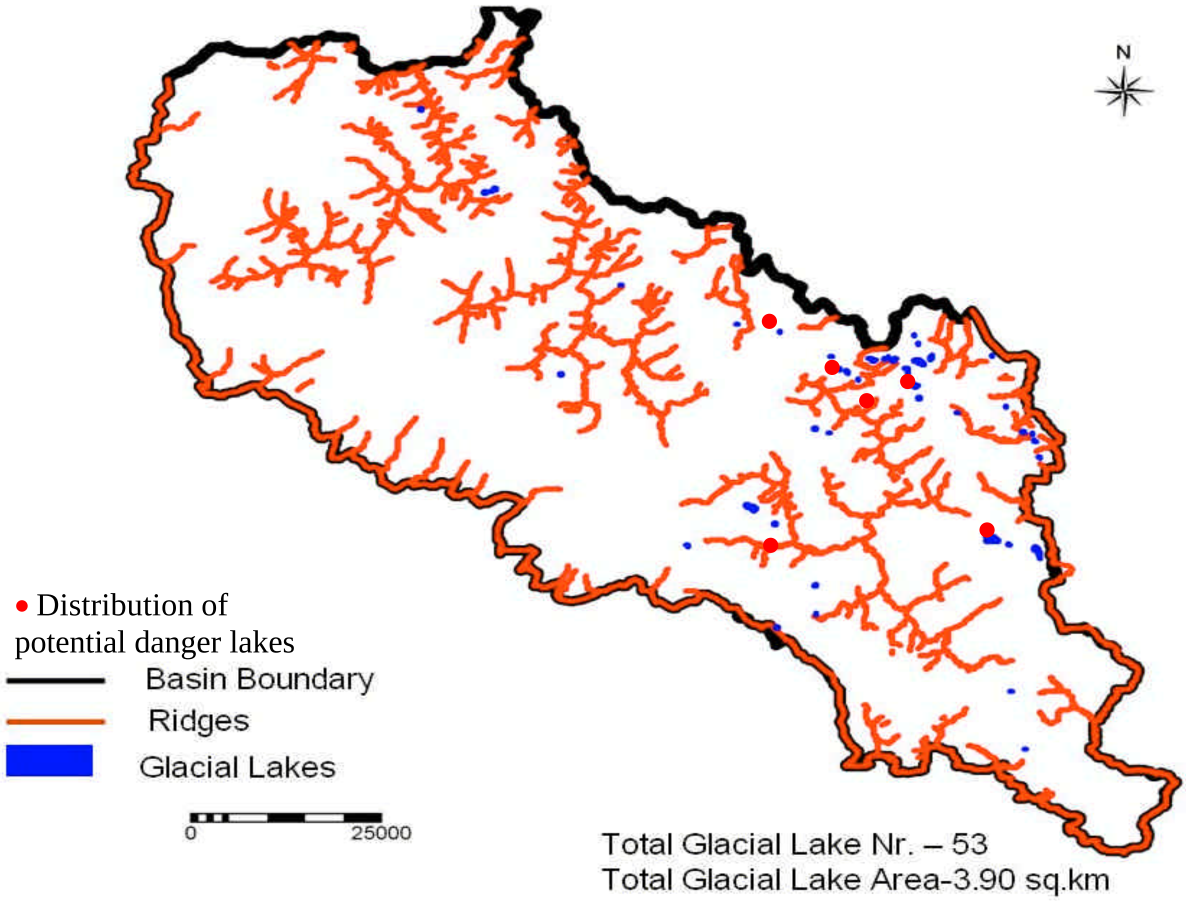


Fig. 10.9: Potential danger Glacial Lakes of Chenab Basin

10.2.5 Sub-basin 2

Only three major glacial lakes are identified in the Sub-basin 2. Out of which two are of Moraine dammed and one is Blocked Lake. The largest lake is sub-basin2_gl 2, which has an area of 52793 square metre (Table 10.5).

Table 10.9: Major glacial lakes of Sub basin 2						
S. N	Lake Type	Lake Number	Area (sq m)	Associated Glacier	Distance to Glacier	Remark
1	Morain dammed	Sub-basin2 1	46676	Northern_basin_2 7	0	Lake is growing very fast
2	Morain dammed	Sub-basin2 2	52793	Northern_basin_2 9	96	Lake is growing very fast
3	Blocked	Sub-basin2 5	23171	Northern_basin_2 45	303	Not in the main course of the glacier

Though the lakes are not very large but due to the fast trend of retreat of the glacier indicates the fast expansion of the lakes. So out of three major glacial lakes two are identified as a potential danger lakes in this basin and both of these lakes are of Moraine dammed lakes close to the associated glacier.

Table 10.10: Potentially Dangerous Glacial lakes of Sub-basin 2						
S. N	Lake Number	Latitude and Longitude	Area (sq m)	Associated Glacier	Distance to Glacier	Area of the Glacier
1	Sub-basin2 1	32°12'31.98"N, 78°27'16.29"E	46676	Northern_basin_2 7	0	202008
2	Sub-basin2 2	32°13'05.47"N, 78°26'01.32"E	52793	Northern_basin_2 9	96	111430

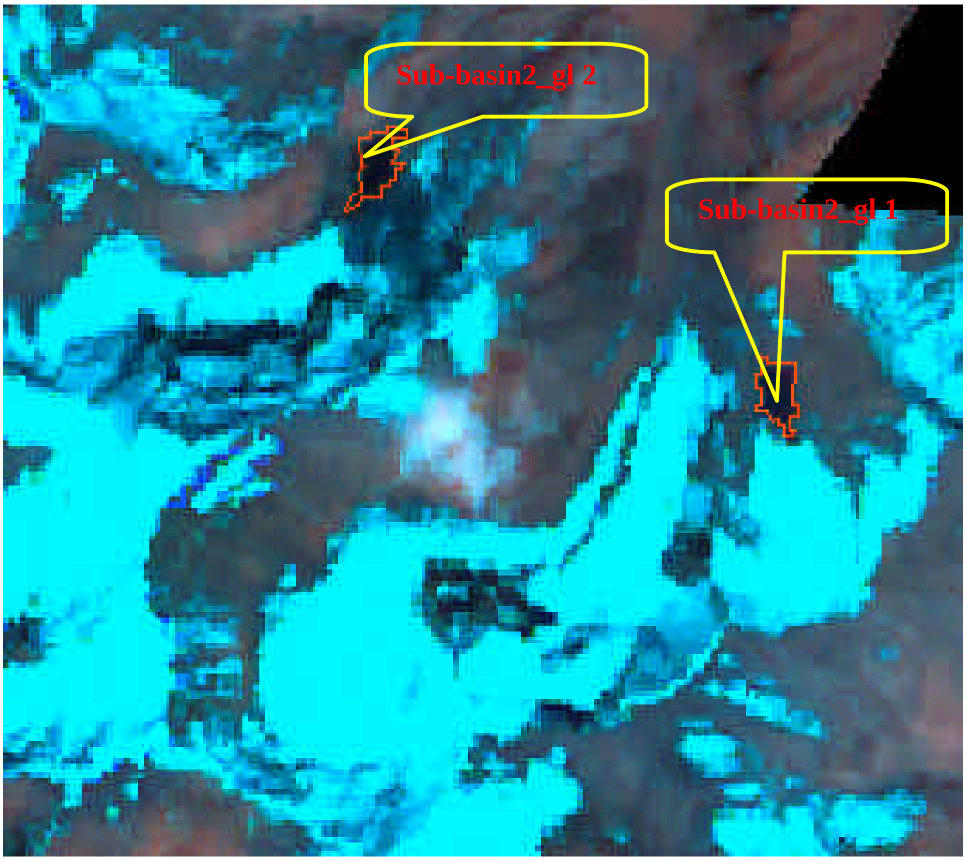


Figure 10.10: potential danger lakes in the Sub_basin2

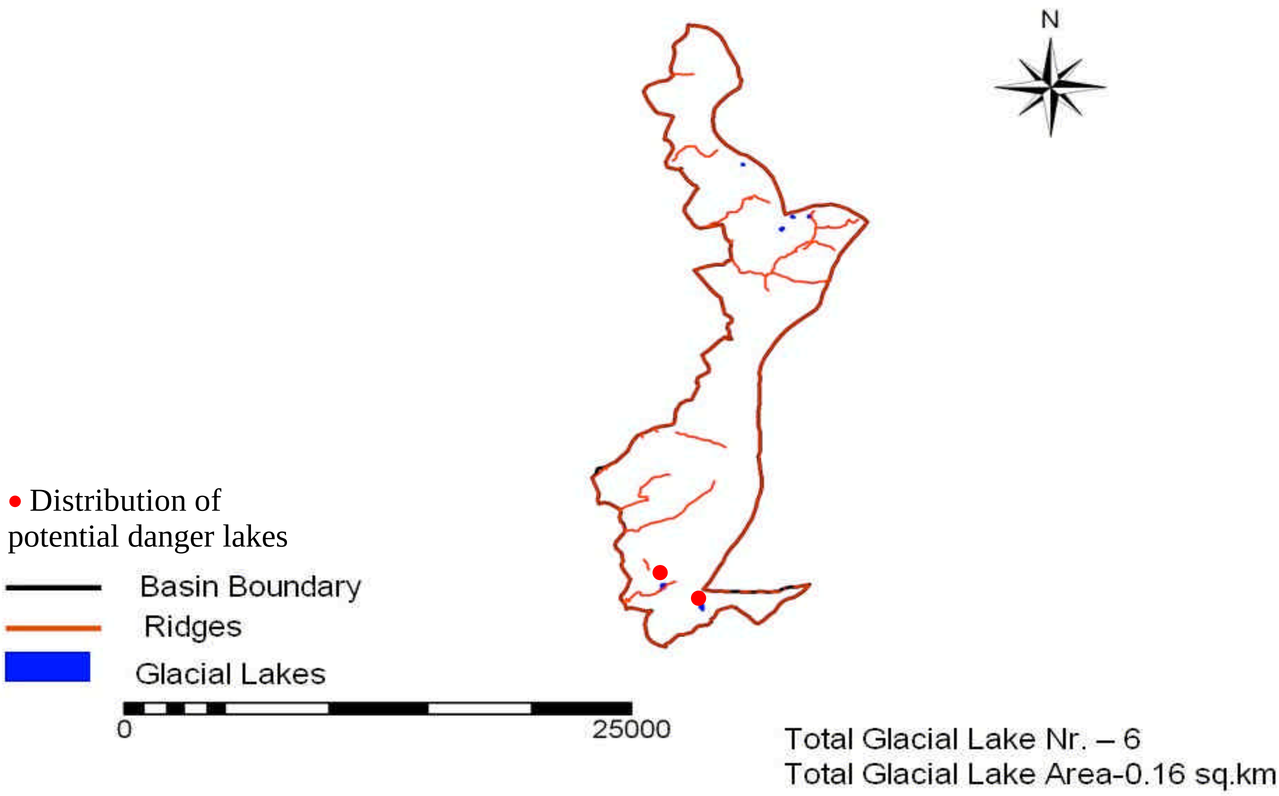


Fig. 10.11 Potential danger Glacial Lakes of Subbasin 2

10.2.6 Summary

Altogether there are 229 glacial lakes in Himachal Pradesh, among them 193 lakes are associated with glaciers. The lakes are classified according to the distance from the glaciers. As the lakes get closer to the glacier and are affected by the different parameters mentioned above, the lakes will be potentially dangerous. Among the glacier associated glacial lakes, 63 lakes are at a distance of less than 50m. The lakes are also classified into different types for the identification of potentially dangerous lakes (Table10.11). There are different types of lakes associated with glaciers: end moraine-dammed lakes, lateral moraine-dammed lakes, supraglacial lakes, blocked lakes, valley trough lakes, cirque lakes, and erosion lakes. Among these lakes, moraine-dammed lakes and blocked lakes are susceptible to breach out easily due to different phenomena. Supraglacial lakes, when they start merging with one another to form a larger lake and finally change into a moraine-dammed lake, become dangerous.

The study of topographic maps, satellite images, and field information showed that most of the identified potentially dangerous lakes started to form more than 40 years ago.

Table 10.11: Summary of glacial lakes with their classifications in the basins and sub-basins of the Himachal Pradesh

Basin		Beas	Ravi	Chenab	Satluj	Sub Basin 1	Sub Basin 2	Sub Basin 3	Sub Basin 4
Area of largest lake (km^2)		235.1283474	0.00058	0.91104	0.05866	0	52793.46	15523.52	0
Area of smallest lake (km^2)		0.033084	0.00003	0.00125	0.00122	0	9382.09	15523.52	0
Distance from glacier	< 50m	32	3	17	9	0	2	0	0
	50–500m	25	12	15	15	0	3	0	0
	500–5000m	10	15	17	18	0	0	0	0
Moraine-dammed lakes		25	2	23	24	0	3	0	0
Blocked lakes		4	2	6	3	0	2	0	0
Lateral moraine-dammed lakes		3		0	0	0	0	0	0
Supra glacial lakes		16	1	11	7	0	1	0	0
Valley lakes		9	9	4	6	0	0	1	0
Erosion lakes		15	25	7	7	0	0	0	0
Cirque lakes		2	6	2	3	0	0	0	0
Total number of lakes		74	45	53	50	0	6	1	0

Table 10.12: Potentially dangerous glacial lakes in Himachal Pradesh					
S No.	Lake Number	Name		Length	Area
		Tsho	Latitude Longitude	(m)	(m2)
Beas Basin					
1	beas_gl 30		32°08’05.00”N, 77°35’48.80”E		375639
2	beas_gl 31		32°07’49.24”N, 77°35’47.49”E		99432
3	beas_gl 35		32°04’38.97”N, 77°40’30.09”E		329243
4	beas_gl 37		32°04’02.75”N, 77°42’06.00”E		502366
5	beas_gl 51		31°55’01.49”N, 77°31’51.84”E		20166
6	beas_gl 54		31°54’57.44”N, 77°31’08.62”E		22512
7	beas_gl 66		31°40’11.08”N, 77°37’13.93”E		43028
8	beas_gl 69		31°40’15.43”N, 77°35’57.62”E		24659
9	beas_gl 70		31°40’16.02”N, 77°35’31.67”E		27062
10	beas_gl 30				375639
Satluj River Basin					
11	Satluj_gl 8		31°45'44.73"N, 78°06'44.25"E		27779
12	Satluj_gl 13		32°00'37.86"N, 78°23'24.62"E		58659
13	Satluj_gl 19		32°15'57.63"N, 78°23'03.14"E		34504
Ravi River basin					
14	Ravi_gl 27		32°15'40.69"N, 76°44'24.84"E		57513
Chenab River Basin					
15	chenab_gl 10		32°50'05.82"N, 77°09'17.65"E		32804
16	chenab_gl 20		32°34'58.10"N, 77°11'15.66"E		564940
17	chenab_gl 26		32°33'03.81"N, 77°31'26.00"E		911043
18	chenab_gl 30		32°47'33.36"N, 77°22'32.24"E		119537
19	chenab_gl 33		32°47'31.43"N, 77°20'49.55"E		124631
20	chenab_gl 38		32°47'55.57"N, 77°25'42.07"E		129219
Sub-basin2 (Takling la)					
21	Sub-basin2 1		32°12'31.98"N, 78°27'16.29"E		46676
22	Sub-basin2 2		32°13'05.47"N, 78°26'01.32"E		52793

Chapter 11

Glacial Lake Outburst Flood Mitigation Measures, Monitoring and Early Warning System

There are several possible methods for mitigating the impact of Glacial Lake Outburst Flood (GLOF) surges, for monitoring, and for early warning systems. The most important mitigation measure for reducing GLOF risk is to reduce the volume of water in the lake in order to reduce the peak surge discharge.

Downstream in the GLOF prone area, measures should be taken to protect infrastructure against the destructive forces of the GLOF surge. There should be monitoring systems prior to, during, and after construction of infrastructures and settlements in the downstream area.

Careful evaluation by detailed studies of the lake, mother glaciers, damming materials, and the surrounding conditions are essential in choosing an appropriate method and in starting any mitigation measure. Any measure taken must be such that it should not create or increase the risk of a GLOF during and after the mitigation measures are in place. Physical monitoring systems of the dam, lake, mother glacier, and surroundings are necessary at different stages during and after the mitigation process.

11.1 Reducing The Volume of Lake Water

Possible peak surge discharge from a GLOF could be reduced by reducing the volume of water in the lake. In general any one or combination of the following methods may be applied for reducing the volume of water in the lake:

- controlled breaching,
- construction of an outlet control structure,
- pumping or siphoning out the water from the lake, and
- making a tunnel through the moraine barrier or under an ice dam.

Controlled breaching

Controlled breaching is carried out by blasting, excavation, or even by dropping bombs from an aircraft. One of the successful examples has been that reported for Bogatyr Lake in Alatau, Kazakhastan (Nurkadilov et al. 1986). An outflow channel was excavated using explosives and 7 million cubic metres of water was successfully released in a period of two days. These methods, however, can give strong, uncontrolled regressive erosion of the moraine wall causing a fast lowering of the lake level. Liboutry et al. (1977a, b, c) described a case from Peru of the sudden discharge of 6–10 million cubic metres of water after two years of careful cutting of a trench in the moraine wall.

Construction of an outlet control structure

For more permanent and precise control of lake outflows, rigid structures made out of stone, concrete, or steel can be used. However, the construction and repairs of the required mitigation works at high elevations, in difficult terrain conditions and in glacial lake areas far from road points and not easily accessed, will cause logistic difficulties. Therefore, preference should be given to construction materials available locally such as boulders and stones. The boulders on the moraine walls can be held in place by wire mesh (‘gabion’) and/or held down by appropriate anchors.
Open cuts in a moraine dam can be excavated during the dry season when a lake’s water level is lower than during the wet season. Such a method is risky as any displacement wave arising from an ice avalanche can rip through the cut and breach the moraine. This method should be attempted where there is no risk of avalanches into the lake.

Pumping or siphoning out the water from the lake

Examples given by Lliboutry et al. (1977a, b, c) from Peru and the pumping programme for the control of Spirit Lake after the eruption of Mount St Helens in Washington State in the USA are very costly because of the large amount of electricity needed for the powerful pumps. The pumping facility consisted of 20 pumps with a total capacity of 5 $m^3 s^{-1}$ and the cost of the pumping plant, operation, and maintenance for about 30 months was approximately US $11 million (Sager and Chambers 1986).

In the Hindu-Kush Himalayan region, there is no hydroelectric power distribution at high altitudes nor a simple means of transporting fuel to high elevations. Many of the lakes are higher than the maximum flying altitude for helicopters.

The use of a turbine, propelled by the water force at the outside of the moraine dam, will lower the energy costs. The problem of coupling the turbine and the pumps has to be solved.

Siphons with manageable component size are attractive in that they are readily transportable, relatively easy to install, and can be very effective for smaller size lakes.

Making a tunnel through the moraine dam

Tunnelling through moraines or debris barriers, although risky and difficult because of the type of material blocking the lake, has been carried out in several countries. In Peru, Lliboutry et al. (1977a, b, c) reported problems related to tunnelling through a moraine dam which had been severely affected by an earthquake.

Tunneling can only be carried out through competent rock beneath or beside a moraine dam. The costs of such a method are very high. Unfortunately, not all moraine dams are suitable for tunneling.

The construction of tunnels would pose difficulties in the Himalayas due to the high cost of transporting construction materials and equipment to high elevations.

11.2 Preventative Measures Around the Lake Area

Any existing and potential source of a larger snow and ice avalanche, slide, or rockfall around the lake area which has a direct impact on the lake and dam has to be studied in detail. Preventative measures against the instabilities of the moraine dam and the surrounding area, such as removing masses of loose rocks to ensure there will be no avalanches into the lake, will reduce to some extent the danger of GLOF.

11.3 Protecting Infrastructure Against the Destructive Forces of the Surge

The sudden hydrostatic and dynamic forces generated by a rapid moving shock wave can be difficult to accommodate by conventionally designed river structures such as diversion weirs, intakes, bridges, settlements on the river banks, and so on. It will be necessary to build bridges with appropriate flow capacities and spans at elevations higher than those expected under GLOF events. The Nepal–China highway, after reconstruction, has arched bridges well above the 1981 GLOF levels. Also, the road has been moved to higher levels and has gabion protection at the base of the embankments. Settlements should not be built at or near low river terraces but at heights well above the riverbed in an area with GLOF potential. Slopes with potential or old landslides and scree slopes on the banks of the river near settlements should be stabilised. It is essential that appropriate warning devices for GLOF events be developed in such areas.

11.4 Monitoring and Early Warning Systems

A programme of monitoring GLOFs throughout the state should be implemented using a multi-stage approach, multi-temporal data sets, and multi-disciplinary professionals. Focus should first be on the known potentially dangerous lakes and the river systems on which infrastructure is developed. Monitoring, mitigation, and early warning system programmes could involve several phases as follow.

- Detailed inventory and development of a spatial and attribute digital database of the glaciers and glacial lakes using reliable medium- to large-scale (1:63,360 to 1:10,000) topographic maps
- Updating of the inventory of glaciers and glacial lakes and identification of potentially dangerous lakes using remote-sensing data such as the LANDSAT TM, IRS1C/D, LISS3, SPOT XS, SPOT PAN (stereo), and IRS1C/D PAN (stereo) images
- Semi-detailed to detailed study of the glacial lakes, identification of potentially dangerous lakes and the possible mechanism of a GLOF using aerial photos
- Annual examination of medium- to high-resolution satellite images, e.g. LANDSAT TM, IRS1D, SPOT, and so on. to assess changes in the different parameters of potentially dangerous lakes and the surrounding terrain
- Brief over-flight reconnaissance with small format cameras to view the lakes of concern more closely and to assess their potential for bursting in the near future
- Field reconnaissance to establish clearly the potential for bursting and to evaluate the need for preventative action
- Detailed studies of the potentially dangerous lakes by multi-disciplinary professionals

- Implementation of appropriate mitigation measure(s) in the highly potentially dangerous lakes.
- Regular monitoring of the site during and after the appropriate mitigation measure(s) have been carried out
- Development of a telecommunication and radio broadcasting system integrated with on-site installed hydrometeorological, geophysical, and other necessary instruments at lakes of concern and downstream as early warning mechanisms for minimising the impact of a GLOF
- Interaction/cooperation among all of the related government departments/institutions/agencies /broadcasting media, and others for detailed studies, mitigation activities, and preparedness for possible disasters arising from GLOF events
- The methodology for the inventory of glaciers and glacial lakes, the use of geographic information systems (GIS), and the remote sensing techniques and identification of potentially dangerous lakes are explained in Chapters 4–6 and 11.

11.5 MITIGATION MEASURES, MONITORING, AND EARLY WARNING SYSTEMS TO BE APPLIED IN THE STATE – BHUTAN EXPERIENCE

Some of the mitigation measures to prevent the bursting of the lakes are:

- siphoning,
- pumping, and
- excavation of a channel.

All these methods were suggested basically to reduce the level of water in a lake by some level initially. The applicability of a method depends on the lake and its situation.

In some of the earlier studies made in Bhutan on Raphstreng Tsho lake, used excavation of a channel as a possible mitigation measure. Details of the procedure are given below:

Considering the site conditions, it was found that the excavation of a channel was the best suited method for mitigating GLOF hazards from Raphstreng Tsho. A detailed topographic survey of Raphstreng Tsho and its two subsidiary lakes was carried out, on a scale of 1:2,000 with 2.5m contour intervals. L-sections and cross-sections of the existing natural channel through which the water from Raphstreng Tsho was going to Pho Chu were prepared. These sections were used to estimate the quantity of excavation required to lower the lake. The water level of the main lake was at 4,348.79 masl. It joined subsidiary lake I at a level of 4,348.50 masl after traveling 5m along the channel. The outlet of subsidiary lake I was at an elevation of 4,348.15 masl and was 70m away from Raphstreng outlet. The water from the subsidiary lake I outlet flowed through a narrow channel 8–15m wide for 60m, joined subsidiary lake II at an elevation of 4,343.9 masl, and flowed out through its outlet at 4343.4 masl. The outlet of subsidiary lake II was 180m away from the main lake along its flow path. From this section the water followed the natural channel and joined the Pho Chu.

The sequence of excavation activities is given below.

- The outlet of subsidiary lake II was excavated first to lower the level of this lake.

- In the next step, the channel between the two subsidiary lakes was excavated. Once this had reached the desired depth, the outlet of subsidiary lake I was cut to allow the water to flow out.
- Then the channel between subsidiary lake I and the main lake was excavated. When this was completed, the outlet of the main lake was excavated to let the water flow out, thus reducing the level of the lake by 4m.

Flood mitigation measures (Phase I—1996)

The scope of the work for the 1996 expedition in Bhutan was to carry out the immediate mitigation measures for the biggest lake (Raphstreng Tsho) as recommended by the joint expedition team of 1995. The project was funded by the Government of India, and Water and Power Consultancy Services (India) Ltd (WAPCOS) was appointed to provide consultants. The Indo-Bhutan expedition team comprised experts from the Department of Geology and Mines (DGM), the Department of Roads (DOR), the Survey of Bhutan and the Royal Bhutan Army (RBA), the Geological Survey of India (GSI), and WAPCOS.

The team was to carry out a site survey and investigation to firm up the various parameters to be used for the preparation of design and cost estimates of civil work planned for preventing a possible outburst of the glacial lakes in Lunana. The survey and investigation carried out comprised hydro-meteorological and topographical surveys and geotechnical, geological, and foundation investigations.

Due to the urgency to lower the lake level of Raphstreng Tsho, the civil work for this purpose was carried out simultaneously. The initial proposal, to siphon together with excavating the spillway to reduce the lake level by 20m, was found unfeasible, so an alternative solution had to be found. Based on the reconnaissance study it was decided that the existing channel through which the lake water was flowing into the Pho Chu would be used for lowering the lake water level. The excavation work was done using manual tools like crowbars, shovels, spades, pick axes, and so on. The team reached Lunana on 7 July 1996 and actual excavation of the channel started on 12 July. The total number of person days used at this site until 19 October 1996 was 67 848 (WAPCOS 1997). During this period the water level in the main lake (Raphstreng Tsho) was lowered by 0.95m, in the lower subsidiary lake I by 0.94m, and in the subsidiary lake II by 1.5m (Figure 12.1). The report of WAPCOS 1997 recommended that lowering of the lake by 20m was not absolutely necessary and that lowering it by 4m should be sufficient. To implement this recommendation of lowering the lake water level by 4m, work was carried out in 1997 and 1998.

Raphstreng Tsho outburst flood mitigation project (Lunana) of Bhutan, Phase II—1999

After a fact finding mission (Phase I), actual fieldwork (Phase II) under Austro-Bhutanese cooperation was planned as the Raphstreng Tsho Outburst Flood Mitigation Project. The main aim of the project was to assess the geo-risks of the Raphstreng/Thorthormi Tsho area (Häuslar et.al. 2000). An integrated multi-disciplinary approach was adopted using remote sensing, geological, hydro-geological, and geophysical methods. IRS-1D PAN digital data for 3 January 1999 with a ground resolution of 5.8m was acquired. ERDAS/IMAGINE software was used to generate the required satellite image maps: on a

scale of 1:2500 for monitoring the decay of glaciers, at a scale of 1:5,000 for a base map for field work, and a 3-D digital elevation model (DEM) for geomorphological and geological interpretation.
From the hydrological studies conducted, a hypothesis was postulated that (i) seepage water is not pure glacial melt, (ii) local ice must be expected along the flow path, (iii) in a multi-source groundwater system lake water is not the major contributor, and (iv) in multi-genetic moraines a very stable piping system exists. It is concluded that if this hypothesis is proved, the seepages will not weaken the morainic dam (Häuslar et.al. 2000).

Sub-surface radar, geoelectric resistivity, and seismic investigation were used to interpret the sub-surface nature of the moraine dam. The findings from these investigations were that the end moraine of Raphstreng Tsho is not an ice core dam. It is concluded that the present day risk for an outburst from Raphstreng is low, but the risk of an outburst of Thorthormi Glacial Lake in the future is considered high and it could occur in 15–20 years considering the present trend of climate change (Häuslar et.al. 2000). Häuslar and Leber (1998) proposed that special risk engineering at Lugge Tsho outlet and a more sound GLOF risk assessment east of Thanza be carried out.

Chapter 12
Conclusions

Databases of the glaciers and glacial lakes of Himachal Pradesh, based on medium- to large-scale topographic maps, have not been developed prior to the present study. For the glacier inventory the study used the methodology developed by the Temporary Technical Secretary for the World Glacier Inventory (Muller et al. 1977), and for the glacial lake inventory, the methodology developed by the Lanzhou Institute of Glaciology and Geocryology (LIGG) [LIGG/WECS/NEA 1988] was used with modification.

Creating inventories of and monitoring glaciers and glacial lakes can be done quickly and correctly using a combination of satellite images and aerial photographs simultaneously with topographic maps. The multi-stage approach of using remotely sensed data and field data increases the ability and accuracy of the work. The integration of visual and digital image analysis with a geographic information system (GIS) can provide very useful tools for the study of glaciers, glacial lakes, and Glacial Lake Outburst Floods (GLOFs).

Analysts' experiences and adequate field knowledge of the physical characteristics of glaciers, glacial lakes, and their associated features are necessary for the interpretation of topographic maps, satellite images, and aerial photographs. Evaluation of spectral responses by different surface cover types in different bands of satellite images is necessary. Different techniques of digital image enhancement and spectral classification of ground features are useful for the study of glaciers and lakes. With different spectral band combinations in false colour composite (FCC) and individual spectral bands, glaciers and glacial lakes were studied using the knowledge of image interpretation keys.

The Digital Elevation Model (DEM) is useful in deciding the rules for discrimination of features and land-cover types in GIS techniques and for better perspective viewing and presentations. The DEM suitable for the present study of the whole state is now available.

The topographic maps published by the Survey of India in the 1960s–1970s on a scale of 1:50,000, based on aerial photographs and field verification are the only map series that cover the whole of Himachal Pradesh on medium scale. Based on this map series, spatial and attribute databases of glaciers and glacial lakes were developed.

The inventory of glaciers and glacial lakes of Himachal Pradesh as a whole is divided into the following four river basins and four sub basins.

- Beas Basin
- Ravi Basin
- Chenab Basin
- Satluj Basin
- Sub Basins
    - Sub Basin 1
    - Sub Basin 2
    - Sub Basin 3
    - Sub Basin 4

A digital database of glaciers and glacial lakes was developed for Himachal Pradesh covering a total of 8 basins and sub basins. Major glaciers and glacial lakes were digitized on geo-coded LISS III satellite imagery using software Ilwis 3.1. The spatial distribution of glaciers and glacial lakes was digitized on satellite image and verified from topographic maps. A total of 8 basins and sub-basins were covered by the study. The present study indicate that there are 2554 glaciers altogether inventoried within the territory of Himachal, covering an area of 4160.5 sq. km with an ice reserves of 385.05 km^3.

Prior to the present study, there was no inventory of glaciers as well as lakes covering the entire state as a whole. In this study any lakes in contact with or near a glacier, or occupying a basin produced by glacial erosion or deposition, were termed ‘glacial lakes’. However, some of the lakes inventoried were isolated and far behind the ice mass, and their water may or may not actually be derived from glacial melt water. Altogether 229 lakes were identified in Himachal Pradesh.

The Beas river basin has a total of 358 glaciers covering an area of 758.18 sq. km. The estimated ice reserves in the basin is 76.42 sq km. The major glaciers identified in the basin are; Tichu glacier, Sara umga glacier, Samsi Glacier , Parbati glacier, Jaryun glacier, Jarnu glacier, Dudhon glacier, Duahan Glacier, Dibika glacier, Beas kund glacier and Banagal glacier. Seventy four lakes are identified in the whole basin, out of that 67 are found to be associated with glaciers hence could be classified as glacial lakes. Further, the basin has 25 moraine dammed, 4 blocked lakes which falls in the category of potentially more dangerous lakes.

The Ravi basin comprises of 198 glaciers. The total area covered by these glaciers is 235.21 with an ice reserve of 14.58 km^3. A total of 45 lakes have been identified in the Ravi basin and 30 of them are associated with glaciers. The basin is dominated by erosion lakes. As many as there are 681 glaciers which feed Chenab river in Chenab basin covering an area of 1704.70 sq. km and an ice reserves of 187.66 Km^3. The basin contains 49 glacial lakes wherein moraine dammed type of lakes dominated in number. Satluj basin, the largest of all, consists of 945 glaciers with a cumulative area of 1217.70 sq. km and an estimated ice reserve of 94.45 km^3. Most of the lakes are small in size and about 42 are found to be associated with glaciers, however, moraine dammed types of lakes are common in the basin.

Though no major apparent GLOF event has ever occurred in the state however, quite a few lakes have been identified which may pose danger in the coming future as the glaciers are retreating at an alarming rate due to global warming. There are significant number of lakes in all the basins having the area ranging between 0.1 and 1.25 sq. km. Among the glacial lakes studied, a lake associated with Geopang gath glacier in the Chenab basin has received the greatest attention.

The characteristic features used to identify potentially dangerous lakes in general are:

- moraine-dammed glacial lakes in contact or very near to large glaciers,
- merging of supraglacial lakes at the glacier tongue.
- some new lakes of considerable size formed at glacier tongues,
- lakes rapidly growing in size, and
- rejuvenation of lakes after a past glacial lake outburst event.

Nineteen glacial lakes have been identified as potentially dangerous lakes from the study of topographic maps, literature, and satellite images available. The potentially dangerous lakes identified are located within four basins. Among the potentially dangerous lakes, five lakes belong to the Beas basin, six lakes belong to the Chenab basin, one lake belong to the Ravi basin andseven lakes belong to the Satluj basin.

It is recommended that the potentially dangerous lakes identified be further investigated and field surveys carried out.

It is concluded that the present day risk for an outburst from glacial lakes occurring in Himachal Pradesh is low, but the risk of outburst of glacial Lake in the future could be anticipated high and it might occur in coming 15–20 years considering the present trend of climate change (Häuslar and Leber (2000). It is proposed that besides making a temporal inventory, a close monitoring of these lakes is required to assess the change in their behaviour. This will help in strengthening database and also help in undertaking an appropriate pre disaster mitigation measure and in avoiding flash flood tragedies common in the hilly region.

Chapter 13

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ANNEXES

Inventory of Glaciers of Beas River Basin

Number of Glaciers= 358 Area of Glaciers= 758.14 km^2 Total Ice Reseerve= 76.40km^3

Glacier Number	Latitude Longitude	Glacier Name	Map code	Orientation	Length (m)	Area (m^2)	Thickness (m)	Ice reserve (km^3)	Classification	Glacier Type
Beas_gr 1	32°13'25.64"N, 76°45'12.63"E	x	52d	SE	492	186127	21.01	0.00399	64021	Cirque
Beas_gr 2	32°14'15.35"N, 76°45'15.23"E	x	52d	S	494	216070	22.46	0.00494	67021	Ice Apron
Beas_gr 3	32°14'36.13"N, 76°45'31.84"E	x	52d	S	248	54838	10.34	0.00052	37021	Ice Cap
Beas_gr 4	32°14'28.74"N, 76°48'04.41"E	x	52d	S	440	72047	12.64	0.00088	65021	Niche
Beas_gr 5	32°14'12.48"N, 76°48'12.81"E	x	52d	S	467	61259	11.56	0.00069	65021	Niche
Beas_gr 6	32°14'01.86"N, 76°48'27.51"E	x	52d	W	438	68359	12.64	0.00088	65021	Niche
Beas_gr 7	32°13'44.31"N, 76°48'17.37"E	x	52d	W	1158	394871	28.80	0.01123	63021	Mountain basin
Beas_gr 8	32°13'15.24"N, 76°48'58.42"E	x	52d	SW	279	47330	10.34	0.00052	64021	Cirque
Beas_gr 9	32°12'50.57"N, 76°48'57.09"E	x	52d	NW	422	160659	19.39	0.00310	60021	Mountain
Beas_gr 10	32°12'28.46"N, 76°48'34.78"E	x	52d	NW	1498	982585	41.57	0.04074	63021	Mountain basin
Beas_gr 11	32°11'50.50"N, 76°47'57.82"E	x	52d	NW	793	287943	25.38	0.00736	60021	Mountain
Beas_gr 12	32°11'40.38"N, 76°47'37.09"E	x	52d	N	768	195015	21.51	0.00430	63021	Mountain basin
Beas_gr 13	32°11'19.73"N, 76°47'44.86"E	x	52d	SE	305	73621	12.64	0.00088	64021	Cirque
Beas_gr 14	32°11'02.09"N, 76°47'55.52"E	x	52d	SW	280	47962	10.34	0.00052	64021	Cirque
Beas_gr 15	32°12'08.96"N, 76°49'30.45"E	x	52d	E	1287	387542	28.80	0.01123	63021	Mountain basin
Beas_gr 16	32°12'24.22"N, 76°49'19.87"E	x	52d	E	482	81463	13.62	0.00109	65021	Niche
Beas_gr 17	32°12'40.49"N, 76°49'16.33"E	x	52d	NE	923	312256	26.13	0.00810	63021	Mountain basin
Beas_gr 18	32°13'11.99"N, 76°49'20.84"E	x	52d	E	675	123024	16.85	0.00202	65021	Niche
Beas_gr 19	32°13'35.03"N, 76°49'57.74"E	x	52d	SE	564	428779	29.99	0.01289	60021	Mountain
Beas_gr 20	32°13'31.22"N, 76°51'33.74"E	x	52d	SW	392	87799	14.52	0.00131	60321	Mountain
Beas_gr 21	32°14'15.49"N, 76°55'03.24"E	x	52d	SE	2368	1391824	47.42	0.06591	63021	Mountain basin
Beas_gr 22	32°13'54.62"N, 76°54'53.70"E	x	52d	SW	990	281681	25.00	0.00700	63021	Mountain basin
Beas_gr 23	32°13'24.63"N, 76°54'39.78"E	x	52d	SW	1643	680987	36.08	0.02453	60021	Mountain

Beas_gr 24	32°13'03.38"N, 76°54'00.11"E	x	52d	NW	727	129361	17.53	0.00228	65021	Niche
Beas_gr 25	32°13'59.94"N, 76°55'26.24"E	x	52d	S	492	155720	19.39	0.00310	63021	Mountain basin
Beas_gr 26	32°14'04.98"N, 76°55'51.26"E	x	52d	S	298	106004	16.12	0.00177	60021	Mountain
Beas_gr 27	32°13'36.66"N, 76°56'51.74"E	x	52d	SW	339	55469	11.56	0.00069	64021	Cirque
Beas_gr 28	32°13'51.81"N, 76°58'38.20"E	x	52d	SW	387	295193	25.76	0.00773	60021	Mountain
Beas_gr 29	32°13'29.00"N, 76°58'46.49"E	x	52d	W	1214	484433	31.37	0.01506	60021	Mountain
Beas_gr 30	32°13'03.99"N, 76°58'35.83"E	x	52d	W	1028	506083	32.16	0.01640	63021	Mountain basin
Beas_gr 31	32°12'28.65"N, 76°58'18.18"E	x	52d	NW	2084	434993	29.99	0.01289	63021	Mountain basin
Beas_gr 32	32°11'28.64"N, 76°56'10.55"E	x	52d	N	580	109212	16.12	0.00177	65021	Niche
Beas_gr 33	32°12'18.89"N, 76°58'58.15"E	x	52d	S	911	292597	25.38	0.00736	60021	Mountain
Beas_gr 34	32°13'48.09"N, 77°00'02.14"E	x	52h	SE	485	361196	27.84	0.01002	60021	Mountain
Beas_gr 35	32°16'12.04"N, 77°01'46.42"E	x	52h	NE	573	228968	22.92	0.00527	60021	Mountain
Beas_gr 36	32°16'44.04"N, 77°01'12.36"E	x	52h	SE	1568	939499	40.91	0.03846	60021	Mountain
Beas_gr 37	32°17'16.72"N, 77°01'18.65"E	x	52h	SE	1616	909927	40.41	0.03677	60021	Mountain
Beas_gr 38	32°17'58.62"N, 77°01'01.82"E	x	52h	E	1217	1542621	49.25	0.07584	60021	Mountain
Beas_gr 39	32°20'45.36"N, 77°02'48.99"E	x	52h	S	661	108984	16.12	0.00177	65021	Niche
Beas_gr 40	32°21'12.31"N, 77°03'22.23"E	x	52h	S	3108	2758147	60.83	0.16790	63021	Mountain basin
Beas_gr 41	32°20'59.54"N, 77°04'10.84"E	x	52h	S	1965	509484	32.16	0.01640	63021	Mountain basin
Beas_gr 42	32°19'21.34"N, 77°03'59.49"E	x	52h	SW	3915	3321912	64.95	0.21562	63021	Mountain basin
Beas_gr 43	32°18'24.60"N, 77°03'29.14"E	x	52h	NW	3152	1741585	51.51	0.08963	63021	Mountain basin
Beas_gr 44	32°17'42.79"N, 77°03'17.99"E	x	52h	W	643	164960	19.39	0.00310	65021	Niche
Beas_gr 45	32°18'06.05"N, 77°03'54.53"E	x	52h	S	441	89162	14.52	0.00131	37021	Ice Cap
Beas_gr 46	32°21'33.29"N, 77°04'35.90"E	x	52h	SE	1181	1003962	41.89	0.04189	60021	Mountain
Beas_gr 47	32°21'54.17"N, 77°04'20.50"E	Jarnu glacier	52h	NE	1801	1666581	50.74	0.08473	60021	Mountain
Beas_gr 48	32°23'35.16"N, 77°02'29.24"E	Beas kund glacier	52h	NE	2509	1028024	42.36	0.04363	63021	Mountain basin
Beas_gr 49	32°25'36.83"N, 77°02'55.31"E	x	52h	S	1296	623166	34.78	0.02156	60021	Mountain
Beas_gr 50	32°26'01.70"N, 77°03'17.69"E	x	52h	S	1809	828727	39.00	0.03237	63021	Mountain basin
Beas_gr 51	32°26'30.80"N, 77°03'55.42"E	x	52h	S	1961	2431907	58.13	0.14126	60021	Mountain
Beas_gr 52	32°26'01.72"N, 77°04'58.60"E	x	52h	S	1508	663468	35.65	0.02353	63021	Mountain basin
Beas_gr 53	32°26'07.12"N, 77°05'31.95"E	x	52h	S	1153	343224	27.18	0.00924	67021	Ice Apron
Beas_gr 54	32°27'10.81"N, 77°07'24.74"E	x	52h	S	876	250238	23.79	0.00595	63021	Mountain basin
Beas_gr 55	32°27'29.28"N, 77°07'43.73"E	x	52h	S	436	110570	16.12	0.00177	60021	Mountain

Beas_gr 56	32°26'16.07"N, 77°09'10.95"E	x	52h	SW	2276	1398338	47.54	0.06656	67021	Ice Apron
Beas_gr 57	32°25'25.29"N, 77°10'07.72"E	x	52h	SW	2406	1721278	51.29	0.08822	67021	Ice Apron
Beas_gr 58	32°22'46.94"N, 77°14'57.30"E	x	52h	SW	1191	1323229	46.51	0.06140	60021	Mountain
Beas_gr 59	32°20'55.24"N, 77°17'52.16"E	x	52h	W	3356	3911830	68.78	0.26894	67021	Ice Apron
Beas_gr 60	32°20'20.52"N, 77°18'46.15"E	x	52h	SW	989	715219	36.90	0.02657	60021	Mountain
Beas_gr 61	32°17'55.88"N, 77°18'57.02"E	x	52h	NW	2666	2055550	54.77	0.11283	60021	Mountain
Beas_gr 62	32°17'37.44"N, 77°18'08.17"E	x	52h	SW	1167	861276	39.54	0.03400	60021	Mountain
Beas_gr 63	32°17'36.60"N, 77°18'48.55"E	x	52h	S	222	94128	14.52	0.00131	37021	Ice Cap
Beas_gr 64	32°17'12.32"N, 77°19'04.37"E	x	52h	SW	1299	438084	30.27	0.01332	63021	Mountain basin
Beas_gr 65	32°17'06.40"N, 77°19'29.54"E	x	52h	SW	655	334260	26.83	0.00886	60021	Mountain
Beas_gr 66	32°16'44.11"N, 77°19'20.06"E	x	52h	SW	1066	414961	29.40	0.01205	63021	Mountain basin
Beas_gr 67	32°16'33.43"N, 77°19'43.60"E	x	52h	SW	422	89529	14.52	0.00131	60021	Mountain
Beas_gr 68	32°16'03.34"N, 77°19'53.16"E	x	52h	W	889	442623	30.27	0.01332	60021	Mountain
Beas_gr 69	32°14'59.71"N, 77°19'32.98"E	x	52h	NW	4987	9227567	92.33	0.85217	53012	Valley glacier
Beas_gr 70	32°14'35.49"N, 77°18'20.49"E	x	52h	N	1490	196983	21.51	0.00430	65021	Niche
Beas_gr 71	32°14'39.42"N, 77°17'58.23"E	x	52h	N	1930	1338216	46.77	0.06268	63021	Mountain basin
Beas_gr 72	32°15'04.23"N, 77°17'05.30"E	x	52h	N	1735	940405	40.91	0.03846	67021	Ice Apron
Beas_gr 73	32°13'40.31"N, 77°20'27.93"E	x	52h	S	1223	552358	33.15	0.01823	63021	Mountain basin
Beas_gr 74	32°13'23.23"N, 77°21'17.87"E	x	52h	S	1743	863800	39.54	0.03400	60021	Mountain
Beas_gr 75	32°12'58.12"N, 77°22'16.90"E	x	52h	W	3788	1505727	48.89	0.07383	63021	Mountain basin
Beas_gr 76	32°11'56.04"N, 77°21'50.10"E	x	52h	NW	2834	1577589	49.72	0.07855	63021	Mountain basin
Beas_gr 77	32°11'37.53"N, 77°21'13.72"E	x	52h	NW	1840	1452467	48.16	0.06984	63021	Mountain basin
Beas_gr 78	32°11'26.31"N, 77°20'36.36"E	x	52h	N	1607	1148839	44.17	0.05079	63021	Mountain basin
Beas_gr 79	32°11'26.87"N, 77°19'37.30"E	x	52h	N	1576	2301170	56.99	0.13109	63021	Mountain basin
Beas_gr 80	32°10'46.64"N, 77°18'37.76"E	x	52h	N	692	327188	26.83	0.00886	60021	Mountain
Beas_gr 81	32°10'45.36"N, 77°18'18.73"E	x	52h	N	248	64716	11.56	0.00069	60021	Mountain
Beas_gr 82	32°11'00.96"N, 77°17'59.09"E	x	52h	N	1394	395669	29.10	0.01164	60021	Mountain
Beas_gr 83	32°10'57.02"N, 77°17'36.29"E	x	52h	NW	1243	375340	28.48	0.01082	60021	Mountain
Beas_gr 84	32°10'57.72"N, 77°16'56.49"E	x	52h	NW	1412	337110	27.18	0.00924	67021	Ice Apron
Beas_gr 85	32°11'56.75"N, 77°17'25.26"E	x	52h	N	773	1047013	42.67	0.04481	60021	Mountain
Beas_gr 86	32°10'40.68"N, 77°16'38.50"E	x	52h	SW	382	46114	10.34	0.00052	65021	Niche
Beas_gr 87	32°10'48.84"N, 77°17'02.33"E	x	52h	S	277	45977	10.34	0.00052	37021	Ice Cap

Beas_gr 88	32°10'44.23"N, 77°17'27.42"E	x	52h	SW	457	89500	14.52	0.00131	60021	Mountain
Beas_gr 89	32°10'36.96"N, 77°17'43.62"E	x	52h	S	247	53109	10.34	0.00052	60021	Mountain
Beas_gr 90	32°10'39.39"N, 77°19'00.86"E	x	52h	S	410	81579	13.62	0.00109	60021	Mountain
Beas_gr 91	32°11'01.77"N, 77°19'50.58"E	x	52h	S	666	1195362	44.88	0.05386	60021	Mountain
Beas_gr 92	32°11'06.64"N, 77°21'10.81"E	x	52h	S	612	613719	34.56	0.02108	60021	Mountain
Beas_gr 93	32°11'15.79"N, 77°22'03.81"E	x	52h	S	1253	1140532	44.02	0.05019	60021	Mountain
Beas_gr 94	32°11'07.58"N, 77°22'45.93"E	x	52h	SE	1199	493154	31.64	0.01550	60021	Mountain
Beas_gr 95	32°10'58.91"N, 77°23'14.94"E	x	52h	SE	883	280671	25.00	0.00700	67021	Ice Apron
Beas_gr 96	32°11'52.76"N, 77°22'54.39"E	x	52h	SE	4708	6565153	82.28	0.54056	63051	Mountain basin
Beas_gr 97	32°12'48.01"N, 77°24'03.18"E	Dudhon glacier	52h	SW		17273101	113.76	1.96460	52012	Valley glacier
Beas_gr 98	32°12'12.45"N, 77°25'21.75"E	x	52h	S	3334	2085764	55.06	0.11508	62021	Mountain basin
Beas_gr 99	32°11'05.81"N, 77°25'27.76"E	x	52h	S	3246	1835682	52.57	0.09673	60021	Mountain
Beas_gr 100	32°09'46.13"N, 77°25'26.94"E	x	52h	W	1448	1207218	45.02	0.05448	60021	Mountain
Beas_gr 101	32°09'02.73"N, 77°25'34.01"E	x	52h	NW	2417	1379195	47.29	0.06526	60021	Mountain
Beas_gr 102	32°08'49.91"N, 77°25'02.95"E	x	52h	NW	757	201494	21.51	0.00430	60021	Mountain
Beas_gr 103	32°08'35.26"N, 77°25'10.18"E	x	52h	NW	1035	282451	25.00	0.00700	63021	Mountain basin
Beas_gr 104	32°08'02.57"N, 77°25'20.14"E	x	52h	N	2294	961684	41.24	0.03959	60021	Mountain
Beas_gr 105	32°07'31.42"N, 77°24'30.72"E	Duahan Glacier	52h	N	4979	5591506	77.85	0.43518	62021	Mountain basin
Beas_gr 106	32°08'15.18"N, 77°23'42.64"E	x	52h	E	687	255289	24.20	0.00629	63051	Mountain basin
Beas_gr 107	32°08'49.00"N, 77°23'35.41"E	Samsi Glacier	52h	N	1622	599260	34.33	0.02060	63021	Mountain basin
Beas_gr 108	32°07'48.34"N, 77°22'54.79"E	x	52h	N	3756	2017187	54.39	0.10986	63021	Mountain basin
Beas_gr 109	32°07'43.23"N, 77°22'12.49"E	x	52h	N	2474	1312435	46.38	0.06076	63021	Mountain basin
Beas_gr 110	32°07'33.46"N, 77°21'46.89"E	x	52h	NW	350	151758	18.80	0.00282	64021	Cirque
Beas_gr 111	32°06'54.68"N, 77°22'23.91"E	x	52h	SW	762	158136	19.39	0.00310	60021	Mountain
Beas_gr 112	32°06'24.81"N, 77°23'25.28"E	x	52h	SW	1230	531177	32.66	0.01731	60021	Mountain
Beas_gr 113	32°06'22.91"N, 77°23'48.97"E	x	52h	S	1081	516664	32.41	0.01685	60021	Mountain
Beas_gr 114	32°05'51.43"N, 77°23'30.01"E	x	52h	W	909	416949	29.70	0.01247	63021	Mountain basin
Beas_gr 115	32°05'21.41"N, 77°23'23.39"E	x	52h	W	1417	656092	35.65	0.02353	67021	Ice Apron
Beas_gr 116	32°05'06.77"N, 77°23'56.69"E	x	52h	S	1351	548546	33.15	0.01823	60021	Mountain
Beas_gr 117	32°05'41.18"N, 77°24'06.61"E	x	52h	E	898	482785	31.37	0.01506	60021	Mountain
Beas_gr 118	32°06'05.68"N, 77°24'35.22"E	x	52h	S	617	566440	33.63	0.01917	60021	Mountain
Beas_gr 119	32°05'48.44"N, 77°25'41.03"E	x	52h	S	1051	800357	38.44	0.03076	60021	Mountain

Beas_gr 120	32°06'52.08"N, 77°25'57.52"E	x	52h	E	2590	1394258	47.42	0.06591	63021	Mountain basin
Beas_gr 121	32°07'31.89"N, 77°26'08.02"E	x	52h	E	2570	1877916	52.98	0.09961	62021	Mountain basin
Beas_gr 122	32°08'05.70"N, 77°26'23.17"E	x	52h	E	2010	556313	33.39	0.01870	63021	Mountain basin
Beas_gr 123	32°08'22.80"N, 77°26'03.71"E	x	52h	E	3094	1824911	52.36	0.09530	63021	Mountain basin
Beas_gr 124	32°09'16.95"N, 77°26'09.80"E	x	52h	SE	376	71969	12.64	0.00088	67021	Ice Apron
Beas_gr 125	32°09'48.64"N, 77°26'12.00"E	x	52h	SE	2291	1019981	42.21	0.04305	63021	Mountain basin
Beas_gr 126	32°10'52.78"N, 77°26'01.77"E	x	52h	SE	1645	739059	37.29	0.02760	63021	Mountain basin
Beas_gr 127	32°11'36.09"N, 77°26'50.33"E	x	52h	SE	959	723230	36.90	0.02657	60021	Mountain
Beas_gr 128	32°11'59.40"N, 77°31'14.49"E	Sara umga glacier	52h	S		63179177	173.25	10.94610	51012	Valley glacier
Beas_gr 129	32°13'49.68"N, 77°29'36.19"E	x	52h	E	617	180525	20.49	0.00369	60021	Mountain
Beas_gr 130	32°13'12.50"N, 77°30'36.39"E	x	52h	S	1503	360839	27.84	0.01002	63021	Mountain basin
Beas_gr 131	32°12'03.63"N, 77°33'46.89"E	x	52h	SW	1327	643760	35.22	0.02254	63021	Mountain basin
Beas_gr 132	32°11'32.91"N, 77°30'12.03"E	x	52h	W	1705	966923	41.41	0.04016	60021	Mountain
Beas_gr 133	32°10'38.93"N, 77°29'51.67"E	x	52h	W	2368	1157831	44.31	0.05140	63021	Mountain basin
Beas_gr 134	32°10'04.57"N, 77°29'40.25"E	x	52h	NW	1018	879892	39.89	0.03510	60021	Mountain
Beas_gr 135	32°10'14.72"N, 77°30'33.20"E	x	52h	S	3347	3103733	63.39	0.19652	63051	Mountain basin
Beas_gr 136	32°08'07.15"N, 77°32'34.76"E	x	52h	W		34682944	142.86	4.95425	52012	Valley glacier
Beas_gr 137	32°06'47.02"N, 77°30'23.80"E	x	52h	SW	1750	639952	35.22	0.02254	67021	Ice Apron
Beas_gr 138	32°06'44.37"N, 77°31'09.25"E	x	52h	S	1381	565538	33.63	0.01917	63021	Mountain basin
Beas_gr 139	32°06'41.17"N, 77°31'38.58"E	x	52h	S	1258	281196	25.00	0.00700	65021	Niche
Beas_gr 140	32°06'44.13"N, 77°32'04.52"E	x	52h	S	1369	554297	33.15	0.01823	63021	Mountain basin
Beas_gr 141	32°06'55.05"N, 77°32'49.96"E	x	52h	SE	1297	718334	36.90	0.02657	60021	Mountain
Beas_gr 142	32°07'19.46"N, 77°33'16.75"E	x	52h	E	866	363590	27.84	0.01002	60021	Mountain
Beas_gr 143	32°07'47.65"N, 77°33'47.10"E	x	52h	SE	1704	925500	40.74	0.03789	63021	Mountain basin
Beas_gr 144	32°08'22.25"N, 77°34'07.21"E	x	52h	S	1238	339665	27.18	0.00924	60021	Mountain
Beas_gr 145	32°08'07.90"N, 77°34'31.49"E	x	52h	SE	1960	896249	40.23	0.03621	63021	Mountain basin
Beas_gr 146	32°07'54.01"N, 77°35'44.75"E	Tichu glacier	52h	SW		43532199	153.74	6.69210	51012	Valley glacier
Beas_gr 147	32°05'40.82"N, 77°36'29.05"E	x	52h	SW	3603	2583721	59.39	0.15323	63021	Mountain basin
Beas_gr 148	32°05'05.94"N, 77°36'01.50"E	x	52h	SW	2458	998945	41.89	0.04189	63021	Mountain basin
Beas_gr 149	32°04'14.32"N, 77°35'17.35"E	x	52h	NW	5368	8960448	91.41	0.81901	62021	Mountain basin
Beas_gr 150	32°04'35.90"N, 77°34'03.10"E	x	52h	NE	2238	2245245	56.55	0.12723	60021	Mountain
Beas_gr 151	32°05'22.83"N, 77°33'28.62"E	x	52h	N	2077	2225699	56.36	0.12569	60021	Mountain

Beas_gr 152	32°04'28.53"N, 77°33'14.41"E	x	52h	N	2257	1213466	45.02	0.05448	60021	Mountain
Beas_gr 153	32°04'01.45"N, 77°32'30.38"E	x	52h	NW	2881	4014248	69.39	0.27826	63021	Mountain basin
Beas_gr 154	32°03'32.21"N, 77°31'12.94"E	x	52h	N	2827	2522207	58.89	0.14841	63021	Mountain basin
Beas_gr 155	32°03'08.61"N, 77°30'23.60"E	x	52h	NW	1344	661073	35.65	0.02353	63021	Mountain basin
Beas_gr 156	32°02'49.48"N, 77°31'15.39"E	x	52h	S	1685	715788	36.90	0.02657	60021	Mountain
Beas_gr 157	32°02'52.95"N, 77°32'12.32"E	x	52h	S	2852	2550847	59.14	0.15081	60021	Mountain
Beas_gr 158	32°03'03.42"N, 77°32'59.61"E	x	52h	S	2158	2137516	55.53	0.11884	60021	Mountain
Beas_gr 159	32°03'29.11"N, 77°34'20.94"E	x	52h	S	2083	1841622	52.57	0.09673	60021	Mountain
Beas_gr 160	32°02'33.51"N, 77°35'49.35"E	Parbati glacier	52h	SW	7735	11176612	98.46	1.10079	62021	Mountain basin
Beas_gr 161	32°01'39.88"N, 77°35'38.20"E	x	52h	SW	1762	822313	38.81	0.03183	60021	Mountain
Beas_gr 162	32°01'32.85"N, 77°36'34.36"E	x	52h	SW	3022	2507343	58.81	0.14761	60021	Mountain
Beas_gr 163	32°00'50.09"N, 77°36'53.10"E	x	52h	SW	713	181447	20.49	0.00369	64021	Cirque
Beas_gr 164	32°01'08.63"N, 77°37'16.43"E	x	52h	E	1271	561136	33.39	0.01870	60021	Mountain
Beas_gr 165	32°01'50.14"N, 77°37'39.32"E	x	52h	SE	2313	2477316	58.56	0.14522	60021	Mountain
Beas_gr 166	32°02'16.86"N, 77°38'13.45"E	x	52h	E	490	106498	16.12	0.00177	67021	Ice Apron
Beas_gr 167	32°01'55.37"N, 77°38'27.48"E	x	52h	SE	1123	267336	24.61	0.00664	67021	Ice Apron
Beas_gr 168	32°02'23.49"N, 77°39'12.28"E	x	52h	SE	292	197108	21.51	0.00430	67021	Ice Apron
Beas_gr 169	32°02'53.93"N, 77°38'12.55"E	x	52h	SE	4456	4376064	71.56	0.31342	60051	Mountain
Beas_gr 170	32°03'49.63"N, 77°37'35.22"E	x	52h	SE	3036	3157238	63.82	0.20169	60051	Mountain
Beas_gr 171	32°04'33.62"N, 77°37'22.02"E	x	52h	SE	1987	1964924	53.79	0.10543	60051	Mountain
Beas_gr 172	32°05'11.13"N, 77°37'18.42"E	x	52h	SE	1832	1809607	52.26	0.09458	60051	Mountain
Beas_gr 173	32°06'23.29"N, 77°38'24.61"E	x	52h	S		16663141	112.42	1.87285	51012	Valley glacier
Beas_gr 174	32°04'53.96"N, 77°38'57.91"E	x	52h	W	944	196099	21.51	0.00430	65051	Niche
Beas_gr 175	32°04'30.27"N, 77°39'24.44"E	x	52h	S	1499	632425	35.00	0.02205	63021	Mountain basin
Beas_gr 176	32°06'14.40"N, 77°40'49.05"E	x	52h	S	7931	13278377	104.28	1.38482	51012	Valley glacier
Beas_gr 177	32°05'22.74"N, 77°39'53.50"E	x	52h	SE	867	104100	15.35	0.00153	65021	Niche
Beas_gr 178	32°05'49.60"N, 77°39'51.65"E	x	52h	E	1641	703632	36.49	0.02554	60051	Mountain
Beas_gr 179	32°05'16.33"N, 77°41'35.29"E	x	52h	SE	3813	2600685	59.55	0.15484	60051	Mountain
Beas_gr 180	32°04'31.79"N, 77°44'13.73"E	Dibika glacier	52h	W		41699247	151.62	6.32265	52012	Valley glacier
Beas_gr 181	32°03'47.08"N, 77°43'31.07"E	x	52h	W	1677	668895	35.87	0.02403	67021	Ice Apron
Beas_gr 182	32°03'26.92"N, 77°42'49.17"E	x	52h	NW	1767	1149526	44.17	0.05079	67021	Ice Apron
Beas_gr 183	32°03'12.44"N, 77°42'21.28"E	x	52h	NW	2207	536496	32.91	0.01777	67021	Ice Apron

Beas_gr 184	32°02'34.43"N, 77°42'09.36"E	x	52h	NW	3613	1903031	53.19	0.10106	63021	Mountain basin
Beas_gr 185	32°02'12.03"N, 77°41'23.23"E	x	52h	NW	2357	1377315	47.29	0.06526	63021	Mountain basin
Beas_gr 186	32°01'54.32"N, 77°42'44.69"E	x	52h	NW	5308	4541750	72.45	0.32894	60021	Mountain
Beas_gr 187	32°01'15.78"N, 77°43'36.07"E	x	52h	SW	3346	2388378	57.79	0.13811	63021	Mountain basin
Beas_gr 188	31°59'52.83"N, 77°45'16.58"E	x	53e	NW		28619488	134.22	3.84149	52012	Valley glacier
Beas_gr 189	31°59'47.94"N, 77°40'51.35"E	x	53e	E	1562	617211	34.78	0.02156	60021	Mountain
Beas_gr 190	32°00'23.72"N, 77°40'44.13"E	x	52h	E	1225	488644	31.64	0.01550	67021	Ice Apron
Beas_gr 191	32°00'56.99"N, 77°40'22.76"E	x	52h	NE	955	381440	28.48	0.01082	67021	Ice Apron
Beas_gr 192	32°00'13.84"N, 77°39'57.44"E	x	52h	NW	1645	703968	36.49	0.02554	60021	Mountain
Beas_gr 193	31°59'34.40"N, 77°39'17.70"E	x	53e	SW	916	218384	22.46	0.00494	67021	Ice Apron
Beas_gr 194	31°59'29.93"N, 77°39'56.98"E	x	53e	S	791	423660	29.70	0.01247	64021	Cirque
Beas_gr 195	31°59'26.85"N, 77°40'30.61"E	x	53e	S	1026	310234	26.13	0.00810	64021	Cirque
Beas_gr 196	31°58'42.54"N, 77°41'38.37"E	x	53e	S	596	253580	23.79	0.00595	64021	Cirque
Beas_gr 197	31°58'07.05"N, 77°42'59.35"E	x	53e	SW	463	143544	18.18	0.00255	67021	Ice Apron
Beas_gr 198	31°58'22.56"N, 77°43'42.67"E	x	53e	S	613	143125	18.18	0.00255	60021	Mountain
Beas_gr 199	31°58'25.25"N, 77°44'17.89"E	x	53e	S	603	128906	17.53	0.00228	60021	Mountain
Beas_gr 200	31°58'03.61"N, 77°44'43.67"E	x	53e	SW	2318	1234236	45.30	0.05572	60021	Mountain
Beas_gr 201	31°57'40.39"N, 77°45'08.90"E	x	53e	SW	1488	527500	32.66	0.01731	63021	Mountain basin
Beas_gr 202	31°56'49.88"N, 77°45'45.89"E	x	53e	SW	1103	475299	31.37	0.01506	60021	Mountain
Beas_gr 203	31°56'27.67"N, 77°46'26.74"E	x	53e	S	751	197167	21.51	0.00430	65021	Niche
Beas_gr 204	31°55'48.08"N, 77°47'01.98"E	x	53e	NW	355	64239	11.56	0.00069	65021	Niche
Beas_gr 205	31°55'30.05"N, 77°46'37.38"E	x	53e	W	1127	220079	22.46	0.00494	37021	Ice Cap
Beas_gr 206	31°55'12.26"N, 77°47'09.16"E	x	53e	W	2320	836840	39.18	0.03291	67021	Ice Apron
Beas_gr 207	31°54'57.81"N, 77°49'25.71"E	x	53e	NW	2629	1612122	50.06	0.08060	63021	Mountain basin
Beas_gr 208	31°54'42.77"N, 77°48'56.01"E	x	53e	NW	1789	707432	36.69	0.02605	63021	Mountain basin
Beas_gr 209	31°54'43.52"N, 77°48'13.84"E	x	53e	NW	1997	792775	38.26	0.03022	60021	Mountain
Beas_gr 210	31°54'21.29"N, 77°47'48.19"E	x	53e	N	1656	973987	41.41	0.04016	60021	Mountain
Beas_gr 211	31°54'07.79"N, 77°47'17.81"E	x	53e	NW	1769	418278	29.70	0.01247	65021	Niche
Beas_gr 212	31°53'37.77"N, 77°47'43.31"E	x	53e	SW	1735	356745	27.84	0.01002	65021	Niche
Beas_gr 213	31°53'45.55"N, 77°48'14.57"E	x	53e	S	1523	575519	33.87	0.01964	60021	Mountain
Beas_gr 214	31°54'25.65"N, 77°48'59.87"E	x	53e	S	826	221047	22.46	0.00494	60021	Mountain
Beas_gr 215	31°54'09.30"N, 77°50'01.32"E	x	53e	SW	3266	2710918	60.44	0.16379	62021	Mountain basin

Beas_gr 216	31°53'09.76"N, 77°49'44.13"E	x	53e	NW	800	157726	19.39	0.00310	60021	Mountain
Beas_gr 217	31°52'38.66"N, 77°49'18.87"E	x	53e	N	1127	650115	35.44	0.02304	60021	Mountain
Beas_gr 218	31°52'35.15"N, 77°48'50.53"E	x	53e	N	1493	757788	37.68	0.02864	67021	Ice Apron
Beas_gr 219	31°52'32.85"N, 77°48'27.09"E	x	53e	N	810	366502	28.17	0.01042	67021	Ice Apron
Beas_gr 220	31°52'17.68"N, 77°47'53.70"E	x	53e	NW	457	486531	31.64	0.01550	67021	Ice Apron
Beas_gr 221	31°52'17.16"N, 77°48'43.28"E	x	53e	SW	431	241464	23.36	0.00561	60021	Mountain
Beas_gr 222	31°51'59.49"N, 77°49'02.65"E	x	53e	SW	445	155516	19.39	0.00310	60051	Mountain
Beas_gr 223	31°51'30.52"N, 77°48'55.26"E	x	53e	W	1877	1119680	43.73	0.04898	67021	Ice Apron
Beas_gr 224	31°51'17.96"N, 77°48'05.03"E	x	53e	NW	1652	506219	32.16	0.01640	67051	Ice Apron
Beas_gr 225	31°49'46.53"N, 77°49'41.36"E	x	53e	NW	4344	5476310	77.32	0.42371	63021	Mountain basin
Beas_gr 226	31°50'16.78"N, 77°48'33.76"E	x	53e	W	2433	1496351	48.77	0.07316	67051	Ice Apron
Beas_gr 227	31°49'34.38"N, 77°48'47.41"E	x	53e	W	1291	448999	30.56	0.01375	67051	Ice Apron
Beas_gr 228	31°49'12.39"N, 77°48'45.91"E	x	53e	NW	946	270258	24.61	0.00664	67051	Ice Apron
Beas_gr 229	31°48'28.44"N, 77°49'16.96"E	x	53e	SW	1198	604747	34.33	0.02060	60021	Mountain
Beas_gr 230	31°50'07.86"N, 77°47'09.94"E	x	53e	N		65677834	175.41	11.52119	51012	Valley glacier
Beas_gr 231	31°48'01.82"N, 77°47'05.67"E	x	53e	NE	2136	1241415	45.44	0.05634	60051	Mountain
Beas_gr 232	31°51'56.91"N, 77°45'44.98"E	x	53e	E	1235	388635	28.80	0.01123	67021	Ice Apron
Beas_gr 233	31°52'12.93"N, 77°45'23.20"E	x	53e	NE	1389	788505	38.26	0.03022	60021	Mountain
Beas_gr 234	31°52'36.11"N, 77°44'25.16"E	x	53e	NE	9165	14832442	108.17	1.60418	52012	Valley glacier
Beas_gr 235	31°53'27.98"N, 77°44'13.53"E	x	53e	E	2231	871477	39.71	0.03455	60021	Mountain
Beas_gr 236	31°53'37.99"N, 77°43'27.23"E	x	53e	NE	3167	3417305	65.63	0.22445	63021	Mountain basin
Beas_gr 237	31°54'14.69"N, 77°42'58.92"E	x	53e	NE	2523	1527532	49.13	0.07517	60021	Mountain
Beas_gr 238	31°54'50.99"N, 77°42'51.70"E	x	53e	NE	2519	892732	40.06	0.03566	63021	Mountain basin
Beas_gr 239	31°55'39.13"N, 77°42'37.74"E	x	53e	S	2025	1377157	47.29	0.06526	67021	Ice Apron
Beas_gr 240	31°55'10.06"N, 77°42'11.17"E	x	53e	S	840	250687	23.79	0.00595	67021	Ice Apron
Beas_gr 241	31°54'42.31"N, 77°41'53.22"E	x	53e	W	1618	569247	33.63	0.01917	67021	Ice Apron
Beas_gr 242	31°54'17.41"N, 77°42'29.05"E	x	53e	N	1144	403856	29.10	0.01164	60021	Mountain
Beas_gr 243	31°54'05.64"N, 77°41'54.70"E	x	53e	NW	1430	1069195	42.98	0.04599	60021	Mountain
Beas_gr 244	31°53'25.97"N, 77°42'10.76"E	x	53e	NW	3663	2648139	59.96	0.15889	63051	Mountain basin
Beas_gr 245	31°52'59.57"N, 77°41'45.94"E	x	53e	W	1595	1515519	49.01	0.07450	60051	Mountain
Beas_gr 246	31°52'54.77"N, 77°40'22.52"E	x	53e	NE	8693	15575449	109.95	1.71307	52012	Valley glacier
Beas_gr 247	31°53'44.18"N, 77°39'11.48"E	x	53e	SE	1620	963202	41.24	0.03959	60021	Mountain

Beas_gr 248	31°54'05.34"N, 77°39'51.41"E	x	53e	NE	1645	999333	41.89	0.04189	60021	Mountain
Beas_gr 249	31°54'20.86"N, 77°39'30.86"E	x	53e	NE	1608	729335	37.10	0.02708	60021	Mountain
Beas_gr 250	31°55'03.28"N, 77°39'33.87"E	x	53e	E	455	154042	18.80	0.00282	64021	Cirque
Beas_gr 251	31°55'25.38"N, 77°39'55.79"E	x	53e	E	1796	762690	37.68	0.02864	63021	Mountain basin
Beas_gr 252	31°55'50.52"N, 77°39'57.74"E	x	53e	E	737	310868	26.13	0.00810	67021	Ice Apron
Beas_gr 253	31°56'15.93"N, 77°40'07.73"E	x	53e	N	1008	983494	41.57	0.04074	67021	Ice Apron
Beas_gr 254	31°54'14.03"N, 77°38'11.06"E	x	53e	N	4898	8435842	89.58	0.75606	60021	Mountain
Beas_gr 255	31°54'22.78"N, 77°35'28.29"E	x	53e	NE	4908	7848133	87.41	0.68618	60021	Mountain
Beas_gr 256	31°55'22.84"N, 77°36'15.08"E	x	53e	SE	2414	2019436	54.39	0.10986	60021	Mountain
Beas_gr 257	31°55'39.40"N, 77°37'29.31"E	x	53e	NE	1923	1106699	43.58	0.04838	63021	Mountain basin
Beas_gr 258	31°56'33.02"N, 77°37'40.47"E	x	53e	SE	708	151328	18.80	0.00282	60021	Mountain
Beas_gr 259	31°56'55.35"N, 77°37'36.34"E	x	53e	NE	866	324519	26.48	0.00847	67021	Ice Apron
Beas_gr 260	31°56'15.65"N, 77°36'34.32"E	x	53e	NE	3612	3201035	64.11	0.20515	60021	Mountain
Beas_gr 261	31°57'04.82"N, 77°36'04.15"E	x	53e	NE	2425	1275502	45.98	0.05885	67021	Ice Apron
Beas_gr 262	31°57'56.51"N, 77°35'31.36"E	x	53e	NE	2041	972682	41.41	0.04016	67021	Ice Apron
Beas_gr 263	31°58'09.50"N, 77°35'13.39"E	x	53e	NE	787	270517	24.61	0.00664	67021	Ice Apron
Beas_gr 264	31°55'57.21"N, 77°35'09.45"E	x	53e	NW	4190	4785071	73.81	0.35356	63021	Mountain basin
Beas_gr 265	31°56'25.03"N, 77°34'26.01"E	x	53e	NE	1451	423111	29.70	0.01247	63021	Mountain basin
Beas_gr 266	31°56'35.31"N, 77°34'05.07"E	x	53e	NE	2561	970407	41.41	0.04016	63021	Mountain basin
Beas_gr 267	31°56'37.28"N, 77°33'45.76"E	x	53e	NW	886	152126	18.80	0.00282	65021	Niche
Beas_gr 268	31°55'04.08"N, 77°33'55.70"E	x	53e	NW	1551	855176	39.54	0.03400	63021	Mountain basin
Beas_gr 269	31°54'17.60"N, 77°33'23.79"E	x	53e	N	5024	4333387	71.27	0.30861	63021	Mountain basin
Beas_gr 270	31°54'27.13"N, 77°32'40.59"E	x	53e	N	1772	777307	38.07	0.02969	63021	Mountain basin
Beas_gr 271	31°55'07.99"N, 77°32'28.13"E	x	53e	NE	579	147796	18.80	0.00282	67021	Ice Apron
Beas_gr 272	31°54'41.25"N, 77°32'09.56"E	x	53e	N	1690	896857	40.23	0.03621	63021	Mountain basin
Beas_gr 273	31°54'36.45"N, 77°31'20.02"E	x	53e	NE	2712	1840961	52.57	0.09673	60021	Mountain
Beas_gr 274	31°55'43.00"N, 77°31'11.30"E	x	53e	NE	3931	2120331	55.34	0.11733	67021	Ice Apron
Beas_gr 275	31°56'23.22"N, 77°29'53.15"E	x	53e	E	2862	2211295	56.18	0.12416	63021	Mountain basin
Beas_gr 276	31°57'09.50"N, 77°30'33.11"E	x	53e	SE	1526	1469589	48.41	0.07116	63021	Mountain basin
Beas_gr 277	31°57'48.52"N, 77°31'14.67"E	x	53e	NE	1930	946745	41.08	0.03902	60021	Mountain
Beas_gr 278	31°58'24.54"N, 77°30'59.32"E	x	53e	NE	1707	572785	33.63	0.01917	63021	Mountain basin
Beas_gr 279	31°57'55.41"N, 77°30'16.68"E	x	53e	NE	2921	2300613	56.99	0.13109	63021	Mountain basin

Beas_gr 280	31°58'24.94"N, 77°29'22.57"E	x	53e	N	1020	664903	35.65	0.02353	67021	Ice Apron
Beas_gr 281	31°57'23.24"N, 77°29'36.66"E	x	53e	NW	2414	1013965	42.05	0.04247	63021	Mountain basin
Beas_gr 282	31°57'01.11"N, 77°29'00.51"E	x	53e	NW	1754	656227	35.65	0.02353	67021	Ice Apron
Beas_gr 283	31°55'28.45"N, 77°28'08.95"E	x	53e	N	625	662676	35.65	0.02353	67021	Ice Apron
Beas_gr 284	31°55'43.97"N, 77°26'47.63"E	x	53e	N	351	309854	26.13	0.00810	67021	Ice Apron
Beas_gr 285	31°56'03.93"N, 77°26'04.52"E	x	53e	NE	1909	426699	29.99	0.01289	65021	Niche
Beas_gr 286	31°56'49.69"N, 77°25'27.61"E	x	53e	N	823	817801	38.81	0.03183	60021	Mountain
Beas_gr 287	31°56'46.88"N, 77°24'51.16"E	x	53e	N	1412	570413	33.63	0.01917	60021	Mountain
Beas_gr 288	31°55'37.38"N, 77°25'21.60"E	x	53e	NW	1709	1648700	50.52	0.08335	60021	Mountain
Beas_gr 289	31°55'15.58"N, 77°24'54.14"E	x	53e	NW	2022	685817	36.28	0.02504	65021	Niche
Beas_gr 290	31°55'44.19"N, 77°29'00.41"E	x	53e	SE	478	124807	16.85	0.00202	37021	Ice Cap
Beas_gr 291	31°55'47.23"N, 77°29'37.67"E	x	53e	S	350	183666	20.49	0.00369	37021	Ice Cap
Beas_gr 292	31°54'56.89"N, 77°30'25.89"E	x	53e	S	484	164589	19.39	0.00310	37021	Ice Cap
Beas_gr 293	31°54'27.01"N, 77°30'35.20"E	x	53e	NW	550	224540	22.46	0.00494	60021	Mountain
Beas_gr 294	31°54'13.59"N, 77°30'05.82"E	x	53e	NW	1011	849877	39.36	0.03345	67021	Ice Apron
Beas_gr 295	31°54'06.98"N, 77°31'22.29"E	x	53e	SE	646	305234	26.13	0.00810	60021	Mountain
Beas_gr 296	31°53'37.53"N, 77°33'04.27"E	x	53e	SW	690	390614	28.80	0.01123	60021	Mountain
Beas_gr 297	31°53'29.25"N, 77°33'35.72"E	x	53e	S	1074	300424	25.76	0.00773	65021	Niche
Beas_gr 298	31°53'06.32"N, 77°35'00.84"E	x	53e	NW	4236	5687086	78.33	0.44567	62012	Mountain basin
Beas_gr 299	31°51'17.25"N, 77°33'41.17"E	x	53e	SW	2099	1837476	52.57	0.09673	63021	Mountain basin
Beas_gr 300	31°51'35.62"N, 77°32'52.93"E	x	53e	N	1394	441809	30.27	0.01332	63021	Mountain basin
Beas_gr 301	31°51'32.05"N, 77°32'25.73"E	x	53e	N	1510	810012	38.63	0.03129	63021	Mountain basin
Beas_gr 302	31°51'32.58"N, 77°31'35.16"E	x	53e	N	2253	1495898	48.77	0.07316	60021	Mountain
Beas_gr 303	31°51'33.73"N, 77°30'50.04"E	x	53e	N	900	793965	38.26	0.03022	67021	Ice Apron
Beas_gr 304	31°50'48.18"N, 77°34'44.44"E	x	53e	NE	738	246952	23.79	0.00595	60021	Mountain
Beas_gr 305	31°51'14.39"N, 77°34'31.63"E	x	53e	NE	1613	1051076	42.67	0.04481	60021	Mountain
Beas_gr 306	31°51'53.73"N, 77°34'52.96"E	x	53e	E	1787	781123	38.07	0.02969	60021	Mountain
Beas_gr 307	31°52'37.24"N, 77°35'23.90"E	x	53e	S	530	269353	24.61	0.00664	67021	Ice Apron
Beas_gr 308	31°52'43.37"N, 77°36'55.23"E	x	53e	S	3319	4343056	71.33	0.30957	60021	Mountain
Beas_gr 309	31°52'15.14"N, 77°37'14.44"E	x	53e	SW	2409	1488852	48.65	0.07249	60021	Mountain
Beas_gr 310	31°52'27.86"N, 77°38'03.87"E	x	53e	S	1535	622150	34.78	0.02156	63021	Mountain basin
Beas_gr 311	31°52'00.97"N, 77°38'50.39"E	x	53e	SW	1837	1135198	44.02	0.05019	63021	Mountain basin

Beas_gr 312	31°51'07.43"N, 77°39'05.28"E	x	53e	W	1992	3639656	67.08	0.24418	60021	Mountain
Beas_gr 313	31°50'53.92"N, 77°40'07.48"E	x	53e	SW	4258	4774481	73.71	0.35157	60021	Mountain
Beas_gr 314	31°50'44.70"N, 77°41'32.65"E	x	53e	S	3369	4344960	71.33	0.30957	63021	Mountain basin
Beas_gr 315	31°49'43.09"N, 77°41'49.67"E	x	53e	W	2888	1697844	51.07	0.08682	63021	Mountain basin
Beas_gr 316	31°49'18.19"N, 77°42'25.53"E	x	53e	NW	2469	1597241	49.95	0.07992	63021	Mountain basin
Beas_gr 317	31°48'02.49"N, 77°42'14.24"E	x	53e	NW	2825	5190470	75.89	0.39385	60021	Mountain
Beas_gr 318	31°47'56.03"N, 77°40'58.24"E	x	53e	NE	1938	1916755	53.39	0.10251	67021	Ice Apron
Beas_gr 319	31°47'46.07"N, 77°39'57.67"E	x	53e	N	1707	1212793	45.02	0.05448	67021	Ice Apron
Beas_gr 320	31°47'26.82"N, 77°40'47.47"E	x	53e	SW	1244	262464	24.20	0.00629	65021	Niche
Beas_gr 321	31°47'11.05"N, 77°41'07.66"E	x	53e	SW	949	607744	34.56	0.02108	64021	Cirque
Beas_gr 322	31°47'10.62"N, 77°41'58.18"E	x	53e	S	2066	1852606	52.67	0.09745	60021	Mountain
Beas_gr 323	31°47'37.75"N, 77°43'08.29"E	x	53e	S	785	261869	24.20	0.00629	67021	Ice Apron
Beas_gr 324	31°47'36.08"N, 77°43'39.41"E	x	53e	S	1750	401516	29.10	0.01164	67021	Ice Apron
Beas_gr 325	31°47'06.27"N, 77°44'04.95"E	x	53e	W	3708	1987859	54.09	0.10764	60021	Mountain
Beas_gr 326	31°45'19.05"N, 77°43'53.49"E	x	53e	NW	6730	15201488	109.06	1.65768	61021	Mountain basin
Beas_gr 327	31°45'09.22"N, 77°42'10.86"E	x	53e	N	1306	503880	31.90	0.01595	67021	Ice Apron
Beas_gr 328	31°44'57.26"N, 77°41'44.06"E	x	53e	NW	1906	810085	38.63	0.03129	67021	Ice Apron
Beas_gr 329	31°44'37.99"N, 77°41'24.95"E	x	53e	NW	1215	387975	28.80	0.01123	67021	Ice Apron
Beas_gr 330	31°43'07.09"N, 77°41'23.83"E	x	53e	N	3587	3784285	67.97	0.25694	63021	Mountain basin
Beas_gr 331	31°43'25.46"N, 77°40'20.96"E	x	53e	NE	1137	252806	23.79	0.00595	63021	Mountain basin
Beas_gr 332	31°43'29.04"N, 77°39'54.51"E	x	53e	NE	1261	420665	29.70	0.01247	63021	Mountain basin
Beas_gr 333	31°44'18.71"N, 77°39'16.68"E	x	53e	E	2479	2009449	54.29	0.10912	60021	Mountain
Beas_gr 334	31°44'46.92"N, 77°39'23.80"E	x	53e	SE	1159	397278	29.10	0.01164	63021	Mountain basin
Beas_gr 335	31°45'15.23"N, 77°40'28.76"E	x	53e	NE	931	517504	32.41	0.01685	67021	Ice Apron
Beas_gr 336	31°45'26.92"N, 77°39'38.79"E	x	53e	N	1884	1264165	45.71	0.05759	63021	Mountain basin
Beas_gr 337	31°45'18.26"N, 77°38'51.33"E	x	53e	N	2348	930585	40.74	0.03789	63021	Mountain basin
Beas_gr 338	31°45'05.38"N, 77°38'24.05"E	Banagal glacier	53e	N	981	637411	35.22	0.02254	60021	Mountain
Beas_gr 339	31°44'30.64"N, 77°37'53.58"E	x	53e	N	1695	1119721	43.73	0.04898	60021	Mountain
Beas_gr 340	31°44'01.38"N, 77°37'41.25"E	x	53e	N	914	245737	23.79	0.00595	65021	Niche
Beas_gr 341	31°43'49.23"N, 77°37'22.89"E	x	53e	N	583	239822	23.36	0.00561	65021	Niche
Beas_gr 342	31°43'59.22"N, 77°36'22.48"E	x	53e	N	474	355798	27.84	0.01002	37021	Ice Cap
Beas_gr 343	31°44'45.33"N, 77°35'26.71"E	x	53e	NE	396	148179	18.80	0.00282	67021	Ice Apron

Beas_gr 344	31°45'43.71"N, 77°35'33.46"E	x	53e	NE	337	115449	16.85	0.00202	67021	Ice Apron
Beas_gr 345	31°44'18.33"N, 77°31'33.85"E	x	53e	NE	1670	997732	41.89	0.04189	67021	Ice Apron
Beas_gr 346	31°43'46.10"N, 77°38'57.12"E	Jaryun glacier	53e	S	1492	519699	32.41	0.01685	60021	Mountain
Beas_gr 347	31°42'25.53"N, 77°40'21.25"E	x	53e	NW	1024	812269	38.63	0.03129	60021	Mountain
Beas_gr 348	31°41'34.00"N, 77°40'02.06"E	x	53e	NW	1704	928550	40.74	0.03789	63021	Mountain basin
Beas_gr 349	31°41'20.76"N, 77°39'37.43"E	x	53e	NW	1033	399514	29.10	0.01164	63021	Mountain basin
Beas_gr 350	31°40'35.85"N, 77°39'21.62"E	x	53e	N	2419	1145085	44.17	0.05079	63021	Mountain basin
Beas_gr 351	31°40'22.11"N, 77°38'54.93"E	x	53e	N	3053	1950592	53.69	0.10470	63021	Mountain basin
Beas_gr 352	31°40'05.62"N, 77°38'21.53"E	x	53e	N	2197	850976	39.36	0.03345	63021	Mountain basin
Beas_gr 353	31°39'59.11"N, 77°37'45.57"E	x	53e	NW	2338	1804718	52.15	0.09387	63021	Mountain basin
Beas_gr 354	31°39'53.13"N, 77°37'12.22"E	x	53e	NE	629	321136	26.48	0.00847	60021	Mountain
Beas_gr 355	31°40'07.50"N, 77°36'50.53"E	x	53e	NE	1374	310719	26.13	0.00810	65021	Niche
Beas_gr 356	31°40'03.51"N, 77°36'10.26"E	x	53e	NE	659	270010	24.61	0.00664	60021	Mountain
Beas_gr 357	31°40'00.27"N, 77°35'39.40"E	x	53e	NE	819	252139	23.79	0.00595	60021	Mountain
Beas_gr 358	31°39'27.79"N, 77°37'06.76"E	x	53e	W	1347	423001	29.70	0.01247	60021	Mountain

Inventory of Glaciers of Chenab River Basin

Number of Glaciers= 681 Area of Glaciers= 1704.73 km^2 Total Ice Reseerve= 187.66 km^3

Glacier Number	Latitude Longitude	Glacier Name	Map code	Orientation	Length (m)	Area (m^2)	Thickness (m)	Ice reserve (km^3)	Classification	Glacier Type
Chenab_gr 1	33°11'37.40"N, 76°30'15.88"E	x	52C	N	1663.6	1340711	46.77	0.06268	60021	Mountain
Chenab_gr 2	33°10'53.65"N, 76°30'51.26"E	x	52C	W	4742.5	5771975	78.70	0.45411	60021	Mountain
Chenab_gr 3	33°09'38.54"N, 76°28'09.80"E	x	52C	NW	3110.6	4302799	71.10	0.30573	60021	Mountain
Chenab_gr 4	33°09'03.59"N, 76°26'55.28"E	x	52C	NW	507.0	1728377	51.40	0.08892	60021	Mountain
Chenab_gr 5	33°09'43.62"N, 76°31'12.72"E	x	52C	SW	5856.7	7332128	85.40	0.62600	60021	Mountain
Chenab_gr 6	33°08'30.21"N, 76°30'31.99"E	x	52C	SW	1379.0	467619	31.11	0.01462	67021	Ice Apron
Chenab_gr 7	33°08'13.56"N, 76°31'02.38"E	x	52C	SW	1725.6	902813	40.23	0.03621	60021	Mountain
Chenab_gr 8	33°07'41.47"N, 76°31'06.64"E	x	52C	SW	1064.7	192969	21.01	0.00399	65021	Niche
Chenab_gr 9	33°07'54.07"N, 76°31'22.52"E	x	52C	S	777.4	135547	18.18	0.00255	60021	Mountain
Chenab_gr 10	33°08'53.24"N, 76°32'01.94"E	x	52C	S	3679.7	3980359	69.21	0.27546	60021	Mountain
Chenab_gr 11	33°10'11.53"N, 76°32'58.32"E	x	52C	E	2882.8	3988671	69.27	0.27639	60021	Mountain
Chenab_gr 12	33°11'42.42"N, 76°33'08.87"E	x	52C	E	3253.0	4856192	74.18	0.36053	60021	Mountain
Chenab_gr 13	33°12'17.94"N, 76°35'31.05"E	x	52C	W	1390.0	546812	33.15	0.01823	60021	Mountain
Chenab_gr 14	33°11'45.20"N, 76°35'32.91"E	x	52C	W	1334.3	374141	28.17	0.01042	63021	Mountain basin
Chenab_gr 15	33°10'14.26"N, 76°40'03.83"E	x	52C	N	3308.2	1897398	53.19	0.10106	60021	Mountain
Chenab_gr 16	33°09'41.20"N, 76°37'46.78"E	x	52C	NW	925.5	228672	22.92	0.00527	60021	Mountain
Chenab_gr 17	33°09'17.96"N, 76°37'30.61"E	x	52C	NW	796.7	294531	25.38	0.00736	60021	Mountain
Chenab_gr 18	33°09'14.30"N, 76°37'11.60"E	x	52C	NW	470.7	50078	10.34	0.00052	60021	Mountain
Chenab_gr 19	33°09'00.00"N, 76°37'18.52"E	x	52C	NW	653.5	119375	16.85	0.00202	60021	Mountain
Chenab_gr 20	33°08'46.74"N, 76°36'56.56"E	x	52C	W	833.2	176142	20.49	0.00369	65021	Niche
Chenab_gr 21	33°08'26.33"N, 76°36'56.83"E	x	52C	W	331.6	78516	13.62	0.00109	60021	Mountain
Chenab_gr 22	33°09'13.44"N, 76°38'04.06"E	x	52C	S	1956.0	527999	32.66	0.01731	63021	Mountain basin
Chenab_gr 23	33°09'03.18"N, 76°38'21.23"E	x	52C	S	564.1	127656	17.53	0.00228	60021	Mountain

Chenab_gr 24	33°09'16.21"N, 76°38'56.32"E	x	52C	S	1425.4	855351	39.54	0.03400	60021	Mountain	
Chenab_gr 25	33°09'40.45"N, 76°39'19.42"E	x	52C	S	723.1	307656	26.13	0.00810	60021	Mountain	
Chenab_gr 26	33°09'28.06"N, 76°41'11.93"E	x	52C	SW	3612.0	3348314	65.15	0.21826	60021	Mountain	
Chenab_gr 27	33°08'05.81"N, 76°41'43.34"E	x	52C	SW	3669.2	3705834	67.53	0.25054	60021	Mountain	
Chenab_gr 28	33°07'28.90"N, 76°42'08.97"E	x	52C	SW	1208.8	642755	35.22	0.02254	60021	Mountain	
Chenab_gr 29	33°06'20.33"N, 76°42'26.75"E	x	52C	W	3586.3	3093888	63.32	0.19566	60021	Mountain	
Chenab_gr 30	33°05'43.50"N, 76°43'20.34"E	x	52C	SW	1766.9	1171406	44.46	0.05201	60021	Mountain	
Chenab_gr 31	33°05'00.29"N, 76°42'37.34"E	x	52C	W	772.4	133359	17.53	0.00228	65021	Niche	
Chenab_gr 32	33°04'51.74"N, 76°43'01.38"E	x	52C	W	1559.0	353737	27.51	0.00963	37021	Ice Cap	
Chenab_gr 33	33°04'23.07"N, 76°42'55.11"E	x	52C	W	637.5	114141	16.12	0.00177	60021	Mountain	
Chenab_gr 34	33°03'49.91"N, 76°43'24.88"E	x	52C	SW	1421.7	396150	29.10	0.01164	60021	Mountain	
Chenab_gr 35	33°03'12.46"N, 76°43'55.74"E	x	52C	SW	1168.2	490712	31.64	0.01550	60021	Mountain	
Chenab_gr 36	33°02'51.33"N, 76°43'56.04"E	x	52C	SW	1256.7	439366	30.27	0.01332	60021	Mountain	
Chenab_gr 37	33°01'57.71"N, 76°43'46.78"E	x	52C	NW	1137.4	249531	23.79	0.00595	60021	Mountain	
Chenab_gr 38	33°01'06.05"N, 76°42'53.80"E	x	52C	NW	1002.4	340469	27.18	0.00924	60021	Mountain	
Chenab_gr 39	33°00'37.38"N, 76°41'50.84"E	x	52C	N	3136.2	2454988	58.30	0.14284	60021	Mountain	
Chenab_gr 40	33°01'16.23"N, 76°41'56.53"E	x	52C	N	1332.5	474922	31.11	0.01462	60021	Mountain	
Chenab_gr 41	33°01'20.83"N, 76°41'24.87"E	x	52C	E	924.5	428488	29.99	0.01289	60021	Mountain	
Chenab_gr 42	33°01'47.41"N, 76°41'14.67"E	x	52C	E	586.8	134688	17.53	0.00228	60021	Mountain	
Chenab_gr 43	33°04'22.64"N, 76°39'13.27"E	x	52C	E	417.8	44688	8.94	0.00036	65021	Niche	
Chenab_gr 44	33°04'20.41"N, 76°38'44.16"E	x	52C	E	532.5	54688	10.34	0.00052	65021	Niche	
Chenab_gr 45	33°04'41.47"N, 76°38'32.94"E	x	52C	NE	288.9	40703	8.94	0.00036	65021	Niche	
Chenab_gr 46	33°05'00.91"N, 76°37'58.67"E	x	52C	NE	896.7	183984	20.49	0.00369	60021	Mountain	
Chenab_gr 47	33°05'32.05"N, 76°37'53.43"E	x	52C	N	1241.1	376059	28.48	0.01082	67021	Ice Apron	
Chenab_gr 48	33°05'24.56"N, 76°36'33.53"E	x	52C	N	2047.5	815146	38.81	0.03183	67021	Ice Apron	
Chenab_gr 49	33°04'44.80"N, 76°37'32.46"E	x	52C	S	406.3	67813	12.64	0.00088	65021	Niche	
Chenab_gr 50	33°04'16.79"N, 76°38'01.97"E	x	52C	S	765.2	225938	22.92	0.00527	64021	Cirque	
Chenab_gr 51	33°04'06.29"N, 76°38'13.03"E	x	52C	E	282.5	36016	8.94	0.00036	64021	Cirque	
Chenab_gr 52	33°03'48.08"N, 76°38'50.71"E	x	52C	S	989.0	228477	22.92	0.00527	63021	Mountain basin	
Chenab_gr 53	33°01'01.12"N, 76°39'47.17"E	x	52C	NW	8331.8	13039435	103.65	1.35157	53012	Valley glacier	
Chenab_gr 54	33°00'38.68"N, 76°38'11.00"E	x	52C	W	2811.1	2967458	62.44	0.18545	53012	Valley glacier	
Chenab_gr 55	32°59'22.31"N, 76°38'15.29"E	x	52D	SW	5049.6	7145570	84.68	0.60548	67021	Ice Apron	
Chenab_gr 56	32°59'29.52"N, 76°39'46.46"E	x	52D	SW	2989.2	1767401	51.83	0.09174	63021	Mountain basin	

Chenab_gr 57	32°57'50.22"N, 76°39'43.29"E	x	52D	W	627.0	171016	19.95	0.00339	60021	Mountain
Chenab_gr 58	32°55'39.46"N, 76°37'26.76"E	x	52D	N	4455.3	3850054	68.41	0.26339	63021	Mountain basin
Chenab_gr 59	32°56'26.84"N, 76°35'54.31"E	x	52D	NE	5957.0	3632565	67.02	0.24327	60021	Mountain
Chenab_gr 60	32°56'56.40"N, 76°34'50.74"E	x	52D	SE	1407.6	445547	30.56	0.01375	60021	Mountain
Chenab_gr 61	32°57'25.20"N, 76°34'55.12"E	x	52D	NE	932.9	242381	23.36	0.00561	65021	Niche
Chenab_gr 62	32°57'29.53"N, 76°34'04.63"E	x	52D	W	571.6	68516	12.64	0.00088	65021	Niche
Chenab_gr 63	32°55'47.43"N, 76°33'03.89"E	Kalibari reburf glacier	52D	NW	6296.2	7296844	85.28	0.62257	63021	Mountain basin
Chenab_gr 64	32°57'45.63"N, 76°31'08.27"E	x	52D	E	1749.2	546204	33.15	0.01823	67021	Ice Apron
Chenab_gr 65	32°58'19.56"N, 76°29'55.45"E	Mojjar glacier	52D	N	3252.3	2354666	57.44	0.13498	60021	Mountain
Chenab_gr 66	32°57'05.61"N, 76°30'10.93"E	x	52D	SW	598.6	84766	13.62	0.00109	60021	Mountain
Chenab_gr 67	32°56'52.16"N, 76°30'17.75"E	x	52D	SW	1021.6	192090	21.01	0.00399	60021	Mountain
Chenab_gr 68	32°56'35.98"N, 76°30'48.10"E	x	52D	S	2341.0	941973	40.91	0.03846	60021	Mountain
Chenab_gr 69	32°56'14.74"N, 76°31'26.04"E	x	52D	SW	1591.4	243984	23.36	0.00561	65021	Niche
Chenab_gr 70	32°54'54.85"N, 76°32'19.41"E	x	52D	W	2198.5	1096704	43.43	0.04778	63021	Mountain basin
Chenab_gr 71	32°53'57.43"N, 76°30'32.13"E	Ramdhari jariun glacier	52D	NW	6618.6	9928296	94.62	0.93962	63021	Mountain basin
Chenab_gr 72	32°53'17.99"N, 76°29'05.81"E	x	52D	NW	3222.3	5608139	77.95	0.43727	63021	Mountain basin
Chenab_gr 73	32°53'00.30"N, 76°27'27.51"E	Jatbarn ment glacier	52D	NW	5228.8	7874388	87.49	0.68852	63021	Mountain basin
Chenab_gr 74	32°52'15.89"N, 76°26'19.73"E	x	52D	NW	590.8	145437	18.80	0.00282	60021	Mountain
Chenab_gr 75	32°51'51.98"N, 76°26'09.02"E	x	52D	SW	872.4	189922	21.01	0.00399	65021	Niche
Chenab_gr 76	32°51'53.00"N, 76°27'09.84"E	x	52D	SW	388.5	97969	15.35	0.00153	64021	Cirque
Chenab_gr 77	32°52'19.67"N, 76°29'13.08"E	x	52D	S	1149.3	770391	37.88	0.02917	60021	Mountain
Chenab_gr 78	32°52'51.01"N, 76°30'18.63"E	x	52D	S	2072.5	1394762	47.42	0.06591	60021	Mountain
Chenab_gr 79	32°52'11.02"N, 76°30'43.38"E	x	52D	S	1627.6	478266	31.37	0.01506	67021	Ice Apron
Chenab_gr 80	32°52'21.43"N, 76°30'56.87"E	x	52D	S	1186.1	209772	22.00	0.00462	67021	Ice Apron
Chenab_gr 81	32°53'02.65"N, 76°32'14.87"E	Urgand glacier	52D	S	4659.2	5490386	77.37	0.42475	60021	Mountain
Chenab_gr 82	32°53'18.35"N, 76°34'17.48"E	x	52D	S	1780.1	1000249	41.89	0.04189	60021	Mountain
Chenab_gr 83	32°53'10.19"N, 76°35'02.16"E	x	52D	S	1422.8	370469	28.17	0.01042	65021	Niche
Chenab_gr 84	32°52'53.70"N, 76°35'30.03"E	x	52D	S	785.4	231094	22.92	0.00527	65021	Niche
Chenab_gr 85	32°53'59.51"N, 76°34'40.85"E	x	52D	S	8790.9	16517575	112.10	1.85194	63021	Mountain basin
Chenab_gr 86	32°54'52.84"N, 76°37'39.48"E	x	52D	S	804.4	220938	22.46	0.00494	64021	Cirque

Chenab_gr 87	32°51'34.67"N, 76°38'22.95"E	x	52D	E	936.6	138516	18.18	0.00255	65021	Niche
Chenab_gr 88	32°52'09.98"N, 76°38'26.37"E	x	52D	E	773.1	96875	15.35	0.00153	65021	Niche
Chenab_gr 89	32°52'42.68"N, 76°38'32.04"E	x	52D	SE	670.9	338700	27.18	0.00924	60021	Mountain
Chenab_gr 90	32°53'18.10"N, 76°39'01.34"E	x	52D	SE	871.7	236953	23.36	0.00561	60021	Mountain
Chenab_gr 91	32°53'06.25"N, 76°38'35.04"E	x	52D	SE	405.1	117031	16.85	0.00202	60021	Mountain
Chenab_gr 92	32°53'40.19"N, 76°38'36.37"E	x	52D	E	1662.6	932726	40.74	0.03789	60021	Mountain
Chenab_gr 93	32°54'08.37"N, 76°38'18.61"E	x	52D	NE	2036.0	911875	40.41	0.03677	60021	Mountain
Chenab_gr 94	32°54'44.36"N, 76°38'39.25"E	x	52D	E	708.8	155156	19.39	0.00310	60021	Mountain
Chenab_gr 95	32°55'14.18"N, 76°38'50.53"E	x	52D	E	853.9	161875	19.39	0.00310	60021	Mountain
Chenab_gr 96	32°54'56.80"N, 76°38'21.29"E	x	52D	E	1077.2	198125	21.51	0.00430	60021	Mountain
Chenab_gr 97	32°55'33.09"N, 76°38'49.47"E	x	52D	E	643.6	88750	14.52	0.00131	65021	Niche
Chenab_gr 98	32°55'49.75"N, 76°39'00.40"E	x	52D	E	430.3	77578	13.62	0.00109	60021	Mountain
Chenab_gr 99	32°56'03.68"N, 76°39'10.42"E	x	52D	SE	903.3	105520	16.12	0.00177	65021	Niche
Chenab_gr 100	32°56'34.14"N, 76°39'28.14"E	x	52D	SE	1170.7	286250	25.38	0.00736	60021	Mountain
Chenab_gr 101	32°56'58.01"N, 76°39'38.67"E	x	52D	S	1728.2	428533	29.99	0.01289	60021	Mountain
Chenab_gr 102	32°57'17.39"N, 76°40'02.98"E	x	52D	S	1063.5	404935	29.10	0.01164	60021	Mountain
Chenab_gr 103	32°56'55.89"N, 76°41'00.41"E	x	52D	NE	950.8	149901	18.80	0.00282	60021	Mountain
Chenab_gr 104	32°58'15.92"N, 76°40'45.70"E	x	52D	SE	4236.6	6797244	83.25	0.56609	60021	Mountain
Chenab_gr 105	32°57'49.81"N, 76°43'06.90"E	x	52D	NE	663.2	145625	18.80	0.00282	60021	Mountain
Chenab_gr 106	32°58'03.79"N, 76°42'43.46"E	x	52D	NE	1323.2	314609	26.13	0.00810	60021	Mountain
Chenab_gr 107	32°59'36.93"N, 76°41'19.49"E	x	52D	SE	5796.6	8982355	91.48	0.82145	53012	Valley glacier
Chenab_gr 108	33°00'24.62"N, 76°43'39.91"E	x	52D	S	1827.7	1366719	47.16	0.06461	60021	Mountain
Chenab_gr 109	33°00'05.39"N, 76°44'31.17"E	x	52D	S	1484.9	631094	35.00	0.02205	60021	Mountain
Chenab_gr 110	33°00'01.54"N, 76°45'00.00"E	x	52D	S	2226.3	626415	35.00	0.02205	63021	Mountain basin
Chenab_gr 111	33°00'13.96"N, 76°45'37.60"E	x	52D	SW	3054.9	2860265	61.61	0.17620	63021	Mountain basin
Chenab_gr 112	32°59'12.48"N, 76°46'21.46"E	x	52D	SW	2277.6	1503399	48.77	0.07316	60021	Mountain
Chenab_gr 113	32°58'54.65"N, 76°46'50.50"E	x	52D	SW	1155.6	374766	28.17	0.01042	65021	Niche
Chenab_gr 114	32°58'50.81"N, 76°47'27.95"E	x	52D	SE	601.3	85312	14.52	0.00131	60021	Mountain
Chenab_gr 115	32°59'21.67"N, 76°48'08.37"E	x	52D	SE	1170.1	297969	25.76	0.00773	63021	Mountain basin
Chenab_gr 116	32°59'49.57"N, 76°48'51.91"E	x	52D	NE	2017.1	1124549	43.73	0.04898	60021	Mountain
Chenab_gr 117	33°00'12.85"N, 76°47'12.40"E	x	52D	NE	6540.3	8884946	91.13	0.80925	63021	Mountain basin
Chenab_gr 118	33°01'08.32"N, 76°47'09.75"E	x	52C	NE	1734.2	987813	41.73	0.04131	60021	Mountain
Chenab_gr 119	33°01'57.18"N, 76°47'13.56"E	x	52C	NE	3368.1	2044322	54.58	0.11134	63021	Mountain basin

Chenab_gr 120	33°02'30.64"N, 76°47'02.01"E	x	52C	SE	730.6	145547	18.80	0.00282	60021	Mountain
Chenab_gr 121	33°02'20.72"N, 76°45'05.66"E	x	52C	NE	8299.9	14519096	107.42	1.55968	61021	Mountain basin
Chenab_gr 122	33°04'13.24"N, 76°44'54.60"E	x	52C	E	1061.1	248906	23.79	0.00595	60021	Mountain
Chenab_gr 123	33°04'59.66"N, 76°46'03.90"E	x	52C	NE	1285.8	547211	33.15	0.01823	60021	Mountain
Chenab_gr 124	33°04'34.15"N, 76°43'40.52"E	x	52C	NE	4670.1	2847260	61.53	0.17537	63021	Mountain basin
Chenab_gr 125	33°05'23.90"N, 76°43'43.71"E	x	52C	NE	1099.4	516097	32.41	0.01685	63021	Mountain basin
Chenab_gr 126	33°06'01.58"N, 76°43'49.74"E	x	52C	S	692.9	122969	16.85	0.00202	65021	Niche
Chenab_gr 127	33°06'10.86"N, 76°44'08.14"E	x	52C	SE	562.1	97422	15.35	0.00153	65021	Niche
Chenab_gr 128	33°06'39.82"N, 76°43'27.09"E	x	52C	NE	2626.9	1390763	47.42	0.06591	63021	Mountain basin
Chenab_gr 129	33°06'53.58"N, 76°43'09.60"E	x	52C	NE	744.9	82656	13.62	0.00109	65021	Niche
Chenab_gr 130	33°07'08.04"N, 76°42'58.53"E	x	52C	NE	736.9	157044	19.39	0.00310	60021	Mountain
Chenab_gr 131	33°07'50.22"N, 76°42'52.41"E	x	52C	NE	755.4	118281	16.85	0.00202	60021	Mountain
Chenab_gr 132	33°11'00.80"N, 76°46'51.44"E	Kangla, Miyar glacier	52C	SW	9833.1	25139512	128.67	3.23481	51012	Valley glacier
Chenab_gr 133	33°10'12.84"N, 76°46'16.94"E	x	52C	NW	512.5	94922	14.52	0.00131	60021	Mountain
Chenab_gr 134	33°10'08.46"N, 76°46'02.85"E	x	52C	NW	672.7	75781	13.62	0.00109	60021	Mountain
Chenab_gr 135	33°10'17.14"N, 76°45'36.15"E	x	52C	W	378.7	54844	10.34	0.00052	60021	Mountain
Chenab_gr 136	33°09'19.69"N, 76°45'48.29"E	x	52C	SW	423.9	109062	16.12	0.00177	65021	Niche
Chenab_gr 137	33°09'29.07"N, 76°45'55.44"E	x	52C	SW	380.1	105078	16.12	0.00177	65021	Niche
Chenab_gr 138	33°09'41.94"N, 76°46'10.07"E	x	52C	SW	840.4	311953	26.13	0.00810	60021	Mountain
Chenab_gr 139	33°09'33.53"N, 76°47'45.81"E	Jaugpar glacier	52C	SW	698.5	4177266	70.40	0.29429	62021	Mountain basin
Chenab_gr 140	33°09'30.93"N, 76°48'34.03"E	x	52C	S	1233.5	594144	34.10	0.02012	60021	Mountain
Chenab_gr 141	33°10'20.90"N, 76°49'12.65"E	x	52C	SW	4694.3	1811036	52.26	0.09458	60021	Mountain
Chenab_gr 142	33°12'29.76"N, 76°49'45.09"E	x	52C	S	919.4	1876314	52.98	0.09961	60021	Mountain
Chenab_gr 143	33°09'02.97"N, 76°49'16.70"E	Chhudong glacier	52C	SW	2621.2	3160095	63.82	0.20169	50012	Valley glacier
Chenab_gr 144	33°07'03.87"N, 76°49'59.24"E	Takdubng glacier	52C	W	6381.1	11526310	99.48	1.14701	50012	Valley glacier
Chenab_gr 145	33°05'51.32"N, 76°50'17.80"E	x	52C	SW	1786.3	301321	25.76	0.00773	65021	Niche
Chenab_gr 146	33°05'18.60"N, 76°50'40.73"E	x	52C	SE	593.2	192641	21.01	0.00399	64021	Cirque
Chenab_gr 147	33°04'30.04"N, 76°51'31.16"E	x	52C	SE	770.3	189531	21.01	0.00399	65021	Niche
Chenab_gr 148	33°04'50.80"N, 76°51'14.11"E	x	52C	SE	429.4	43047	8.94	0.00036	65021	Niche
Chenab_gr 149	33°04'57.70"N, 76°51'18.79"E	x	52C	S	316.2	94429	14.52	0.00131	65021	Niche

Chenab_gr 150	33°05'22.80"N, 76°51'02.03"E	x	52C	SE	504.3	99922	15.35	0.00153	60021	Mountain
Chenab_gr 151	33°05'59.25"N, 76°51'06.04"E	x	52C	SE	2260.4	881038	39.89	0.03510	63051	Mountain basin
Chenab_gr 152	33°06'37.67"N, 76°51'10.86"E	x	52C	SE	1923.1	851906	39.36	0.03345	62051	Mountain basin
Chenab_gr 153	33°06'25.26"N, 76°52'03.76"E	Gumba glacier	52C	S	2229.2	2137249	55.53	0.11884	50012	Valley glacier
Chenab_gr 154	33°05'30.51"N, 76°53'41.92"E	x	52C	SW	5833.0	7421135	85.76	0.63631	50512	Valley glacier
Chenab_gr 155	33°04'34.40"N, 76°54'02.87"E	x	52C	W	2797.1	1219000	45.16	0.05510	60051	Mountain
Chenab_gr 156	33°04'09.51"N, 76°53'44.43"E	x	52C	W	564.2	204459	21.51	0.00430	63021	Mountain basin
Chenab_gr 157	33°03'28.87"N, 76°54'58.73"E	x	52C	NE	334.0	803932	38.44	0.03076	50012	Valley glacier
Chenab_gr 158	33°02'24.60"N, 76°54'31.53"E	x	52C	SE	1097.0	326969	26.83	0.00886	65021	Niche
Chenab_gr 159	33°02'06.26"N, 76°55'07.86"E	x	52C	NE	2258.4	65000	11.56	0.00069	60021	Mountain
Chenab_gr 160	33°01'22.14"N, 76°54'00.11"E	x	52C	NE	2256.7	2787785	61.07	0.17038	62021	Mountain basin
Chenab_gr 161	33°00'09.98"N, 76°53'08.53"E	x	52C	NE	372.8	24766	5.14	0.00010	64021	Cirque
Chenab_gr 162	33°00'39.52"N, 76°54'09.44"E	x	52C	S	487.5	89717	14.52	0.00131	64021	Cirque
Chenab_gr 163	33°00'25.21"N, 76°54'27.21"E	x	52C	S	1099.8	301172	25.76	0.00773	65021	Niche
Chenab_gr 164	32°59'59.57"N, 76°54'50.18"E	x	52D	SW	1148.8	197031	21.51	0.00430	62021	Mountain basin
Chenab_gr 165	32°59'45.72"N, 76°55'21.71"E	x	52D	SW	543.1	74844	12.64	0.00088	65021	Niche
Chenab_gr 166	32°58'29.37"N, 76°55'02.81"E	x	52D	W	3053.1	1186318	44.74	0.05324	65021	Niche
Chenab_gr 167	32°57'02.28"N, 76°54'38.97"E	x	52D	NW	4216.2	5097240	75.43	0.38469	60021	Mountain
Chenab_gr 168	32°55'47.12"N, 76°54'04.41"E	x	52D	NW	5520.3	6801618	83.25	0.56609	63021	Mountain basin
Chenab_gr 169	32°55'40.12"N, 76°52'36.77"E	x	52D	NW	809.8	187187	21.01	0.00399	65021	Niche
Chenab_gr 170	32°55'00.69"N, 76°53'51.44"E	x	52D	SW	1953.3	568666	33.63	0.01917	65021	Niche
Chenab_gr 171	32°54'23.86"N, 76°53'35.28"E	x	52D	S	1240.4	405312	29.40	0.01205	65021	Niche
Chenab_gr 172	32°54'22.50"N, 76°53'09.18"E	x	52D	W	436.1	48594	10.34	0.00052	60021	Mountain
Chenab_gr 173	32°54'10.85"N, 76°54'07.20"E	x	52D	SW	688.9	279453	25.00	0.00700	64021	Cirque
Chenab_gr 174	32°53'24.50"N, 76°52'47.88"E	x	52D	NW	8196.5	8073701	88.23	0.71204	52012	Valley glacier
Chenab_gr 175	32°53'03.46"N, 76°50'57.92"E	x	52D	NW	7438.6	8201845	88.71	0.72744	53012	Valley glacier
Chenab_gr 176	32°52'25.78"N, 76°49'39.32"E	x	52D	NW	6462.3	4103516	69.93	0.28672	53012	Valley glacier
Chenab_gr 177	32°51'36.98"N, 76°47'51.40"E	x	52D	N	6942.6	6592115	82.36	0.54277	53012	Valley glacier
Chenab_gr 178	32°52'56.12"N, 76°46'48.33"E	x	52D	N	1073.7	188203	21.01	0.00399	65021	Niche
Chenab_gr 179	32°53'27.17"N, 76°45'36.85"E	x	52D	N	389.3	57969	11.56	0.00069	64021	Cirque
Chenab_gr 180	32°52'17.41"N, 76°46'20.15"E	x	52D	NW	1748.9	681016	36.08	0.02453	63021	Mountain basin
Chenab_gr 181	32°51'25.89"N, 76°46'22.05"E	x	52D	NW	1087.8	362109	27.84	0.01002	60021	Mountain
Chenab_gr 182	32°51'25.36"N, 76°45'48.12"E	x	52D	NW	397.6	57422	11.56	0.00069	60021	Mountain

Chenab_gr 183	32°51'00.73"N, 76°45'08.67"E	x	52D	NW	369.7	46563	10.34	0.00052	60021	Mountain
Chenab_gr 184	32°50'18.63"N, 76°44'52.32"E	x	52D	NW	880.8	271563	24.61	0.00664	60021	Mountain
Chenab_gr 185	32°50'42.00"N, 76°44'51.04"E	x	52D	NW	823.2	69687	12.64	0.00088	65021	Niche
Chenab_gr 186	32°50'10.17"N, 76°44'35.30"E	x	52D	W	322.0	63594	11.56	0.00069	60021	Mountain
Chenab_gr 187	32°50'01.23"N, 76°44'13.80"E	x	52D	SW	428.1	50469	10.34	0.00052	65021	Niche
Chenab_gr 188	32°48'48.73"N, 76°44'11.09"E	x	52D	NW	1813.3	846719	39.36	0.03345	63021	Mountain basin
Chenab_gr 189	32°49'24.01"N, 76°45'56.41"E	x	52D	SW	7198.8	4318262	71.22	0.30765	53012	Valley glacier
Chenab_gr 190	32°48'46.78"N, 76°46'51.11"E	x	52D	SE	1095.3	602188	34.33	0.02060	60021	Mountain
Chenab_gr 191	32°49'15.28"N, 76°46'43.72"E	x	52D	SE	1001.9	292891	25.38	0.00736	60021	Mountain
Chenab_gr 192	32°49'42.34"N, 76°46'49.82"E	x	52D	SE	1349.5	819453	38.81	0.03183	60021	Mountain
Chenab_gr 193	32°50'27.75"N, 76°47'13.08"E	x	52D	S	4221.1	2939891	62.22	0.18291	60021	Mountain
Chenab_gr 194	32°50'23.82"N, 76°48'16.26"E	x	52D	S	2041.3	1382164	47.29	0.06526	60021	Mountain
Chenab_gr 195	32°49'59.50"N, 76°49'09.49"E	x	52D	SE	412.5	86250	14.52	0.00131	60021	Mountain
Chenab_gr 196	32°50'13.89"N, 76°49'02.88"E	x	52D	SE	938.1	202266	21.51	0.00430	60021	Mountain
Chenab_gr 197	32°50'52.47"N, 76°49'22.36"E	x	52D	SE	2957.8	2785295	61.07	0.17038	60021	Mountain
Chenab_gr 198	32°51'22.26"N, 76°49'55.93"E	x	52D	SE	688.3	195313	21.51	0.00430	60021	Mountain
Chenab_gr 199	32°51'41.42"N, 76°50'38.04"E	x	52D	S	1751.7	1108516	43.58	0.04838	60021	Mountain
Chenab_gr 200	32°51'43.26"N, 76°52'16.73"E	x	52D	S	886.2	291829	25.38	0.00736	63021	Mountain basin
Chenab_gr 201	32°52'12.59"N, 76°52'32.57"E	x	52D	S	965.7	166482	19.95	0.00339	63021	Mountain basin
Chenab_gr 202	32°52'12.71"N, 76°53'01.53"E	x	52D	SE	1691.5	667790	35.87	0.02403	63021	Mountain basin
Chenab_gr 203	32°50'46.68"N, 76°54'41.45"E	Gangs tong glacier	52D	SW	9692.1	35897379	144.46	5.18624	51012	Valley glacier
Chenab_gr 204	32°50'20.99"N, 76°56'22.03"E	x	52D	S	1199.1	634297	35.00	0.02205	60021	Mountain
Chenab_gr 205	32°49'43.71"N, 76°55'56.79"E	x	52D	W	1635.7	782131	38.07	0.02969	60021	Mountain
Chenab_gr 206	32°48'04.01"N, 76°52'29.45"E	x	52D	NW	2769.8	4339124	71.33	0.30957	60021	Mountain
Chenab_gr 207	32°46'28.26"N, 76°51'37.74"E	x	52D	NW	4342.9	7609122	86.50	0.65823	60021	Mountain
Chenab_gr 208	32°45'37.82"N, 76°51'49.14"E	x	52D	SW	393.9	52422	10.34	0.00052	64021	Cirque
Chenab_gr 209	32°44'31.03"N, 76°53'12.39"E	x	52D	SW	387.5	52266	10.34	0.00052	65021	Niche
Chenab_gr 210	32°44'55.87"N, 76°53'02.96"E	x	52D	SE	939.2	267734	24.61	0.00664	60021	Mountain
Chenab_gr 211	32°45'42.90"N, 76°53'05.65"E	x	52D	SE	3400.1	2156443	55.72	0.12035	60021	Mountain
Chenab_gr 212	32°46'28.52"N, 76°53'20.56"E	x	52D	SE	4027.1	4083528	69.81	0.28483	63021	Mountain basin
Chenab_gr 213	32°46'57.99"N, 76°53'56.08"E	x	52D	SE	1292.9	496953	31.90	0.01595	60021	Mountain
Chenab_gr 214	32°46'58.93"N, 76°55'25.38"E	x	52D	S	2720.5	2097568	55.16	0.11583	60021	Mountain

Chenab_gr 215	32°46'03.45"N, 76°56'23.89"E	x	52D	SW	409.7	71172	12.64	0.00088	60021	Mountain
Chenab_gr 216	32°45'28.24"N, 76°56'15.35"E	x	52D	W	817.5	180078	20.49	0.00369	60021	Mountain
Chenab_gr 217	32°44'43.11"N, 76°56'17.85"E	x	52D	W	1245.1	960318	41.24	0.03959	62021	Mountain basin
Chenab_gr 218	32°44'33.04"N, 76°55'54.66"E	x	52D	NW	478.1	41641	8.94	0.00036	65021	Niche
Chenab_gr 219	32°44'26.79"N, 76°55'42.84"E	x	52D	NW	553.3	83672	13.62	0.00109	65021	Niche
Chenab_gr 220	32°43'41.06"N, 76°56'28.08"E	x	52D	W	1630.5	1243511	45.44	0.05634	63021	Mountain basin
Chenab_gr 221	32°42'40.87"N, 76°55'57.15"E	x	52D	W	714.3	109688	16.12	0.00177	65021	Niche
Chenab_gr 222	32°42'48.06"N, 76°56'47.09"E	x	52D	SE	567.0	113125	16.12	0.00177	64021	Cirque
Chenab_gr 223	32°42'48.16"N, 76°57'42.04"E	x	52D	SE	308.2	33750	7.26	0.00022	65021	Niche
Chenab_gr 224	32°41'21.74"N, 76°57'56.87"E	x	52D	E	496.6	171608	19.95	0.00339	60021	Mountain
Chenab_gr 225	32°42'01.85"N, 76°58'17.50"E	x	52D	SE	509.8	69297	12.64	0.00088	65021	Niche
Chenab_gr 226	32°42'10.89"N, 76°58'10.98"E	x	52D	E	668.4	77266	13.62	0.00109	65021	Niche
Chenab_gr 227	32°42'34.30"N, 76°58'16.79"E	x	52D	E	696.1	145156	18.80	0.00282	60021	Mountain
Chenab_gr 228	32°42'41.76"N, 76°58'01.79"E	x	52D	E	484.6	69922	12.64	0.00088	60021	Mountain
Chenab_gr 229	32°43'12.75"N, 76°57'34.47"E	x	52D	E	2042.0	913906	40.41	0.03677	60021	Mountain
Chenab_gr 230	32°43'55.43"N, 76°57'02.50"E	x	52D	SE	1776.5	694309	36.28	0.02504	60021	Mountain
Chenab_gr 231	32°44'40.43"N, 76°57'23.29"E	x	52D	E	2275.0	2438516	58.22	0.14205	60021	Mountain
Chenab_gr 232	32°45'31.08"N, 76°57'02.97"E	x	52D	SE	2144.0	886130	40.06	0.03566	60021	Mountain
Chenab_gr 233	32°45'54.44"N, 76°57'17.45"E	x	52D	SE	1605.1	849490	39.36	0.03345	60021	Mountain
Chenab_gr 234	32°46'22.65"N, 76°57'13.81"E	x	52D	E	1664.6	1172031	44.46	0.05201	60021	Mountain
Chenab_gr 235	32°47'51.18"N, 76°56'51.43"E	Kelas buk glacier	52D	S	6452.8	12912362	103.30	1.33364	63021	Mountain basin
Chenab_gr 236	32°47'25.31"N, 77°00'01.43"E	x	52D	S	5159.7	4668691	73.17	0.34169	62021	Mountain basin
Chenab_gr 237	32°46'23.83"N, 76°59'47.46"E	x	52D	SW	623.5	194453	21.01	0.00399	60021	Mountain
Chenab_gr 238	32°45'11.30"N, 77°00'01.78"E	x	52H	SW	449.8	79688	13.62	0.00109	64021	Cirque
Chenab_gr 239	32°44'39.62"N, 77°00'10.50"E	x	52H	W	447.2	75078	13.62	0.00109	64021	Cirque
Chenab_gr 240	32°44'54.61"N, 77°00'29.10"E	x	52H	SW	348.2	63487	11.56	0.00069	64021	Cirque
Chenab_gr 241	32°44'29.66"N, 77°00'15.81"E	x	52H	SW	338.3	49297	10.34	0.00052	64021	Cirque
Chenab_gr 242	32°44'06.97"N, 77°00'41.17"E	x	52H	SW	516.4	109062	16.12	0.00177	64021	Cirque
Chenab_gr 243	32°43'56.42"N, 77°01'03.89"E	x	52H	SW	555.8	112109	16.12	0.00177	60021	Mountain
Chenab_gr 244	32°43'34.70"N, 77°01'21.14"E	x	52H	SW	544.0	86250	14.52	0.00131	65021	Niche
Chenab_gr 245	32°42'41.08"N, 77°02'02.71"E	x	52H	W	1537.8	1008408	42.05	0.04247	60021	Mountain
Chenab_gr 246	32°42'15.97"N, 77°01'44.89"E	x	52H	NW	543.3	71797	12.64	0.00088	60021	Mountain

Chenab_gr 247	32°41'39.49"N, 77°01'26.16"E	x	52H	W	2489.0	721625	36.90	0.02657	60021	Mountain
Chenab_gr 248	32°41'06.13"N, 77°01'34.95"E	x	52H	SW	2577.4	672898	35.87	0.02403	63021	Mountain basin
Chenab_gr 249	32°40'18.18"N, 77°02'06.33"E	x	52H	SW	808.4	97656	15.35	0.00153	65021	Niche
Chenab_gr 250	32°41'14.82"N, 77°02'55.74"E	Risang glacier	52H	SW	5569.7	5402641	76.93	0.41542	62021	Mountain basin
Chenab_gr 251	32°42'06.78"N, 77°03'46.11"E	x	52H	SE	819.4	289453	25.38	0.00736	63021	Mountain basin
Chenab_gr 252	32°42'34.11"N, 77°04'06.85"E	x	52H	SE	458.8	117891	16.85	0.00202	64021	Cirque
Chenab_gr 253	32°42'59.35"N, 77°04'28.20"E	x	52H	SE	1838.5	927359	40.74	0.03789	60021	Mountain
Chenab_gr 254	32°43'57.37"N, 77°06'32.63"E	x	52H	SE	1218.7	732504	37.10	0.02708	60021	Mountain
Chenab_gr 255	32°44'30.39"N, 77°06'30.50"E	x	52H	NE	1128.0	306875	26.13	0.00810	65021	Niche
Chenab_gr 256	32°44'18.16"N, 77°01'59.02"E	Chhangang palu glacier	52H	NE	12494.7	30110448	136.46	4.10872	65021	Niche
Chenab_gr 257	32°45'03.25"N, 77°03'16.59"E	x	52H	SE	1227.9	323125	26.48	0.00847	64021	Cirque
Chenab_gr 258	32°45'16.18"N, 77°03'35.68"E	x	52H	SE	554.3	111406	16.12	0.00177	64021	Cirque
Chenab_gr 259	32°45'43.68"N, 77°04'19.80"E	x	52H	NE	2168.7	1119456	43.73	0.04898	65021	Niche
Chenab_gr 260	32°45'54.46"N, 77°03'19.94"E	x	52H	NE	3334.3	2652058	59.96	0.15889	60021	Mountain
Chenab_gr 261	32°46'23.24"N, 77°02'20.86"E	x	52H	NE	3075.2	3193512	64.04	0.20428	63021	Mountain basin
Chenab_gr 262	32°47'39.92"N, 77°01'57.94"E	Shamshar gang glacier	52H	NE	7519.1	15148611	108.94	1.65042	63021	Mountain basin
Chenab_gr 263	32°49'40.60"N, 77°02'17.44"E	x	52H	NE	4233.6	3393437	65.43	0.22179	63021	Mountain basin
Chenab_gr 264	32°50'50.88"N, 77°02'16.35"E	x	52H	NE	1505.9	515078	32.41	0.01685	65021	Niche
Chenab_gr 265	32°51'30.10"N, 77°02'06.56"E	x	52H	NE	2194.1	584375	33.87	0.01964	65021	Niche
Chenab_gr 266	32°51'48.06"N, 77°01'45.84"E	x	52H	NE	2113.4	835547	39.18	0.03291	65021	Niche
Chenab_gr 267	32°52'17.66"N, 77°01'28.80"E	x	52H	N	759.1	125469	17.53	0.00228	65021	Niche
Chenab_gr 268	32°51'53.54"N, 77°00'59.10"E	x	52H	NW	1123.5	163437	19.39	0.00310	65021	Niche
Chenab_gr 269	32°50'39.41"N, 77°01'18.46"E	x	52H	W	2444.3	2714163	60.44	0.16379	60021	Mountain
Chenab_gr 270	32°49'56.92"N, 76°59'20.29"E	Chhallopath gang glacier	52D	NE	8722.0	26530673	130.95	3.47411	51012	Valley glacier
Chenab_gr 271	32°50'54.46"N, 76°56'56.22"E	x	52D	NE	1495.5	1025206	42.36	0.04363	60021	Mountain
Chenab_gr 272	32°51'28.05"N, 76°58'07.55"E	x	52D	NE	1565.3	629922	35.00	0.02205	60021	Mountain
Chenab_gr 273	32°52'23.48"N, 76°57'12.97"E	x	52D	NE	6965.1	10887433	97.60	1.06285	52512	Valley glacier
Chenab_gr 274	32°53'34.73"N, 76°58'27.04"E	x	52D	SW	2064.4	316009	26.48	0.00847	63021	Mountain basin
Chenab_gr 275	32°54'36.74"N, 76°59'18.44"E	x	52D	NE	2415.7	916250	40.58	0.03733	63021	Mountain basin
Chenab_gr 276	32°55'19.85"N, 76°59'35.97"E	x	52D	NE	657.6	77500	13.62	0.00109	65021	Niche

Chenab_gr 277	32°54'29.83"N, 76°58'08.24"E	x	52D	NE	5628.6	3966312	69.15	0.27452	63021	Mountain basin
Chenab_gr 278	32°54'51.87"N, 76°57'41.25"E	x	52D	E	727.7	269259	24.61	0.00664	60051	Mountain
Chenab_gr 279	32°55'09.76"N, 76°57'38.58"E	x	52D	E	1409.1	467143	31.11	0.01462	63021	Mountain basin
Chenab_gr 280	32°55'41.12"N, 76°57'49.83"E	x	52D	SE	1577.7	606641	34.56	0.02108	63051	Mountain basin
Chenab_gr 281	32°56'00.90"N, 76°57'59.12"E	x	52D	SE	442.9	44075	8.94	0.00036	65021	Niche
Chenab_gr 282	32°56'09.53"N, 76°58'18.46"E	x	52D	E	856.7	228359	22.92	0.00527	60021	Mountain
Chenab_gr 283	32°57'39.20"N, 76°59'33.79"E	x	52D	N	303.3	32500	7.26	0.00022	65021	Niche
Chenab_gr 284	32°57'41.59"N, 76°59'00.95"E	x	52D	N	487.9	67813	12.64	0.00088	64021	Cirque
Chenab_gr 285	32°56'56.41"N, 76°58'26.31"E	x	52D	N	2485.1	1327725	46.64	0.06203	63021	Mountain basin
Chenab_gr 286	32°55'20.39"N, 76°56'02.48"E	x	52D	NE	10005.6	12506565	102.23	1.27884	51012	Valley glacier
Chenab_gr 287	32°56'26.36"N, 76°55'36.68"E	x	52D	E	2051.7	1585824	49.83	0.07923	63051	Mountain basin
Chenab_gr 288	32°57'17.38"N, 76°55'53.77"E	x	52D	E	2506.1	2568114	59.31	0.15242	63051	Mountain basin
Chenab_gr 289	32°58'48.54"N, 76°57'10.81"E	x	52D	SE	6084.5	12221260	101.43	1.23947	61551	Mountain basin
Chenab_gr 290	33°00'36.06"N, 76°57'16.36"E	x	52D	S	1345.9	943087	40.91	0.03846	60021	Mountain
Chenab_gr 291	32°59'51.22"N, 76°58'28.51"E	x	52D	S	805.3	174132	19.95	0.00339	63021	Mountain basin
Chenab_gr 292	32°59'53.48"N, 76°58'50.79"E	x	52D	S	489.1	149805	18.80	0.00282	60021	Mountain
Chenab_gr 293	32°58'01.39"N, 77°06'06.67"E	x	52H	W	728.2	208828	22.00	0.00462	60021	Mountain
Chenab_gr 294	32°56'37.47"N, 77°05'51.61"E	x	52H	NW	4692.4	2371279	57.61	0.13654	63021	Mountain basin
Chenab_gr 295	32°56'26.58"N, 77°04'49.33"E	x	52H	NW	4131.9	2553219	59.14	0.15081	63021	Mountain basin
Chenab_gr 296	32°55'10.67"N, 77°03'54.74"E	x	52H	NW	1070.6	302002	25.76	0.00773	64021	Cirque
Chenab_gr 297	32°55'16.00"N, 77°04'42.66"E	x	52H	S	719.2	100547	15.35	0.00153	60021	Mountain
Chenab_gr 298	32°55'31.12"N, 77°05'02.53"E	x	52H	S	658.9	76016	13.62	0.00109	60021	Mountain
Chenab_gr 299	32°55'37.48"N, 77°05'39.22"E	x	52H	S	791.1	548098	33.15	0.01823	60021	Mountain
Chenab_gr 300	32°55'31.63"N, 77°06'16.53"E	x	52H	S	831.8	272840	24.61	0.00664	60021	Mountain
Chenab_gr 301	32°56'09.23"N, 77°06'41.28"E	x	52H	E	2709.0	1427710	47.92	0.06852	60021	Mountain
Chenab_gr 302	32°57'03.34"N, 77°06'50.54"E	x	52H	E	1595.6	623750	34.78	0.02156	60021	Mountain
Chenab_gr 303	32°57'31.36"N, 77°06'49.10"E	x	52H	SE	957.6	286406	25.38	0.00736	60021	Mountain
Chenab_gr 304	32°58'08.46"N, 77°07'00.10"E	x	52H	E	2624.2	1822315	52.36	0.09530	60021	Mountain
Chenab_gr 305	32°58'55.06"N, 77°07'14.92"E	x	52H	SE	2153.8	632469	35.00	0.02205	60021	Mountain
Chenab_gr 306	32°56'50.38"N, 77°09'35.19"E	x	52H	W	852.9	198981	21.51	0.00430	60021	Mountain
Chenab_gr 307	32°53'19.59"N, 77°10'06.91"E	x	52H	N	3975.2	3445455	65.83	0.22712	63021	Mountain basin
Chenab_gr 308	32°53'41.93"N, 77°09'33.40"E	x	52H	N	2035.0	877656	39.89	0.03510	60021	Mountain
Chenab_gr 309	32°54'17.94"N, 77°09'20.31"E	x	52H	NE	1112.7	477344	31.37	0.01506	60021	Mountain

Chenab_gr 310	32°55'07.80"N, 77°08'59.46"E	x	52H	N	1275.4	322891	26.48	0.00847	60021	Mountain
Chenab_gr 311	32°52'16.82"N, 77°08'49.92"E	x	52H	N	2861.3	3347176	65.15	0.21826	63021	Mountain basin
Chenab_gr 312	32°52'53.12"N, 77°07'39.12"E	x	52H	NE	1377.4	490201	31.64	0.01550	63021	Mountain basin
Chenab_gr 313	32°53'23.61"N, 77°07'36.15"E	x	52H	E	461.8	363129	27.84	0.01002	60021	Mountain
Chenab_gr 314	32°53'49.35"N, 77°07'32.01"E	x	52H	E	826.8	529394	32.66	0.01731	60021	Mountain
Chenab_gr 315	32°52'46.49"N, 77°06'47.53"E	x	52H	N	1661.4	832109	39.00	0.03237	63021	Mountain basin
Chenab_gr 316	32°52'10.71"N, 77°07'23.93"E	x	52H	S	2254.4	806797	38.63	0.03129	60021	Mountain
Chenab_gr 317	32°51'22.06"N, 77°09'26.87"E	x	52H	SW	763.5	239219	23.36	0.00561	64021	Cirque
Chenab_gr 318	32°51'00.03"N, 77°09'45.64"E	x	52H	SW	991.9	155078	19.39	0.00310	65021	Niche
Chenab_gr 319	32°49'51.59"N, 77°09'59.98"E	x	52H	W	1647.4	1043253	42.52	0.04422	60021	Mountain
Chenab_gr 320	32°48'43.23"N, 77°09'04.45"E	x	52H	NW	754.5	191170	21.01	0.00399	60021	Mountain
Chenab_gr 321	32°49'20.09"N, 77°08'10.05"E	x	52H	E	171.8	29297	7.26	0.00022	64021	Cirque
Chenab_gr 322	32°49'13.37"N, 77°09'36.12"E	x	52H	SE	396.4	92109	14.52	0.00131	64021	Cirque
Chenab_gr 323	32°50'57.72"N, 77°10'25.09"E	x	52H	SE	1565.9	828851	39.00	0.03237	60021	Mountain
Chenab_gr 324	32°51'29.82"N, 77°10'18.00"E	x	52H	E	1203.2	601562	34.33	0.02060	60021	Mountain
Chenab_gr 325	32°52'03.24"N, 77°10'10.84"E	x	52H	E	2408.4	951719	41.08	0.03902	63021	Mountain basin
Chenab_gr 326	32°52'32.20"N, 77°10'38.71"E	x	52H	E	1827.3	593047	34.10	0.02012	60021	Mountain
Chenab_gr 327	32°52'53.10"N, 77°10'48.56"E	x	52H	E	1263.3	571641	33.63	0.01917	60021	Mountain
Chenab_gr 328	32°53'33.93"N, 77°11'02.18"E	x	52H	E	684.4	252344	23.79	0.00595	60021	Mountain
Chenab_gr 329	32°54'00.12"N, 77°11'00.17"E	x	52H	E	1139.3	514688	32.16	0.01640	60021	Mountain
Chenab_gr 330	32°54'28.04"N, 77°10'58.75"E	x	52H	SE	1469.6	941875	40.91	0.03846	60021	Mountain
Chenab_gr 331	32°55'06.82"N, 77°11'02.92"E	x	52H	SE	1473.0	1365098	47.16	0.06461	60021	Mountain
Chenab_gr 332	32°50'48.39"N, 77°16'15.21"E	x	52H	N	253.0	2171678	55.81	0.12111	60021	Mountain
Chenab_gr 333	32°47'28.80"N, 77°19'24.79"E	x	52H	W	1194.6	344453	27.18	0.00924	60021	Mountain
Chenab_gr 334	32°46'34.36"N, 77°20'38.49"E	x	52H	W	1148.3	1308905	46.38	0.06076	63021	Mountain basin
Chenab_gr 335	32°45'27.43"N, 77°19'20.16"E	x	52H	N	646.7	242862	23.36	0.00561	60021	Mountain
Chenab_gr 336	32°45'33.54"N, 77°17'27.91"E	x	52H	N	5949.5	9515960	93.29	0.88815	63021	Mountain basin
Chenab_gr 337	32°46'12.08"N, 77°15'52.65"E	x	52H	N	5087.7	6684684	82.74	0.55273	62021	Mountain basin
Chenab_gr 338	32°46'51.64"N, 77°14'27.29"E	x	52H	SE	268.4	33125	7.26	0.00022	65021	Niche
Chenab_gr 339	32°47'20.57"N, 77°14'17.08"E	x	52H	NE	374.2	38594	8.94	0.00036	65021	Niche
Chenab_gr 340	32°46'10.19"N, 77°14'19.27"E	x	52H	NW	201.8	25156	7.26	0.00022	65021	Niche
Chenab_gr 341	32°45'47.70"N, 77°13'33.24"E	x	52H	NW	848.5	329297	26.83	0.00886	64021	Cirque
Chenab_gr 342	32°45'30.58"N, 77°14'43.32"E	x	52H	SW	1706.3	424063	29.70	0.01247	65021	Niche

Chenab_gr 343	32°44'29.85"N, 77°15'51.69"E	x	52H	W	5980.3	6709745	82.87	0.55607	62021	Mountain basin
Chenab_gr 344	32°43'32.20"N, 77°14'27.71"E	x	52H	W	1358.0	350312	27.51	0.00963	60021	Mountain
Chenab_gr 345	32°43'21.65"N, 77°15'35.57"E	x	52H	SW	1410.7	610134	34.56	0.02108	60021	Mountain
Chenab_gr 346	32°42'55.57"N, 77°16'03.81"E	x	52H	SW	881.0	243334	23.36	0.00561	63021	Mountain basin
Chenab_gr 347	32°43'38.80"N, 77°17'18.77"E	x	52H	SW	5152.5	10043147	94.98	0.95355	52012	Valley glacier
Chenab_gr 348	32°41'10.02"N, 77°19'33.91"E	x	52H	W	7765.2	14897522	108.34	1.61427	51012	Valley glacier
Chenab_gr 349	32°40'06.73"N, 77°19'45.12"E	x	52H	SW	1672.0	446429	30.56	0.01375	60021	Mountain
Chenab_gr 350	32°39'36.72"N, 77°20'14.19"E	x	52H	S	2947.7	1361454	47.03	0.06396	63021	Mountain basin
Chenab_gr 351	32°39'48.33"N, 77°21'04.26"E	x	52H	S	1045.3	270000	24.61	0.00664	60021	Mountain
Chenab_gr 352	32°39'27.12"N, 77°21'23.40"E	x	52H	SW	2336.2	1205240	45.02	0.05448	63021	Mountain basin
Chenab_gr 353	32°38'54.54"N, 77°21'39.47"E	x	52H	SW	607.9	359770	27.84	0.01002	60021	Mountain
Chenab_gr 354	32°38'53.49"N, 77°22'14.51"E	x	52H	SW	983.5	283420	25.00	0.00700	60021	Mountain
Chenab_gr 355	32°38'23.00"N, 77°22'33.67"E	x	52H	SW	618.9	397250	29.10	0.01164	60021	Mountain
Chenab_gr 356	32°37'47.09"N, 77°22'42.83"E	x	52H	NW	507.9	48359	10.34	0.00052	60021	Mountain
Chenab_gr 357	32°38'23.17"N, 77°19'09.99"E	Mulkila glacier	52H	NW	12597.9	34820091	143.04	4.98074	51012	Valley glacier
Chenab_gr 358	32°37'10.97"N, 77°17'57.31"E	x	52H	E	2244.8	836861	39.18	0.03291	63051	Mountain basin
Chenab_gr 359	32°37'39.23"N, 77°17'39.20"E	x	52H	SE	850.4	181325	20.49	0.00369	60021	Mountain
Chenab_gr 360	32°38'10.08"N, 77°17'44.36"E	x	52H	NE	1774.6	367288	28.17	0.01042	63051	Mountain basin
Chenab_gr 361	32°37'45.73"N, 77°17'12.29"E	x	52H	W	692.4	142223	18.18	0.00255	60021	Mountain
Chenab_gr 362	32°37'37.82"N, 77°17'27.11"E	x	52H	W	802.1	105948	16.12	0.00177	60021	Mountain
Chenab_gr 363	32°37'08.30"N, 77°16'57.59"E	x	52H	NW	287.0	70872	12.64	0.00088	63021	Mountain basin
Chenab_gr 364	32°35'48.39"N, 77°17'23.95"E	x	52H	SW	1247.6	484135	31.37	0.01506	63021	Mountain basin
Chenab_gr 365	32°35'06.28"N, 77°17'30.16"E	x	52H	S	850.7	185648	21.01	0.00399	64021	Cirque
Chenab_gr 366	32°35'06.69"N, 77°17'54.36"E	x	52H	S	1421.5	511211	32.16	0.01640	65021	Niche
Chenab_gr 367	32°35'08.84"N, 77°18'31.34"E	x	52H	W	2243.4	1409337	47.67	0.06721	63051	Mountain basin
Chenab_gr 368	32°34'13.12"N, 77°18'46.46"E	x	52H	NW	3191.1	1970711	53.89	0.10617	63021	Mountain basin
Chenab_gr 369	32°33'35.36"N, 77°17'46.07"E	x	52H	NW	461.8	112799	16.12	0.00177	64021	Cirque
Chenab_gr 370	32°32'45.68"N, 77°16'00.26"E	x	52H	N	15758.7	27889245	133.10	3.71216	51012	Valley glacier
Chenab_gr 371	32°35'19.29"N, 77°14'30.33"E	x	52H	NE	1334.9	870267	39.71	0.03455	60021	Mountain
Chenab_gr 372	32°36'07.66"N, 77°14'08.04"E	x	52H	NE	1191.1	266529	24.61	0.00664	65021	Niche
Chenab_gr 373	32°38'24.71"N, 77°14'10.62"E	x	52H	NE	767.4	294297	25.38	0.00736	60021	Mountain
Chenab_gr 374	32°39'19.93"N, 77°13'17.69"E	x	52H	NE	391.7	63750	11.56	0.00069	65021	Niche
Chenab_gr 375	32°37'34.68"N, 77°13'00.91"E	Tinga goh	52H	NE	3905.1	2357958	57.52	0.13576	60021	Mountain

		glacier								
Chenab_gr 376	32°37'56.45"N, 77°11'09.95"E	x	52H	NW	3656.0	2630401	59.80	0.15727	60021	Mountain
Chenab_gr 377	32°38'57.09"N, 77°10'02.54"E	x	52H	NW	2317.8	1166852	44.46	0.05201	63021	Mountain basin
Chenab_gr 378	32°39'03.86"N, 77°09'11.09"E	Srangbar goh glacier	52H	NW	967.8	439562	30.27	0.01332	64021	Cirque
Chenab_gr 379	32°37'58.92"N, 77°10'05.41"E	x	52H	NW	3030.6	1478623	48.53	0.07183	60021	Mountain
Chenab_gr 380	32°37'26.86"N, 77°09'22.58"E	Bugsub gang glacier	52H	NW	4732.7	5327529	76.58	0.40820	63021	Mountain basin
Chenab_gr 381	32°36'49.15"N, 77°08'34.21"E	Bugsab gang glacier	52H	NW	3636.5	3802201	68.10	0.25878	63021	Mountain basin
Chenab_gr 382	32°36'09.45"N, 77°08'10.70"E	x	52H	NW	629.7	143125	18.18	0.00255	65021	Niche
Chenab_gr 383	32°35'41.72"N, 77°06'50.72"E	Mulari glacier	52H	NW	2918.7	3374771	65.29	0.22003	60021	Mountain
Chenab_gr 384	32°34'52.15"N, 77°05'49.58"E	x	52H	SW	508.2	100391	15.35	0.00153	65021	Niche
Chenab_gr 385	32°36'06.55"N, 77°08'41.99"E	x	52H	S	1654.1	478001	31.37	0.01506	63021	Mountain basin
Chenab_gr 386	32°36'25.67"N, 77°09'38.46"E	x	52H	S	1222.6	451328	30.56	0.01375	63021	Mountain basin
Chenab_gr 387	32°36'55.11"N, 77°09'30.34"E	x	52H	S	834.6	150454	18.80	0.00282	63521	Mountain basin
Chenab_gr 388	32°36'43.15"N, 77°10'34.80"E	x	52H	SE	774.2	99219	15.35	0.00153	65021	Niche
Chenab_gr 389	32°37'16.05"N, 77°11'19.85"E	x	52H	S	3836.8	2170216	55.81	0.12111	63021	Mountain basin
Chenab_gr 390	32°36'30.28"N, 77°11'36.46"E	x	52H	S	567.3	111719	16.12	0.00177	62021	Mountain basin
Chenab_gr 391	32°36'51.44"N, 77°12'08.94"E	x	52H	SW	2798.2	2816486	61.30	0.17287	62021	Mountain basin
Chenab_gr 392	32°36'51.53"N, 77°13'08.76"E	x	52H	S	498.2	116328	16.85	0.00202	60021	Mountain
Chenab_gr 393	32°36'31.51"N, 77°13'24.64"E	x	52H	SW	2390.7	1128438	43.88	0.04958	63021	Mountain basin
Chenab_gr 394	32°35'44.41"N, 77°13'14.22"E	x	52H	SW	3179.8	1479841	48.53	0.07183	63021	Mountain basin
Chenab_gr 395	32°34'48.67"N, 77°12'57.32"E	x	52H	SW	573.1	234807	22.92	0.00527	60021	Mountain
Chenab_gr 396	32°35'03.48"N, 77°13'47.35"E	x	52H	S	2531.0	1080780	43.13	0.04658	63521	Mountain basin
Chenab_gr 397	32°34'37.79"N, 77°13'58.67"E	x	52H	SW	1015.0	252109	23.79	0.00595	65021	Niche
Chenab_gr 398	32°34'19.47"N, 77°14'06.85"E	x	52H	SW	689.6	101789	15.35	0.00153	65021	Niche
Chenab_gr 399	32°33'59.30"N, 77°14'20.31"E	x	52H	SW	565.8	174797	19.95	0.00339	64021	Cirque
Chenab_gr 400	32°33'21.05"N, 77°12'25.88"E	Geopang gath glacier	52H	NW	7430.4	23061795	125.09	2.88461	52012	Valley glacier
Chenab_gr 401	32°32'33.28"N, 77°09'30.75"E	x	52H	NW	3831.5	4373813	71.50	0.31246	60021	Mountain
Chenab_gr 402	32°31'39.65"N, 77°09'54.91"E	x	52H	SW	605.9	116094	16.85	0.00202	65021	Niche
Chenab_gr 403	32°32'05.95"N, 77°10'17.07"E	x	52H	S	889.6	384531	28.48	0.01082	60021	Mountain

Chenab_gr 404	32°32'02.09"N, 77°10'38.69"E	x	52H	S	321.4	41094	8.94	0.00036	60021	Mountain
Chenab_gr 405	32°32'13.57"N, 77°10'51.93"E	x	52H	S	777.0	192031	21.01	0.00399	60021	Mountain
Chenab_gr 406	32°31'42.26"N, 77°11'35.72"E	x	52H	SW	3066.6	1534108	49.13	0.07517	63021	Mountain basin
Chenab_gr 407	32°31'22.17"N, 77°12'14.05"E	x	52H	S	3412.9	2576334	59.39	0.15323	63021	Mountain basin
Chenab_gr 408	32°30'08.16"N, 77°12'39.21"E	x	52H	S	962.8	182630	20.49	0.00369	65021	Niche
Chenab_gr 409	32°30'57.09"N, 77°12'45.73"E	x	52H	SE	1171.2	765720	37.88	0.02917	60021	Mountain
Chenab_gr 410	32°31'47.13"N, 77°13'03.94"E	x	52H	S	365.2	100625	15.35	0.00153	60021	Mountain
Chenab_gr 411	32°31'40.27"N, 77°13'22.94"E	x	52H	S	898.0	332077	26.83	0.00886	60021	Mountain
Chenab_gr 412	32°31'53.44"N, 77°14'40.29"E	x	52H	E	476.4	235078	23.36	0.00561	60021	Mountain
Chenab_gr 413	32°31'10.79"N, 77°15'07.30"E	x	52H	SW	1824.5	2660096	60.04	0.15971	60021	Mountain
Chenab_gr 414	32°31'07.13"N, 77°16'08.30"E	x	52H	S`E	1885.1	2191324	56.00	0.12263	60021	Mountain
Chenab_gr 415	32°31'12.65"N, 77°18'13.01"E	Gangring glacier	52H	SW	4730.4	5005276	74.97	0.37558	63021	Mountain basin
Chenab_gr 416	32°29'00.30"N, 77°16'13.10"E	x	52H	S	638.9	214219	22.00	0.00462	37021	Ice Cap
Chenab_gr 417	32°31'28.51"N, 77°19'27.09"E	x	52H	S	2576.2	608906	34.56	0.02108	63021	Mountain basin
Chenab_gr 418	32°31'54.90"N, 77°20'17.34"E	x	52H	S	943.8	1761225	51.72	0.09104	62521	Mountain basin
Chenab_gr 419	32°30'55.36"N, 77°21'23.37"E	x	52H	SE	1015.2	2067871	54.87	0.11358	60021	Mountain
Chenab_gr 420	32°29'17.72"N, 77°21'32.34"E	x	52H	NE	7720.3	15481932	109.72	1.69845	62521	Mountain basin
Chenab_gr 421	32°28'59.81"N, 77°20'26.99"E	x	52H	NE	391.1	60469	11.56	0.00069	65021	Niche
Chenab_gr 422	32°28'17.77"N, 77°19'44.85"E	x	52H	N	5602.1	7915632	87.67	0.69438	63521	Mountain basin
Chenab_gr 423	32°28'00.28"N, 77°18'38.72"E	x	52H	NE	1635.8	834134	39.00	0.03237	60021	Mountain
Chenab_gr 424	32°27'18.37"N, 77°18'50.46"E	x	52H	NE	971.4	353697	27.51	0.00963	60021	Mountain
Chenab_gr 425	32°26'44.50"N, 77°18'26.58"E	x	52H	NE	969.6	1597110	49.95	0.07992	60021	Mountain
Chenab_gr 426	32°26'10.58"N, 77°17'28.18"E	x	52H	S	976.8	233952	22.92	0.00527	60021	Mountain
Chenab_gr 427	32°27'07.90"N, 77°19'26.19"E	x	52H	S	1916.7	1059400	42.83	0.04540	63021	Mountain basin
Chenab_gr 428	32°25'47.24"N, 77°20'00.55"E	x	52H	S	6207.4	12174683	101.29	1.23271	61021	Mountain basin
Chenab_gr 429	32°26'15.35"N, 77°23'13.79"E	x	52H	S	6952.8	24433813	127.47	3.11419	62021	Mountain basin
Chenab_gr 430	32°24'10.29"N, 77°23'13.70"E	x	52H	W	1005.9	484844	31.37	0.01506	60021	Mountain
Chenab_gr 431	32°23'40.72"N, 77°23'20.96"E	x	52H	W	1311.8	305825	26.13	0.00810	60021	Mountain
Chenab_gr 432	32°23'18.22"N, 77°23'18.45"E	x	52H	W	209.2	33906	7.26	0.00022	60021	Mountain
Chenab_gr 433	32°22'50.33"N, 77°23'00.33"E	x	52H	S	572.8	91094	14.52	0.00131	60021	Mountain
Chenab_gr 434	32°22'31.50"N, 77°22'59.08"E	x	52H	S	404.6	55313	11.56	0.00069	60021	Mountain
Chenab_gr 435	32°23'13.59"N, 77°23'42.48"E	x	52H	S	1388.4	1128863	43.88	0.04958	60021	Mountain

Chenab_gr 436	32°23'58.26"N, 77°23'55.46"E	x	52H	S	710.9	182344	20.49	0.00369	60021	Mountain
Chenab_gr 437	32°25'03.14"N, 77°24'19.73"E	x	52H	S	4039.4	7711960	86.88	0.66984	60021	Mountain
Chenab_gr 438	32°24'48.26"N, 77°25'38.39"E	x	52H	S	1285.0	1341543	46.77	0.06268	61021	Mountain basin
Chenab_gr 439	32°24'16.11"N, 77°27'29.25"E	x	52H	SW	5426.4	5187849	75.89	0.39385	63021	Mountain basin
Chenab_gr 440	32°22'58.97"N, 77°26'56.12"E	x	52H	SW	2127.7	1470913	48.41	0.07116	63021	Mountain basin
Chenab_gr 441	32°23'08.77"N, 77°27'50.38"E	x	52H	S	1639.3	662281	35.65	0.02353	60021	Mountain
Chenab_gr 442	32°22'22.86"N, 77°28'24.71"E	x	52H	SW	2488.2	1453361	48.16	0.06984	60021	Mountain
Chenab_gr 443	32°21'57.66"N, 77°29'30.10"E	x	52H	S	2000.6	1116404	43.73	0.04898	60021	Mountain
Chenab_gr 444	32°22'15.24"N, 77°30'19.78"E	x	52H	SE	1013.4	295205	25.76	0.00773	63021	Mountain basin
Chenab_gr 445	32°22'31.01"N, 77°31'08.49"E	x	52H	SW	1517.2	632343	35.00	0.02205	63021	Mountain basin
Chenab_gr 446	32°22'56.09"N, 77°32'11.49"E	x	52H	SW	1981.3	1294647	46.11	0.05949	63021	Mountain basin
Chenab_gr 447	32°23'20.15"N, 77°32'43.84"E	x	52H	NE	3657.0	3146101	63.75	0.20082	63021	Mountain basin
Chenab_gr 448	32°24'11.13"N, 77°32'35.12"E	x	52H	SW	1307.7	385367	28.80	0.01123	63021	Mountain basin
Chenab_gr 449	32°25'47.76"N, 77°32'58.59"E	x	52H	NE	2302.4	493108	31.64	0.01550	65021	Niche
Chenab_gr 450	32°25'52.43"N, 77°32'26.26"E	x	52H	NW	1619.4	428339	29.99	0.01289	63021	Mountain basin
Chenab_gr 451	32°25'29.10"N, 77°32'15.78"E	x	52H	NW	888.6	201989	21.51	0.00430	63051	Mountain basin
Chenab_gr 452	32°24'48.39"N, 77°31'34.54"E	x	52H	N	3010.4	912333	40.41	0.03677	63051	Mountain basin
Chenab_gr 453	32°24'44.80"N, 77°29'44.92"E	x	52H	NE	10720.8	21000496	121.32	2.54762	51012	Valley glacier
Chenab_gr 454	32°26'27.20"N, 77°30'07.42"E	x	52H	SE	191.1	175856	20.49	0.00369	60021	Mountain
Chenab_gr 455	32°27'43.22"N, 77°31'36.48"E	x	52H	NE	2161.4	580210	33.87	0.01964	63021	Mountain basin
Chenab_gr 456	32°28'08.04"N, 77°31'12.14"E	x	52H	NW	823.0	192878	21.01	0.00399	64021	Cirque
Chenab_gr 457	32°27'31.36"N, 77°30'32.80"E	x	52H	NW	2997.8	1235051	45.44	0.05634	63021	Mountain basin
Chenab_gr 458	32°26'44.65"N, 77°29'45.83"E	x	52H	NW	1598.1	463123	30.83	0.01418	63021	Mountain basin
Chenab_gr 459	32°26'31.72"N, 77°26'56.53"E	x	52H	NE	8741.2	28656734	134.28	3.84861	51012	Valley glacier
Chenab_gr 460	32°28'24.29"N, 77°27'41.67"E	x	52H	E	2715.2	1305001	46.38	0.06076	60021	Mountain
Chenab_gr 461	32°28'53.72"N, 77°28'14.65"E	x	52H	SE	746.3	236525	23.36	0.00561	63021	Mountain basin
Chenab_gr 462	32°28'58.57"N, 77°28'40.75"E	x	52H	SE	682.9	156983	19.39	0.00310	63021	Mountain basin
Chenab_gr 463	32°29'12.89"N, 77°28'59.03"E	x	52H	SE	607.8	89609	14.52	0.00131	63021	Mountain basin
Chenab_gr 464	32°29'32.33"N, 77°29'24.96"E	x	52H	SE	485.9	87891	14.52	0.00131	60021	Mountain
Chenab_gr 465	32°29'49.10"N, 77°28'10.41"E	x	52H	NE	5435.7	7832607	87.34	0.68384	63021	Mountain basin
Chenab_gr 466	32°31'09.14"N, 77°28'16.59"E	x	52H	E	2449.9	2313984	57.08	0.13186	63051	Mountain basin
Chenab_gr 467	32°33'04.03"N, 77°24'04.18"E	x	52H	SE	24003.0	106070981	204.29	21.66915	51012	Valley glacier
Chenab_gr 468	32°35'17.54"N, 77°28'20.87"E	x	52H	SE	1072.7	156468	19.39	0.00310	60021	Mountain

Chenab_gr 469	32°35'33.74"N, 77°28'03.04"E	x	52H	NE	1150.5	462063	30.83	0.01418	65021	Niche
Chenab_gr 470	32°36'02.47"N, 77°27'23.70"E	x	52H	NE	2121.1	2088203	55.06	0.11508	62021	Mountain basin
Chenab_gr 471	32°36'59.32"N, 77°27'31.51"E	x	52H	SE	1785.8	713347	36.69	0.02605	63021	Mountain basin
Chenab_gr 472	32°37'26.34"N, 77°26'32.72"E	x	52H	NE	4676.6	4849430	74.13	0.35953	63021	Mountain basin
Chenab_gr 473	32°36'25.93"N, 77°25'45.06"E	x	52H	NE	370.7	62188	11.56	0.00069	60021	Mountain
Chenab_gr 474	32°37'25.76"N, 77°24'31.49"E	x	52H	NE	10526.3	12461965	102.09	1.27203	62021	Mountain basin
Chenab_gr 475	32°38'08.78"N, 77°23'22.94"E	x	52H	SE	2189.0	1952635	53.69	0.10470	65051	Niche
Chenab_gr 476	32°38'40.47"N, 77°24'10.46"E	x	52H	SE	494.3	118281	16.85	0.00202	64021	Cirque
Chenab_gr 477	32°40'14.63"N, 77°25'28.24"E	x	52H	NE	1773.9	732727	37.10	0.02708	63021	Mountain basin
Chenab_gr 478	32°40'35.72"N, 77°25'14.84"E	x	52H	NE	466.7	67344	12.64	0.00088	37021	Ice Cap
Chenab_gr 479	32°40'06.14"N, 77°23'16.30"E	x	52H	NE	6536.3	10994430	97.90	1.07589	51012	Valley glacier
Chenab_gr 480	32°40'55.70"N, 77°23'26.34"E	x	52H	SE	734.4	159757	19.39	0.00310	65021	Niche
Chenab_gr 481	32°41'19.99"N, 77°23'25.15"E	x	52H	SE	1517.7	368441	28.17	0.01042	60021	Mountain
Chenab_gr 482	32°41'35.34"N, 77°23'53.93"E	x	52H	SE	1865.6	523190	32.41	0.01685	63021	Mountain basin
Chenab_gr 483	32°42'23.70"N, 77°24'11.58"E	x	52H	N	2107.2	903330	40.23	0.03621	60021	Mountain
Chenab_gr 484	32°42'13.22"N, 77°22'46.84"E	x	52H	NE	8193.2	8574999	90.04	0.77168	53012	Valley glacier
Chenab_gr 485	32°43'19.69"N, 77°22'54.07"E	x	52H	E	1033.1	266875	24.61	0.00664	63021	Mountain basin
Chenab_gr 486	32°43'44.11"N, 77°23'21.46"E	x	52H	E	647.3	81875	13.62	0.00109	65021	Niche
Chenab_gr 487	32°44'26.58"N, 77°23'51.78"E	x	52H	S	1154.0	328906	26.83	0.00886	60021	Mountain
Chenab_gr 488	32°44'51.31"N, 77°23'28.18"E	x	52H	S	974.3	436492	30.27	0.01332	63021	Mountain basin
Chenab_gr 489	32°44'20.69"N, 77°23'19.67"E	x	52H	N	1241.5	463125	30.83	0.01418	63021	Mountain basin
Chenab_gr 490	32°44'02.07"N, 77°23'00.10"E	x	52H	N	1724.8	516406	32.41	0.01685	63021	Mountain basin
Chenab_gr 491	32°43'34.23"N, 77°21'39.52"E	x	52H	NE	7586.7	7611671	86.50	0.65823	52512	Valley glacier
Chenab_gr 492	32°44'09.95"N, 77°20'38.08"E	x	52H	NE	9141.4	2643928	59.88	0.15808	53512	Valley glacier
Chenab_gr 493	32°44'46.16"N, 77°19'40.33"E	x	52H	E	1802.6	16921168	112.99	1.91183	53512	Valley glacier
Chenab_gr 494	32°46'34.11"N, 77°22'21.30"E	x	52H	NE	2694.8	561328	33.39	0.01870	63021	Mountain basin
Chenab_gr 495	32°46'51.53"N, 77°21'44.90"E	x	52H	NE	2691.5	1355078	47.03	0.06396	63021	Mountain basin
Chenab_gr 496	32°47'09.71"N, 77°20'18.95"E	x	52H	E	2342.4	2824364	61.30	0.17287	63021	Mountain basin
Chenab_gr 497	32°48'40.82"N, 77°21'32.51"E	x	52H	N	352.7	181885	20.49	0.00369	63021	Mountain basin
Chenab_gr 498	32°48'36.92"N, 77°20'48.84"E	x	52H	N	642.9	131378	17.53	0.00228	63021	Mountain basin
Chenab_gr 499	32°48'25.19"N, 77°19'46.49"E	x	52H	SW	1715.2	1439844	48.04	0.06918	63021	Mountain basin
Chenab_gr 500	32°49'23.38"N, 77°18'34.74"E	x	52H	SW	2431.3	1216563	45.16	0.05510	63021	Mountain basin
Chenab_gr 501	32°50'00.05"N, 77°17'13.29"E	x	52H	NE	2529.3	1913829	53.29	0.10178	62021	Mountain basin

Chenab_gr 502	32°50'21.58"N, 77°16'49.80"E	x	52H	NE	1433.3	580234	33.87	0.01964	60021	Mountain
Chenab_gr 503	32°48'54.69"N, 77°27'47.19"E	x	52H	N	5111.6	6167422	80.53	0.49687	63021	Mountain basin
Chenab_gr 504	32°49'45.41"N, 77°26'49.44"E	x	52H	N	2971.2	2092578	55.06	0.11508	63021	Mountain basin
Chenab_gr 505	32°50'14.69"N, 77°25'31.73"E	x	52H	N	3116.8	4084922	69.81	0.28483	63021	Mountain basin
Chenab_gr 506	32°51'22.50"N, 77°25'07.45"E	x	52H	N	1833.7	593172	34.10	0.02012	63021	Mountain basin
Chenab_gr 507	32°50'37.54"N, 77°24'24.07"E	x	52H	NW	1487.3	716662	36.90	0.02657	63021	Mountain basin
Chenab_gr 508	32°49'41.13"N, 77°24'31.58"E	x	52H	NW	533.9	144844	18.18	0.00255	64021	Cirque
Chenab_gr 509	32°48'53.54"N, 77°25'03.45"E	x	52H	W	1420.2	1109781	43.58	0.04838	60021	Mountain
Chenab_gr 510	32°47'48.83"N, 77°25'21.85"E	x	52H	W	6166.6	7889813	87.56	0.69086	52012	Valley glacier
Chenab_gr 511	32°46'06.27"N, 77°26'40.21"E	x	52H	SE	806.9	294375	25.38	0.00736	64021	Cirque
Chenab_gr 512	32°46'35.77"N, 77°26'39.74"E	x	52H	SE	1960.8	785156	38.26	0.03022	63021	Mountain basin
Chenab_gr 513	32°47'20.34"N, 77°27'23.34"E	x	52H	S	2117.4	816094	38.81	0.03183	63021	Mountain basin
Chenab_gr 514	32°47'39.34"N, 77°28'06.28"E	x	52H	S	3073.3	1848184	52.67	0.09745	63021	Mountain basin
Chenab_gr 515	32°46'59.19"N, 77°28'46.34"E	x	52H	SE	1636.7	803828	38.44	0.03076	63021	Mountain basin
Chenab_gr 516	32°47'56.65"N, 77°29'10.23"E	x	52H	SE	3033.9	3687420	67.40	0.24872	62021	Mountain basin
Chenab_gr 517	32°49'23.78"N, 77°29'14.64"E	x	52H	SE	2684.3	1546083	49.37	0.07652	63021	Mountain basin
Chenab_gr 518	32°50'15.84"N, 77°28'59.75"E	x	52H	SE	2399.7	2285636	56.91	0.13031	60021	Mountain
Chenab_gr 519	32°46'18.36"N, 77°33'22.73"E	x	52H	N	4285.0	5286956	76.39	0.40408	63021	Mountain basin
Chenab_gr 520	32°46'47.83"N, 77°32'42.24"E	x	52H	N	847.3	316797	26.48	0.00847	63021	Mountain basin
Chenab_gr 521	32°46'37.20"N, 77°32'12.07"E	x	52H	N	1648.0	691244	36.28	0.02504	63021	Mountain basin
Chenab_gr 522	32°46'37.85"N, 77°31'33.70"E	x	52H	N	1686.6	645940	35.44	0.02304	60021	Mountain
Chenab_gr 523	32°46'20.60"N, 77°30'57.71"E	x	52H	N	1084.5	562713	33.39	0.01870	60021	Mountain
Chenab_gr 524	32°45'49.97"N, 77°32'39.61"E	x	52H	S	251.0	28906	7.26	0.00022	60021	Mountain
Chenab_gr 525	32°45'28.46"N, 77°32'00.78"E	x	52H	NW	2862.1	3004644	62.66	0.18799	62021	Mountain basin
Chenab_gr 526	32°45'03.22"N, 77°30'56.82"E	x	52H	NW	2281.9	971695	41.41	0.04016	63021	Mountain basin
Chenab_gr 527	32°45'28.52"N, 77°30'26.48"E	x	52H	NW	1198.6	352464	27.51	0.00963	63021	Mountain basin
Chenab_gr 528	32°45'02.45"N, 77°32'54.91"E	x	52H	S	638.6	182031	20.49	0.00369	63021	Mountain basin
Chenab_gr 529	32°44'42.59"N, 77°33'34.95"E	x	52H	W	1275.0	317049	26.48	0.00847	63021	Mountain basin
Chenab_gr 530	32°44'24.36"N, 77°33'46.54"E	x	52H	W	765.9	126406	17.53	0.00228	63021	Mountain basin
Chenab_gr 531	32°43'24.20"N, 77°33'32.51"E	x	52H	NW	2384.8	2465587	58.47	0.14442	63021	Mountain basin
Chenab_gr 532	32°43'07.61"N, 77°32'37.35"E	x	52H	NW	2677.7	1864844	52.78	0.09817	63021	Mountain basin
Chenab_gr 533	32°42'01.02"N, 77°31'50.69"E	Janjiwara glacier	52H	NW	5628.8	10163990	95.35	0.96880	62021	Mountain basin

Chenab_gr 534	32°42'29.72"N, 77°30'08.95"E	x	52H	N	3480.6	3104162	63.39	0.19652	62021	Mountain basin
Chenab_gr 535	32°42'48.16"N, 77°29'25.57"E	x	52H	NE	1333.2	498359	31.90	0.01595	63021	Mountain basin
Chenab_gr 536	32°43'03.26"N, 77°28'57.26"E	x	52H	NE	619.0	150547	18.80	0.00282	60021	Mountain
Chenab_gr 537	32°43'37.97"N, 77°29'17.83"E	x	52H	NE	738.2	204766	21.51	0.00430	63021	Mountain basin
Chenab_gr 538	32°44'03.27"N, 77°29'00.52"E	x	52H	N	949.9	217716	22.46	0.00494	63021	Mountain basin
Chenab_gr 539	32°43'47.02"N, 77°28'35.24"E	x	52H	N	2008.9	564400	33.39	0.01870	63021	Mountain basin
Chenab_gr 540	32°44'06.49"N, 77°28'03.64"E	x	52H	N	1098.9	305376	26.13	0.00810	63021	Mountain basin
Chenab_gr 541	32°42'27.15"N, 77°28'32.64"E	x	52H	NW	2634.5	2050375	54.68	0.11209	63021	Mountain basin
Chenab_gr 542	32°41'01.03"N, 77°32'11.51"E	x	52H	S	1338.4	375512	28.48	0.01082	60021	Mountain
Chenab_gr 543	32°42'14.89"N, 77°33'44.13"E	x	52H	SE	1705.8	688594	36.28	0.02504	63021	Mountain basin
Chenab_gr 544	32°42'32.03"N, 77°33'57.88"E	x	52H	S	2028.1	1074057	42.98	0.04599	63021	Mountain basin
Chenab_gr 545	32°42'59.82"N, 77°34'42.55"E	x	52H	S	3321.1	3290879	64.74	0.21299	63021	Mountain basin
Chenab_gr 546	32°41'27.46"N, 77°36'08.87"E	x	52H	SW	2925.5	1437840	48.04	0.06918	63021	Mountain basin
Chenab_gr 547	32°41'16.46"N, 77°35'27.25"E	x	52H	SW	3315.3	1712717	51.18	0.08752	62021	Mountain basin
Chenab_gr 548	32°40'42.49"N, 77°36'07.98"E	x	52H	S	1141.5	635324	35.22	0.02254	60021	Mountain
Chenab_gr 549	32°39'38.11"N, 77°36'21.72"E	x	52H	SW	3198.9	1876235	52.98	0.09961	63021	Mountain basin
Chenab_gr 550	32°39'17.61"N, 77°35'43.61"E	x	52H	NW	1848.9	293327	25.38	0.00736	60021	Mountain
Chenab_gr 551	32°38'32.01"N, 77°35'03.63"E	x	52H	NW	2186.8	2207432	56.18	0.12416	63021	Mountain basin
Chenab_gr 552	32°38'51.16"N, 77°34'18.69"E	x	52H	N	404.9	47109	10.34	0.00052	37021	Ice Cap
Chenab_gr 553	32°38'30.74"N, 77°34'10.28"E	x	52H	NW	1181.7	284844	25.00	0.00700	60021	Mountain
Chenab_gr 554	32°37'30.63"N, 77°33'55.82"E	x	52H	NW	1588.8	695001	36.49	0.02554	63021	Mountain basin
Chenab_gr 555	32°36'58.72"N, 77°33'19.82"E	x	52H	N	3978.9	3748538	67.78	0.25419	62021	Mountain basin
Chenab_gr 556	32°38'03.25"N, 77°32'47.43"E	x	52H	N	842.1	217734	22.46	0.00494	60021	Mountain
Chenab_gr 557	32°37'12.25"N, 77°32'13.97"E	x	52H	N	3402.6	3109782	63.47	0.19738	63021	Mountain basin
Chenab_gr 558	32°37'32.10"N, 77°31'13.51"E	x	52H	N	2582.7	1499325	48.77	0.07316	63021	Mountain basin
Chenab_gr 559	32°38'10.67"N, 77°30'41.51"E	x	52H	N	1664.6	522155	32.41	0.01685	63021	Mountain basin
Chenab_gr 560	32°38'17.49"N, 77°30'20.81"E	x	52H	N	430.9	45313	10.34	0.00052	64021	Cirque
Chenab_gr 561	32°25'06.90"N, 77°36'57.85"E	x	52H	N	650.4	148650	18.80	0.00282	60021	Mountain
Chenab_gr 562	32°24'21.89"N, 77°41'58.11"E	x	52H	SW	2675.5	685208	36.28	0.02504	65021	Niche
Chenab_gr 563	32°23'04.75"N, 77°43'13.61"E	x	52H	S	1383.5	612751	34.56	0.02108	60021	Mountain
Chenab_gr 564	32°22'33.49"N, 77°43'39.33"E	x	52H	SW	1886.3	464951	30.83	0.01418	63021	Mountain basin
Chenab_gr 565	32°21'28.70"N, 77°42'59.18"E	x	52H	NW	4129.6	4035586	69.57	0.28107	63021	Mountain basin
Chenab_gr 566	32°22'03.41"N, 77°41'51.73"E	x	52H	NW	1280.0	432144	29.99	0.01289	60021	Mountain

Chenab_gr 567	32°20'48.49"N, 77°41'45.76"E	x	52H	NW	3783.8	1968920	53.89	0.10617	63021	Mountain basin
Chenab_gr 568	32°20'04.99"N, 77°41'01.34"E	x	52H	N	5165.9	3096815	63.39	0.19652	63021	Mountain basin
Chenab_gr 569	32°20'27.81"N, 77°40'27.77"E	x	52H	N	2211.0	675725	36.08	0.02453	60021	Mountain
Chenab_gr 570	32°19'09.38"N, 77°40'09.43"E	x	52H	N	6223.2	6005493	79.81	0.47965	63021	Mountain basin
Chenab_gr 571	32°20'33.60"N, 77°38'52.92"E	x	52H	E	1230.5	351248	27.51	0.00963	65021	Niche
Chenab_gr 572	32°21'07.96"N, 77°38'59.46"E	x	52H	E	1217.1	345313	27.51	0.00963	65021	Niche
Chenab_gr 573	32°21'43.74"N, 77°38'46.43"E	x	52H	NE	1455.1	339864	27.18	0.00924	65021	Niche
Chenab_gr 574	32°21'08.23"N, 77°38'04.97"E	x	52H	N	3540.3	2740631	60.68	0.16626	63021	Mountain basin
Chenab_gr 575	32°21'44.22"N, 77°37'17.77"E	x	52H	N	1621.1	494951	31.64	0.01550	63021	Mountain basin
Chenab_gr 576	32°21'34.80"N, 77°37'01.13"E	x	52H	NW	461.8	51337	10.34	0.00052	60021	Mountain
Chenab_gr 577	32°20'52.38"N, 77°36'59.04"E	x	52H	NW	1888.7	1735010	51.51	0.08963	60021	Mountain
Chenab_gr 578	32°20'03.80"N, 77°38'39.71"E	x	52H	SW	736.4	200547	21.51	0.00430	60021	Mountain
Chenab_gr 579	32°19'38.48"N, 77°38'17.31"E	x	52H	W	2872.0	2090859	55.06	0.11508	63021	Mountain basin
Chenab_gr 580	32°19'17.13"N, 77°37'30.33"E	x	52H	W	1263.6	488141	31.64	0.01550	64021	Cirque
Chenab_gr 581	32°18'26.50"N, 77°37'05.86"E	x	52H	NW	2472.7	1015000	42.05	0.04247	63021	Mountain basin
Chenab_gr 582	32°17'31.16"N, 77°36'43.24"E	x	52H	NW	2153.9	1064786	42.83	0.04540	63021	Mountain basin
Chenab_gr 583	32°17'26.16"N, 77°36'15.84"E	x	52H	NW	1366.6	440367	30.27	0.01332	65051	Niche
Chenab_gr 584	32°17'51.34"N, 77°35'31.60"E	x	52H	N	675.1	158470	19.39	0.00310	64021	Cirque
Chenab_gr 585	32°14'58.83"N, 77°36'52.13"E	Bara Shigri glacier	52H	NW	34237.2	180264458	241.47	43.52772	51012	Valley glacier
Chenab_gr 586	32°16'06.97"N, 77°30'36.68"E	x	52H	N	2089.7	570651	33.63	0.01917	60051	Mountain
Chenab_gr 587	32°15'05.61"N, 77°29'55.95"E	Chhota Shigri glacier	52H	E	10835.3	20317564	120.01	2.43864	61021	Mountain basin
Chenab_gr 588	32°18'04.07"N, 77°29'17.51"E	x	52H	N	999.9	209844	22.00	0.00462	64021	Cirque
Chenab_gr 589	32°17'59.34"N, 77°28'19.22"E	x	52H	N	3158.3	2108409	55.25	0.11658	60021	Mountain
Chenab_gr 590	32°18'23.29"N, 77°28'00.20"E	x	52H	NE	1123.8	389758	28.80	0.01123	60021	Mountain
Chenab_gr 591	32°17'59.80"N, 77°27'32.06"E	x	52H	E	922.9	162770	19.39	0.00310	65021	Niche
Chenab_gr 592	32°17'59.60"N, 77°27'06.07"E	x	52H	N	1637.0	414241	29.40	0.01205	65021	Niche
Chenab_gr 593	32°18'41.80"N, 77°27'21.92"E	x	52H	N	500.4	57188	11.56	0.00069	65021	Niche
Chenab_gr 594	32°18'27.06"N, 77°26'50.12"E	x	52H	W	357.3	37188	8.94	0.00036	65021	Niche
Chenab_gr 595	32°16'54.06"N, 77°27'45.26"E	x	52H	NW	1022.5	234361	22.92	0.00527	63051	Mountain basin
Chenab_gr 596	32°16'21.22"N, 77°27'12.79"E	x	52H	NW	4404.8	3717370	67.59	0.25145	63021	Mountain basin
Chenab_gr 597	32°16'19.51"N, 77°26'22.49"E	x	52H	W	852.1	191953	21.01	0.00399	60021	Mountain

Chenab_gr 598	32°15'31.83"N, 77°26'03.87"E	x	52H	W	945.2	147958	18.80	0.00282	65021	Niche
Chenab_gr 599	32°15'09.04"N, 77°26'36.65"E	x	52H	N	2492.1	1022715	42.21	0.04305	63051	Mountain basin
Chenab_gr 600	32°14'27.98"N, 77°25'14.14"E	x	52H	NE	5764.4	5558090	77.71	0.43204	63021	Mountain basin
Chenab_gr 601	32°14'35.12"N, 77°24'23.43"E	x	52H	N	1509.7	425471	29.99	0.01289	60051	Mountain
Chenab_gr 602	32°15'16.44"N, 77°23'33.50"E	x	52H	NE	5598.6	5400247	76.93	0.41542	63021	Mountain basin
Chenab_gr 603	32°15'55.89"N, 77°23'48.65"E	x	52H	NE	604.9	54350	10.34	0.00052	37021	Ice Cap
Chenab_gr 604	32°16'01.17"N, 77°24'03.02"E	x	52H	E	420.8	44141	8.94	0.00036	65021	Niche
Chenab_gr 605	32°16'36.80"N, 77°23'06.84"E	x	52H	E	3607.6	4263357	70.87	0.30190	63021	Mountain basin
Chenab_gr 606	32°17'24.57"N, 77°23'26.46"E	x	52H	E	1724.2	917287	40.58	0.03733	60021	Mountain
Chenab_gr 607	32°17'34.06"N, 77°22'44.55"E	x	52H	NE	3606.0	2215767	56.27	0.12493	63021	Mountain basin
Chenab_gr 608	32°18'20.29"N, 77°23'18.88"E	x	52H	N	1114.9	352118	27.51	0.00963	63021	Mountain basin
Chenab_gr 609	32°18'44.41"N, 77°23'25.02"E	x	52H	N	1962.0	1037031	42.52	0.04422	60021	Mountain
Chenab_gr 610	32°18'16.75"N, 77°22'15.65"E	x	52H	NW	4472.9	4766067	73.71	0.35157	63021	Mountain basin
Chenab_gr 611	32°18'16.06"N, 77°21'16.23"E	x	52H	NW	2147.3	894976	40.06	0.03566	60021	Mountain
Chenab_gr 612	32°15'50.14"N, 77°21'31.09"E	x	52H	NE	9387.8	13190125	104.04	1.37233	52012	Valley glacier
Chenab_gr 613	32°20'28.20"N, 77°19'27.78"E	x	52H	NE	1412.3	293882	25.38	0.00736	65021	Niche
Chenab_gr 614	32°20'57.33"N, 77°19'10.90"E	x	52H	NE	1498.5	757452	37.68	0.02864	60021	Mountain
Chenab_gr 615	32°23'18.23"N, 77°15'56.95"E	x	52H	NE	492.8	297266	25.76	0.00773	60021	Mountain
Chenab_gr 616	32°28'44.56"N, 77°03'05.34"E	x	52H	NE	8250.8	7510385	86.11	0.64667	63021	Mountain basin
Chenab_gr 617	32°30'12.14"N, 77°01'48.48"E	x	52H	N	2268.6	1185960	44.74	0.05324	63021	Mountain basin
Chenab_gr 618	32°31'08.06"N, 77°00'51.63"E	x	52H	E	1381.4	887642	40.06	0.03566	63021	Mountain basin
Chenab_gr 619	32°31'07.12"N, 77°00'16.61"E	x	52H	S	346.1	350756	27.51	0.00963	60021	Mountain
Chenab_gr 620	32°29'58.36"N, 77°00'11.47"E	x	52H	S	3193.8	1245083	45.57	0.05697	63051	Mountain basin
Chenab_gr 621	32°29'29.25"N, 77°00'37.42"E	x	52H	S	1041.1	255391	24.20	0.00629	63051	Mountain basin
Chenab_gr 622	32°29'52.50"N, 77°00'56.56"E	x	52H	S	353.0	28672	7.26	0.00022	63051	Mountain basin
Chenab_gr 623	32°29'31.78"N, 77°01'09.05"E	x	52H	NW	1077.2	201861	21.51	0.00430	60051	Mountain
Chenab_gr 624	32°28'30.46"N, 76°59'59.78"E	x	52D	N	7196.4	5753114	78.61	0.45199	63021	Mountain basin
Chenab_gr 625	32°27'28.32"N, 76°56'38.32"E	x	52D	NE	5371.9	11655273	99.85	1.16430	63021	Mountain basin
Chenab_gr 626	32°27'57.75"N, 76°54'07.42"E	x	52D	NE	3061.7	1546710	49.37	0.07652	60021	Mountain
Chenab_gr 627	32°29'34.43"N, 76°53'21.55"E	x	52D	SE	3489.6	5115067	75.53	0.38672	60021	Mountain
Chenab_gr 628	32°30'35.94"N, 76°53'24.18"E	x	52D	NE	762.5	114453	16.12	0.00177	60021	Mountain
Chenab_gr 629	32°31'36.93"N, 76°50'20.02"E	Shipting glacier	52D	S	616.5	203786	21.51	0.00430	60021	Mountain
Chenab_gr 630	32°32'27.83"N, 76°50'28.68"E	Shipting glacier	52D	S	3180.4	950571	41.08	0.03902	63021	Mountain basin

Chenab_gr 631	32°33'45.93"N, 76°51'20.29"E	Shipting glacier	52D	S	403.1	48281	10.34	0.00052	60021	Mountain
Chenab_gr 632	32°33'49.80"N, 76°51'32.31"E	Shipting glacier	52D	S	702.5	103181	15.35	0.00153	60021	Mountain
Chenab_gr 633	32°34'06.87"N, 76°52'08.06"E	Shipting glacier	52D	NE	1841.2	1070102	42.98	0.04599	63021	Mountain basin
Chenab_gr 634	32°34'45.12"N, 76°53'09.77"E	Shipting glacier	52D	SE	3113.5	2002973	54.19	0.10838	63021	Mountain basin
Chenab_gr 635	32°35'28.69"N, 76°53'21.27"E	x	52D	E	1279.3	415467	29.70	0.01247	63021	Mountain basin
Chenab_gr 636	32°36'02.84"N, 76°53'22.65"E	x	52D	NE	2614.5	1474485	48.41	0.07116	60021	Mountain
Chenab_gr 637	32°35'20.01"N, 76°51'21.86"E	x	52D	N	3726.5	2821863	61.30	0.17287	63021	Mountain basin
Chenab_gr 638	32°35'22.87"N, 76°49'20.00"E	x	52D	NE	6034.8	4434177	71.84	0.31825	63021	Mountain basin
Chenab_gr 639	32°35'41.03"N, 76°47'06.95"E	x	52D	E	5597.4	2882706	61.76	0.17787	63021	Mountain basin
Chenab_gr 640	32°36'31.63"N, 76°46'36.15"E	x	52D	NE	810.3	705371	36.69	0.02605	60021	Mountain
Chenab_gr 641	32°39'19.86"N, 76°48'06.49"E	x	52D	N	1397.1	366563	28.17	0.01042	65021	Niche
Chenab_gr 642	32°36'40.48"N, 76°45'13.03"E	x	52D	NW	8866.1	10254788	95.64	0.98028	63021	Mountain basin
Chenab_gr 643	32°37'32.05"N, 76°43'58.81"E	x	52D	N	454.4	135128	18.18	0.00255	64021	Cirque
Chenab_gr 644	32°37'14.09"N, 76°43'03.65"E	x	52D	N	873.2	267915	24.61	0.00664	60512	Mountain
Chenab_gr 645	32°36'39.90"N, 76°41'59.72"E	x	52D	E	6220.4	10060934	95.04	0.95609	63021	Mountain basin
Chenab_gr 646	32°37'40.27"N, 76°41'52.46"E	x	52D	E	882.4	246641	23.79	0.00595	60021	Mountain
Chenab_gr 647	32°37'59.80"N, 76°42'01.83"E	x	52D	NE	571.0	86875	14.52	0.00131	60021	Mountain
Chenab_gr 648	32°38'14.35"N, 76°41'55.80"E	x	52D	NE	2362.9	753125	37.49	0.02812	60021	Mountain
Chenab_gr 649	32°38'46.38"N, 76°41'48.80"E	x	52D	E	1419.7	471094	31.11	0.01462	60021	Mountain
Chenab_gr 650	32°39'26.66"N, 76°41'45.91"E	x	52D	E	599.9	53359	10.34	0.00052	60021	Mountain
Chenab_gr 651	32°39'39.90"N, 76°41'48.45"E	x	52D	N	621.3	101484	15.35	0.00153	60021	Mountain
Chenab_gr 652	32°38'08.97"N, 76°39'36.26"E	x	52D	NE	5879.5	10735884	97.15	1.04335	61021	Mountain basin
Chenab_gr 653	32°38'51.83"N, 76°36'58.23"E	x	52D	NE	5393.6	4694386	73.28	0.34366	62021	Mountain basin
Chenab_gr 654	32°42'00.28"N, 76°36'40.12"E	x	52D	NE	8476.5	12658124	102.63	1.29933	62021	Mountain basin
Chenab_gr 655	32°43'14.77"N, 76°30'59.44"E	x	52D	NE	6861.2	6891200	83.62	0.57616	60021	Mountain
Chenab_gr 656	32°43'56.61"N, 76°30'37.43"E	x	52D	S	1929.3	1124962	43.73	0.04898	60021	Mountain
Chenab_gr 657	32°44'25.96"N, 76°30'59.30"E	x	52D	NE	712.9	193437	21.01	0.00399	60021	Mountain
Chenab_gr 658	32°46'33.38"N, 76°33'25.11"E	x	52D	N	1284.4	591935	34.10	0.02012	60021	Mountain
Chenab_gr 659	32°46'11.48"N, 76°31'22.05"E	x	52D	NW	6626.4	9752431	94.04	0.91693	63021	Mountain basin
Chenab_gr 660	32°44'24.34"N, 76°29'10.82"E	x	52D	NE	5196.7	6596111	82.41	0.54387	63021	Mountain basin
Chenab_gr 661	32°43'05.61"N, 76°25'33.21"E	x	52D	NE	2984.0	2728526	60.60	0.16543	60021	Mountain
Chenab_gr 662	32°44'52.12"N, 76°26'44.26"E	x	52D	N	925.1	312199	26.13	0.00810	60021	Mountain
Chenab_gr 663	32°44'45.02"N, 76°25'10.48"E	x	52D	NE	5222.6	6367888	81.41	0.51860	63021	Mountain basin

Chenab_gr 664	32°46'39.44"N, 76°24'15.42"E	x	52D	NE	1851.0	1914525	53.29	0.10178	67021	Ice Apron
Chenab_gr 665	32°46'56.37"N, 76°23'32.12"E	x	52D	NE	1603.9	659298	35.65	0.02353	67021	Ice Apron
Chenab_gr 666	32°47'25.59"N, 76°22'56.72"E	x	52D	NE	1279.6	323302	26.48	0.00847	67021	Ice Apron
Chenab_gr 667	32°47'33.91"N, 76°22'32.34"E	x	52D	NE	876.6	183038	20.49	0.00369	60021	Mountain
Chenab_gr 668	32°48'22.62"N, 76°22'12.95"E	x	52D	NE	703.8	182128	20.49	0.00369	67021	Ice Apron
Chenab_gr 669	32°49'56.34"N, 76°21'37.35"E	x	52D	NE	694.5	223190	22.46	0.00494	67021	Ice Apron
Chenab_gr 670	32°54'01.80"N, 76°20'50.91"E	x	52D	NE	3339.3	1274477	45.85	0.05822	63021	Mountain basin
Chenab_gr 671	32°55'32.72"N, 76°19'57.07"E	x	52D	NE	5842.7	4990294	74.86	0.37357	63021	Mountain basin
Chenab_gr 672	32°57'54.57"N, 76°20'49.01"E	x	52D	NE	415.4	78125	13.62	0.00109	60021	Mountain
Chenab_gr 673	32°59'23.77"N, 76°20'46.38"E	x	52D	NE	2031.2	454609	30.56	0.01375	60021	Mountain
Chenab_gr 674	33°00'33.77"N, 76°19'12.86"E	x	52C	NE	5041.3	5321063	76.54	0.40717	60021	Mountain
Chenab_gr 675	33°02'18.55"N, 76°18'52.23"E	x	52C	E	1952.6	637669	35.22	0.02254	60021	Mountain
Chenab_gr 676	33°04'37.89"N, 76°20'19.17"E	x	52C	NE	918.7	699400	36.49	0.02554	60021	Mountain
Chenab_gr 677	33°05'01.60"N, 76°20'05.59"E	x	52C	E	1631.8	603747	34.33	0.02060	60021	Mountain
Chenab_gr 678	33°06'03.59"N, 76°20'06.94"E	x	52C	NE	954.5	133906	17.53	0.00228	65021	Niche
Chenab_gr 679	33°07'20.59"N, 76°19'45.64"E	x	52C	N	1278.2	456536	30.83	0.01418	63021	Mountain basin
Chenab_gr 680	33°05'45.70"N, 76°19'30.03"E	x	52C	NW	1557.2	533271	32.66	0.01731	63021	Mountain basin
Chenab_gr 681	33°04'08.11"N, 76°18'39.76"E	x	52C	NW	2924.9	3122334	63.54	0.19824	63021	Mountain basin

Inventory of Glaciers of Sutlaz River Basin

Number of Glaciers= 945 Area of Glaciers= 1217.59 km^2 Total Ice Reseerve= 94.45km^3

Glacier Number	Latitude Longitude	Glacier Name	Map code	Orientation	Length (m)	Area (m^2)	Thickness (m)	Ice reserve (km^3)	Classification	Glacier Type
satluj_gr 1	31°39'32.82"N, 77°39'12.32"E	x	53E	SW	1382.4	700010	36.30	0.0254	37021	Ice Cap
satluj_gr 2	31°39'39.94"N, 77°39'40.13"E	x	53E	E	809.9	245738	23.65	0.0059	60021	Mountain
satluj_gr 3	31°42'15.68"N, 77°41'58.77"E	x	53E	SE	1657.4	759197	37.49	0.0285	60021	Mountain
satluj_gr 4	31°42'59.05"N, 77°43'01.06"E	x	53E	SE	1539.3	434782	29.82	0.0128	60021	Mountain
satluj_gr 5	31°42'25.49"N, 77°44'06.23"E	x	53E	SW	4496.2	4086144	69.55	0.2845	63021	Mountain basin
satluj_gr 6	31°42'06.23"N, 77°45'06.46"E	x	53E	S	1995.6	951204	40.87	0.0388	60021	Mountain
satluj_gr 7	31°42'50.21"N, 77°45'40.15"E	x	53E	S	2532.4	1707803	50.94	0.0871	60021	Mountain
satluj_gr 8	31°42'12.02"N, 77°46'46.74"E	x	53E	SW	1042.2	467904	30.94	0.0145	60021	Mountain
satluj_gr 9	31°42'31.14"N, 77°47'03.02"E	x	53E	S	1320.2	1006422	41.84	0.0423	60021	Mountain
satluj_gr 10	31°42'48.79"N, 77°46'32.85"E	x	53E	S	1436.9	609841	34.38	0.0210	60021	Mountain
satluj_gr 11	31°43'26.43"N, 77°47'02.39"E	x	53E	SE	2272.4	1328766	46.41	0.0617	60021	Mountain
satluj_gr 12	31°44'38.07"N, 77°46'11.43"E	x	53E	SE	6647.0	16244469	110.99	1.8024	62021	Mountain basin
satluj_gr 13	31°45'51.56"N, 77°47'39.38"E	x	53E	S	3060.4	2584453	59.11	0.1525	60021	Mountain
satluj_gr 14	31°45'46.12"N, 77°48'36.13"E	x	53E	E	3408.7	3023694	62.52	0.1888	63021	Mountain basin
satluj_gr 15	31°44'40.43"N, 77°50'45.77"E	x	53E	NW	3964.5	2973239	62.15	0.1846	63021	Mountain basin
satluj_gr 16	31°44'23.99"N, 77°49'43.44"E	x	53E	N	1547.3	778158	37.87	0.0295	60021	Mountain
satluj_gr 17	31°44'03.99"N, 77°49'15.55"E	x	53E	SW	587.7	106505	16.01	0.0018	64021	Cirque
satluj_gr 18	31°43'52.53"N, 77°49'45.44"E	x	53E	SW	1107.9	462619	30.67	0.0141	60021	Mountain
satluj_gr 19	31°43'45.19"N, 77°50'15.15"E	x	53E	SW	676.2	214781	21.86	0.0046	60021	Mountain
satluj_gr 20	31°43'20.09"N, 77°50'34.62"E	x	53E	SW	1277.1	579871	33.69	0.0195	60021	Mountain
satluj_gr 21	31°43'50.17"N, 77°50'54.11"E	x	53E	S	1529.8	1181945	44.38	0.0524	63021	Mountain basin
satluj_gr 22	31°43'28.07"N, 77°51'31.19"E	x	53E	S	2232.7	1177793	44.38	0.0524	63021	Mountain basin
satluj_gr 23	31°42'55.11"N, 77°52'37.07"E	x	53E	SW	481.5	85821	14.42	0.0013	60021	Mountain

satluj_gr 24	31°42'08.35"N, 77°53'51.94"E	x	53E	SW	747.6	150747	18.68	0.0028	60021	Mountain
satluj_gr 25	31°41'49.46"N, 77°53'59.53"E	x	53E	S	1171.0	139050	18.06	0.0025	60021	Mountain
satluj_gr 26	31°41'45.85"N, 77°53'43.16"E	x	53E	NW	417.4	72265	12.55	0.0009	60021	Mountain
satluj_gr 27	31°41'45.00"N, 77°54'38.88"E	x	53E	SE	1164.6	371539	28.01	0.0104	60021	Mountain
satluj_gr 28	31°41'28.80"N, 77°56'59.71"E	x	53E	SW	2281.5	1156114	44.09	0.0511	60021	Mountain
satluj_gr 29	31°40'08.26"N, 77°58'10.03"E	x	53E	SE	1455.5	530429	32.49	0.0172	60021	Mountain
satluj_gr 30	31°40'11.90"N, 77°58'27.61"E	x	53E	NE	839.1	306187	25.98	0.0081	60021	Mountain
satluj_gr 31	31°40'30.17"N, 77°58'16.43"E	x	53E	NE	898.1	282540	24.86	0.0070	60021	Mountain
satluj_gr 32	31°40'49.73"N, 77°58'30.89"E	x	53E	NE	436.9	59994	11.47	0.0007	60021	Mountain
satluj_gr 33	31°40'51.16"N, 77°58'10.02"E	x	53E	NE	872.9	264919	24.06	0.0063	60021	Mountain
satluj_gr 34	31°41'14.93"N, 77°57'53.10"E	x	53E	NE	1505.5	936912	40.71	0.0383	63021	Mountain basin
satluj_gr 35	31°41'28.77"N, 77°57'32.31"E	x	53E	NE	752.8	178574	20.37	0.0037	60021	Mountain
satluj_gr 36	31°41'50.77"N, 77°57'25.24"E	x	53E	NE	1774.9	952893	40.87	0.0388	63021	Mountain basin
satluj_gr 37	31°42'32.86"N, 77°57'32.61"E	x	53E	E	1026.3	305687	25.98	0.0081	63021	Mountain basin
satluj_gr 38	31°42'38.01"N, 77°57'02.40"E	x	53E	N	2621.8	1153977	43.95	0.0505	63021	Mountain basin
satluj_gr 39	31°42'17.27"N, 77°56'26.58"E	x	53E	N	2715.3	1183521	44.38	0.0524	63021	Mountain basin
satluj_gr 40	31°42'17.64"N, 77°55'14.96"E	x	53E	N	4654.1	4799229	73.53	0.3529	63021	Mountain basin
satluj_gr 41	31°42'31.38"N, 77°54'34.59"E	x	53E	NE	625.1	88674	14.42	0.0013	65021	Niche
satluj_gr 42	31°42'58.89"N, 77°54'38.29"E	x	53E	NE	2872.2	1203384	44.66	0.0536	63021	Mountain basin
satluj_gr 43	31°43'01.60"N, 77°53'35.74"E	x	53E	N	3677.3	3781333	67.66	0.2558	62021	Mountain basin
satluj_gr 44	31°43'19.82"N, 77°52'37.86"E	x	53E	NE	1220.5	666740	35.68	0.0239	60021	Mountain
satluj_gr 45	31°43'38.54"N, 77°52'08.27"E	x	53E	NE	397.0	73190	12.55	0.0009	60021	Mountain
satluj_gr 46	31°44'18.67"N, 77°51'33.45"E	x	53E	NE	1231.7	498815	31.73	0.0159	60021	Mountain
satluj_gr 47	31°44'39.09"N, 77°52'31.33"E	x	53E	E	1007.9	264211	24.06	0.0063	63021	Mountain basin
satluj_gr 48	31°44'54.95"N, 77°52'09.82"E	x	53E	NE	1060.0	186404	20.88	0.0040	65021	Niche
satluj_gr 49	31°44'55.07"N, 77°51'40.42"E	x	53E	NE	2314.9	1128886	43.66	0.0493	63021	Mountain basin
satluj_gr 50	31°44'53.75"N, 77°51'14.77"E	x	53E	E	907.2	282501	24.86	0.0070	60021	Mountain
satluj_gr 51	31°45'09.52"N, 77°51'06.73"E	x	53E	NE	684.2	156673	19.27	0.0031	60021	Mountain
satluj_gr 52	31°45'34.64"N, 77°51'00.11"E	x	53E	E	632.8	272139	24.46	0.0066	60021	Mountain
satluj_gr 53	31°46'47.58"N, 77°51'39.15"E	x	53E	SE	4885.9	3810245	67.85	0.2585	62021	Mountain basin
satluj_gr 54	31°47'02.68"N, 77°51'05.42"E	x	53E	E	1544.7	502861	31.73	0.0159	60021	Mountain
satluj_gr 55	31°47'02.38"N, 77°52'22.60"E	x	53E	SE	1931.3	621537	34.60	0.0215	60051	Mountain
satluj_gr 56	31°46'35.42"N, 77°53'09.71"E	x	53E	W	402.2	105391	16.01	0.0018	64021	Cirque

satluj_gr 57	31°46'00.37"N, 77°53'29.61"E	x	53E	W	785.4	316255	26.33	0.0084	60051	Mountain
satluj_gr 58	31°46'04.10"N, 77°53'00.06"E	x	53E	W	575.0	100313	15.24	0.0015	60021	Mountain
satluj_gr 59	31°45'45.28"N, 77°54'11.91"E	x	53E	S	1875.3	1978619	53.73	0.1064	60021	Mountain
satluj_gr 60	31°45'00.27"N, 77°56'07.74"E	x	53E	SW	529.7	92266	14.42	0.0013	60021	Mountain
satluj_gr 61	31°45'15.08"N, 77°56'49.00"E	x	53E	S	423.4	157578	19.27	0.0031	60021	Mountain
satluj_gr 62	31°45'25.94"N, 77°56'15.47"E	x	53E	SE	749.5	274219	24.46	0.0066	60021	Mountain
satluj_gr 63	31°45'50.78"N, 77°55'59.70"E	x	53E	SE	1011.1	354453	27.36	0.0096	60021	Mountain
satluj_gr 64	31°46'22.96"N, 77°56'00.66"E	x	53E	SE	1316.2	394331	28.64	0.0112	60021	Mountain
satluj_gr 65	31°47'12.62"N, 77°56'18.72"E	x	53E	NE	1136.3	266719	24.46	0.0066	63021	Mountain basin
satluj_gr 66	31°48'13.72"N, 77°56'22.21"E	x	53E	SE	701.3	139986	18.06	0.0025	60021	Mountain
satluj_gr 67	31°48'03.58"N, 77°58'26.99"E	x	53E	S	537.3	91177	14.42	0.0013	60021	Mountain
satluj_gr 68	31°47'14.98"N, 77°59'51.31"E	x	53E	S	1475.0	825666	38.80	0.0322	60021	Mountain
satluj_gr 69	31°47'03.44"N, 78°02'02.24"E	x	53I	SE	902.5	236677	23.22	0.0056	60021	Mountain
satluj_gr 70	31°46'23.30"N, 78°02'08.23"E	x	53I	SE	1076.7	246719	23.65	0.0059	60021	Mountain
satluj_gr 71	31°47'29.55"N, 78°02'15.39"E	x	53I	SE	718.5	242729	23.22	0.0056	60021	Mountain
satluj_gr 72	31°47'40.29"N, 78°02'46.17"E	x	53I	SE	1423.9	459808	30.67	0.0141	63021	Mountain basin
satluj_gr 73	31°48'08.40"N, 78°02'58.27"E	x	53I	S	1256.4	947644	40.87	0.0388	60021	Mountain
satluj_gr 74	31°48'08.70"N, 78°03'42.97"E	x	53I	S	1027.5	250989	23.65	0.0059	60021	Mountain
satluj_gr 75	31°47'43.42"N, 78°04'10.37"E	x	53I	SW	495.9	81875	13.52	0.0011	60021	Mountain
satluj_gr 76	31°46'52.39"N, 78°04'17.34"E	x	53I	SW	4040.9	3701902	67.16	0.2485	61021	Mountain basin
satluj_gr 77	31°46'10.95"N, 78°04'24.95"E	x	53I	SW	584.2	80625	13.52	0.0011	67021	Ice Apron
satluj_gr 78	31°46'04.07"N, 78°04'36.87"E	x	53I	SW	482.4	73828	12.55	0.0009	60021	Mountain
satluj_gr 79	31°45'49.48"N, 78°04'50.34"E	x	53I	SW	950.6	300000	25.61	0.0077	60021	Mountain
satluj_gr 80	31°45'06.74"N, 78°04'33.76"E	x	53I	NW	1393.9	767912	37.68	0.0290	60021	Mountain
satluj_gr 81	31°44'37.69"N, 78°04'30.08"E	x	53I	NW	874.8	164688	19.27	0.0031	60021	Mountain
satluj_gr 82	31°44'24.89"N, 78°04'17.15"E	x	53I	N	836.6	199255	21.38	0.0043	60021	Mountain
satluj_gr 83	31°42'25.10"N, 78°03'37.50"E	x	53I	N	9519.2	17926846	114.67	2.0561	51012	Valley glacier
satluj_gr 84	31°42'32.34"N, 78°02'26.69"E	x	53I	NE	1366.1	500735	31.73	0.0159	63051	Mountain basin
satluj_gr 85	31°42'50.64"N, 78°01'59.60"E	x	53I	NE	1863.3	889377	39.86	0.0355	63021	Mountain basin
satluj_gr 86	31°42'02.33"N, 78°02'13.08"E	x	53I	SW	1286.3	411882	29.24	0.0120	60021	Mountain
satluj_gr 87	31°41'14.66"N, 78°02'43.24"E	x	53I	SW	1260.5	636094	35.04	0.0224	60021	Mountain
satluj_gr 88	31°41'11.99"N, 78°03'25.38"E	x	53I	W	381.3	143984	18.06	0.0025	60021	Mountain
satluj_gr 89	31°40'42.02"N, 78°04'51.68"E	x	53I	SW	2843.8	2045378	54.42	0.1116	60021	Mountain

satluj_gr 90	31°38'12.66"N, 78°06'53.45"E	x	53I	W	2362.3	2038799	54.32	0.1108	60021	Mountain
satluj_gr 91	31°38'57.77"N, 78°07'16.04"E	x	53I	S	1187.8	320326	26.33	0.0084	60021	Mountain
satluj_gr 92	31°35'43.31"N, 78°10'39.29"E	x	53I	W	962.4	451785	30.39	0.0137	64021	Cirque
satluj_gr 93	31°37'48.98"N, 78°10'06.02"E	x	53I	NE	898.5	244795	23.22	0.0056	60021	Mountain
satluj_gr 94	31°37'59.90"N, 78°09'50.89"E	x	53I	NE	859.5	212161	21.86	0.0046	60021	Mountain
satluj_gr 95	31°39'37.83"N, 78°10'17.46"E	x	53I	N	1397.0	405705	29.24	0.0120	65021	Niche
satluj_gr 96	31°38'39.16"N, 78°09'50.51"E	x	53I	W	873.0	350802	27.36	0.0096	60021	Mountain
satluj_gr 97	31°38'28.91"N, 78°09'17.90"E	x	53I	N	3271.7	1335456	46.54	0.0624	63021	Mountain basin
satluj_gr 98	31°39'33.81"N, 78°08'00.61"E	x	53I	NE	3864.6	2434244	57.86	0.1406	63021	Mountain basin
satluj_gr 99	31°40'17.10"N, 78°07'56.38"E	x	53I	NE	1462.5	941757	40.71	0.0383	60021	Mountain
satluj_gr 100	31°39'56.20"N, 78°06'38.94"E	Sankari glacier	53I	NE	5619.5	5001300	74.57	0.3729	62021	Mountain basin
satluj_gr 101	31°40'54.81"N, 78°05'53.68"E	x	53I	E	1600.1	613463	34.38	0.0210	63051	Mountain basin
satluj_gr 102	31°41'39.80"N, 78°05'48.79"E	x	53I	E	1170.6	347564	27.36	0.0096	60021	Mountain
satluj_gr 103	31°42'10.27"N, 78°06'05.26"E	x	53I	SE	946.9	278125	24.86	0.0070	60021	Mountain
satluj_gr 104	31°42'25.98"N, 78°06'47.14"E	x	53I	S	1811.5	1269433	45.62	0.0579	60021	Mountain
satluj_gr 105	31°42'22.57"N, 78°07'28.29"E	x	53I	S	2025.5	854310	39.16	0.0333	63021	Mountain basin
satluj_gr 106	31°42'54.25"N, 78°10'51.42"E	x	53I	SE	683.4	267308	24.46	0.0066	60021	Mountain
satluj_gr 107	31°42'58.09"N, 78°10'23.72"E	x	53I	E	589.2	150273	18.68	0.0028	60021	Mountain
satluj_gr 108	31°42'32.88"N, 78°09'52.32"E	x	53I	N	2551.3	1268172	45.62	0.0579	63021	Mountain basin
satluj_gr 109	31°42'44.16"N, 78°09'13.92"E	Phuldang glacier	53I	N	1696.7	1840416	52.32	0.0963	60021	Mountain
satluj_gr 110	31°43'02.30"N, 78°08'22.99"E	Drimbling glacier	53I	N	3367.5	2792314	60.78	0.1696	63021	Mountain basin
satluj_gr 111	31°43'44.07"N, 78°07'31.68"E	x	53I	NW	1332.5	616571	34.60	0.0215	60021	Mountain
satluj_gr 112	31°43'28.28"N, 78°06'47.05"E	x	53I	NE	2304.0	1035547	42.31	0.0440	63021	Mountain basin
satluj_gr 113	31°43'53.08"N, 78°05'54.60"E	x	53I	NE	2698.9	2750313	60.47	0.1663	60021	Mountain
satluj_gr 114	31°45'49.52"N, 78°07'48.25"E	x	53I	N	499.5	61617	11.47	0.0007	64021	Cirque
satluj_gr 115	31°45'10.67"N, 78°06'35.16"E	x	53I	N	1054.8	506719	31.99	0.0163	60021	Mountain
satluj_gr 116	31°45'30.72"N, 78°06'14.13"E	x	53I	NE	578.0	118205	16.74	0.0020	65021	Niche
satluj_gr 117	31°45'06.90"N, 78°05'20.63"E	x	53I	NE	4565.8	4865095	73.90	0.3599	63021	Mountain basin
satluj_gr 118	31°46'33.72"N, 78°05'54.97"E	x	53I	SE	522.4	123828	16.74	0.0020	60021	Mountain
satluj_gr 119	31°46'51.43"N, 78°06'16.89"E	x	53I	SE	811.1	243438	23.22	0.0056	60021	Mountain
satluj_gr 120	31°47'01.24"N, 78°07'09.15"E	x	53I	SE	582.2	99673	15.24	0.0015	60021	Mountain

satluj_gr 121	31°47'07.95"N, 78°06'33.96"E	x	53I	S	1536.9	569922	33.46	0.0191	60021	Mountain
satluj_gr 122	31°47'29.03"N, 78°05'42.25"E	x	53I	N	2117.1	943509	40.71	0.0383	60021	Mountain
satluj_gr 123	31°47'43.35"N, 78°05'06.74"E	x	53I	NE	770.6	310206	25.98	0.0081	60021	Mountain
satluj_gr 124	31°47'54.93"N, 78°04'21.81"E	x	53I	NE	568.9	190625	20.88	0.0040	60021	Mountain
satluj_gr 125	31°48'18.41"N, 78°04'11.63"E	x	53I	E	635.9	293672	25.24	0.0073	60021	Mountain
satluj_gr 126	31°48'53.91"N, 78°04'23.62"E	x	53I	E	619.6	137578	18.06	0.0025	60021	Mountain
satluj_gr 127	31°49'21.64"N, 78°04'17.56"E	x	53I	SE	766.4	189219	20.88	0.0040	60021	Mountain
satluj_gr 128	31°50'18.45"N, 78°05'07.86"E	x	53I	SE	2043.1	783828	37.87	0.0295	63021	Mountain basin
satluj_gr 129	31°50'45.06"N, 78°04'54.41"E	x	53I	E	453.3	73359	12.55	0.0009	64021	Cirque
satluj_gr 130	31°51'08.55"N, 78°05'02.01"E	x	53I	SE	336.3	39766	8.86	0.0004	65021	Niche
satluj_gr 131	31°51'25.12"N, 78°05'03.16"E	x	53I	E	545.0	101094	15.24	0.0015	65021	Niche
satluj_gr 132	31°51'50.30"N, 78°04'40.65"E	x	53I	SE	1173.9	407500	29.24	0.0120	60021	Mountain
satluj_gr 133	31°52'25.65"N, 78°04'29.98"E	x	53I	E	682.2	102500	15.24	0.0015	64021	Cirque
satluj_gr 134	31°52'50.44"N, 78°04'33.84"E	x	53I	N	280.2	32765	7.19	0.0002	37021	Ice Cap
satluj_gr 135	31°53'09.39"N, 78°04'45.30"E	x	53I	SE	1062.5	228594	22.78	0.0052	65021	Niche
satluj_gr 136	31°49'38.24"N, 78°15'22.20"E	x	53I	SW	457.5	100058	15.24	0.0015	64021	Cirque
satluj_gr 137	31°48'50.32"N, 78°15'09.42"E	x	53I	NW	738.4	215746	22.33	0.0049	64021	Cirque
satluj_gr 138	31°48'10.78"N, 78°15'18.37"E	x	53I	NW	1699.4	532135	32.49	0.0172	63021	Mountain basin
satluj_gr 139	31°48'03.88"N, 78°15'43.50"E	x	53I	E	723.0	200582	21.38	0.0043	60021	Mountain
satluj_gr 140	31°48'50.60"N, 78°15'50.81"E	x	53I	SE	858.1	211795	21.86	0.0046	65021	Niche
satluj_gr 141	31°49'23.67"N, 78°16'08.47"E	x	53I	S	2471.5	1370444	46.93	0.0643	63021	Mountain basin
satluj_gr 142	31°47'47.16"N, 78°18'20.70"E	x	53I	W	637.4	103483	15.24	0.0015	60021	Mountain
satluj_gr 143	31°47'07.68"N, 78°19'03.91"E	x	53I	NE	883.4	250342	23.65	0.0059	60021	Mountain
satluj_gr 144	31°47'30.10"N, 78°18'34.23"E	x	53I	SW	958.1	388058	28.64	0.0112	63021	Mountain basin
satluj_gr 145	31°49'05.77"N, 78°20'20.99"E	x	53I	N	627.6	145187	18.68	0.0028	63021	Mountain basin
satluj_gr 146	31°49'10.76"N, 78°19'37.91"E	x	53I	NE	684.9	135192	18.06	0.0025	63021	Mountain basin
satluj_gr 147	31°48'55.82"N, 78°19'21.35"E	x	53I	SW	774.7	216936	22.33	0.0049	60021	Mountain
satluj_gr 148	31°48'08.60"N, 78°18'56.27"E	x	53I	NW	1899.7	1663044	50.38	0.0836	63021	Mountain basin
satluj_gr 149	31°48'32.98"N, 78°18'05.93"E	x	53I	NE	1627.7	317119	26.33	0.0084	63021	Mountain basin
satluj_gr 150	31°48'47.07"N, 78°17'52.50"E	x	53I	NE	475.0	82254	13.52	0.0011	60021	Mountain
satluj_gr 151	31°49'00.14"N, 78°17'21.35"E	x	53I	NE	2010.3	671928	35.68	0.0239	60021	Mountain
satluj_gr 152	31°50'31.69"N, 78°17'14.64"E	x	53I	E	421.8	76982	13.52	0.0011	65021	Niche
satluj_gr 153	31°50'48.34"N, 78°16'42.11"E	x	53I	N	999.2	199470	21.38	0.0043	65021	Niche

satluj_gr 154	31°50'15.58"N, 78°16'12.43"E	x	53I	N	2239.7	1098531	43.22	0.0475	63021	Mountain basin
satluj_gr 155	31°53'14.46"N, 78°09'54.94"E	x	53I	SE	620.7	150942	18.68	0.0028	60021	Mountain
satluj_gr 156	31°53'32.05"N, 78°09'37.67"E	x	53I	SE	838.4	238407	23.22	0.0056	60021	Mountain
satluj_gr 157	31°54'01.61"N, 78°10'16.30"E	x	53I	SW	1593.7	333760	26.68	0.0088	63021	Mountain basin
satluj_gr 158	31°53'53.33"N, 78°10'51.58"E	x	53I	SW	1295.0	353823	27.36	0.0096	63021	Mountain basin
satluj_gr 159	31°53'49.34"N, 78°11'32.21"E	x	53I	NE	951.5	220877	22.33	0.0049	63021	Mountain basin
satluj_gr 160	31°54'11.03"N, 78°10'55.76"E	x	53I	E	377.9	82048	13.52	0.0011	64021	Cirque
satluj_gr 161	31°54'29.63"N, 78°10'37.83"E	x	53I	NE	889.7	171675	19.83	0.0034	63021	Mountain basin
satluj_gr 162	31°55'16.93"N, 78°10'11.37"E	x	53I	E	541.3	117819	16.74	0.0020	64021	Cirque
satluj_gr 163	31°55'49.92"N, 78°10'08.17"E	x	53I	E	462.9	94826	14.42	0.0013	64021	Cirque
satluj_gr 164	31°58'00.18"N, 78°20'07.64"E	x	53I	E	2499.8	952613	40.87	0.0388	60021	Mountain
satluj_gr 165	31°58'57.39"N, 78°19'39.42"E	x	53I	SE	1576.9	543180	32.73	0.0177	60021	Mountain
satluj_gr 166	31°59'34.19"N, 78°20'03.54"E	x	53I	SE	1518.1	757028	37.49	0.0285	60021	Mountain
satluj_gr 167	31°59'33.23"N, 78°21'21.08"E	x	53I	S	3628.2	2241015	56.19	0.1259	63021	Mountain basin
satluj_gr 168	31°59'12.53"N, 78°22'53.40"E	x	53I	SW	1917.7	1124658	43.51	0.0487	60021	Mountain
satluj_gr 169	31°58'34.15"N, 78°23'19.22"E	x	53I	SW	2193.8	467531	30.94	0.0145	60021	Mountain
satluj_gr 170	31°57'13.02"N, 78°23'36.81"E	x	53I	NW	934.9	310605	25.98	0.0081	63021	Mountain basin
satluj_gr 171	31°57'44.63"N, 78°24'01.09"E	x	53I	NE	1731.0	721439	36.71	0.0264	62021	Mountain basin
satluj_gr 172	31°58'38.62"N, 78°24'06.00"E	x	53I	S	2079.0	685082	36.10	0.0249	63021	Mountain basin
satluj_gr 173	31°58'46.12"N, 78°24'52.95"E	x	53I	S	1621.8	599386	34.15	0.0205	63021	Mountain basin
satluj_gr 174	31°58'29.81"N, 78°25'29.77"E	x	53I	S	1106.0	261132	24.06	0.0063	63021	Mountain basin
satluj_gr 175	31°54'00.87"N, 78°26'20.50"E	x	53I	NW	2073.6	589461	33.92	0.0200	63021	Mountain basin
satluj_gr 176	31°52'48.51"N, 78°27'18.45"E	x	53I	SW	719.6	188583	20.88	0.0040	37021	Ice Cap
satluj_gr 177	32°00'27.58"N, 78°26'02.63"E	x	53I	E	1260.5	414326	29.24	0.0120	60021	Mountain
satluj_gr 178	32°01'47.50"N, 78°24'18.88"E	x	53I	N	1290.0	455104	30.67	0.0141	63021	Mountain basin
satluj_gr 179	32°00'19.80"N, 78°25'22.94"E	x	53I	NW	2130.5	846355	39.16	0.0333	63021	Mountain basin
satluj_gr 180	31°59'52.15"N, 78°25'32.60"E	x	53I	SW	1063.1	235024	23.22	0.0056	60021	Mountain
satluj_gr 181	31°59'16.47"N, 78°25'13.12"E	x	53I	NW	2942.9	2022301	54.13	0.1093	63021	Mountain basin
satluj_gr 182	31°59'17.23"N, 78°23'48.42"E	x	53I	N	2920.9	2341954	57.08	0.1336	63021	Mountain basin
satluj_gr 183	32°00'02.39"N, 78°22'58.81"E	x	53I	NE	1825.3	1041412	42.31	0.0440	63021	Mountain basin
satluj_gr 184	32°00'25.70"N, 78°22'41.94"E	x	53I	NE	1355.2	423305	29.54	0.0124	63021	Mountain basin
satluj_gr 185	32°00'27.02"N, 78°21'38.07"E	x	52L	N	1533.8	990915	41.52	0.0411	63021	Mountain basin
satluj_gr 186	32°00'44.30"N, 78°19'53.13"E	x	52L	NE	846.9	150458	18.68	0.0028	65021	Niche

satluj_gr 187	32°01'30.89"N, 78°19'31.88"E	x	52L	NW	1609.2	663249	35.47	0.0234	63021	Mountain basin
satluj_gr 188	32°01'09.25"N, 78°19'25.41"E	x	53I	W	1416.2	535040	32.73	0.0177	60021	Mountain
satluj_gr 189	31°59'58.68"N, 78°20'12.39"E	x	53I	W	1805.7	605526	34.38	0.0210	63021	Mountain basin
satluj_gr 190	31°58'33.85"N, 78°18'57.21"E	x	53I	N	2756.7	934914	40.54	0.0377	63021	Mountain basin
satluj_gr 191	31°58'45.44"N, 78°17'51.72"E	x	52L	N	2201.8	2018195	54.13	0.1093	63021	Mountain basin
satluj_gr 192	31°59'31.85"N, 78°18'24.23"E	x	52L	NW	978.7	294606	25.24	0.0073	60021	Mountain
satluj_gr 193	31°58'36.13"N, 78°16'38.48"E	x	52L	NW	1262.1	396729	28.94	0.0116	60021	Mountain
satluj_gr 194	31°58'58.22"N, 78°16'15.50"E	x	52L	NW	736.0	168076	19.83	0.0034	60021	Mountain
satluj_gr 195	31°58'02.63"N, 78°16'23.87"E	x	52L	N	1931.4	711928	36.50	0.0259	60021	Mountain
satluj_gr 196	32°00'22.01"N, 78°06'46.85"E	x	52L	NE	1791.8	467229	30.94	0.0145	63021	Mountain basin
satluj_gr 197	31°58'01.62"N, 78°10'19.21"E	x	53I	NW	1324.7	458277	30.67	0.0141	64021	Cirque
satluj_gr 198	31°57'25.19"N, 78°10'10.89"E	x	53I	N	1316.7	337729	27.03	0.0092	65021	Niche
satluj_gr 199	31°57'17.17"N, 78°09'44.23"E	x	53I	N	982.4	488469	31.47	0.0154	64021	Cirque
satluj_gr 200	31°54'38.24"N, 78°10'12.84"E	x	53I	SW	588.7	162163	19.27	0.0031	64021	Cirque
satluj_gr 201	31°53'53.58"N, 78°08'54.98"E	x	53I	N	1134.5	252148	23.65	0.0059	63021	Mountain basin
satluj_gr 202	31°53'43.35"N, 78°08'23.52"E	x	53I	N	920.3	323083	26.33	0.0084	63021	Mountain basin
satluj_gr 203	31°53'59.52"N, 78°07'00.71"E	x	53I	N	991.1	229154	22.78	0.0052	63021	Mountain basin
satluj_gr 204	31°53'28.02"N, 78°04'25.08"E	x	53I	NE	882.3	269430	24.46	0.0066	63021	Mountain basin
satluj_gr 205	31°53'41.71"N, 78°03'58.76"E	x	53I	N	1240.7	638906	35.04	0.0224	60021	Mountain
satluj_gr 206	31°54'03.73"N, 78°03'00.20"E	x	53I	NW	780.7	125859	17.42	0.0023	60021	Mountain
satluj_gr 207	31°50'54.53"N, 78°03'50.35"E	x	53I	N	3214.1	3288181	64.44	0.2120	62021	Mountain basin
satluj_gr 208	31°51'35.03"N, 78°02'47.36"E	x	53I	N	1682.1	592266	33.92	0.0200	63021	Mountain basin
satluj_gr 209	31°49'59.57"N, 78°03'39.08"E	x	53I	W	382.1	47031	10.26	0.0005	64021	Cirque
satluj_gr 210	31°49'36.93"N, 78°03'59.63"E	x	53I	SW	631.8	196797	21.38	0.0043	63021	Mountain basin
satluj_gr 211	31°48'45.97"N, 78°03'15.22"E	x	53I	N	2321.0	1462624	48.05	0.0702	61021	Mountain basin
satluj_gr 212	31°49'43.65"N, 78°01'59.27"E	x	53I	SW	858.7	330474	26.68	0.0088	60021	Mountain
satluj_gr 213	31°48'58.65"N, 78°02'15.26"E	x	53I	NW	871.1	132109	17.42	0.0023	65021	Niche
satluj_gr 214	31°48'20.91"N, 78°02'15.02"E	x	53I	NW	1346.7	747180	37.30	0.0280	63021	Mountain basin
satluj_gr 215	31°47'59.32"N, 78°01'44.70"E	x	53I	NW	1715.0	984375	41.36	0.0405	63051	Mountain basin
satluj_gr 216	31°48'00.33"N, 78°00'48.56"E	x	53I	N	3948.3	4001700	69.01	0.2761	62021	Mountain basin
satluj_gr 217	31°48'48.98"N, 77°59'59.32"E	x	53I	W	508.3	58418	11.47	0.0007	65021	Niche
satluj_gr 218	31°48'08.63"N, 77°59'28.58"E	x	53I	N	2274.6	1138016	43.80	0.0499	63021	Mountain basin
satluj_gr 219	31°48'21.83"N, 77°58'29.82"E	x	53I	NE	1872.1	1120156	43.51	0.0487	60021	Mountain

satluj_gr 220	31°48'53.99"N, 77°58'33.35"E	x	53I	E	504.5	64588	11.47	0.0007	65021	Niche
satluj_gr 221	31°49'09.84"N, 77°58'10.87"E	x	53I	NE	604.2	155938	19.27	0.0031	60021	Mountain
satluj_gr 222	31°49'20.39"N, 77°57'26.92"E	x	53I	NW	725.6	197578	21.38	0.0043	60021	Mountain
satluj_gr 223	31°49'10.92"N, 77°57'55.51"E	x	53I	E	408.9	49219	10.26	0.0005	37021	Ice Cap
satluj_gr 224	31°48'18.80"N, 77°57'24.67"E	x	53I	NW	2919.1	1090000	43.07	0.0469	63021	Mountain basin
satluj_gr 225	31°48'19.47"N, 77°56'55.85"E	x	53E	N	961.3	119390	16.74	0.0020	63021	Mountain basin
satluj_gr 226	31°48'47.09"N, 77°56'29.54"E	x	53E	NE	1253.0	608808	34.38	0.0210	60021	Mountain
satluj_gr 227	31°46'52.65"N, 77°55'44.88"E	x	53E	N	903.7	219531	22.33	0.0049	60021	Mountain
satluj_gr 228	31°46'25.46"N, 77°55'18.14"E	x	53E	N	3654.3	2100725	54.89	0.1153	63021	Mountain basin
satluj_gr 229	31°46'38.34"N, 77°54'43.29"E	x	53E	NE	624.9	148482	18.68	0.0028	60021	Mountain
satluj_gr 230	31°47'06.73"N, 77°54'42.06"E	x	53E	NE	1117.5	426250	29.82	0.0128	60021	Mountain
satluj_gr 231	31°47'12.72"N, 77°54'18.53"E	x	53E	N	835.6	168281	19.83	0.0034	60021	Mountain
satluj_gr 232	31°46'39.27"N, 77°53'49.97"E	x	53E	N	3109.1	2383384	57.43	0.1367	63021	Mountain basin
satluj_gr 233	31°47'11.14"N, 77°52'54.95"E	x	53E	NE	1647.3	1134328	43.66	0.0493	60021	Mountain
satluj_gr 234	31°47'39.99"N, 77°52'51.85"E	x	53E	NE	763.8	232036	22.78	0.0052	60021	Mountain
satluj_gr 235	31°48'02.21"N, 77°53'08.03"E	x	53E	NE	643.8	175282	20.37	0.0037	60021	Mountain
satluj_gr 236	31°48'27.54"N, 77°53'24.69"E	x	53E	SE	1107.5	287925	25.24	0.0073	60021	Mountain
satluj_gr 237	31°48'59.08"N, 77°53'45.98"E	x	53E	SE	1001.6	517740	32.24	0.0168	60021	Mountain
satluj_gr 238	31°50'22.71"N, 77°55'14.24"E	x	53E	NE	1327.6	430851	29.82	0.0128	60021	Mountain
satluj_gr 239	31°50'41.40"N, 77°54'59.95"E	x	53E	NE	1048.2	374660	28.01	0.0104	60021	Mountain
satluj_gr 240	31°49'32.97"N, 77°54'03.49"E	x	53E	N	2233.8	1966172	53.64	0.1057	60021	Mountain
satluj_gr 241	31°50'19.53"N, 77°53'31.44"E	x	53E	N	1337.2	577597	33.69	0.0195	63021	Mountain basin
satluj_gr 242	31°49'49.47"N, 77°53'29.07"E	x	53E	NW	213.3	34444	7.19	0.0002	37021	Ice Cap
satluj_gr 243	31°49'32.10"N, 77°53'18.80"E	x	53E	NW	432.8	61288	11.47	0.0007	65021	Niche
satluj_gr 244	31°49'08.98"N, 77°53'19.20"E	x	53E	NW	1049.4	328084	26.68	0.0088	60021	Mountain
satluj_gr 245	31°48'46.05"N, 77°53'13.47"E	x	53E	NW	639.6	121603	16.74	0.0020	60021	Mountain
satluj_gr 246	31°48'27.48"N, 77°52'24.92"E	x	53E	N	4043.3	5070952	74.93	0.3799	62021	Mountain basin
satluj_gr 247	31°49'03.42"N, 77°51'11.05"E	x	53E	N	2698.3	1822290	52.11	0.0948	63021	Mountain basin
satluj_gr 248	31°49'28.18"N, 77°50'36.26"E	x	53E	NE	1457.1	1160965	44.09	0.0511	60021	Mountain
satluj_gr 249	31°50'10.35"N, 77°50'29.50"E	x	53E	NE	1336.1	737603	37.10	0.0275	63021	Mountain basin
satluj_gr 250	31°50'46.93"N, 77°50'25.43"E	x	53E	E	1072.4	305204	25.98	0.0081	63021	Mountain basin
satluj_gr 251	31°51'40.24"N, 77°50'31.66"E	x	53E	E	3325.9	3515933	65.99	0.2323	63021	Mountain basin
satluj_gr 252	31°52'49.07"N, 77°50'21.88"E	x	53E	E	4001.1	4528466	72.07	0.3265	63051	Mountain basin

satluj_gr 253	31°53'53.19"N, 77°51'28.32"E	x	53E	S	1496.7	1020085	42.00	0.0428	60051	Mountain
satluj_gr 254	31°53'42.16"N, 77°52'45.44"E	x	53E	S	7311.6	12297407	101.20	1.2448	51012	Valley glacier
satluj_gr 255	31°52'38.35"N, 77°53'28.08"E	x	53E	SE	2339.9	994066	41.52	0.0411	63021	Mountain basin
satluj_gr 256	31°53'17.58"N, 77°53'59.47"E	x	53E	SE	2974.6	2081267	54.70	0.1138	63021	Mountain basin
satluj_gr 257	31°53'23.93"N, 77°54'36.20"E	x	53E	SE	771.2	103783	15.24	0.0015	37021	Ice Cap
satluj_gr 258	31°53'36.91"N, 77°54'54.64"E	x	53E	SE	2679.8	2571618	59.03	0.1517	63021	Mountain basin
satluj_gr 259	31°53'38.52"N, 77°57'08.68"E	x	53E	SE	1050.1	369058	28.01	0.0104	63021	Mountain basin
satluj_gr 260	31°54'11.68"N, 77°57'44.65"E	x	53E	NE	811.9	209271	21.86	0.0046	60021	Mountain
satluj_gr 261	31°53'56.93"N, 77°56'45.20"E	x	53E	NE	4074.1	3220467	63.95	0.2059	63021	Mountain basin
satluj_gr 262	31°54'37.44"N, 77°56'17.70"E	x	53E	E	1762.5	746306	37.30	0.0280	63051	Mountain basin
satluj_gr 263	31°55'01.10"N, 77°56'13.61"E	x	53E	SE	1135.0	370110	28.01	0.0104	60021	Mountain
satluj_gr 264	31°55'15.99"N, 77°56'27.07"E	x	53E	SE	964.5	303828	25.61	0.0077	60021	Mountain
satluj_gr 265	31°55'56.41"N, 77°58'36.92"E	x	53E	NE	1690.0	420402	29.54	0.0124	67021	Ice Apron
satluj_gr 266	31°56'10.79"N, 77°58'00.12"E	x	53E	NE	477.8	97566	15.24	0.0015	67021	Ice Apron
satluj_gr 267	31°56'27.06"N, 77°58'08.01"E	x	53E	NE	802.0	186939	20.88	0.0040	67021	Ice Apron
satluj_gr 268	31°56'51.64"N, 77°58'17.38"E	x	53E	E	896.3	206408	21.86	0.0046	67021	Ice Apron
satluj_gr 269	31°57'24.91"N, 77°58'23.31"E	x	53E	E	1514.5	676353	35.89	0.0244	67021	Ice Apron
satluj_gr 270	31°58'17.77"N, 77°57'56.88"E	x	53E	NE	292.1	23389	5.07	0.0001	65021	Niche
satluj_gr 271	31°58'43.55"N, 77°57'46.26"E	x	53E	NE	427.9	52133	10.26	0.0005	67021	Ice Apron
satluj_gr 272	32°00'03.14"N, 77°59'03.14"E	x	53E	NE	851.4	138048	18.06	0.0025	67021	Ice Apron
satluj_gr 273	32°00'04.82"N, 77°58'33.61"E	x	53E	NE	1310.0	384976	28.33	0.0108	67021	Ice Apron
satluj_gr 274	32°01'24.41"N, 77°59'23.59"E	x	53E	SE	685.4	84550	13.52	0.0011	67021	Ice Apron
satluj_gr 275	32°01'23.49"N, 78°01'14.12"E	x	53E	NE	1285.6	775078	37.87	0.0295	67021	Ice Apron
satluj_gr 276	32°01'45.97"N, 78°00'13.62"E	x	53E	E	1150.5	217625	22.33	0.0049	65021	Niche
satluj_gr 277	32°02'23.68"N, 78°00'16.92"E	x	53E	NE	471.8	125951	17.42	0.0023	60021	Mountain
satluj_gr 278	32°01'52.09"N, 77°59'24.25"E	x	53E	N	1527.5	846780	39.16	0.0333	63021	Mountain basin
satluj_gr 279	32°02'33.70"N, 77°58'41.33"E	x	53E	N	727.5	110537	16.01	0.0018	65021	Niche
satluj_gr 280	32°00'30.52"N, 77°58'15.93"E	x	53E	N	888.9	295791	25.61	0.0077	60021	Mountain
satluj_gr 281	32°00'18.70"N, 77°58'01.10"E	x	53E	N	892.0	169366	19.83	0.0034	60021	Mountain
satluj_gr 282	31°55'56.55"N, 77°57'13.49"E	x	52H	N	3294.7	2636351	59.60	0.1573	63021	Mountain basin
satluj_gr 283	31°56'31.95"N, 77°56'30.87"E	x	52L	NE	1319.1	738039	37.10	0.0275	60021	Mountain
satluj_gr 284	31°55'51.16"N, 77°55'58.91"E	x	52L	NW	842.1	309632	25.98	0.0081	67021	Ice Apron
satluj_gr 285	31°55'37.22"N, 77°55'59.51"E	x	52L	NW	250.8	31847	7.19	0.0002	67021	Ice Apron

satluj_gr 286	31°55'29.84"N, 77°55'54.92"E	x	52H	NW	446.0	42859	8.86	0.0004	65021	Niche
satluj_gr 287	31°55'10.07"N, 77°55'50.87"E	x	52H	NW	407.1	47162	10.26	0.0005	65021	Niche
satluj_gr 288	31°57'19.19"N, 77°55'30.20"E	x	52H	NE	7002.1	14247693	106.28	1.5145	62021	Mountain basin
satluj_gr 289	31°57'08.71"N, 77°53'45.15"E	x	52H	S	625.8	165042	19.83	0.0034	67021	Ice Apron
satluj_gr 290	31°57'51.81"N, 77°54'12.10"E	x	53E	NE	4526.8	2436822	57.94	0.1414	63021	Mountain basin
satluj_gr 291	31°59'00.33"N, 77°53'51.93"E	x	53E	NE	4000.1	2196118	55.82	0.1228	63021	Mountain basin
satluj_gr 292	31°59'47.07"N, 77°53'41.91"E	x	53E	NE	6311.6	4766534	73.37	0.3500	63021	Mountain basin
satluj_gr 293	32°00'31.90"N, 77°53'08.04"E	x	53E	NE	6173.1	4345966	71.06	0.3091	63021	Mountain basin
satluj_gr 294	32°01'48.23"N, 77°53'05.92"E	x	53E	NE	1998.7	574837	33.46	0.0191	63021	Mountain basin
satluj_gr 295	32°02'30.24"N, 77°52'53.65"E	x	53E	NW	1218.4	571619	33.46	0.0191	67021	Ice Apron
satluj_gr 296	32°01'24.29"N, 77°52'11.11"E	x	53E	N	2078.7	983901	41.36	0.0405	67021	Ice Apron
satluj_gr 297	32°01'44.47"N, 77°51'38.56"E	x	53E	NW	1610.8	641767	35.04	0.0224	67021	Ice Apron
satluj_gr 298	32°01'07.41"N, 77°51'10.73"E	x	53E	NW	1987.0	1182061	44.38	0.0524	67021	Ice Apron
satluj_gr 299	32°00'53.08"N, 77°50'42.52"E	x	53E	NW	1505.8	689907	36.10	0.0249	67021	Ice Apron
satluj_gr 300	31°59'27.84"N, 77°52'09.16"E	x	53E	S	436.2	321988	26.33	0.0084	67021	Ice Apron
satluj_gr 301	31°57'56.81"N, 77°52'53.65"E	x	52H	W	4677.7	3653635	66.84	0.2440	63021	Mountain basin
satluj_gr 302	31°57'06.20"N, 77°52'22.13"E	x	52H	SW	373.4	253793	23.65	0.0059	67021	Ice Apron
satluj_gr 303	31°57'18.24"N, 77°50'47.75"E	x	52H	N	9390.3	30684153	136.70	4.1941	51012	Valley glacier
satluj_gr 304	31°59'25.69"N, 77°49'27.14"E	x	52H	NE	2591.1	1925739	53.24	0.1027	67021	Ice Apron
satluj_gr 305	31°58'04.00"N, 77°46'43.89"E	x	52H	NE	10433.0	19565801	118.03	2.3098	53012	Valley glacier
satluj_gr 306	31°59'38.24"N, 77°46'48.26"E	x	52H	SE	2089.9	806016	38.43	0.0311	67051	Ice Apron
satluj_gr 307	31°59'58.66"N, 77°46'39.98"E	x	52H	E	1866.1	688070	36.10	0.0249	67051	Ice Apron
satluj_gr 308	32°00'08.51"N, 77°47'29.86"E	x	53E	SE	2300.8	1155182	44.09	0.0511	67051	Ice Apron
satluj_gr 309	32°00'48.05"N, 77°47'04.77"E	x	53E	SE	707.8	328028	26.68	0.0088	67021	Ice Apron
satluj_gr 310	32°00'59.73"N, 77°47'47.21"E	x	53E	SE	3927.3	3450182	65.53	0.2261	63021	Mountain basin
satluj_gr 311	32°01'51.49"N, 77°47'31.40"E	x	53E	E	6975.9	9765995	93.69	0.9154	67021	Ice Apron
satluj_gr 312	32°02'47.73"N, 77°48'16.77"E	x	53E	SE	849.1	277914	24.86	0.0070	62021	Mountain basin
satluj_gr 313	32°02'31.72"N, 77°49'06.60"E	x	53E	SE	1193.3	414256	29.24	0.0120	67021	Ice Apron
satluj_gr 314	32°02'53.45"N, 77°49'06.87"E	x	53E	SE	2678.3	1125628	43.66	0.0493	63021	Mountain basin
satluj_gr 315	32°03'19.16"N, 77°49'35.20"E	x	53E	E	2341.6	703159	36.30	0.0254	63021	Mountain basin
satluj_gr 316	32°03'45.09"N, 77°49'37.73"E	x	52H	E	759.3	180087	20.37	0.0037	67021	Ice Apron
satluj_gr 317	32°04'09.12"N, 77°49'45.26"E	x	52H	SE	1119.8	336686	27.03	0.0092	63021	Mountain basin
satluj_gr 318	32°04'14.44"N, 77°50'23.10"E	x	52H	NE	2815.9	706812	36.50	0.0259	67021	Ice Apron

satluj_gr 319	32°04'51.86"N, 77°50'44.78"E	x	52H	N	1843.4	749227	37.30	0.0280	63021	Mountain basin
satluj_gr 320	32°04'20.61"N, 77°48'26.14"E	x	52H	NE	7273.3	13204832	103.61	1.3677	62021	Mountain basin
satluj_gr 321	32°06'00.53"N, 77°48'46.26"E	x	52H	N	3565.3	1686918	50.72	0.0857	63051	Mountain basin
satluj_gr 322	32°06'23.75"N, 77°47'22.91"E	x	52H	NE	11005.0	25138409	128.12	3.2209	52012	Valley glacier
satluj_gr 323	32°08'36.63"N, 77°46'48.69"E	x	52H	SE	6990.7	11877941	100.04	1.1884	63021	Mountain basin
satluj_gr 324	32°09'24.56"N, 77°48'05.21"E	x	52H	SE	7592.9	12450691	101.61	1.2651	63021	Mountain basin
satluj_gr 325	32°10'27.21"N, 77°48'23.30"E	x	52H	S	1508.2	359607	27.69	0.0100	67021	Ice Apron
satluj_gr 326	32°10'32.71"N, 77°48'58.09"E	x	52H	S	1325.4	484297	31.21	0.0150	63021	Mountain basin
satluj_gr 327	32°10'20.95"N, 77°50'00.09"E	x	52H	S	3175.5	2239090	56.19	0.1259	60021	Mountain
satluj_gr 328	32°09'27.15"N, 77°50'42.12"E	x	52H	W	1391.8	430788	29.82	0.0128	63021	Mountain basin
satluj_gr 329	32°09'00.66"N, 77°50'38.37"E	x	52H	W	1066.2	161653	19.27	0.0031	67021	Ice Apron
satluj_gr 330	32°08'22.48"N, 77°51'29.85"E	x	52H	SE	1174.6	229382	22.78	0.0052	67021	Ice Apron
satluj_gr 331	32°08'46.29"N, 77°51'14.05"E	x	52H	SE	1542.3	552076	32.98	0.0181	67021	Ice Apron
satluj_gr 332	32°09'34.91"N, 77°51'30.96"E	x	52H	S	1430.9	407966	29.24	0.0120	67021	Ice Apron
satluj_gr 333	32°09'20.51"N, 77°51'50.03"E	x	52H	S	449.3	96591	15.24	0.0015	67021	Ice Apron
satluj_gr 334	32°09'07.25"N, 77°52'45.93"E	x	52H	S	809.6	160547	19.27	0.0031	63021	Mountain basin
satluj_gr 335	32°08'26.96"N, 77°53'50.25"E	x	52H	W	2138.4	896968	40.03	0.0360	63021	Mountain basin
satluj_gr 336	32°06'51.57"N, 77°54'11.63"E	x	52H	NW	469.5	90287	14.42	0.0013	67021	Ice Apron
satluj_gr 337	32°06'27.00"N, 77°54'48.94"E	x	52H	W	474.7	75080	13.52	0.0011	64021	Cirque
satluj_gr 338	32°06'50.41"N, 77°54'36.86"E	x	52H	SE	347.5	96264	15.24	0.0015	64021	Cirque
satluj_gr 339	32°07'06.19"N, 77°55'02.34"E	x	52H	NE	2761.2	1459279	48.05	0.0702	63021	Mountain basin
satluj_gr 340	32°07'55.11"N, 77°54'26.41"E	x	52H	SE	1184.0	530771	32.49	0.0172	63021	Mountain basin
satluj_gr 341	32°08'36.94"N, 77°54'41.18"E	x	52H	NE	1727.5	1868334	52.63	0.0984	63021	Mountain basin
satluj_gr 342	32°09'20.53"N, 77°54'12.85"E	x	52H	SE	2289.2	695456	36.30	0.0254	63021	Mountain basin
satluj_gr 343	32°09'57.65"N, 77°55'37.28"E	x	52H	SE	223.8	26980	7.19	0.0002	64021	Cirque
satluj_gr 344	32°10'16.51"N, 77°55'45.07"E	x	52H	SE	272.2	30156	7.19	0.0002	64021	Cirque
satluj_gr 345	32°08'15.22"N, 78°01'28.39"E	x	52H	SE	1585.1	882187	39.69	0.0349	67021	Ice Apron
satluj_gr 346	32°08'34.61"N, 78°01'19.58"E	x	52H	NE	814.5	211866	21.86	0.0046	63021	Mountain basin
satluj_gr 347	32°08'54.91"N, 78°01'07.04"E	x	52H	NE	669.4	160155	19.27	0.0031	63021	Mountain basin
satluj_gr 348	32°08'35.24"N, 78°00'19.33"E	x	52H	NW	1765.0	466687	30.94	0.0145	67021	Ice Apron
satluj_gr 349	32°10'34.67"N, 77°56'37.20"E	x	52H	NE	450.1	69392	12.55	0.0009	67021	Ice Apron
satluj_gr 350	32°13'30.82"N, 77°58'50.76"E	x	52H	NE	1179.5	239961	23.22	0.0056	63021	Mountain basin
satluj_gr 351	32°14'19.16"N, 77°59'07.13"E	x	52H	N	709.1	193664	20.88	0.0040	64021	Cirque

satluj_gr 352	32°13'30.09"N, 77°58'18.19"E	x	52H	N	1413.4	336635	27.03	0.0092	63021	Mountain basin
satluj_gr 353	32°10'39.52"N, 77°55'40.43"E	x	52L	N	531.9	145201	18.68	0.0028	64021	Cirque
satluj_gr 354	32°10'27.38"N, 77°55'11.46"E	x	52L	N	267.9	52607	10.26	0.0005	64021	Cirque
satluj_gr 355	32°10'07.92"N, 77°54'44.03"E	x	52L	NW	800.4	78900	13.52	0.0011	65021	Niche
satluj_gr 356	32°09'41.51"N, 77°54'26.13"E	x	52L	NW	1415.3	376404	28.33	0.0108	63021	Mountain basin
satluj_gr 357	32°09'43.28"N, 77°53'59.62"E	x	52H	N	1378.6	339331	27.03	0.0092	63021	Mountain basin
satluj_gr 358	32°09'27.12"N, 77°53'22.22"E	x	52H	NW	1957.6	1395338	47.31	0.0662	63021	Mountain basin
satluj_gr 359	32°10'13.69"N, 77°52'49.96"E	x	52H	W	1032.1	259386	24.06	0.0063	63021	Mountain basin
satluj_gr 360	32°10'27.83"N, 77°51'49.10"E	x	52H	NE	3750.4	3483660	65.73	0.2287	62021	Mountain basin
satluj_gr 361	32°10'33.72"N, 77°51'05.81"E	x	52H	SE	1659.7	837750	38.98	0.0327	63051	Mountain basin
satluj_gr 362	32°10'56.71"N, 77°50'56.80"E	x	52H	NE	785.2	266087	24.46	0.0066	67021	Ice Apron
satluj_gr 363	32°11'19.20"N, 77°50'36.13"E	x	52H	N	2609.8	1552119	49.13	0.0761	63021	Mountain basin
satluj_gr 364	32°12'06.19"N, 77°50'00.85"E	x	52H	N	757.6	151930	18.68	0.0028	63021	Mountain basin
satluj_gr 365	32°12'07.90"N, 77°48'59.90"E	x	52H	NE	5617.0	12542107	101.86	1.2773	51012	Valley glacier
satluj_gr 366	32°14'06.04"N, 77°50'00.45"E	x	52H	SE	1101.2	296915	25.61	0.0077	63021	Mountain basin
satluj_gr 367	32°14'17.04"N, 77°50'38.10"E	x	52H	S	1941.9	530326	32.49	0.0172	63021	Mountain basin
satluj_gr 368	32°13'59.22"N, 77°52'30.57"E	x	52H	NE	630.6	159339	19.27	0.0031	63021	Mountain basin
satluj_gr 369	32°14'22.42"N, 77°51'21.89"E	x	52H	NE	2327.7	643129	35.04	0.0224	63021	Mountain basin
satluj_gr 370	32°14'45.47"N, 77°51'47.94"E	x	52H	NE	1514.3	306305	25.98	0.0081	67021	Ice Apron
satluj_gr 371	32°14'52.18"N, 77°52'04.25"E	x	52H	NE	823.0	174405	19.83	0.0034	64021	Cirque
satluj_gr 372	32°15'08.31"N, 77°51'38.32"E	x	52H	NE	3593.5	1468176	48.17	0.0708	62021	Mountain basin
satluj_gr 373	32°15'57.69"N, 77°51'29.37"E	x	52H	NE	776.7	217024	22.33	0.0049	67021	Ice Apron
satluj_gr 374	32°16'16.57"N, 77°51'21.16"E	x	52H	E	2126.2	853746	39.16	0.0333	63021	Mountain basin
satluj_gr 375	32°16'52.38"N, 77°51'25.11"E	x	52H	SE	941.7	289877	25.24	0.0073	64021	Cirque
satluj_gr 376	32°17'32.61"N, 77°52'11.34"E	x	52H	E	1117.2	450823	30.39	0.0137	63021	Mountain basin
satluj_gr 377	32°17'52.68"N, 77°52'07.99"E	x	52H	SE	786.6	203990	21.38	0.0043	63021	Mountain basin
satluj_gr 378	32°17'11.61"N, 77°54'05.81"E	x	52H	S	133.8	17302	5.07	0.0001	37021	Ice Cap
satluj_gr 379	32°16'57.30"N, 77°54'28.28"E	x	52H	SW	717.8	159335	19.27	0.0031	63021	Mountain basin
satluj_gr 380	32°17'27.30"N, 77°54'29.00"E	x	52H	SE	380.3	85791	14.42	0.0013	64021	Cirque
satluj_gr 381	32°17'35.90"N, 77°54'05.85"E	x	52H	NE	866.1	266429	24.46	0.0066	65021	Niche
satluj_gr 382	32°18'16.85"N, 77°53'22.83"E	x	52H	NE	3132.6	1951721	53.44	0.1042	63021	Mountain basin
satluj_gr 383	32°18'43.77"N, 77°52'50.25"E	x	52H	NE	3088.8	1047634	42.46	0.0446	63021	Mountain basin
satluj_gr 384	32°19'20.02"N, 77°52'18.50"E	x	52H	NE	609.2	156593	19.27	0.0031	64021	Cirque

satluj_gr 385	32°20'12.00"N, 77°51'57.38"E	x	52H	NW	836.0	218767	22.33	0.0049	67021	Ice Apron
satluj_gr 386	32°19'39.20"N, 77°51'50.83"E	x	52H	NW	1060.3	444667	30.11	0.0132	60021	Mountain
satluj_gr 387	32°18'27.33"N, 77°52'03.84"E	x	52H	W	559.5	88349	14.42	0.0013	37021	Ice Cap
satluj_gr 388	32°18'07.11"N, 77°51'45.65"E	x	52H	NW	1016.1	635765	35.04	0.0224	60021	Mountain
satluj_gr 389	32°17'25.61"N, 77°51'08.72"E	x	52H	NW	1454.5	1067743	42.77	0.0458	60021	Mountain
satluj_gr 390	32°16'18.09"N, 77°50'39.09"E	x	52H	NW	1334.9	621165	34.60	0.0215	60021	Mountain
satluj_gr 391	32°15'12.60"N, 77°49'51.55"E	x	52H	N	3021.7	3794529	67.72	0.2567	62021	Mountain basin
satluj_gr 392	32°14'39.65"N, 77°48'50.52"E	x	52H	N	5047.3	2762352	60.55	0.1671	63021	Mountain basin
satluj_gr 393	32°14'47.05"N, 77°48'06.52"E	x	52H	N	3111.3	797946	38.25	0.0306	37021	Ice Cap
satluj_gr 394	32°14'41.89"N, 77°47'17.54"E	x	52H	NE	5489.6	4753303	73.26	0.3480	63021	Mountain basin
satluj_gr 395	32°16'02.15"N, 77°46'35.80"E	x	52H	NE	1464.2	652604	35.25	0.0229	63021	Mountain basin
satluj_gr 396	32°16'52.19"N, 77°46'31.70"E	x	52H	SE	1756.5	1122190	43.51	0.0487	63021	Mountain basin
satluj_gr 397	32°18'04.52"N, 77°46'49.38"E	x	52H	NE	2105.4	618360	34.60	0.0215	63021	Mountain basin
satluj_gr 398	32°18'51.56"N, 77°47'21.12"E	x	52H	E	1178.9	271192	24.46	0.0066	63021	Mountain basin
satluj_gr 399	32°20'33.37"N, 77°48'27.98"E	x	52H	SE	550.1	109511	16.01	0.0018	37021	Ice Cap
satluj_gr 400	32°21'06.54"N, 77°48'13.56"E	x	52H	E	723.8	178573	20.37	0.0037	37021	Ice Cap
satluj_gr 401	32°19'18.19"N, 77°47'16.85"E	x	52H	N	1493.2	478066	31.21	0.0150	63021	Mountain basin
satluj_gr 402	32°18'52.21"N, 77°46'40.46"E	x	52H	N	2386.6	758013	37.49	0.0285	63021	Mountain basin
satluj_gr 403	32°18'00.50"N, 77°46'04.27"E	x	52H	N	3336.6	1409834	47.43	0.0669	63021	Mountain basin
satluj_gr 404	32°18'06.72"N, 77°45'48.60"E	x	52H	N	2413.8	603040	34.15	0.0205	63021	Mountain basin
satluj_gr 405	32°16'28.28"N, 77°45'55.50"E	x	52H	NW	1656.1	462817	30.67	0.0141	63021	Mountain basin
satluj_gr 406	32°15'30.82"N, 77°46'26.39"E	x	52H	W	1037.9	309453	25.98	0.0081	60021	Mountain
satluj_gr 407	32°15'03.81"N, 77°45'34.08"E	x	52H	N	5222.8	4643960	72.67	0.3372	63021	Mountain basin
satluj_gr 408	32°15'14.68"N, 77°44'29.61"E	x	52H	N	6131.0	5162407	75.39	0.3890	63021	Mountain basin
satluj_gr 409	32°15'42.04"N, 77°44'11.76"E	x	52H	N	3066.7	1196213	44.66	0.0536	63021	Mountain basin
satluj_gr 410	32°16'45.79"N, 77°43'59.64"E	x	52H	NE	1848.8	516183	32.24	0.0168	63021	Mountain basin
satluj_gr 411	32°17'02.68"N, 77°43'37.95"E	x	52H	NE	1617.3	383917	28.33	0.0108	63021	Mountain basin
satluj_gr 412	32°15'32.17"N, 77°43'05.76"E	x	52H	N	5839.5	3791067	67.72	0.2567	63021	Mountain basin
satluj_gr 413	32°16'06.05"N, 77°42'25.72"E	x	52H	NE	7163.1	11374099	98.58	1.1209	61021	Mountain basin
satluj_gr 414	32°18'40.31"N, 77°41'45.44"E	x	52H	E	2882.2	1272818	45.62	0.0579	63021	Mountain basin
satluj_gr 415	32°19'28.27"N, 77°41'56.79"E	x	52H	SE	1531.5	386848	28.64	0.0112	63021	Mountain basin
satluj_gr 416	32°19'54.58"N, 77°42'26.99"E	x	52H	SE	421.9	96631	15.24	0.0015	64021	Cirque
satluj_gr 417	32°20'18.05"N, 77°42'37.00"E	x	52H	SE	1937.1	738178	37.10	0.0275	60021	Mountain

satluj_gr 418	32°22'17.56"N, 77°44'22.41"E	x	52H	SE	533.3	140781	18.06	0.0025	60021	Mountain
satluj_gr 419	32°22'57.10"N, 77°44'29.25"E	x	52H	E	603.9	150261	18.68	0.0028	60021	Mountain
satluj_gr 420	32°23'04.83"N, 77°43'56.25"E	x	52H	NE	937.9	437731	30.11	0.0132	60021	Mountain
satluj_gr 421	32°23'23.34"N, 77°43'36.31"E	x	52H	NE	1325.8	374427	28.01	0.0104	60021	Mountain
satluj_gr 422	32°24'30.12"N, 77°44'46.59"E	x	52H	S	321.5	43906	8.86	0.0004	64021	Cirque
satluj_gr 423	32°24'05.29"N, 77°45'19.14"E	x	52H	S	875.8	136092	18.06	0.0025	65021	Niche
satluj_gr 424	32°23'52.07"N, 77°46'11.22"E	x	52H	NE	919.5	287410	25.24	0.0073	65021	Niche
satluj_gr 425	32°24'36.21"N, 77°45'43.97"E	x	52H	SE	1157.3	426893	29.82	0.0128	60021	Mountain
satluj_gr 426	32°24'31.34"N, 77°47'19.07"E	x	52H	NE	796.9	237861	23.22	0.0056	60021	Mountain
satluj_gr 427	32°25'16.42"N, 77°46'48.71"E	x	52H	NE	2379.8	925170	40.54	0.0377	63021	Mountain basin
satluj_gr 428	32°25'09.06"N, 77°45'56.05"E	x	52H	E	796.6	233507	22.78	0.0052	63051	Mountain basin
satluj_gr 429	32°25'46.97"N, 77°46'04.81"E	x	52H	NE	1942.9	953318	40.87	0.0388	63021	Mountain basin
satluj_gr 430	32°26'08.02"N, 77°45'43.53"E	x	52H	NE	1894.2	618355	34.60	0.0215	63021	Mountain basin
satluj_gr 431	32°26'42.86"N, 77°46'38.04"E	x	52H	S	1642.4	383473	28.33	0.0108	63021	Mountain basin
satluj_gr 432	32°26'25.08"N, 77°50'38.31"E	x	52H	SE	1771.3	630435	34.82	0.0219	63021	Mountain basin
satluj_gr 433	32°26'45.26"N, 77°50'55.29"E	x	52H	SE	1007.5	148163	18.68	0.0028	37021	Ice Cap
satluj_gr 434	32°27'12.84"N, 77°50'43.59"E	x	52H	NE	1660.9	617766	34.60	0.0215	63021	Mountain basin
satluj_gr 435	32°27'43.69"N, 77°50'04.62"E	x	52H	N	436.4	106499	16.01	0.0018	65021	Niche
satluj_gr 436	32°27'26.41"N, 77°49'58.00"E	x	52H	N	1910.7	525027	32.49	0.0172	63021	Mountain basin
satluj_gr 437	32°26'38.26"N, 77°49'47.05"E	x	52H	NW	2442.8	1206624	44.80	0.0542	63021	Mountain basin
satluj_gr 438	32°26'53.56"N, 77°48'34.26"E	x	52H	N	658.7	166368	19.83	0.0034	64021	Cirque
satluj_gr 439	32°27'09.34"N, 77°48'09.52"E	x	52H	NE	952.8	216324	22.33	0.0049	60021	Mountain
satluj_gr 440	32°27'09.63"N, 77°47'46.08"E	x	52H	N	1439.9	725439	36.91	0.0269	60021	Mountain
satluj_gr 441	32°26'57.05"N, 77°46'35.41"E	x	52H	NE	2204.1	729599	36.91	0.0269	63021	Mountain basin
satluj_gr 442	32°27'19.32"N, 77°46'03.59"E	x	52H	NE	823.9	182630	20.37	0.0037	37021	Ice Cap
satluj_gr 443	32°27'35.22"N, 77°45'26.51"E	x	52H	NE	476.0	84100	13.52	0.0011	37021	Ice Cap
satluj_gr 444	32°26'46.93"N, 77°45'37.32"E	x	52H	NW	1090.6	281996	24.86	0.0070	63021	Mountain basin
satluj_gr 445	32°26'25.59"N, 77°45'00.69"E	x	52H	NW	1947.3	671268	35.68	0.0239	63021	Mountain basin
satluj_gr 446	32°25'59.44"N, 77°44'52.01"E	x	52H	NW	486.7	101233	15.24	0.0015	37021	Ice Cap
satluj_gr 447	32°25'58.33"N, 77°43'40.83"E	x	52H	N	6598.8	11022450	97.56	1.0751	61021	Mountain basin
satluj_gr 448	32°27'15.37"N, 77°42'38.78"E	x	52H	NE	458.8	100929	15.24	0.0015	64021	Cirque
satluj_gr 449	32°27'27.73"N, 77°42'20.95"E	x	52H	NE	1224.0	278749	24.86	0.0070	63021	Mountain basin
satluj_gr 450	32°27'50.46"N, 77°42'03.89"E	x	52H	NE	1012.9	271173	24.46	0.0066	63021	Mountain basin

satluj_gr 451	32°28'06.00"N, 77°41'48.38"E	x	52H	N	924.1	179843	20.37	0.0037	60021	Mountain
satluj_gr 452	32°27'41.27"N, 77°41'23.62"E	x	52H	SW	783.3	181221	20.37	0.0037	64021	Cirque
satluj_gr 453	32°27'11.37"N, 77°41'10.82"E	x	52H	NW	5074.2	3167086	63.60	0.2016	62021	Mountain basin
satluj_gr 454	32°26'06.37"N, 77°40'24.75"E	x	52H	NW	7390.4	9027327	91.24	0.8239	62021	Mountain basin
satluj_gr 455	32°26'12.76"N, 77°38'23.05"E	x	52H	NW	2698.5	1713591	50.94	0.0871	67021	Ice Apron
satluj_gr 456	32°25'54.67"N, 77°37'51.84"E	x	52H	NW	916.8	282700	24.86	0.0070	63021	Mountain basin
satluj_gr 457	32°31'18.91"N, 77°37'59.00"E	x	52H	NE	251.9	41006	8.86	0.0004	64021	Cirque
satluj_gr 458	32°31'25.78"N, 77°37'31.54"E	x	52H	E	624.2	123910	16.74	0.0020	65021	Niche
satluj_gr 459	32°32'08.47"N, 77°37'33.23"E	x	52H	NE	282.6	49169	10.26	0.0005	64021	Cirque
satluj_gr 460	32°31'39.62"N, 77°37'05.58"E	x	52H	N	1335.6	473576	30.94	0.0145	60021	Mountain
satluj_gr 461	32°32'29.48"N, 77°36'47.53"E	x	52H	NE	579.1	147379	18.68	0.0028	67021	Ice Apron
satluj_gr 462	32°33'41.41"N, 77°36'26.61"E	x	52H	N	1049.7	398241	28.94	0.0116	60021	Mountain
satluj_gr 463	32°33'49.64"N, 77°36'54.27"E	x	52H	NE	891.8	126466	17.42	0.0023	65021	Niche
satluj_gr 464	32°34'01.64"N, 77°36'41.37"E	x	52H	NE	750.9	119982	16.74	0.0020	65021	Niche
satluj_gr 465	32°34'36.19"N, 77°36'21.87"E	x	52H	NE	2886.4	1305843	46.15	0.0605	67021	Ice Apron
satluj_gr 466	32°35'38.64"N, 77°35'17.85"E	x	52H	NE	2980.7	2938055	61.93	0.1821	61021	Mountain basin
satluj_gr 467	32°36'33.57"N, 77°34'33.30"E	x	52H	SE	1081.8	155222	19.27	0.0031	60021	Mountain
satluj_gr 468	32°36'46.18"N, 77°34'38.88"E	x	52H	SE	1318.7	409560	29.24	0.0120	63021	Mountain basin
satluj_gr 469	32°37'10.62"N, 77°34'42.67"E	x	52H	SE	551.7	88828	14.42	0.0013	65021	Niche
satluj_gr 470	32°37'32.61"N, 77°34'50.28"E	x	52H	SE	1883.5	818213	38.62	0.0317	63021	Mountain basin
satluj_gr 471	32°38'00.17"N, 77°34'58.25"E	x	52H	SE	985.4	147541	18.68	0.0028	60021	Mountain
satluj_gr 472	32°38'35.43"N, 77°36'03.29"E	x	52H	S	3011.3	1210964	44.80	0.0542	63021	Mountain basin
satluj_gr 473	32°37'57.12"N, 77°36'50.15"E	x	52H	SE	1779.5	491552	31.47	0.0154	63021	Mountain basin
satluj_gr 474	32°38'32.11"N, 77°37'15.69"E	x	52H	S	2798.0	3438215	65.46	0.2252	63021	Mountain basin
satluj_gr 475	32°38'04.47"N, 77°38'12.55"E	x	52H	SW	487.5	55072	11.47	0.0007	65021	Niche
satluj_gr 476	32°36'32.76"N, 77°39'24.70"E	x	52H	SW	2712.0	1225769	45.08	0.0554	63021	Mountain basin
satluj_gr 477	32°36'07.94"N, 77°39'09.18"E	x	52H	W	1574.9	606410	34.38	0.0210	63021	Mountain basin
satluj_gr 478	32°35'59.89"N, 77°39'32.39"E	x	52H	SW	841.5	247822	23.65	0.0059	60021	Mountain
satluj_gr 479	32°35'46.64"N, 77°39'38.56"E	x	52H	S	1609.8	330099	26.68	0.0088	63021	Mountain basin
satluj_gr 480	32°34'28.80"N, 77°40'03.75"E	x	52H	NW	3322.4	1916491	53.14	0.1020	63021	Mountain basin
satluj_gr 481	32°33'18.09"N, 77°41'05.36"E	x	52H	NE	940.3	428984	29.82	0.0128	60021	Mountain
satluj_gr 482	32°33'48.76"N, 77°40'53.46"E	x	52H	SE	830.4	362094	27.69	0.0100	64021	Cirque
satluj_gr 483	32°34'09.48"N, 77°41'10.41"E	x	52H	SE	1069.6	232543	22.78	0.0052	63021	Mountain basin

satluj_gr 484	32°34'30.81"N, 77°41'13.75"E	x	52H	E	2028.9	1222586	44.94	0.0548	63021	Mountain basin
satluj_gr 485	32°35'19.32"N, 77°40'57.94"E	x	52H	E	3304.8	1971892	53.64	0.1057	63021	Mountain basin
satluj_gr 486	32°36'07.42"N, 77°40'40.92"E	x	52H	NE	3365.2	2775410	60.71	0.1688	63021	Mountain basin
satluj_gr 487	32°36'55.38"N, 77°40'23.90"E	x	52H	NE	2288.3	1212306	44.80	0.0542	63021	Mountain basin
satluj_gr 488	32°37'40.85"N, 77°39'54.02"E	x	52H	NE	5281.2	4521753	72.01	0.3255	62021	Mountain basin
satluj_gr 489	32°38'25.53"N, 77°39'43.32"E	x	52H	NE	997.7	143225	18.06	0.0025	37021	Ice Cap
satluj_gr 490	32°38'40.85"N, 77°39'37.05"E	x	52H	NE	1136.7	336988	27.03	0.0092	63021	Mountain basin
satluj_gr 491	32°39'08.95"N, 77°38'42.03"E	x	52H	NE	2321.7	2359809	57.25	0.1351	63021	Mountain basin
satluj_gr 492	32°39'30.39"N, 77°37'29.39"E	x	52H	NE	4109.4	3352864	64.85	0.2173	63021	Mountain basin
satluj_gr 493	32°40'47.44"N, 77°37'47.43"E	x	52H	SE	4657.6	6117671	79.94	0.4893	62021	Mountain basin
satluj_gr 494	32°40'46.73"N, 77°39'17.03"E	x	52H	S	336.9	42078	8.86	0.0004	64021	Cirque
satluj_gr 495	32°40'56.44"N, 77°39'45.00"E	x	52H	SE	1062.9	258585	24.06	0.0063	63021	Mountain basin
satluj_gr 496	32°41'14.90"N, 77°39'55.88"E	x	52H	S	1437.8	605287	34.38	0.0210	63021	Mountain basin
satluj_gr 497	32°41'40.43"N, 77°40'16.94"E	x	52H	S	2361.1	1171255	44.24	0.0518	63021	Mountain basin
satluj_gr 498	32°41'23.22"N, 77°41'17.04"E	x	52H	SE	1057.5	297755	25.61	0.0077	60021	Mountain
satluj_gr 499	32°41'38.16"N, 77°41'31.18"E	x	52H	SE	1060.3	158418	19.27	0.0031	63021	Mountain basin
satluj_gr 500	32°40'40.48"N, 77°42'12.13"E	x	52H	NW	1875.1	1045571	42.46	0.0446	60021	Mountain
satluj_gr 501	32°39'27.46"N, 77°41'54.47"E	x	52H	N	3121.1	1128802	43.66	0.0493	63021	Mountain basin
satluj_gr 502	32°36'59.00"N, 77°43'57.07"E	x	52H	S	2157.4	740821	37.10	0.0275	63021	Mountain basin
satluj_gr 503	32°36'07.17"N, 77°46'53.49"E	x	52H	S	1092.2	398845	28.94	0.0116	60021	Mountain
satluj_gr 504	32°36'29.07"N, 77°47'27.43"E	x	52H	S	359.1	81294	13.52	0.0011	64921	Cirque
satluj_gr 505	32°36'40.83"N, 77°47'55.91"E	x	52H	S	447.9	82061	13.52	0.0011	64021	Cirque
satluj_gr 506	32°35'45.27"N, 77°48'22.47"E	x	52H	SW	1600.7	582650	33.69	0.0195	60021	Mountain
satluj_gr 507	32°35'29.52"N, 77°47'59.11"E	x	52H	SW	665.7	101487	15.24	0.0015	65021	Niche
satluj_gr 508	32°35'09.84"N, 77°48'14.80"E	x	52H	S	949.9	155463	19.27	0.0031	65021	Niche
satluj_gr 509	32°34'11.41"N, 77°48'11.86"E	x	52H	NW	887.5	120750	16.74	0.0020	67021	Ice Apron
satluj_gr 510	32°33'56.73"N, 77°47'33.03"E	x	52H	N	2695.6	1262606	45.49	0.0573	63021	Mountain basin
satluj_gr 511	32°34'03.83"N, 77°46'55.69"E	x	52H	NE	524.0	139875	18.06	0.0025	37021	Ice Cap
satluj_gr 512	32°33'49.40"N, 77°45'52.17"E	x	52H	NW	477.1	31797	7.19	0.0002	37021	Ice Cap
satluj_gr 513	32°33'34.99"N, 77°46'27.37"E	x	52H	NW	398.6	97949	15.24	0.0015	37021	Ice Cap
satluj_gr 514	32°33'03.17"N, 77°46'02.89"E	x	52H	NW	1753.0	1282841	45.75	0.0586	63021	Mountain basin
satluj_gr 515	32°32'49.63"N, 77°45'07.37"E	x	52H	NW	1155.0	367732	28.01	0.0104	63021	Mountain basin
satluj_gr 516	32°31'44.52"N, 77°44'53.66"E	x	52H	NW	2174.4	1028150	42.15	0.0434	63021	Mountain basin

satluj_gr 517	32°31'59.12"N, 77°45'25.69"E	x	52H	SE	953.9	275019	24.86	0.0070	63021	Mountain basin
satluj_gr 518	32°32'24.45"N, 77°45'41.20"E	x	52H	S	1480.2	257437	24.06	0.0063	63021	Mountain basin
satluj_gr 519	32°32'40.00"N, 77°45'58.39"E	x	52H	SE	599.7	125968	17.42	0.0023	60051	Mountain
satluj_gr 520	32°32'35.81"N, 77°46'29.42"E	x	52H	S	801.6	151965	18.68	0.0028	65021	Niche
satluj_gr 521	32°32'45.15"N, 77°47'02.93"E	x	52H	S	1461.8	297696	25.61	0.0077	60021	Mountain
satluj_gr 522	32°32'27.14"N, 77°47'38.90"E	x	52H	W	535.2	84606	13.52	0.0011	60021	Mountain
satluj_gr 523	32°32'21.66"N, 77°48'01.97"E	x	52H	SE	768.6	201196	21.38	0.0043	60021	Mountain
satluj_gr 524	32°32'50.91"N, 77°48'10.53"E	x	52H	E	419.0	65120	12.55	0.0009	64021	Cirque
satluj_gr 525	32°32'57.69"N, 77°47'39.38"E	x	52H	SE	2552.1	816530	38.62	0.0317	63021	Mountain basin
satluj_gr 526	32°33'35.22"N, 77°47'52.51"E	x	52H	S	791.9	198371	21.38	0.0043	63051	Mountain basin
satluj_gr 527	32°34'09.78"N, 77°48'21.81"E	x	52H	SE	1356.6	249592	23.65	0.0059	60051	Mountain
satluj_gr 528	32°33'42.86"N, 77°48'37.82"E	x	52H	SE	380.2	70432	12.55	0.0009	64021	Cirque
satluj_gr 529	32°33'56.28"N, 77°48'53.26"E	x	52H	SE	1191.3	111427	16.01	0.0018	65021	Niche
satluj_gr 530	32°34'39.97"N, 77°48'47.97"E	x	52H	SE	267.6	47056	10.26	0.0005	64021	Cirque
satluj_gr 531	32°35'36.70"N, 77°49'15.06"E	x	52H	S	2635.8	1668568	50.49	0.0843	63021	Mountain basin
satluj_gr 532	32°35'26.53"N, 77°50'27.10"E	x	52H	SE	1725.7	716552	36.71	0.0264	60021	Mountain
satluj_gr 533	32°36'33.11"N, 77°50'05.01"E	x	52H	S	477.2	106258	16.01	0.0018	60021	Mountain
satluj_gr 534	32°36'28.52"N, 77°50'23.73"E	x	52H	S	520.8	66324	12.55	0.0009	65021	Niche
satluj_gr 535	32°36'29.29"N, 77°50'48.38"E	x	52H	SW	658.8	84125	13.52	0.0011	65021	Niche
satluj_gr 536	32°36'19.90"N, 77°51'02.38"E	x	52H	SW	408.2	79241	13.52	0.0011	64021	Cirque
satluj_gr 537	32°35'29.13"N, 77°52'23.63"E	x	52H	W	1391.8	427830	29.82	0.0128	63021	Mountain basin
satluj_gr 538	32°34'22.33"N, 77°52'34.59"E	x	52H	NW	1537.7	490881	31.47	0.0154	63021	Mountain basin
satluj_gr 539	32°34'36.74"N, 77°51'58.79"E	x	52H	N	555.4	129631	17.42	0.0023	37021	Ice Cap
satluj_gr 540	32°34'06.83"N, 77°52'35.28"E	x	52H	S	1145.4	404298	28.94	0.0116	60021	Mountain
satluj_gr 541	32°34'22.04"N, 77°53'15.33"E	x	52H	SE	1102.7	216851	22.33	0.0049	63051	Mountain basin
satluj_gr 542	32°33'44.24"N, 77°53'31.18"E	x	52H	NW	590.2	198719	21.38	0.0043	64021	Cirque
satluj_gr 543	32°32'42.31"N, 77°52'58.48"E	x	52H	S	1137.0	333312	26.68	0.0088	60021	Mountain
satluj_gr 544	32°33'26.97"N, 77°53'37.24"E	x	52H	S	391.1	81094	13.52	0.0011	37051	Ice Cap
satluj_gr 545	32°33'05.15"N, 77°53'34.49"E	x	52H	S	536.3	60078	11.47	0.0007	65021	Niche
satluj_gr 546	32°33'07.69"N, 77°54'06.46"E	x	52H	SE	805.2	191774	20.88	0.0040	65021	Niche
satluj_gr 547	32°33'45.60"N, 77°54'02.69"E	x	52H	SE	993.4	294995	25.24	0.0073	63021	Mountain basin
satluj_gr 548	32°34'14.85"N, 77°53'54.62"E	x	52H	SE	691.8	164531	19.27	0.0031	60021	Mountain
satluj_gr 549	32°34'43.18"N, 77°53'16.97"E	x	52H	SE	2298.2	907136	40.20	0.0366	63021	Mountain basin

satluj_gr 550	32°35'11.80"N, 77°53'39.16"E	x	52H	S	479.4	110025	16.01	0.0018	64021	Cirque
satluj_gr 551	32°35'34.21"N, 77°54'01.01"E	x	52H	S	850.0	548852	32.98	0.0181	63021	Mountain basin
satluj_gr 552	32°35'18.78"N, 77°55'11.42"E	x	52H	SE	619.3	315565	26.33	0.0084	37051	Ice Cap
satluj_gr 553	32°34'59.80"N, 77°55'16.57"E	x	52H	SE	453.2	127887	17.42	0.0023	63021	Mountain basin
satluj_gr 554	32°34'30.56"N, 77°55'58.58"E	x	52H	SE	831.9	199134	21.38	0.0043	60021	Mountain
satluj_gr 555	32°31'00.47"N, 77°57'30.97"E	x	52H	S	1932.3	614958	34.38	0.0210	60021	Mountain
satluj_gr 556	32°32'54.57"N, 77°58'01.20"E	x	52H	S	3935.3	2541450	58.78	0.1493	62021	Mountain basin
satluj_gr 557	32°32'13.92"N, 77°59'16.97"E	x	52H	S	601.6	167308	19.83	0.0034	37021	Ice Cap
satluj_gr 558	32°29'32.25"N, 78°05'24.17"E	x	52H	NW	2163.8	1021094	42.00	0.0428	63021	Mountain basin
satluj_gr 559	32°29'11.05"N, 78°05'07.18"E	x	52H	NW	1793.0	843799	38.98	0.0327	63021	Mountain basin
satluj_gr 560	32°28'47.70"N, 78°04'47.21"E	x	52H	NW	1313.5	667548	35.68	0.0239	67021	Ice Apron
satluj_gr 561	32°27'33.64"N, 78°03'52.39"E	x	52H	NW	579.5	148172	18.68	0.0028	60021	Mountain
satluj_gr 562	32°26'04.82"N, 78°03'35.80"E	x	52H	NW	3129.7	1193295	44.52	0.0530	63021	Mountain basin
satluj_gr 563	32°25'51.82"N, 78°02'41.51"E	x	52H	NW	493.9	118353	16.74	0.0020	60021	Mountain
satluj_gr 564	32°25'55.53"N, 78°05'16.63"E	x	52H	N	690.3	169769	19.83	0.0034	60021	Mountain
satluj_gr 565	32°25'36.76"N, 78°04'54.01"E	x	52H	NE	2500.0	1840178	52.32	0.0963	63021	Mountain basin
satluj_gr 566	32°26'40.95"N, 78°04'03.24"E	x	52L	E	1314.6	747163	37.30	0.0280	60021	Mountain
satluj_gr 567	32°27'48.93"N, 78°05'24.81"E	x	52L	NE	3415.0	1525535	48.89	0.0748	63021	Mountain basin
satluj_gr 568	32°29'02.23"N, 78°05'41.46"E	x	52L	SE	2907.8	866831	39.51	0.0344	60021	Mountain
satluj_gr 569	32°29'16.20"N, 78°07'09.03"E	x	52L	SE	1439.8	552669	32.98	0.0181	60021	Mountain
satluj_gr 570	32°29'21.82"N, 78°08'17.23"E	x	52L	SE	488.0	115646	16.74	0.0020	64021	Cirque
satluj_gr 571	32°29'42.59"N, 78°09'30.71"E	x	52L	SW	1838.4	684002	35.89	0.0244	63021	Mountain basin
satluj_gr 572	32°28'54.20"N, 78°09'56.75"E	x	52L	SW	1260.8	437228	30.11	0.0132	63021	Mountain basin
satluj_gr 573	32°28'34.30"N, 78°09'48.33"E	x	52L	SW	1344.2	392650	28.64	0.0112	63021	Mountain basin
satluj_gr 574	32°27'38.92"N, 78°09'29.66"E	x	52L	NW	1700.4	765358	37.68	0.0290	63021	Mountain basin
satluj_gr 575	32°27'23.90"N, 78°09'06.86"E	x	52L	NW	475.2	81358	13.52	0.0011	60021	Mountain
satluj_gr 576	32°26'57.59"N, 78°09'09.19"E	x	52L	NW	1375.1	456255	30.67	0.0141	63021	Mountain basin
satluj_gr 577	32°26'49.10"N, 78°08'51.63"E	x	52L	NW	349.2	55904	11.47	0.0007	63021	Mountain basin
satluj_gr 578	32°26'30.50"N, 78°08'34.83"E	x	52L	NW	643.4	170681	19.83	0.0034	60021	Mountain
satluj_gr 579	32°24'16.82"N, 78°09'37.85"E	x	52L	NW	981.0	122538	16.74	0.0020	60021	Mountain
satluj_gr 580	32°23'29.58"N, 78°09'14.55"E	x	52L	NW	2697.7	1120221	43.51	0.0487	63021	Mountain basin
satluj_gr 581	32°23'57.02"N, 78°08'22.29"E	x	52L	NW	1219.6	331907	26.68	0.0088	63021	Mountain basin
satluj_gr 582	32°22'35.14"N, 78°07'59.21"E	x	52L	SW	536.5	141796	18.06	0.0025	60021	Mountain

satluj_gr 583	32°22'28.63"N, 78°07'31.15"E	x	52L	NW	1195.2	258342	24.06	0.0063	63021	Mountain basin
satluj_gr 584	32°18'37.46"N, 78°11'31.56"E	x	52L	SW	1524.4	460253	30.67	0.0141	63021	Mountain basin
satluj_gr 585	32°17'57.30"N, 78°11'15.36"E	x	52L	NW	712.0	257605	24.06	0.0063	60021	Mountain
satluj_gr 586	32°17'43.44"N, 78°11'54.70"E	x	52L	S	1892.1	928366	40.54	0.0377	63021	Mountain basin
satluj_gr 587	32°18'07.94"N, 78°13'01.46"E	x	52L	NE	990.6	237436	23.22	0.0056	63021	Mountain basin
satluj_gr 588	32°18'33.17"N, 78°12'39.51"E	x	52L	NE	2524.6	591036	33.92	0.0200	63021	Mountain basin
satluj_gr 589	32°19'00.82"N, 78°11'54.50"E	x	52L	NE	1599.7	500246	31.73	0.0159	63021	Mountain basin
satluj_gr 590	32°19'24.30"N, 78°11'25.84"E	x	52L	SE	1005.2	192704	20.88	0.0040	63021	Mountain basin
satluj_gr 591	32°20'01.89"N, 78°11'02.14"E	x	52L	NE	2034.5	526509	32.49	0.0172	63021	Mountain basin
satluj_gr 592	32°21'32.59"N, 78°11'48.90"E	x	52L	NE	1678.2	584457	33.69	0.0195	63021	Mountain basin
satluj_gr 593	32°21'44.08"N, 78°11'34.88"E	x	52L	N	1804.2	383844	28.33	0.0108	63021	Mountain basin
satluj_gr 594	32°20'34.66"N, 78°10'37.40"E	x	52L	N	3167.8	1211151	44.80	0.0542	63021	Mountain basin
satluj_gr 595	32°21'01.78"N, 78°10'09.81"E	x	52L	N	2400.3	1036079	42.31	0.0440	63021	Mountain basin
satluj_gr 596	32°21'39.54"N, 78°09'16.53"E	x	52L	NE	1498.1	454830	30.39	0.0137	63021	Mountain basin
satluj_gr 597	32°21'45.34"N, 78°08'44.88"E	x	52L	NE	1959.8	410188	29.24	0.0120	63021	Mountain basin
satluj_gr 598	32°22'06.09"N, 78°07'58.46"E	x	52L	NE	964.5	371453	28.01	0.0104	60021	Mountain
satluj_gr 599	32°22'31.88"N, 78°08'31.25"E	x	52L	SE	1448.2	742552	37.10	0.0275	63021	Mountain basin
satluj_gr 600	32°22'24.53"N, 78°09'02.97"E	x	52L	SE	982.2	170069	19.83	0.0034	63021	Mountain basin
satluj_gr 601	32°23'08.17"N, 78°08'34.06"E	x	52L	SE	2756.9	1025985	42.15	0.0434	63021	Mountain basin
satluj_gr 602	32°22'56.12"N, 78°09'39.84"E	x	52L	S	445.9	110440	16.01	0.0018	37021	Ice Cap
satluj_gr 603	32°23'23.66"N, 78°09'44.25"E	x	52L	SE	568.1	87241	14.42	0.0013	65021	Niche
satluj_gr 604	32°23'39.29"N, 78°09'47.91"E	x	52L	SE	1585.6	399382	28.94	0.0116	63021	Mountain basin
satluj_gr 605	32°23'52.71"N, 78°10'04.61"E	x	52L	S	1491.5	279671	24.86	0.0070	63021	Mountain basin
satluj_gr 606	32°24'00.49"N, 78°10'13.66"E	x	52L	SE	492.0	36342	8.86	0.0004	37021	Ice Cap
satluj_gr 607	32°23'59.48"N, 78°10'41.12"E	x	52L	SE	236.9	31597	7.19	0.0002	67021	Ice Apron
satluj_gr 608	32°24'07.53"N, 78°10'51.26"E	x	52L	S	375.3	49520	10.26	0.0005	67021	Ice Apron
satluj_gr 609	32°23'34.55"N, 78°11'12.70"E	x	52L	SE	1974.0	1606227	49.82	0.0802	60021	Mountain
satluj_gr 610	32°24'03.58"N, 78°11'33.07"E	x	52L	S	721.9	284878	24.86	0.0070	60021	Mountain
satluj_gr 611	32°24'14.32"N, 78°10'24.92"E	x	52L	NE	2690.8	962299	41.03	0.0394	63021	Mountain basin
satluj_gr 612	32°24'52.03"N, 78°10'05.19"E	x	52L	E	1267.0	657290	35.47	0.0234	60021	Mountain
satluj_gr 613	32°25'29.27"N, 78°09'54.72"E	x	52L	SE	2616.5	1874829	52.63	0.0984	63021	Mountain basin
satluj_gr 614	32°26'28.23"N, 78°09'51.06"E	x	52L	SE	3387.3	2679672	59.92	0.1606	61021	Mountain basin
satluj_gr 615	32°28'00.94"N, 78°10'17.44"E	x	52L	S	1129.7	312729	25.98	0.0081	63021	Mountain basin

satluj_gr 616	32°26'52.16"N, 78°12'59.26"E	x	52L	W	1612.3	877057	39.69	0.0349	60021	Mountain
satluj_gr 617	32°26'24.74"N, 78°13'30.58"E	x	52L	W	786.2	150361	18.68	0.0028	67021	Ice Apron
satluj_gr 618	32°26'06.31"N, 78°13'19.00"E	x	52L	W	1197.9	300663	25.61	0.0077	67021	Ice Apron
satluj_gr 619	32°25'51.92"N, 78°13'04.19"E	x	52L	W	1151.2	461931	30.67	0.0141	67021	Ice Apron
satluj_gr 620	32°24'56.70"N, 78°15'28.85"E	x	52L	SW	844.8	186365	20.88	0.0040	64021	Cirque
satluj_gr 621	32°24'36.26"N, 78°16'14.02"E	x	52L	NE	995.2	350858	27.36	0.0096	60021	Mountain
satluj_gr 622	32°25'01.31"N, 78°15'45.29"E	x	52L	SE	821.0	164350	19.27	0.0031	67021	Ice Apron
satluj_gr 623	32°25'32.65"N, 78°15'37.87"E	x	52L	SE	567.8	111404	16.01	0.0018	67021	Ice Apron
satluj_gr 624	32°25'45.49"N, 78°14'44.98"E	x	52L	NW	684.7	116165	16.74	0.0020	67021	Ice Apron
satluj_gr 625	32°25'28.19"N, 78°14'18.57"E	x	52L	N	721.4	165720	19.83	0.0034	67021	Ice Apron
satluj_gr 626	32°25'27.41"N, 78°13'51.49"E	x	52L	N	734.6	143577	18.06	0.0025	65021	Niche
satluj_gr 627	32°28'02.03"N, 78°13'23.02"E	x	52L	NE	563.5	161466	19.27	0.0031	64021	Cirque
satluj_gr 628	32°28'55.63"N, 78°13'15.90"E	x	52L	NE	768.2	130525	17.42	0.0023	67021	Ice Apron
satluj_gr 629	32°28'40.20"N, 78°13'01.12"E	x	52L	NW	513.1	104780	15.24	0.0015	67021	Ice Apron
satluj_gr 630	32°28'14.33"N, 78°13'00.94"E	x	52L	NW	808.9	366620	28.01	0.0104	60021	Mountain
satluj_gr 631	32°27'45.84"N, 78°12'41.67"E	x	52L	N	2363.8	1416788	47.56	0.0675	63021	Mountain basin
satluj_gr 632	32°28'02.62"N, 78°11'19.62"E	x	52L	NE	3060.8	1596319	49.71	0.0795	63021	Mountain basin
satluj_gr 633	32°28'27.91"N, 78°10'42.21"E	x	52L	NE	1441.1	1088034	43.07	0.0469	60051	Mountain
satluj_gr 634	32°29'10.00"N, 78°10'30.62"E	x	52L	SE	1100.9	315816	26.33	0.0084	63021	Mountain basin
satluj_gr 635	32°30'28.77"N, 78°11'46.91"E	x	52L	NE	967.9	274803	24.46	0.0066	67021	Ice Apron
satluj_gr 636	32°30'47.10"N, 78°11'41.23"E	x	52L	NE	481.9	76255	13.52	0.0011	37021	Ice Cap
satluj_gr 637	32°29'58.53"N, 78°10'49.58"E	x	52L	NE	3570.6	2684496	59.92	0.1606	63021	Mountain basin
satluj_gr 638	32°30'12.38"N, 78°09'34.40"E	x	52L	NE	880.8	162283	19.27	0.0031	67051	Ice Apron
satluj_gr 639	32°30'43.25"N, 78°10'21.84"E	x	52L	NE	2060.7	1409224	47.43	0.0669	63021	Mountain basin
satluj_gr 640	32°31'13.75"N, 78°10'21.20"E	x	52L	SE	856.8	223308	22.33	0.0049	60021	Mountain
satluj_gr 641	32°31'28.34"N, 78°10'24.92"E	x	52L	NE	1532.3	384287	28.33	0.0108	63021	Mountain basin
satluj_gr 642	32°32'03.47"N, 78°09'29.81"E	x	52L	SE	1426.8	642071	35.04	0.0224	60021	Mountain
satluj_gr 643	32°32'03.25"N, 78°09'57.57"E	x	52L	E	2304.1	551284	32.98	0.0181	63021	Mountain basin
satluj_gr 644	32°32'31.57"N, 78°10'15.52"E	x	52L	S	1252.6	188342	20.88	0.0040	60021	Mountain
satluj_gr 645	32°32'39.43"N, 78°11'12.56"E	x	52L	S	248.3	44416	8.86	0.0004	67021	Ice Apron
satluj_gr 646	32°32'37.03"N, 78°11'54.61"E	x	52L	SE	2971.4	717625	36.71	0.0264	63021	Mountain basin
satluj_gr 647	32°33'09.27"N, 78°12'54.35"E	x	52L	SE	419.9	68466	12.55	0.0009	67021	Ice Apron
satluj_gr 648	32°32'28.59"N, 78°14'31.36"E	x	52L	SW	551.5	96214	15.24	0.0015	37021	Ice Cap

satluj_gr 649	32°31'55.22"N, 78°14'22.23"E	x	52L	W	1601.2	763132	37.49	0.0285	60021	Mountain
satluj_gr 650	32°31'11.14"N, 78°14'36.35"E	x	52L	W	607.1	159004	19.27	0.0031	37021	Ice Cap
satluj_gr 651	32°31'57.01"N, 78°14'48.68"E	x	52L	SE	1828.9	383964	28.33	0.0108	60051	Mountain
satluj_gr 652	32°31'39.86"N, 78°15'04.17"E	x	52L	S	464.5	53032	10.26	0.0005	64021	Cirque
satluj_gr 653	32°31'53.08"N, 78°15'14.12"E	x	52L	S	382.6	58943	11.47	0.0007	64021	Cirque
satluj_gr 654	32°31'43.17"N, 78°15'29.32"E	x	52L	SW	396.2	31849	7.19	0.0002	37021	Ice Cap
satluj_gr 655	32°31'27.10"N, 78°15'46.62"E	x	52L	S	512.9	126085	17.42	0.0023	67021	Ice Apron
satluj_gr 656	32°30'43.61"N, 78°16'35.24"E	x	52L	SW	871.9	203152	21.38	0.0043	37021	Ice Cap
satluj_gr 657	32°30'12.52"N, 78°16'51.91"E	x	52L	SW	412.6	73977	12.55	0.0009	37021	Ice Cap
satluj_gr 658	32°29'43.42"N, 78°16'29.03"E	x	52L	SW	1481.6	222692	22.33	0.0049	37021	Ice Cap
satluj_gr 659	32°29'10.32"N, 78°17'00.93"E	x	52L	NE	1262.2	453924	30.39	0.0137	37021	Ice Cap
satluj_gr 660	32°29'32.62"N, 78°17'03.12"E	x	52L	NE	421.9	91982	14.42	0.0013	37021	Ice Cap
satluj_gr 661	32°26'28.34"N, 78°20'48.75"E	x	52L	NE	1194.8	345190	27.36	0.0096	63021	Mountain basin
satluj_gr 662	32°29'30.74"N, 78°25'51.00"E	x	52L	NE	920.7	550338	32.98	0.0181	37021	Ice Cap
satluj_gr 663	32°28'39.62"N, 78°25'16.62"E	x	52L	NW	345.8	55021	11.47	0.0007	64021	Cirque
satluj_gr 664	32°28'22.43"N, 78°25'12.35"E	x	52L	W	1445.4	324471	26.33	0.0084	65021	Niche
satluj_gr 665	32°27'57.95"N, 78°24'28.31"E	x	52L	W	653.1	175555	20.37	0.0037	37021	Ice Cap
satluj_gr 666	32°24'48.88"N, 78°26'01.92"E	x	52L	NW	1076.4	275546	24.86	0.0070	65021	Niche
satluj_gr 667	32°24'54.94"N, 78°25'37.66"E	x	52L	NW	676.8	125045	17.42	0.0023	60021	Mountain
satluj_gr 668	32°24'10.95"N, 78°26'09.91"E	x	52L	SW	424.2	425091	29.82	0.0128	67021	Ice Apron
satluj_gr 669	32°23'35.14"N, 78°27'21.50"E	x	52L	S	1954.1	1335055	46.54	0.0624	63021	Mountain basin
satluj_gr 670	32°20'52.96"N, 78°27'19.74"E	x	52L	NW	2959.9	2168325	55.55	0.1205	63021	Mountain basin
satluj_gr 671	32°21'17.85"N, 78°26'44.30"E	x	52L	NW	812.0	126381	17.42	0.0023	65021	Niche
satluj_gr 672	32°21'11.14"N, 78°25'47.92"E	x	52L	NW	379.5	93607	14.42	0.0013	37021	Ice Cap
satluj_gr 673	32°21'07.63"N, 78°25'14.20"E	x	52L	N	1811.6	937053	40.71	0.0383	63021	Mountain basin
satluj_gr 674	32°22'20.92"N, 78°23'53.15"E	x	52L	N	757.6	224704	22.33	0.0049	67021	Ice Apron
satluj_gr 675	32°21'41.47"N, 78°24'25.47"E	x	52L	NW	465.0	88970	14.42	0.0013	37021	Ice Cap
satluj_gr 676	32°20'44.38"N, 78°24'56.02"E	x	52L	SW	722.4	248977	23.65	0.0059	60021	Mountain
satluj_gr 677	32°20'26.71"N, 78°24'33.93"E	x	52L	SE	301.6	56981	11.47	0.0007	37021	Ice Cap
satluj_gr 678	32°20'11.99"N, 78°26'50.27"E	x	52L	W	1786.0	700607	36.30	0.0254	63021	Mountain basin
satluj_gr 679	32°19'45.14"N, 78°26'32.84"E	x	52L	NW	1714.9	901289	40.03	0.0360	63021	Mountain basin
satluj_gr 680	32°18'56.36"N, 78°26'21.80"E	x	52L	NW	2449.7	1114732	43.37	0.0481	63021	Mountain basin
satluj_gr 681	32°18'44.61"N, 78°26'08.10"E	x	52L	NW	2452.7	757041	37.49	0.0285	63021	Mountain basin

satluj_gr 682	32°18'07.86"N, 78°25'47.98"E	x	52L	NW	2562.6	1295867	46.02	0.0598	63021	Mountain basin
satluj_gr 683	32°17'49.60"N, 78°25'04.38"E	x	52L	N	1949.0	1105652	43.37	0.0481	63021	Mountain basin
satluj_gr 684	32°17'01.67"N, 78°24'13.95"E	x	52L	N	4488.8	2580197	59.11	0.1525	63021	Mountain basin
satluj_gr 685	32°18'16.93"N, 78°23'46.40"E	x	52L	NW	2051.0	624021	34.60	0.0215	63021	Mountain basin
satluj_gr 686	32°18'43.13"N, 78°23'21.37"E	x	52L	N	305.0	64561	11.47	0.0007	37021	Ice Cap
satluj_gr 687	32°17'56.44"N, 78°23'15.82"E	x	52L	NW	877.3	520664	32.24	0.0168	60021	Mountain
satluj_gr 688	32°17'21.44"N, 78°23'54.72"E	x	52L	W	845.5	188033	20.88	0.0040	60021	Mountain
satluj_gr 689	32°17'20.24"N, 78°23'11.08"E	x	52L	NW	2134.5	1071388	42.77	0.0458	60021	Mountain
satluj_gr 690	32°16'47.75"N, 78°22'55.74"E	x	52L	NW	2446.4	609469	34.38	0.0210	63021	Mountain basin
satluj_gr 691	32°16'44.49"N, 78°22'12.80"E	x	52L	NW	956.1	375386	28.33	0.0108	37021	Ice Cap
satluj_gr 692	32°16'20.47"N, 78°23'29.35"E	x	52L	SW	1916.2	795397	38.25	0.0306	63021	Mountain basin
satluj_gr 693	32°15'39.57"N, 78°23'27.87"E	x	52L	W	722.0	141267	18.06	0.0025	65021	Niche
satluj_gr 694	32°15'16.17"N, 78°22'45.73"E	x	52L	NW	1609.9	420450	29.54	0.0124	60021	Mountain
satluj_gr 695	32°15'13.62"N, 78°22'09.54"E	x	52L	NW	1059.4	310419	25.98	0.0081	60021	Mountain
satluj_gr 696	32°15'04.95"N, 78°21'36.67"E	x	52L	N	1928.1	755187	37.49	0.0285	60021	Mountain
satluj_gr 697	32°15'26.46"N, 78°21'10.60"E	x	52L	NW	915.7	364372	27.69	0.0100	60021	Mountain
satluj_gr 698	32°16'14.79"N, 78°20'04.97"E	x	52L	NW	418.7	48229	10.26	0.0005	37021	Ice Cap
satluj_gr 699	32°15'34.30"N, 78°20'18.26"E	x	52L	N	1079.5	338285	27.03	0.0092	64021	Cirque
satluj_gr 700	32°14'51.02"N, 78°19'46.76"E	x	52L	N	2593.5	1412862	47.43	0.0669	60021	Mountain
satluj_gr 701	32°14'55.87"N, 78°19'17.05"E	x	52L	NW	524.8	95769	15.24	0.0015	37021	Ice Cap
satluj_gr 702	32°12'12.48"N, 78°18'07.60"E	x	52L	NE	1949.3	724354	36.71	0.0264	63021	Mountain basin
satluj_gr 703	32°12'45.25"N, 78°17'38.01"E	x	52L	N	307.2	82419	13.52	0.0011	64021	Cirque
satluj_gr 704	32°10'17.50"N, 78°16'52.92"E	x	52L	NW	1405.3	461139	30.67	0.0141	63021	Mountain basin
satluj_gr 705	32°10'04.37"N, 78°16'27.63"E	x	52L	NW	1046.1	241389	23.22	0.0056	63021	Mountain basin
satluj_gr 706	32°09'32.14"N, 78°16'21.55"E	x	52L	N	2266.0	392300	28.64	0.0112	63021	Mountain basin
satluj_gr 707	32°09'58.59"N, 78°15'30.09"E	x	52L	SW	899.9	173611	19.83	0.0034	37021	Ice Cap
satluj_gr 708	32°09'41.35"N, 78°15'41.21"E	x	52L	SW	232.1	26847	7.19	0.0002	67021	Ice Apron
satluj_gr 709	32°09'14.35"N, 78°16'13.64"E	x	52L	S	919.1	424346	29.54	0.0124	60021	Mountain
satluj_gr 710	32°12'49.01"N, 78°19'12.19"E	x	52L	NE	841.1	177852	20.37	0.0037	37021	Ice Cap
satluj_gr 711	32°13'13.93"N, 78°19'15.50"E	x	52L	E	592.2	105622	16.01	0.0018	65021	Niche
satluj_gr 712	32°15'04.66"N, 78°23'05.19"E	x	52L	S	728.9	144694	18.06	0.0025	60021	Mountain
satluj_gr 713	32°14'57.64"N, 78°23'31.91"E	x	52L	S	1112.2	499819	31.73	0.0159	63021	Mountain basin
satluj_gr 714	32°15'20.49"N, 78°24'12.84"E	x	52L	S	1777.7	699063	36.30	0.0254	60021	Mountain

satluj_gr 715	32°14'22.45"N, 78°24'08.34"E	x	52L	SW	1867.8	418843	29.54	0.0124	63021	Mountain basin
satluj_gr 716	32°14'07.58"N, 78°24'13.22"E	x	52L	SW	1560.5	293625	25.24	0.0073	63021	Mountain basin
satluj_gr 717	32°13'54.36"N, 78°24'21.12"E	x	52L	SW	1068.0	298541	25.61	0.0077	63021	Mountain basin
satluj_gr 718	32°13'29.84"N, 78°23'35.95"E	x	52L	NE	2295.0	878196	39.69	0.0349	63021	Mountain basin
satluj_gr 719	32°12'56.64"N, 78°24'28.28"E	x	52L	E	2424.7	2414935	57.69	0.1390	60021	Mountain
satluj_gr 720	32°12'16.43"N, 78°24'28.00"E	x	52L	W	1865.7	536194	32.73	0.0177	63021	Mountain basin
satluj_gr 721	32°11'52.01"N, 78°25'01.53"E	x	52L	SE	2566.4	1778427	51.69	0.0920	63021	Mountain basin
satluj_gr 722	32°11'09.32"N, 78°25'42.53"E	x	52L	SE	692.0	205713	21.86	0.0046	60021	Mountain
satluj_gr 723	32°10'55.09"N, 78°25'51.68"E	x	52L	S	1445.5	523115	32.24	0.0168	63021	Mountain basin
satluj_gr 724	32°10'47.43"N, 78°26'51.96"E	x	52L	SE	754.4	226076	22.78	0.0052	64021	Cirque
satluj_gr 725	32°10'55.20"N, 78°26'14.78"E	x	52L	SE	1413.2	454962	30.39	0.0137	60021	Mountain
satluj_gr 726	32°11'19.71"N, 78°26'22.44"E	x	52L	SE	1138.9	463586	30.67	0.0141	60021	Mountain
satluj_gr 727	32°11'22.25"N, 78°27'17.66"E	x	52L	E	1285.1	318052	26.33	0.0084	63021	Mountain basin
satluj_gr 728	32°11'53.39"N, 78°28'38.23"E	x	52L	W	451.9	40503	8.86	0.0004	67021	Ice Apron
satluj_gr 729	32°11'47.33"N, 78°28'43.38"E	x	52L	W	537.9	52929	10.26	0.0005	67021	Ice Apron
satluj_gr 730	32°11'29.12"N, 78°28'58.21"E	x	52L	S	546.5	58427	11.47	0.0007	67021	Ice Apron
satluj_gr 731	32°11'58.53"N, 78°29'15.27"E	x	52L	S	446.1	70233	12.55	0.0009	67021	Ice Apron
satluj_gr 732	32°04'51.03"N, 78°39'46.41"E	x	52L	NW	996.8	275877	24.86	0.0070	63021	Mountain basin
satluj_gr 733	32°01'37.43"N, 78°43'13.34"E	x	52L	NW	8103.0	9444641	92.62	0.8743	62021	Mountain basin
satluj_gr 734	32°02'13.31"N, 78°41'19.07"E	x	52L	N	1371.9	320041	26.33	0.0084	63021	Mountain basin
satluj_gr 735	32°01'41.12"N, 78°40'51.55"E	x	52L	NW	5554.6	2974713	62.15	0.1846	63021	Mountain basin
satluj_gr 736	31°59'50.26"N, 78°43'22.39"E	x	52L	SW	2346.8	1456319	48.05	0.0702	63051	Mountain basin
satluj_gr 737	31°58'28.67"N, 78°42'40.15"E	x	52L	NW	7970.4	13994919	105.64	1.4778	62021	Mountain basin
satluj_gr 738	31°59'41.04"N, 78°40'42.00"E	x	52L	NE	1292.9	203342	21.38	0.0043	65051	Niche
satluj_gr 739	31°57'54.83"N, 78°40'59.75"E	x	52L	NW	2325.7	2108985	54.99	0.1160	63021	Mountain basin
satluj_gr 740	31°56'44.85"N, 78°41'42.26"E	x	52L	W	5449.4	6341144	80.92	0.5130	63021	Mountain basin
satluj_gr 741	31°55'54.17"N, 78°40'52.43"E	x	52L	NW	1232.6	329728	26.68	0.0088	63051	Mountain basin
satluj_gr 742	31°56'03.92"N, 78°42'25.26"E	x	52L	S	1345.4	675206	35.89	0.0244	60021	Mountain
satluj_gr 743	31°56'17.63"N, 78°43'17.00"E	x	52L	SE	731.0	317645	26.33	0.0084	64021	Cirque
satluj_gr 744	31°56'51.53"N, 78°43'26.21"E	x	53I	SE	2492.0	1178050	44.38	0.0524	63021	Mountain basin
satluj_gr 745	31°57'31.53"N, 78°43'44.75"E	x	53I	SE	1717.5	1131024	43.66	0.0493	63021	Mountain basin
satluj_gr 746	31°58'03.30"N, 78°43'56.64"E	x	53I	SE	1974.7	982638	41.36	0.0405	63021	Mountain basin
satluj_gr 747	31°57'42.40"N, 78°44'38.21"E	x	53I	E	784.1	221696	22.33	0.0049	64021	Cirque

satluj_gr 748	31°58'48.26"N, 78°44'37.60"E	x	53I	S	817.4	179768	20.37	0.0037	63021	Mountain basin
satluj_gr 749	31°58'23.42"N, 78°45'09.81"E	x	53I	S	329.9	66075	12.55	0.0009	64021	Cirque
satluj_gr 750	31°59'07.33"N, 78°45'08.19"E	x	53I	S	855.0	525205	32.49	0.0172	63051	Mountain basin
satluj_gr 751	31°58'50.01"N, 78°45'48.39"E	x	53I	S	883.0	263842	24.06	0.0063	63021	Mountain basin
satluj_gr 752	31°59'45.67"N, 78°45'30.54"E	x	53I	S	4922.3	6210595	80.34	0.4989	60021	Mountain
satluj_gr 753	31°46'32.20"N, 78°42'11.80"E	x	53I	NW	352.6	938749	40.71	0.0383	63021	Mountain basin
satluj_gr 754	31°45'59.92"N, 78°42'08.63"E	x	53I	NW	1654.5	647557	35.25	0.0229	63021	Mountain basin
satluj_gr 755	31°46'11.00"N, 78°42'41.17"E	x	53I	S	1053.0	361222	27.69	0.0100	63021	Mountain basin
satluj_gr 756	31°45'21.89"N, 78°42'58.54"E	x	53I	S	948.4	190797	20.88	0.0040	63021	Mountain basin
satluj_gr 757	31°43'54.36"N, 78°42'40.87"E	x	53I	NW	3046.8	4319505	70.89	0.3062	63021	Mountain basin
satluj_gr 758	31°43'19.35"N, 78°44'03.62"E	x	53I	SE	756.5	364317	27.69	0.0100	63021	Mountain basin
satluj_gr 759	31°42'33.65"N, 78°43'50.52"E	x	53I	S	2352.5	943683	40.71	0.0383	63021	Mountain basin
satluj_gr 760	31°40'51.78"N, 78°42'38.76"E	x	53I	NW	1881.8	734499	36.91	0.0269	63021	Mountain basin
satluj_gr 761	31°40'56.50"N, 78°41'54.41"E	x	53I	NE	1487.9	495714	31.73	0.0159	63021	Mountain basin
satluj_gr 762	31°40'45.50"N, 78°40'56.77"E	x	53I	N	2828.0	1483375	48.29	0.0715	63021	Mountain basin
satluj_gr 763	31°40'59.62"N, 78°39'40.04"E	x	53I	N	3533.0	2214332	55.91	0.1236	63021	Mountain basin
satluj_gr 764	31°41'24.03"N, 78°38'54.10"E	x	53I	N	2783.0	1056428	42.61	0.0452	63021	Mountain basin
satluj_gr 765	31°41'27.86"N, 78°38'04.58"E	x	53I	N	3056.9	1011867	41.84	0.0423	63021	Mountain basin
satluj_gr 766	31°41'42.54"N, 78°37'10.34"E	x	53I	NE	2056.3	573973	33.46	0.0191	63021	Mountain basin
satluj_gr 767	31°40'51.52"N, 78°37'53.56"E	x	53I	SW	1039.2	341925	27.03	0.0092	60021	Mountain
satluj_gr 768	31°40'22.15"N, 78°39'55.90"E	x	53I	SW	861.6	190209	20.88	0.0040	63021	Mountain basin
satluj_gr 769	31°31'50.94"N, 78°42'53.60"E	x	53I	N	1529.8	893525	39.86	0.0355	63021	Mountain basin
satluj_gr 770	31°32'02.70"N, 78°42'27.23"E	x	53I	NE	329.3	55323	11.47	0.0007	64021	Cirque
satluj_gr 771	31°34'41.33"N, 78°45'14.61"E	x	53I	N	1077.2	316522	26.33	0.0084	63021	Mountain basin
satluj_gr 772	31°34'34.46"N, 78°44'05.63"E	x	53I	N	1665.5	684203	35.89	0.0244	63021	Mountain basin
satluj_gr 773	31°34'09.70"N, 78°43'12.86"E	x	53I	NW	634.0	117433	16.74	0.0020	63021	Mountain basin
satluj_gr 774	31°32'41.40"N, 78°42'24.11"E	x	53I	N	1303.1	589951	33.92	0.0200	63021	Mountain basin
satluj_gr 775	31°32'57.19"N, 78°41'43.75"E	x	53I	NE	776.6	168924	19.83	0.0034	60021	Mountain
satluj_gr 776	31°33'18.96"N, 78°41'36.91"E	x	53I	NE	1339.2	331720	26.68	0.0088	63021	Mountain basin
satluj_gr 777	31°33'39.02"N, 78°41'20.62"E	x	53I	NE	1277.3	247375	23.65	0.0059	63021	Mountain basin
satluj_gr 778	31°34'45.02"N, 78°41'06.12"E	x	53I	NE	1266.8	229912	22.78	0.0052	63021	Mountain basin
satluj_gr 779	31°32'56.84"N, 78°40'41.51"E	x	53I	NW	1792.4	836871	38.98	0.0327	63021	Mountain basin
satluj_gr 780	31°33'10.92"N, 78°39'51.69"E	x	53I	NE	1005.0	251303	23.65	0.0059	63021	Mountain basin

satluj_gr 781	31°33'29.60"N, 78°39'10.35"E	x	53I	N	2150.1	870663	39.51	0.0344	63021	Mountain basin
satluj_gr 782	31°33'35.46"N, 78°38'42.45"E	x	53I	N	1633.0	627883	34.82	0.0219	63021	Mountain basin
satluj_gr 783	31°33'53.51"N, 78°38'05.45"E	x	53I	N	3824.1	1425999	47.68	0.0682	63021	Mountain basin
satluj_gr 784	31°34'19.08"N, 78°37'08.27"E	x	53I	NE	2238.1	590174	33.92	0.0200	63021	Mountain basin
satluj_gr 785	31°34'44.34"N, 78°37'22.92"E	x	53I	N	1955.5	508419	31.99	0.0163	63021	Mountain basin
satluj_gr 786	31°34'50.84"N, 78°36'51.53"E	x	53I	NE	1268.4	210468	21.86	0.0046	63021	Mountain basin
satluj_gr 787	31°35'13.86"N, 78°36'36.84"E	x	53I	NE	1139.1	294053	25.24	0.0073	63021	Mountain basin
satluj_gr 788	31°34'29.92"N, 78°36'07.30"E	x	53I	N	2903.2	1357373	46.80	0.0637	63021	Mountain basin
satluj_gr 789	31°34'23.78"N, 78°35'28.62"E	x	53I	N	2995.2	1964938	53.54	0.1049	62021	Mountain basin
satluj_gr 790	31°34'22.41"N, 78°34'50.57"E	x	53I	NE	1128.1	302869	25.61	0.0077	63021	Mountain basin
satluj_gr 791	31°34'59.07"N, 78°34'39.69"E	x	53I	NE	2366.0	1094107	43.07	0.0469	63021	Mountain basin
satluj_gr 792	31°35'33.64"N, 78°34'32.78"E	x	53I	N	2993.1	1468900	48.17	0.0708	63021	Mountain basin
satluj_gr 793	31°36'27.62"N, 78°34'16.50"E	x	53I	NE	4007.4	3153749	63.46	0.1999	62021	Mountain basin
satluj_gr 794	31°36'31.95"N, 78°33'09.58"E	x	53I	NE	5268.9	4990614	74.52	0.3719	63021	Mountain basin
satluj_gr 795	31°37'34.24"N, 78°32'22.23"E	x	53I	N	4579.0	4997932	74.57	0.3729	63021	Mountain basin
satluj_gr 796	31°37'02.96"N, 78°30'49.91"E	x	53I	NW	1836.1	594049	33.92	0.0200	63021	Mountain basin
satluj_gr 797	31°36'36.81"N, 78°31'10.37"E	x	53I	W	923.4	405395	29.24	0.0120	37021	Ice Cap
satluj_gr 798	31°36'34.06"N, 78°30'36.28"E	x	53I	NW	702.6	170277	19.83	0.0034	67021	Ice Apron
satluj_gr 799	31°35'44.32"N, 78°32'13.19"E	x	53I	NW	2037.8	692826	36.10	0.0249	63021	Mountain basin
satluj_gr 800	31°35'00.19"N, 78°32'04.46"E	x	53I	S	1012.8	339693	27.03	0.0092	60021	Mountain
satluj_gr 801	31°35'23.45"N, 78°32'53.78"E	x	53I	S	1796.8	739166	37.10	0.0275	63551	Mountain basin
satluj_gr 802	31°34'50.00"N, 78°33'28.78"E	x	53I	SW	3160.1	1202006	44.66	0.0536	63021	Mountain basin
satluj_gr 803	31°34'17.34"N, 78°33'45.66"E	x	53I	SW	3411.3	1327945	46.41	0.0617	63551	Mountain basin
satluj_gr 804	31°33'26.70"N, 78°33'39.76"E	x	53I	NW	2333.6	1965698	53.64	0.1057	63021	Mountain basin
satluj_gr 805	31°33'29.77"N, 78°34'26.37"E	x	53I	SE	2367.9	1037782	42.31	0.0440	63021	Mountain basin
satluj_gr 806	31°33'30.93"N, 78°35'10.45"E	x	53I	S	1113.7	387643	28.64	0.0112	63021	Mountain basin
satluj_gr 807	31°30'47.37"N, 78°42'22.69"E	x	53I	NW	315.2	58476	11.47	0.0007	64021	Cirque
satluj_gr 808	31°29'31.18"N, 78°41'13.88"E	x	53I	N	414.0	73969	12.55	0.0009	37021	Ice Cap
satluj_gr 809	31°29'42.37"N, 78°40'25.92"E	x	53I	N	731.8	138165	18.06	0.0025	65021	Niche
satluj_gr 810	31°29'33.32"N, 78°39'18.81"E	x	53I	N	2560.5	1332277	46.41	0.0617	63021	Mountain basin
satluj_gr 811	31°29'53.94"N, 78°38'27.91"E	x	53I	NW	1426.2	509950	31.99	0.0163	63021	Mountain basin
satluj_gr 812	31°29'42.32"N, 78°38'03.25"E	x	53I	N	991.2	315974	26.33	0.0084	63021	Mountain basin
satluj_gr 813	31°29'37.14"N, 78°37'33.18"E	x	53I	NW	827.7	271669	24.46	0.0066	63021	Mountain basin

satluj_gr 814	31°30'38.13"N, 78°43'20.57"E	x	53I	SW	1402.7	540538	32.73	0.0177	60021	Mountain
satluj_gr 815	31°31'07.81"N, 78°42'54.00"E	x	53I	E	848.9	155077	19.27	0.0031	60021	Mountain
satluj_gr 816	31°26'58.83"N, 78°45'46.44"E	x	53I	NE	600.2	155270	19.27	0.0031	64021	Cirque
satluj_gr 817	31°25'31.06"N, 78°44'59.42"E	x	53I	S	700.0	289002	25.24	0.0073	67021	Ice Apron
satluj_gr 818	31°25'04.60"N, 78°44'34.56"E	x	53I	NW	815.2	236552	23.22	0.0056	63021	Mountain basin
satluj_gr 819	31°25'52.08"N, 78°44'32.01"E	x	53I	SW	843.3	302288	25.61	0.0077	67021	Ice Apron
satluj_gr 820	31°24'27.80"N, 78°44'25.50"E	x	53I	W	687.8	249433	23.65	0.0059	67021	Ice Apron
satluj_gr 821	31°23'18.84"N, 78°44'09.81"E	x	53I	NW	1120.4	615250	34.60	0.0215	60021	Mountain
satluj_gr 822	31°22'29.93"N, 78°43'16.27"E	x	53I	NW	442.1	171421	19.83	0.0034	64021	Cirque
satluj_gr 823	31°22'24.31"N, 78°42'56.60"E	x	53I	N	1210.1	308711	25.98	0.0081	63021	Mountain basin
satluj_gr 824	31°22'42.96"N, 78°42'11.99"E	x	53I	NW	261.1	30172	7.19	0.0002	37021	Ice Cap
satluj_gr 825	31°22'16.92"N, 78°42'37.54"E	x	53I	SE	468.9	64655	11.47	0.0007	65021	Niche
satluj_gr 826	31°21'53.90"N, 78°42'38.36"E	x	53I	NW	1169.5	390640	28.64	0.0112	63021	Mountain basin
satluj_gr 827	31°22'02.90"N, 78°41'31.97"E	x	53I	SW	907.0	134149	17.42	0.0023	37021	Ice Cap
satluj_gr 828	31°21'46.19"N, 78°40'11.82"E	x	53I	N	3324.3	4938138	74.26	0.3669	63021	Mountain basin
satluj_gr 829	31°21'29.84"N, 78°38'27.04"E	x	53I	NE	9835.0	9886693	94.08	0.9304	52012	Valley glacier
satluj_gr 830	31°22'38.96"N, 78°37'53.88"E	x	53I	NE	1763.2	656231	35.47	0.0234	65021	Niche
satluj_gr 831	31°22'59.55"N, 78°36'34.53"E	x	53I	NW	5125.7	4752191	73.26	0.3480	63021	Mountain basin
satluj_gr 832	31°22'45.52"N, 78°34'11.37"E	x	53I	N	7859.6	12578739	101.97	1.2827	62021	Mountain basin
satluj_gr 833	31°22'31.54"N, 78°32'18.74"E	x	53I	SE	1085.5	258621	24.06	0.0063	60021	Mountain
satluj_gr 834	31°23'09.68"N, 78°31'28.07"E	x	53I	N	6088.0	5819784	78.58	0.4573	62021	Mountain basin
satluj_gr 835	31°24'30.79"N, 78°29'30.38"E	x	53I	NE	5993.2	4687335	72.94	0.3421	60021	Mountain
satluj_gr 836	31°25'18.55"N, 78°26'57.35"E	x	53I	S	3397.4	3245464	64.16	0.2085	60021	Mountain
satluj_gr 837	31°25'52.46"N, 78°27'33.21"E	x	53I	SE	2909.6	1840197	52.32	0.0963	63021	Mountain basin
satluj_gr 838	31°26'22.44"N, 78°27'59.72"E	x	53I	SE	1271.2	298364	25.61	0.0077	63021	Mountain basin
satluj_gr 839	31°26'58.77"N, 78°28'17.36"E	x	53I	SE	1412.5	713153	36.50	0.0259	63021	Mountain basin
satluj_gr 840	31°27'27.53"N, 78°28'25.77"E	x	53I	S	971.7	391968	28.64	0.0112	63051	Mountain basin
satluj_gr 841	31°28'32.11"N, 78°29'07.41"E	x	53I	NE	4641.9	3675053	67.03	0.2467	63021	Mountain basin
satluj_gr 842	31°27'40.22"N, 78°27'48.98"E	x	53I	NW	1147.8	245668	23.65	0.0059	63021	Mountain basin
satluj_gr 843	31°27'17.78"N, 78°27'30.82"E	x	53I	NW	1932.3	724587	36.71	0.0264	63021	Mountain basin
satluj_gr 844	31°26'58.11"N, 78°26'13.78"E	Lambar glacier	53I	NE	9977.0	11087696	97.76	1.0842	53012	Valley glacier
satluj_gr 845	31°26'50.66"N, 78°24'49.99"E	x	53I	S	601.7	139014	18.06	0.0025	60051	Mountain
satluj_gr 846	31°27'12.69"N, 78°24'53.03"E	x	53I	E	1068.7	513458	31.99	0.0163	60021	Mountain

satluj_gr 847	31°27'57.89"N, 78°25'17.22"E	x	53I	N	2490.9	906222	40.20	0.0366	63021	Mountain basin
satluj_gr 848	31°28'20.97"N, 78°24'25.75"E	x	53I	N	5568.4	4473082	71.74	0.3207	63021	Mountain basin
satluj_gr 849	31°29'40.07"N, 78°24'02.22"E	Garo glacier	53I	NE	8293.0	13276513	103.82	1.3788	52012	Valley glacier
satluj_gr 850	31°31'17.41"N, 78°22'51.84"E	x	53I	NE	5012.5	7881759	87.13	0.6866	52012	Valley glacier
satluj_gr 851	31°30'51.53"N, 78°21'23.47"E	x	53I	NW	2630.8	2128810	55.18	0.1175	63021	Mountain basin
satluj_gr 852	31°29'29.84"N, 78°20'07.12"E	Saro glacier	53I	NW	5093.5	7347227	85.10	0.6255	62021	Mountain basin
satluj_gr 853	31°28'50.80"N, 78°18'56.59"E	x	53I	NW	1649.7	746735	37.30	0.0280	63021	Mountain basin
satluj_gr 854	31°28'23.75"N, 78°19'23.17"E	x	53I	S	870.1	273699	24.46	0.0066	60051	Mountain
satluj_gr 855	31°27'53.26"N, 78°18'52.81"E	x	53I	NW	6002.5	5073408	74.93	0.3799	63021	Mountain basin
satluj_gr 856	31°27'17.13"N, 78°19'21.20"E	x	53I	S	935.2	361307	27.69	0.0100	60021	Mountain
satluj_gr 857	31°27'50.68"N, 78°20'09.15"E	x	53I	S	2347.5	639822	35.04	0.0224	60021	Mountain
satluj_gr 858	31°28'52.66"N, 78°21'20.21"E	x	53I	S	655.1	460531	30.67	0.0141	60021	Mountain
satluj_gr 859	31°27'55.52"N, 78°22'35.93"E	x	53I	SW	7084.7	9405743	92.52	0.8706	52012	Valley glacier
satluj_gr 860	31°26'52.07"N, 78°22'16.79"E	x	53I	SW	1290.3	548192	32.98	0.0181	60021	Mountain
satluj_gr 861	31°27'09.35"N, 78°24'11.08"E	x	53I	SW	2213.5	1534208	48.89	0.0748	63021	Mountain basin
satluj_gr 862	31°25'56.29"N, 78°23'47.98"E	x	53I	SW	1531.0	692343	36.10	0.0249	63021	Mountain basin
satluj_gr 863	31°25'26.04"N, 78°23'38.78"E	x	53I	NW	1497.3	503037	31.73	0.0159	63021	Mountain basin
satluj_gr 864	31°25'06.86"N, 78°23'06.69"E	x	53I	W	1532.7	545211	32.98	0.0181	63021	Mountain basin
satluj_gr 865	31°25'47.80"N, 78°24'24.99"E	x	53I	S	1314.9	466809	30.94	0.0145	63021	Mountain basin
satluj_gr 866	31°25'13.00"N, 78°25'02.97"E	x	53I	SW	1221.2	1049138	42.46	0.0446	63021	Mountain basin
satluj_gr 867	31°24'49.57"N, 78°25'49.66"E	x	53I	S	2476.8	2549736	58.86	0.1501	63021	Mountain basin
satluj_gr 868	31°23'25.34"N, 78°29'51.15"E	x	53I	SW	1362.2	1777825	51.69	0.0920	60021	Mountain
satluj_gr 869	31°22'51.31"N, 78°30'58.09"E	x	53I	SW	957.8	360254	27.69	0.0100	64021	Cirque
satluj_gr 870	31°22'19.02"N, 78°31'48.53"E	x	53I	SW	2120.3	621570	34.60	0.0215	63021	Mountain basin
satluj_gr 871	31°20'55.14"N, 78°34'35.05"E	x	53I	SW	5945.6	5609618	77.59	0.4353	63021	Mountain basin
satluj_gr 872	31°20'24.37"N, 78°35'17.94"E	x	53I	S	2270.8	1988588	53.83	0.1071	60021	Mountain
satluj_gr 873	31°20'19.11"N, 78°37'03.47"E	x	53I	S	3655.7	3779745	67.66	0.2558	63021	Mountain basin
satluj_gr 874	31°20'25.38"N, 78°37'47.27"E	x	53I	S	1517.4	515203	32.24	0.0168	63021	Mountain basin
satluj_gr 875	31°20'52.74"N, 78°38'54.49"E	x	53I	SE	567.8	109934	16.01	0.0018	64021	Cirque
satluj_gr 876	31°20'57.58"N, 78°40'08.00"E	x	53I	S	938.9	314082	25.98	0.0081	67021	Ice Apron
satluj_gr 877	31°20'58.06"N, 78°41'23.11"E	x	53I	S	1509.2	371557	28.01	0.0104	63021	Mountain basin
satluj_gr 878	31°20'28.54"N, 78°41'41.44"E	x	53I	S	645.0	171874	19.83	0.0034	60021	Mountain
satluj_gr 879	31°18'54.10"N, 78°40'13.33"E	x	53I	NW	984.9	512364	31.99	0.0163	60021	Mountain

satluj_gr 880	31°20'21.68"N, 78°42'27.45"E	x	53I	SE	1803.6	652595	35.25	0.0229	63021	Mountain basin
satluj_gr 881	31°20'55.60"N, 78°42'09.83"E	x	53I	E	1412.1	452182	30.39	0.0137	63021	Mountain basin
satluj_gr 882	31°21'28.51"N, 78°42'09.51"E	x	53I	SE	1688.0	783700	37.87	0.0295	63021	Mountain basin
satluj_gr 883	31°21'05.86"N, 78°45'30.95"E	x	53I	W	354.7	126980	17.42	0.0023	60021	Mountain
satluj_gr 884	31°20'43.22"N, 78°45'32.61"E	x	53I	SW	515.0	118880	16.74	0.0020	60021	Mountain
satluj_gr 885	31°19'57.14"N, 78°45'32.51"E	x	53I	NW	2387.3	1750924	51.37	0.0899	63021	Mountain basin
satluj_gr 886	31°19'04.53"N, 78°47'51.61"E	x	53I	S	817.6	403373	28.94	0.0116	60021	Mountain
satluj_gr 887	31°18'46.78"N, 78°48'12.95"E	x	53I	SW	600.5	135839	18.06	0.0025	60021	Mountain
satluj_gr 888	31°18'20.97"N, 78°48'04.36"E	x	53I	SW	1070.0	650183	35.25	0.0229	60021	Mountain
satluj_gr 889	31°17'46.10"N, 78°47'44.86"E	x	53I	NW	2251.4	1786937	51.79	0.0927	63021	Mountain basin
satluj_gr 890	31°17'00.14"N, 78°46'51.24"E	x	53I	NW	7218.5	8856284	90.66	0.8032	63012	Mountain basin
satluj_gr 891	31°17'23.23"N, 78°46'09.87"E	x	53I	NW	3625.8	2444652	57.94	0.1414	63512	Mountain basin
satluj_gr 892	31°17'40.67"N, 78°45'36.46"E	x	53I	NW	2049.8	1293435	45.89	0.0592	63021	Mountain basin
satluj_gr 893	31°17'36.63"N, 78°44'52.59"E	x	53I	N	3005.0	3574187	66.32	0.2368	63021	Mountain basin
satluj_gr 894	31°17'55.89"N, 78°44'04.44"E	x	53I	N	1585.9	822613	38.62	0.0317	63021	Mountain basin
satluj_gr 895	31°17'28.33"N, 78°42'39.98"E	x	53I	NW	3062.5	1621689	49.93	0.0809	60021	Mountain
satluj_gr 896	31°16'17.60"N, 78°42'20.07"E	x	53I	NW	4827.0	2559261	58.95	0.1509	60021	Mountain
satluj_gr 897	31°15'06.09"N, 78°44'55.58"E	x	53I	W	7452.0	17417518	113.59	1.9787	62021	Mountain basin
satluj_gr 898	31°12'06.22"N, 78°45'40.49"E	x	53I	NW	19181.9	63790423	173.05	11.0392	50012	Valley glacier
satluj_gr 899	31°12'51.20"N, 78°39'16.15"E	x	53I	SE	1531.0	968356	41.20	0.0400	60021	Mountain
satluj_gr 900	31°13'22.07"N, 78°39'21.93"E	x	53I	SE	1321.5	561704	33.22	0.0186	60021	Mountain
satluj_gr 901	31°13'56.82"N, 78°39'36.20"E	x	53I	NE	2077.9	985378	41.52	0.0411	63021	Mountain basin
satluj_gr 902	31°14'40.94"N, 78°39'17.34"E	x	53I	N	1485.6	890546	39.86	0.0355	60021	Mountain
satluj_gr 903	31°13'40.26"N, 78°37'54.16"E	x	53I	NE	4584.5	6354278	80.96	0.5141	63021	Mountain basin
satluj_gr 904	31°14'18.22"N, 78°36'00.64"E	x	53I	N	4708.6	6749142	82.67	0.5580	60021	Mountain
satluj_gr 905	31°15'47.12"N, 78°35'20.27"E	x	53I	NW	2193.4	1759145	51.48	0.0906	60021	Mountain
satluj_gr 906	31°15'50.90"N, 78°34'30.08"E	x	53I	NW	2112.5	1168776	44.24	0.0518	60021	Mountain
satluj_gr 907	31°15'22.17"N, 78°33'54.62"E	x	53I	N	1345.5	373796	28.01	0.0104	60021	Mountain
satluj_gr 908	31°14'29.85"N, 78°33'12.57"E	x	53I	N	5876.4	8052518	87.77	0.7065	63021	Mountain basin
satluj_gr 909	31°15'19.25"N, 78°32'32.77"E	x	53I	N	2668.0	1816265	52.11	0.0948	60021	Mountain
satluj_gr 910	31°16'00.52"N, 78°31'23.06"E	x	53I	N	1183.7	3242640	64.09	0.2077	60021	Mountain
satluj_gr 911	31°15'13.15"N, 78°31'02.11"E	x	53I	W	4153.1	2705973	60.16	0.1630	63021	Mountain basin
satluj_gr 912	31°14'20.88"N, 78°30'49.41"E	x	53I	W	4322.9	6842927	83.04	0.5680	60021	Mountain

satluj_gr 913	31°14'51.95"N, 78°28'20.72"E	x	53I	N	20218.2	39260200	148.07	5.8132	50012	Valley glacier
satluj_gr 914	31°18'37.57"N, 78°28'11.28"E	x	53I	NW	1216.4	551458	32.98	0.0181	67021	Ice Apron
satluj_gr 915	31°18'04.90"N, 78°27'53.54"E	x	53I	NW	1784.3	726011	36.91	0.0269	67021	Ice Apron
satluj_gr 916	31°16'53.20"N, 78°27'26.06"E	x	53I	NW	2545.2	2353116	57.17	0.1343	67021	Ice Apron
satluj_gr 917	31°16'30.43"N, 78°26'29.11"E	x	53I	NW	1680.5	844250	38.98	0.0327	65021	Niche
satluj_gr 918	31°16'19.21"N, 78°25'00.66"E	x	53I	NE	7043.6	12063510	100.54	1.2125	63021	Mountain basin
satluj_gr 919	31°17'09.31"N, 78°23'28.12"E	x	53I	NE	3448.9	3224374	63.95	0.2059	63021	Mountain basin
satluj_gr 920	31°18'38.79"N, 78°24'03.20"E	x	53I	SE	1193.9	435506	30.11	0.0132	37021	Ice Cap
satluj_gr 921	31°18'53.36"N, 78°24'27.67"E	x	53I	E	1390.5	411965	29.24	0.0120	37021	Ice Cap
satluj_gr 922	31°19'19.38"N, 78°24'16.31"E	x	53I	N	954.2	464306	30.67	0.0141	37021	Ice Cap
satluj_gr 923	31°19'16.79"N, 78°23'35.83"E	x	53I	N	1928.1	1120325	43.51	0.0487	37021	Ice Cap
satluj_gr 924	31°19'17.64"N, 78°22'47.45"E	x	53I	N	721.3	564981	33.22	0.0186	37021	Ice Cap
satluj_gr 925	31°18'52.14"N, 78°22'51.03"E	x	53I	W	1697.0	533677	32.49	0.0172	37021	Ice Cap
satluj_gr 926	31°18'32.45"N, 78°23'19.42"E	x	53I	SW	1250.0	715994	36.71	0.0264	37021	Ice Cap
satluj_gr 927	31°17'57.01"N, 78°22'19.02"E	x	53I	NW	6021.1	3945565	68.71	0.2714	63021	Mountain basin
satluj_gr 928	31°18'15.86"N, 78°20'50.81"E	x	53I	NW	1988.8	813897	38.43	0.0311	63021	Mountain basin
satluj_gr 929	31°17'27.32"N, 78°20'47.57"E	x	53I	N	4506.6	4072554	69.43	0.2826	60021	Mountain
satluj_gr 930	31°17'25.39"N, 78°18'31.01"E	x	53I	N	2484.1	2715200	60.24	0.1638	60021	Mountain
satluj_gr 931	31°19'19.30"N, 78°17'57.99"E	x	53I	E	3085.4	2644577	59.60	0.1573	60021	Mountain
satluj_gr 932	31°21'29.62"N, 78°19'28.75"E	x	53I	N	1828.7	1342714	46.54	0.0624	67021	Ice Apron
satluj_gr 933	31°21'30.04"N, 78°18'34.96"E	x	53I	N	2568.6	2172863	55.55	0.1205	60021	Mountain
satluj_gr 934	31°20'33.51"N, 78°18'23.47"E	Bilare glacier	53I	SW	5005.5	5296993	76.09	0.4033	63021	Mountain basin
satluj_gr 935	31°23'05.80"N, 78°10'00.11"E	Hamia glaicer	53I	NE	2079.6	917461	40.37	0.0371	67021	Ice Apron
satluj_gr 936	31°24'51.67"N, 78°06'29.54"E	x	53I	SE	1463.3	441419	30.11	0.0132	60021	Mountain
satluj_gr 937	31°25'27.06"N, 78°05'41.14"E	x	53I	NE	1389.9	603672	34.15	0.0205	37021	Ice Cap
satluj_gr 938	31°27'04.59"N, 78°03'50.22"E	x	53I	E	505.8	111679	16.01	0.0018	64021	Cirque
satluj_gr 939	31°25'11.32"N, 77°57'22.94"E	x	53I	SE	1033.9	364719	27.69	0.0100	64021	Cirque
satluj_gr 940	31°25'25.81"N, 77°56'02.75"E	x	53E	SE	1618.1	421162	29.54	0.0124	63021	Mountain basin
satluj_gr 941	31°25'57.09"N, 77°55'24.18"E	x	53E	NE	1064.8	226172	22.78	0.0052	63021	Mountain basin
satluj_gr 942	31°25'57.12"N, 77°54'53.84"E	x	53E	NE	921.5	194853	20.88	0.0040	60021	Mountain
satluj_gr 943	31°26'16.30"N, 77°54'47.28"E	x	53E	NE	817.8	406287	29.24	0.0120	64021	Cirque
satluj_gr 944	31°25'05.45"N, 77°56'49.42"E	x	53E	S	520.9	73785	12.55	0.0009	64021	Cirque
satluj_gr 945	31°24'44.71"N, 77°56'52.60"E	x	53E	SW	538.6	82007	13.52	0.0011	65021	Niche

Inventory of Glaciers of Ravi River Basin

Number of Glaciers= 198 | Area of Glaciers= 235.21 km^2 | Total Ice Reseerve= 6.45km^3

Glacier Number	Latitude Longitude	Glacier Name	Map code	Orientation	Length (m)	Area (m^2)	Thickness (m)	Ice reserve (km^3)	Classification	Glacier Type
Ravi_gr 1	33°01'46.12"N, 76°18'14.44"E	x	52c	N	1519	1374428	47.22	0.06490	67021	Ice Apron
Ravi_gr 2	33°01'25.86"N, 76°17'34.98"E	x	52c	N	1565	1060553	42.84	0.04543	67021	Ice Apron
Ravi_gr 3	33°00'40.16"N, 76°17'42.94"E	x	52c	SW	458	117266	16.65	0.00195	64021	Cirque
Ravi_gr 4	32°58'52.65"N, 76°20'21.53"E	x	52d	W	863	402840	29.19	0.01176	60021	Mountain
Ravi_gr 5	32°55'54.24"N, 76°18'47.19"E	x	52d	N	1385	575902	33.77	0.01945	60021	Mountain
Ravi_gr 6	32°56'01.08"N, 76°18'14.02"E	x	52d	N	451	101467	15.47	0.00157	64021	Cirque
Ravi_gr 7	32°56'07.30"N, 76°17'38.92"E	x	52d	N	314	64141	12.02	0.00077	64021	Cirque
Ravi_gr 8	32°56'33.20"N, 76°17'42.63"E	x	52d	N	1669	561417	33.43	0.01877	60021	Mountain
Ravi_gr 9	32°56'41.44"N, 76°17'16.58"E	x	52d	NE	1384	345546	27.37	0.00946	65021	Niche
Ravi_gr 10	32°57'09.70"N, 76°16'44.75"E	x	52d	N	597	141888	18.30	0.00260	64021	Cirque
Ravi_gr 11	32°55'33.28"N, 76°19'14.31"E	x	52d	SW	255	58858	11.43	0.00067	37021	Ice Cap
Ravi_gr 12	32°55'05.71"N, 76°19'10.04"E	x	52d	SE	580	211454	22.07	0.00467	60021	Mountain
Ravi_gr 13	32°54'39.75"N, 76°19'25.01"E	x	52d	W	1519	78589	13.49	0.00106	60021	Mountain
Ravi_gr 14	32°53'45.16"N, 76°19'19.72"E	x	52d	SW	1565	1432113	47.94	0.06866	62021	Mountain basin
Ravi_gr 15	32°48'59.16"N, 76°21'38.87"E	x	52d	W	458	403331	29.20	0.01178	60021	Mountain
Ravi_gr 16	32°48'17.70"N, 76°22'01.59"E	x	52d	W	863	85089	14.09	0.00120	60021	Mountain
Ravi_gr 17	32°45'16.38"N, 76°23'19.97"E	x	52d	W	1385	3072368	63.19	0.19415	63021	Mountain basin
Ravi_gr 18	32°43'32.74"N, 76°24'34.04"E	x	52d	W	451	1777380	51.91	0.09226	63021	Mountain basin
Ravi_gr 19	32°42'27.26"N, 76°23'56.65"E	x	52d	NW	314	3549360	66.49	0.23600	63021	Mountain basin
Ravi_gr 20	32°39'19.70"N, 76°24'02.34"E	x	52d	SW	1669	1032496	42.40	0.04378	63021	Mountain basin
Ravi_gr 21	32°38'49.76"N, 76°24'18.46"E	x	52d	NE	1384	192052	21.12	0.00406	65021	Niche

Ravi_gr 22	32°40'09.91"N, 76°25'10.26"E	x	52d	NE	597	67686	12.40	0.00084	37021	Ice Cap
Ravi_gr 23	32°40'29.23"N, 76°25'10.61"E	x	52d	E	255	112266	16.29	0.00183	37021	Ice Cap
Ravi_gr 24	32°42'22.99"N, 76°25'12.74"E	x	52d	E	580	704797	36.59	0.02579	60021	Mountain
Ravi_gr 25	32°42'02.34"N, 76°31'36.81"E	x	52d	SE	433	571843	33.68	0.01926	65021	Niche
Ravi_gr 26	32°39'20.22"N, 76°33'59.13"E	x	52d	NW	1690	2213210	56.21	0.12441	60021	Mountain
Ravi_gr 27	32°38'23.66"N, 76°34'50.34"E	x	52d	S	1030	5986639	79.70	0.47715	52012	Valley glacier
Ravi_gr 28	32°35'30.92"N, 76°32'10.18"E	Raskundli glacier	52d	N	346	913628	40.47	0.03697	63021	Mountain basin
Ravi_gr 29	32°35'21.92"N, 76°31'33.46"E	x	52d	N	3236	97813	15.17	0.00148	65021	Niche
Ravi_gr 30	32°34'38.79"N, 76°32'04.00"E	x	52d	W	2695	805940	38.56	0.03107	60021	Mountain
Ravi_gr 31	32°35'03.99"N, 76°33'30.26"E	x	52d	SE	2876	810312	38.64	0.03131	60021	Mountain
Ravi_gr 32	32°34'42.63"N, 76°33'57.59"E	x	52d	SE	1223	88527	14.39	0.00127	65021	Niche
Ravi_gr 33	32°35'33.75"N, 76°33'48.82"E	x	52d	SE	769	546953	33.08	0.01809	60021	Mountain
Ravi_gr 34	32°35'58.16"N, 76°35'22.84"E	x	52d	S	417	327908	26.76	0.00878	65021	Niche
Ravi_gr 35	32°36'29.06"N, 76°35'42.66"E	x	52d	S	498	213047	22.14	0.00472	60021	Mountain
Ravi_gr 36	32°36'44.69"N, 76°35'50.27"E	x	52d	SE	656	182969	20.65	0.00378	60021	Mountain
Ravi_gr 37	32°37'06.90"N, 76°36'11.88"E	x	52d	SE	1521	926088	40.68	0.03767	60021	Mountain
Ravi_gr 38	32°37'13.94"N, 76°36'51.33"E	x	52d	S	863	1460878	48.30	0.07056	60021	Mountain
Ravi_gr 39	32°37'23.55"N, 76°37'31.98"E	x	52d	S	2780	1542607	49.28	0.07602	60021	Mountain
Ravi_gr 40	32°36'53.34"N, 76°38'25.28"E	x	52d	SW	2144	1644678	50.46	0.08298	67021	Ice Apron
Ravi_gr 41	32°36'40.36"N, 76°38'57.36"E	x	52d	SW	564	480469	31.39	0.01508	60021	Mountain
Ravi_gr 42	32°36'07.79"N, 76°39'30.89"E	x	52d	SW	1109	1567418	49.57	0.07770	63021	Mountain basin
Ravi_gr 43	32°35'20.15"N, 76°39'44.64"E	x	52d	SW	1004	1783855	51.98	0.09272	67021	Ice Apron
Ravi_gr 44	32°35'06.05"N, 76°40'40.94"E	x	52d	SW	501	4501128	72.24	0.32515	63021	Mountain basin
Ravi_gr 45	32°33'58.06"N, 76°42'44.89"E	x	52d	NE	922	94129	14.87	0.00140	65021	Niche
Ravi_gr 46	32°34'23.81"N, 76°42'45.43"E	x	52d	NE	1303	141029	18.25	0.00257	65021	Niche
Ravi_gr 47	32°35'22.96"N, 76°42'03.63"E	x	52d	SE	698	2295089	56.95	0.13071	60021	Mountain
Ravi_gr 48	32°35'47.23"N, 76°42'36.25"E	x	52d	SE	635	101172	15.44	0.00156	60021	Mountain
Ravi_gr 49	32°35'31.21"N, 76°43'57.46"E	Guwala glacier	52d	S	1704	368845	28.13	0.01038	60021	Mountain
Ravi_gr 50	32°35'36.06"N, 76°44'52.05"E	x	52d	SW	2264	961879	41.27	0.03970	63021	Mountain basin

Ravi_gr 51	32°35'26.98"N, 76°45'26.55"E	x	52d	SW	2186	2492520	58.66	0.14622	63021	Mountain basin
Ravi_gr 52	32°34'53.73"N, 76°45'53.27"E	x	52d	SW	1495	450882	30.58	0.01379	65021	Niche
Ravi_gr 53	32°34'53.91"N, 76°46'26.56"E	x	52d	SW	555	71836	12.83	0.00092	37021	Ice Cap
Ravi_gr 54	32°34'55.78"N, 76°47'15.44"E	x	52d	SW	3045	115000	16.49	0.00190	60021	Mountain
Ravi_gr 55	32°34'47.32"N, 76°50'01.14"E	x	52d	N	1479	371563	28.22	0.01048	60021	Mountain
Ravi_gr 56	32°32'29.59"N, 76°48'35.58"E	Laihas, kutai glacier	52d	N	4897	10485858	96.37	1.01052	52012	Valley glacier
Ravi_gr 57	32°31'27.74"N, 76°47'43.02"E	x	52d	N	617	1553253	49.40	0.07674	60021	Mountain
Ravi_gr 58	32°31'20.21"N, 76°45'23.77"E	x	52d	N	693	712956	36.75	0.02620	60021	Mountain
Ravi_gr 59	32°31'31.25"N, 76°44'57.71"E	x	52d	N	2127	56612	11.16	0.00063	60021	Mountain
Ravi_gr 60	32°30'34.98"N, 76°47'19.75"E	x	52d	S	311	800547	38.45	0.03079	60021	Mountain
Ravi_gr 61	32°30'36.15"N, 76°47'50.36"E	x	52d	S	813	210703	22.03	0.00464	64021	Cirque
Ravi_gr 62	32°30'49.04"N, 76°48'26.85"E	x	52d	S	2538	100220	15.37	0.00154	60021	Mountain
Ravi_gr 63	32°31'02.88"N, 76°48'45.07"E	x	52d	S	3645	59328	11.48	0.00068	60021	Mountain
Ravi_gr 64	32°31'12.64"N, 76°48'56.94"E	x	52d	S	1434	63984	12.00	0.00077	60021	Mountain
Ravi_gr 65	32°31'12.91"N, 76°49'18.46"E	x	52d	S	407	251172	23.83	0.00599	60021	Mountain
Ravi_gr 66	32°30'12.76"N, 76°49'06.05"E	Tal glacier	52d	SW	539	7068448	84.35	0.59625	53012	Valley glacier
Ravi_gr 67	32°27'20.12"N, 76°45'47.99"E	Sarni glacier	52d	N	1036	5038311	75.11	0.37844	63021	Mountain basin
Ravi_gr 68	32°26'22.58"N, 76°46'25.66"E	x	52d	W	7597	911641	40.43	0.03686	60021	Mountain
Ravi_gr 69	32°25'54.27"N, 76°46'15.47"E	x	52d	W	2650	154375	19.06	0.00294	60021	Mountain
Ravi_gr 70	32°25'07.75"N, 76°45'47.36"E	x	52d	SW	1117	117678	16.68	0.00196	67021	Ice Apron
Ravi_gr 71	32°24'53.41"N, 76°45'16.20"E	x	52d	NW	304	420047	29.70	0.01248	60021	Mountain
Ravi_gr 72	32°24'30.56"N, 76°45'30.49"E	x	52d	NW	1230	268047	24.53	0.00657	60021	Mountain
Ravi_gr 73	32°24'13.33"N, 76°44'41.23"E	Nikora glacier	52d	N	671	2052027	54.70	0.11224	60021	Mountain
Ravi_gr 74	32°24'58.93"N, 76°43'34.84"E	x	52d	N	497	2616615	59.69	0.15618	63021	Mountain basin
Ravi_gr 75	32°25'26.56"N, 76°42'16.99"E	x	52d	N	477	1180198	44.60	0.05264	63021	Mountain basin
Ravi_gr 76	32°24'54.56"N, 76°41'14.21"E	x	52d	N	325	373495	28.28	0.01056	63021	Mountain basin
Ravi_gr 77	32°24'41.13"N, 76°40'52.79"E	x	52d	N	801	648795	35.41	0.02298	60021	Mountain
Ravi_gr 78	32°24'37.60"N, 76°40'18.43"E	x	52d	N	7184	769556	37.87	0.02914	63021	Mountain basin
Ravi_gr 79	32°24'47.51"N, 76°39'38.07"E	x	52d	N	3328	385115	28.64	0.01103	63021	Mountain basin

Ravi_gr 80	32°26'04.15"N, 76°39'24.03"E	x	52d	E	1422	79141	13.54	0.00107	60021	Mountain
Ravi_gr 81	32°25'08.36"N, 76°38'32.97"E	x	52d	N	594	6808616	83.28	0.56705	53012	Valley glacier
Ravi_gr 82	32°24'44.81"N, 76°37'33.65"E	x	52d	N	284	741756	37.33	0.02769	67021	Ice Apron
Ravi_gr 83	32°23'55.64"N, 76°37'08.37"E	x	52d	SE	1070	3025765	62.85	0.19018	63021	Mountain basin
Ravi_gr 84	32°23'05.08"N, 76°37'13.77"E	x	52d	N	447	321016	26.52	0.00851	60021	Mountain
Ravi_gr 85	32°23'15.55"N, 76°37'29.48"E	x	52d	S	2349	36641	8.41	0.00031	67021	Ice Apron
Ravi_gr 86	32°22'57.30"N, 76°37'49.79"E	x	52d	S	3331	612365	34.61	0.02119	60021	Mountain
Ravi_gr 87	32°22'23.52"N, 76°37'39.94"E	x	52d	SE	2357	469155	31.08	0.01458	60021	Mountain
Ravi_gr 88	32°23'10.25"N, 76°38'05.52"E	x	52d	SE	1169	209598	21.98	0.00461	60021	Mountain
Ravi_gr 89	32°23'41.71"N, 76°38'25.93"E	x	52d	SE	909	1607341	50.03	0.08042	60021	Mountain
Ravi_gr 90	32°22'58.33"N, 76°43'58.88"E	x	52d	SE	1638	86953	14.25	0.00124	64021	Cirque
Ravi_gr 91	32°23'19.48"N, 76°43'53.81"E	x	52d	SE	1392	116875	16.63	0.00194	64021	Cirque
Ravi_gr 92	32°24'53.88"N, 76°45'57.10"E	Shau glacier	52d	SE	324	205131	21.76	0.00446	63021	Mountain basin
Ravi_gr 93	32°25'13.27"N, 76°46'03.22"E	Barthal glacier	52d	SE	5972	69283	12.57	0.00087	64021	Cirque
Ravi_gr 94	32°28'45.34"N, 76°48'05.84"E	x	52d	S	768	251152	23.83	0.00599	67021	Ice Apron
Ravi_gr 95	32°28'51.59"N, 76°48'33.77"E	x	52d	S	3197	472344	31.17	0.01472	60021	Mountain
Ravi_gr 96	32°30'20.76"N, 76°50'20.64"E	x	52d	S	552	32266	7.67	0.00025	67021	Ice Apron
Ravi_gr 97	32°30'30.61"N, 76°50'35.11"E	x	52d	S	268	44922	9.66	0.00043	67021	Ice Apron
Ravi_gr 98	32°30'37.71"N, 76°50'49.09"E	x	52d	S	587	25625	6.40	0.00016	67021	Ice Apron
Ravi_gr 99	32°30'39.80"N, 76°51'00.72"E	x	52d	S	1159	10469	2.23	0.00002	67021	Ice Apron
Ravi_gr 100	32°30'21.89"N, 76°52'17.38"E	x	52d	SE	643	7576571	86.37	0.65436	53012	Valley glacier
Ravi_gr 101	32°28'16.07"N, 76°51'03.89"E	x	52d	S	2194	104375	15.69	0.00164	60021	Mountain
Ravi_gr 102	32°28'30.00"N, 76°51'24.67"E	x	52d	S	470	431668	30.04	0.01297	60021	Mountain
Ravi_gr 103	32°28'32.45"N, 76°51'46.06"E	x	52d	S	438	118419	16.74	0.00198	60021	Mountain
Ravi_gr 104	32°28'45.06"N, 76°52'01.04"E	x	52d	S	656	220469	22.49	0.00496	60021	Mountain
Ravi_gr 105	32°28'13.25"N, 76°52'51.26"E	Shah glacier	52d	SE	357	4608801	72.83	0.33567	53012	Valley glacier
Ravi_gr 106	32°27'40.82"N, 76°53'42.35"E	Sili lal glacier	52d	SE	635	662725	35.71	0.02367	60021	Mountain
Ravi_gr 107	32°27'42.90"N, 76°54'29.16"E	x	52d	E	1214	208857	21.94	0.00458	60021	Mountain
Ravi_gr 108	32°26'14.55"N, 76°53'18.56"E	Tapani lal glacier	52d	SE	184	5689383	78.32	0.44561	53012	Valley glacier

Ravi_gr 109	32°24'34.40"N, 76°52'44.31"E	Joshari glacier	52d	SE	455	2750289	60.76	0.16710	63021	Mountain basin
Ravi_gr 110	32°25'32.87"N, 76°54'15.61"E	x	52d	S	211	148203	18.69	0.00277	60021	Mountain
Ravi_gr 111	32°25'29.15"N, 76°54'42.59"E	x	52d	S	168	348170	27.45	0.00956	63021	Mountain basin
Ravi_gr 112	32°25'53.03"N, 76°54'48.37"E	x	52d	S	9412	43203	9.41	0.00041	60021	Mountain
Ravi_gr 113	32°26'14.31"N, 76°55'18.39"E	x	52d	S	415	574643	33.74	0.01939	63021	Mountain basin
Ravi_gr 114	32°26'33.41"N, 76°55'38.53"E	x	52d	S	1695	658541	35.62	0.02346	63021	Mountain basin
Ravi_gr 115	32°26'30.33"N, 76°56'06.88"E	x	52d	S	490	453698	30.66	0.01391	63021	Mountain basin
Ravi_gr 116	32°26'35.84"N, 76°56'27.74"E	x	52d	S	691	103394	15.62	0.00161	60021	Mountain
Ravi_gr 117	32°26'15.43"N, 76°56'35.87"E	x	52d	S	5463	454844	30.69	0.01396	63021	Mountain basin
Ravi_gr 118	32°26'17.07"N, 76°57'03.97"E	x	52d	S	881	251875	23.86	0.00601	63021	Mountain basin
Ravi_gr 119	32°27'40.90"N, 76°59'44.61"E	x	52d	SE	304	138956	18.11	0.00252	60021	Mountain
Ravi_gr 120	32°27'18.49"N, 76°59'55.85"E	Kudi glacier	52d	SE	8941	1628428	50.27	0.08186	63021	Mountain basin
Ravi_gr 121	32°25'15.27"N, 77°00'10.61"E	Balu, Raigarh, Bhadal glacier	52h	SE	3593	18654581	116.69		62021	Mountain basin
Ravi_gr 122	32°22'58.20"N, 77°00'42.68"E	Karu glacier	52h	E	762	5469777	77.27	0.42265	60021	Mountain
Ravi_gr 123	32°21'27.13"N, 77°00'52.25"E	Badunag glacier	52h	E	1523	18155950	115.65	2.09972	62021	Mountain basin
Ravi_gr 124	32°22'19.34"N, 76°58'25.75"E	x	52d	E	248	1064980	42.90	0.04569	60021	Mountain
Ravi_gr 125	32°20'48.61"N, 76°57'38.88"E	x	52d	E	1394	2347204	57.41	0.13476	63021	Mountain basin
Ravi_gr 126	32°19'59.81"N, 76°57'51.41"E	x	52d	S	1373	181484	20.57	0.00373	37021	Ice Cap
Ravi_gr 127	32°20'32.10"N, 76°58'44.46"E	x	52d	S	1317	492500	31.70	0.01561	63021	Mountain basin
Ravi_gr 128	32°20'36.29"N, 76°59'12.86"E	x	52d	S	484	1730515	51.41	0.08896	63021	Mountain basin
Ravi_gr 129	32°19'22.39"N, 77°00'29.00"E	Biyalti glacier	52h	NE	1684	10356880	95.97	0.99396	62021	Mountain basin
Ravi_gr 130	32°18'17.77"N, 76°59'54.68"E	Tantgari glacier	52d	NE	1210	2695558	60.33	0.16261	60021	Mountain
Ravi_gr 131	32°18'05.91"N, 76°58'25.65"E	x	52d	NE	725	632031	35.05	0.02215	60021	Mountain
Ravi_gr 132	32°18'29.99"N, 76°57'42.61"E	x	52d	SE	3405	41797	9.21	0.00038	64021	Cirque
Ravi_gr 133	32°20'27.34"N, 76°55'03.56"E	x	52d	SE	290	53773	10.82	0.00058	67021	Ice Apron
Ravi_gr 134	32°20'46.33"N, 76°55'07.64"E	x	52d	W	4335	199216	21.47	0.00428	67021	Ice Apron
Ravi_gr 135	32°21'25.44"N, 76°54'40.80"E	Biaru glacier	52d	N	8247	188695	20.94	0.00395	65021	Niche
Ravi_gr 136	32°21'01.61"N, 76°54'21.68"E	Biaru glacier	52d	N	1050	188672	20.94	0.00395	60021	Mountain
Ravi_gr 137	32°21'04.60"N, 76°53'47.38"E	Biaru glacier	52d	NE	4661	290943	25.42	0.00740	65021	Niche

Ravi_gr 138	32°20'47.92"N, 76°53'02.40"E	x	52d	NE	257	153819	19.03	0.00293	64021	Cirque
Ravi_gr 139	32°20'25.29"N, 76°53'44.84"E	x	52d	S	1099	916994	40.52	0.03716	60021	Mountain
Ravi_gr 140	32°20'16.16"N, 76°54'26.60"E	x	52d	SE	2002	115859	16.55	0.00192	60021	Mountain
Ravi_gr 141	32°20'16.31"N, 76°54'41.88"E	x	52d	S	7632	237936	23.27	0.00554	60021	Mountain
Ravi_gr 142	32°17'54.73"N, 76°57'50.33"E	x	52d	SE	1113	407602	29.33	0.01196	63021	Mountain basin
Ravi_gr 143	32°17'30.39"N, 76°57'40.40"E	x	52d	SE	1682	711333	36.72	0.02612	63021	Mountain basin
Ravi_gr 144	32°17'24.25"N, 76°58'40.83"E	x	52d	SE	220	29063	7.09	0.00021	67021	Ice Apron
Ravi_gr 145	32°17'40.28"N, 76°59'09.02"E	x	52d	SE	290	149922	18.79	0.00282	60021	Mountain
Ravi_gr 146	32°17'06.89"N, 76°59'42.43"E	Garthala glacier	52h	SE	461	6371375	81.42	0.51875	62021	Mountain basin
Ravi_gr 147	32°15'51.70"N, 76°59'40.21"E	x	52d	SE	864	119766	16.83	0.00202	67021	Ice Apron
Ravi_gr 148	32°15'42.83"N, 77°01'34.56"E	Kalihen glacier	52h	S	350	7340839	85.44	0.62724	60021	Mountain
Ravi_gr 149	32°14'22.89"N, 76°59'21.63"E	Guwala glacier	52d	E	429	6266098	80.96	0.50728	60021	Mountain
Ravi_gr 150	32°14'33.33"N, 76°57'49.78"E	x	52d	SE	368	1182247	44.63	0.05276	60021	Mountain
Ravi_gr 151	32°14'15.97"N, 76°56'45.45"E	x	52d	S	1889	693562	36.36	0.02522	60021	Mountain
Ravi_gr 152	32°14'49.65"N, 76°55'13.37"E	x	52d	NW	551	1328154	46.62	0.06192	60021	Mountain
Ravi_gr 153	32°15'58.50"N, 76°54'32.79"E	x	52d	NW	994	101512	15.47	0.00157	60021	Mountain
Ravi_gr 154	32°15'41.28"N, 76°54'24.48"E	x	52d	NW	1451	192886	21.16	0.00408	37021	Ice Cap
Ravi_gr 155	32°15'34.97"N, 76°54'04.05"E	x	52d	W	1930	41970	9.23	0.00039	65021	Niche
Ravi_gr 156	32°15'18.33"N, 76°54'25.70"E	x	52d	NW	251	189576	20.99	0.00398	67021	Ice Apron
Ravi_gr 157	32°14'52.99"N, 76°54'22.43"E	x	52d	W	465	119802	16.83	0.00202	65021	Niche
Ravi_gr 158	32°14'38.20"N, 76°54'26.17"E	x	52d	W	5388	329028	26.80	0.00882	60021	Mountain
Ravi_gr 159	32°13'49.74"N, 76°52'28.60"E	x	52d	N	603	58155	11.35	0.00066	60021	Mountain
Ravi_gr 160	32°13'44.61"N, 76°51'48.34"E	x	52d	N	2186	470395	31.12	0.01464	60021	Mountain
Ravi_gr 161	32°13'48.41"N, 76°51'02.98"E	x	52d	N	6201	726244	37.02	0.02689	63021	Mountain basin
Ravi_gr 162	32°13'52.95"N, 76°50'29.46"E	x	52d	N	1948	315286	26.32	0.00830	60021	Mountain
Ravi_gr 163	32°13'50.39"N, 76°50'05.87"E	x	52d	N	1342	116526	16.60	0.00193	60021	Mountain
Ravi_gr 164	32°13'55.67"N, 76°49'44.49"E	x	52d	N	1512	27734	6.83	0.00019	60021	Mountain
Ravi_gr 165	32°13'45.02"N, 76°49'19.37"E	x	52d	N	458	832969	39.05	0.03253	63021	Mountain basin
Ravi_gr 166	32°13'48.50"N, 76°48'47.21"E	x	52d	N	580	237188	23.24	0.00551	60021	Mountain
Ravi_gr 167	32°14'32.01"N, 76°48'40.25"E	x	52d	N	349	406094	29.29	0.01189	63021	Mountain basin

Ravi_gr 168	32°14'58.91"N, 76°48'05.79"E	x	52d	NE	746	88750	14.41	0.00128	60021	Mountain
Ravi_gr 169	32°15'06.47"N, 76°47'24.51"E	x	52d	NE	889	669141	35.85	0.02399	60021	Mountain
Ravi_gr 170	32°15'47.59"N, 76°46'57.56"E	x	52d	NE	1289	644257	35.32	0.02275	60021	Mountain
Ravi_gr 171	32°16'09.02"N, 76°47'28.82"E	x	52d	NE	231	49453	10.27	0.00051	65021	Niche
Ravi_gr 172	32°16'35.40"N, 76°47'27.39"E	x	52d	NE	526	63047	11.90	0.00075	65021	Niche
Ravi_gr 173	32°16'28.01"N, 76°46'56.35"E	x	52d	NE	1553	102132	15.52	0.00158	60021	Mountain
Ravi_gr 174	32°14'56.89"N, 76°46'38.22"E	x	52d	S	847	178618	20.42	0.00365	60021	Mountain
Ravi_gr 175	32°15'36.14"N, 76°46'28.23"E	x	52d	N	368	356967	27.74	0.00990	60021	Mountain
Ravi_gr 176	32°15'25.04"N, 76°45'57.40"E	x	52d	S	224	772692	37.93	0.02931	60021	Mountain
Ravi_gr 177	32°15'06.84"N, 76°46'18.03"E	x	52d	S	1756	45938	9.80	0.00045	60021	Mountain
Ravi_gr 178	32°15'04.97"N, 76°45'36.84"E	x	52d	S	793	99450	15.30	0.00152	60021	Mountain
Ravi_gr 179	32°17'32.75"N, 76°45'38.59"E	x	52d	N	1005	123787	17.11	0.00212	64021	Cirque
Ravi_gr 180	32°16'57.05"N, 76°45'33.67"E	x	52d	N	472	532969	32.74	0.01745	60021	Mountain
Ravi_gr 181	32°16'28.86"N, 76°45'19.98"E	x	52d	N	1679	195313	21.28	0.00416	60021	Mountain
Ravi_gr 182	32°16'06.96"N, 76°45'18.23"E	x	52d	N	1749	101851	15.50	0.00158	60021	Mountain
Ravi_gr 183	32°15'50.94"N, 76°45'09.77"E	x	52d	W	360	446540	30.46	0.01360	60021	Mountain
Ravi_gr 184	32°15'28.80"N, 76°45'03.12"E	x	52d	W	185	498104	31.85	0.01586	64021	Cirque
Ravi_gr 185	32°14'46.18"N, 76°44'58.09"E	x	52d	S	181	773594	37.95	0.02935	60021	Mountain
Ravi_gr 186	32°14'22.35"N, 76°44'39.75"E	x	52d	S	631	325801	26.69	0.00870	60021	Mountain
Ravi_gr 187	32°13'50.57"N, 76°44'18.90"E	x	52d	NW	1150	232458	23.03	0.00535	63021	Mountain basin
Ravi_gr 188	32°15'50.50"N, 76°29'47.94"E	x	52d	N	1283	2299844	56.99	0.13107	60021	Mountain
Ravi_gr 189	32°16'27.58"N, 76°28'47.02"E	x	52d	NW	362	741122	37.32	0.02766	60021	Mountain
Ravi_gr 190	32°16'59.10"N, 76°28'31.98"E	x	52d	NW	673	1218515	45.14	0.05500	60021	Mountain
Ravi_gr 191	32°16'34.93"N, 76°27'13.98"E	x	52d	N	421	429531	29.97	0.01287	60021	Mountain
Ravi_gr 192	32°18'30.38"N, 76°24'10.37"E	x	52d	NW	1115	231875	23.00	0.00533	60021	Mountain
Ravi_gr 193	32°18'43.94"N, 76°23'39.43"E	x	52d	NW	608	107813	15.96	0.00172	60021	Mountain
Ravi_gr 194	32°19'04.53"N, 76°22'59.26"E	x	52d	NW	569	258125	24.12	0.00623	60021	Mountain
Ravi_gr 195	32°22'01.21"N, 76°21'55.26"E	x	52d	N	1035	97385	15.14	0.00147	64021	Cirque
Ravi_gr 196	32°21'43.93"N, 76°21'40.82"E	x	52d	NE	1335	152780	18.96	0.00290	64021	Cirque
Ravi_gr 197	32°21'33.90"N, 76°21'07.57"E	x	52d	NE	1054	45547	9.74	0.00044	65021	Niche

Ravi_gr 198	32°21'35.50"N, 76°20'31.43"E	x	52d	NE	603	43281	9.42	0.00041	67021	Ice Apron

Inventory of Glaciers of Tsarap Chu River basin

Number of Glaciers= 250 | Area of Glaciers= 163.32 km^2 | Total Ice Reseerve= 7.98 km^3

Glacier Number	Latitude Longitude	Glacier Name	Map code	Orientation	Length (m)	Area (m^2)	Thickness (m)	Ice reserve (km^3)	Classification	Glacier Type
sub_basin1_gr 1	32°56'47.47"N, 77°44'25.20"E		52h	NE	849.6	161005	19.27	0.0030	60021	Mountain
sub_basin1_gr 2	32°56'18.31"N, 77°45'08.93"E		52h	S	1342.2	322437	26.33	0.0080	60021	Mountain
sub_basin1_gr 3	32°49'18.10"N, 77°51'28.54"E		52h	NE	320.6	61573	11.47	0.0010	64021	Cirque
sub_basin1_gr 4	32°49'04.47"N, 77°51'10.90"E		52h	NE	880.7	383844	28.33	0.0110	63021	Mountain basin
sub_basin1_gr 5	32°46'11.53"N, 77°53'21.63"E		52h	NW	374.7	109274	16.01	0.0020	60021	Mountain
sub_basin1_gr 6	32°46'00.51"N, 77°52'51.50"E		52h	NE	1496.6	538956	32.73	0.0180	63021	Mountain basin
sub_basin1_gr 7	32°45'22.00"N, 77°55'26.90"E		52h	?	453.1	75294	13.52	0.0010	60021	Mountain
sub_basin1_gr 8	32°44'47.29"N, 77°55'24.18"E		52h	S	616.9	77944	13.52	0.0010	37021	Ice Cap
sub_basin1_gr 9	32°44'19.11"N, 77°55'29.97"E		52h	S	992.5	247292	23.65	0.0060	60021	Mountain
sub_basin1_gr 10	32°43'32.35"N, 77°55'14.76"E		52h	NE	1575.5	575484	33.69	0.0200	60021	Mountain
sub_basin1_gr 11	32°43'28.04"N, 77°54'31.98"E		52h	W	474.6	65149	12.55	0.0010	37021	Ice Cap
sub_basin1_gr 12	32°44'50.16"N, 77°54'24.80"E		52h	NW	570.0	83920	13.52	0.0010	65021	Niche
sub_basin1_gr 13	32°37'30.92"N, 77°58'37.22"E		52h	W	1060.5	621476	34.60	0.0220	37021	Ice Cap
sub_basin1_gr 14	32°39'03.60"N, 77°56'29.43"E		52h	W	208.1	39331	8.86	0.0000	37021	Ice Cap
sub_basin1_gr 15	32°36'08.97"N, 78°22'52.55"E		52l	SW	878.1	168802	19.83	0.0030	60021	Mountain
sub_basin1_gr 16	32°35'50.41"N, 78°22'51.33"E		52l	SW	434.1	96107	15.24	0.0020	60021	Mountain
sub_basin1_gr 17	32°35'46.91"N, 78°22'09.68"E		52l	SW	1536.8	1408034	47.43	0.0670	60021	Mountain
sub_basin1_gr 18	32°36'13.46"N, 78°22'23.59"E		52l	SW	785.8	223542	22.33	0.0050	60021	Mountain
sub_basin1_gr 19	32°36'41.57"N, 78°21'55.17"E		52l	NW	3770.1	3833044	67.97	0.2600	63021	Mountain basin
sub_basin1_gr 20	32°37'45.15"N, 78°21'28.60"E		52l	NE	944.2	542299	32.73	0.0180	60021	Mountain
sub_basin1_gr 21	32°37'26.14"N, 78°20'51.63"E		52l	S	1460.7	492584	31.47	0.0150	60021	Mountain
sub_basin1_gr 22	32°36'49.27"N, 78°20'58.94"E		52l	NE	1044.2	189956	20.88	0.0040	60021	Mountain
sub_basin1_gr 23	32°36'38.69"N, 78°20'31.39"E		52l	S	909.8	262631	24.06	0.0060	60021	Mountain

sub_basin1_gr 24	32°36'24.91"N, 78°21'05.10"E		52l	x	1385.4	490945	31.47	0.0150	60021	Mountain
sub_basin1_gr 25	32°35'49.42"N, 78°20'04.09"E		52l	NE	3962.4	3313949	64.58	0.2140	63021	Mountain basin
sub_basin1_gr 26	32°35'07.18"N, 78°19'35.21"E		52l	S	3191.7	2091822	54.80	0.1150	63021	Mountain basin
sub_basin1_gr 27	32°34'31.83"N, 78°19'53.52"E		52l	SE	1959.5	581577	33.69	0.0200	60021	Mountain
sub_basin1_gr 28	32°34'58.26"N, 78°20'41.88"E		52l	SW	2693.0	1540421	49.01	0.0750	60021	Mountain
sub_basin1_gr 29	32°35'37.19"N, 78°20'50.09"E		52l	SE	746.6	129995	17.42	0.0020	60021	Mountain
sub_basin1_gr 30	32°30'19.57"N, 78°17'52.24"E		52l	N	3968.6	3051191	62.74	0.1910	60021	Mountain
sub_basin1_gr 31	32°30'58.22"N, 78°17'31.20"E		52l	SE	1030.9	341839	27.03	0.0090	37021	Ice Cap
sub_basin1_gr 32	32°31'49.73"N, 78°17'40.83"E		52l	N	2096.7	502717	31.73	0.0160	65021	Niche
sub_basin1_gr 33	32°32'38.91"N, 78°17'45.36"E		52l	NE	2811.6	1907838	53.04	0.1010	63021	Mountain basin
sub_basin1_gr 34	32°31'44.18"N, 78°16'20.48"E		52l	NE	5365.2	4838736	73.74	0.3570	62021	Mountain basin
sub_basin1_gr 35	32°32'25.51"N, 78°15'38.52"E		52l	NW	3057.3	1145765	43.95	0.0510	63521	Mountain basin
sub_basin1_gr 36	32°33'10.12"N, 78°15'35.42"E		52l	NW	3157.7	1382566	47.06	0.0650	63021	Mountain basin
sub_basin1_gr 37	32°35'22.05"N, 78°16'32.50"E		52l	NW	2480.8	511106	31.99	0.0160	63021	Mountain basin
sub_basin1_gr 38	32°36'24.40"N, 78°16'01.38"E		52l	NE	1859.6	674758	35.68	0.0240	67021	Ice Apron
sub_basin1_gr 39	32°37'29.93"N, 78°16'05.23"E		52l	N	1659.0	511938	31.99	0.0160	60021	Mountain
sub_basin1_gr 40	32°38'36.28"N, 78°15'59.95"E		52l	SW	1217.5	394908	28.64	0.0110	60021	Mountain
sub_basin1_gr 41	32°38'59.60"N, 78°16'14.63"E		52l	SW	1626.0	944739	40.71	0.0380	60021	Mountain
sub_basin1_gr 42	32°39'17.84"N, 78°15'25.75"E		52l	x	2048.1	1197756	44.66	0.0540	60021	Mountain
sub_basin1_gr 43	32°37'34.44"N, 78°15'54.35"E		52l	S	534.5	69915	12.55	0.0010	67021	Ice Apron
sub_basin1_gr 44	32°37'20.99"N, 78°15'50.99"E		52l	S	779.5	228647	22.78	0.0050	67021	Ice Apron
sub_basin1_gr 45	32°35'10.88"N, 78°15'14.96"E		52l	NE	2601.7	843644	38.98	0.0330	63021	Mountain basin
sub_basin1_gr 46	32°35'02.01"N, 78°14'50.61"E		52l	NE	474.5	78538	13.52	0.0010	37021	Ice Cap
sub_basin1_gr 47	32°34'47.22"N, 78°15'07.14"E		52l	W	890.0	363300	27.69	0.0100	64021	Cirque
sub_basin1_gr 48	32°32'55.24"N, 78°14'31.57"E		52l	NE	3554.4	1252201	45.35	0.0570	63021	Mountain basin
sub_basin1_gr 49	32°35'16.22"N, 78°11'33.55"E		52l	SW	703.2	184040	20.37	0.0040	60021	Mountain
sub_basin1_gr 50	32°35'31.78"N, 78°11'43.96"E		52l	NW	1619.4	637616	35.04	0.0220	63021	Mountain basin
sub_basin1_gr 51	32°38'01.48"N, 78°12'18.15"E		52l	NE	1282.3	640450	35.04	0.0220	63021	Mountain basin
sub_basin1_gr 52	32°38'15.77"N, 78°11'48.29"E		52l	NW	1101.5	464254	30.67	0.0140	60021	Mountain
sub_basin1_gr 53	32°37'28.36"N, 78°11'30.07"E		52l	S	2232.9	755627	37.49	0.0290	63021	Mountain basin
sub_basin1_gr 54	32°37'27.89"N, 78°10'54.97"E		52l	S	1122.8	317004	26.33	0.0080	60021	Mountain
sub_basin1_gr 55	32°36'19.16"N, 78°11'27.30"E		52l	S	1137.9	512964	31.99	0.0160	60021	Mountain
sub_basin1_gr 56	32°35'48.76"N, 78°11'12.95"E		52l	S	2605.0	845170	39.16	0.0330	63021	Mountain basin

sub_basin1_gr 57	32°35'43.79"N, 78°10'32.84"E		52l	S	604.4	238305	23.22	0.0060	60021	Mountain
sub_basin1_gr 58	32°35'24.81"N, 78°11'13.93"E		52l	W	627.4	228886	22.78	0.0050	60021	Mountain
sub_basin1_gr 59	32°33'41.79"N, 78°12'40.72"E		52l	W	564.2	84223	13.52	0.0010	37021	Ice Cap
sub_basin1_gr 60	32°32'59.81"N, 78°12'02.79"E		52l	NE	3155.8	2159934	55.45	0.1200	63021	Mountain basin
sub_basin1_gr 61	32°32'51.80"N, 78°11'11.77"E		52l	NW	1629.9	500198	31.73	0.0160	63521	Mountain basin
sub_basin1_gr 62	32°33'11.55"N, 78°10'57.31"E		52l	NW	640.4	179560	20.37	0.0040	64021	Cirque
sub_basin1_gr 63	32°32'55.61"N, 78°10'33.92"E		52l	S	1540.1	474615	30.94	0.0150	63021	Mountain basin
sub_basin1_gr 64	32°32'40.13"N, 78°09'49.06"E		52l	NE	2775.5	1690814	50.72	0.0860	63021	Mountain basin
sub_basin1_gr 65	32°33'25.24"N, 78°09'06.90"E		52l	NW	1745.0	758167	37.49	0.0290	63021	Mountain basin
sub_basin1_gr 66	32°34'07.81"N, 78°08'50.18"E		52l	NW	824.2	173499	19.83	0.0030	37021	Ice Cap
sub_basin1_gr 67	32°33'53.30"N, 78°08'38.44"E		52l	NE	977.4	274511	24.46	0.0070	60021	Mountain
sub_basin1_gr 68	32°33'05.73"N, 78°08'52.11"E		52l	W	601.1	224227	22.33	0.0050	60021	Mountain
sub_basin1_gr 69	32°32'41.11"N, 78°08'30.38"E		52l	S	3252.7	1796159	51.90	0.0930	62021	Mountain basin
sub_basin1_gr 70	32°33'00.84"N, 78°07'19.70"E		52l	NW	372.1	41755	8.86	0.0000	65021	Niche
sub_basin1_gr 71	32°33'49.49"N, 78°07'24.17"E		52l	NE	1426.1	388667	28.64	0.0110	63021	Mountain basin
sub_basin1_gr 72	32°33'19.41"N, 78°06'52.93"E		52l	S	870.6	236277	23.22	0.0060	60021	Mountain
sub_basin1_gr 73	32°32'57.84"N, 78°06'51.56"E		52l	S	708.0	166016	19.83	0.0030	60021	Mountain
sub_basin1_gr 74	32°33'03.89"N, 78°06'35.05"E		52l	S	645.9	100218	15.24	0.0020	60021	Mountain
sub_basin1_gr 75	32°33'19.19"N, 78°05'31.69"E		52l	S	2811.4	1658549	50.38	0.0840	63021	Mountain basin
sub_basin1_gr 76	32°33'16.27"N, 78°04'50.61"E		52l	NE	851.8	200870	21.38	0.0040	37021	Ice Cap
sub_basin1_gr 77	32°33'48.43"N, 78°04'32.03"E		52l	S	811.7	170453	19.83	0.0030	65021	Niche
sub_basin1_gr 78	32°33'31.46"N, 78°04'38.92"E		52l	W	1164.8	215196	22.33	0.0050	65021	Niche
sub_basin1_gr 79	32°33'03.37"N, 78°04'47.58"E		52l	SE	339.4	51287	10.26	0.0010	67021	Ice Apron
sub_basin1_gr 80	32°31'28.83"N, 78°09'27.47"E		52l	S	2645.8	1197348	44.66	0.0540	63521	Mountain basin
sub_basin1_gr 81	32°30'42.47"N, 78°08'49.10"E		52l	S	5963.3	5405547	76.63	0.4150	52012	Valley glacier
sub_basin1_gr 82	32°30'46.38"N, 78°07'56.32"E		52l	NE	2988.3	823846	38.62	0.0320	63512	Mountain basin
sub_basin1_gr 83	32°31'30.39"N, 78°07'26.53"E		52l	NE	1666.7	477052	31.21	0.0150	63021	Mountain basin
sub_basin1_gr 84	32°30'56.37"N, 78°07'18.85"E		52l	W	727.0	145565	18.68	0.0030	63021	Mountain basin
sub_basin1_gr 85	32°30'55.75"N, 78°07'35.12"E		52l	W	513.9	114430	16.01	0.0020	60051	Mountain
sub_basin1_gr 86	32°30'44.54"N, 78°07'24.54"E		52l	W	509.2	62772	11.47	0.0010	65021	Niche
sub_basin1_gr 87	32°30'03.50"N, 78°06'47.49"E		52l	S	4860.2	5240348	75.79	0.3970	52012	Valley glacier
sub_basin1_gr 88	32°30'13.59"N, 78°05'42.76"E		52l	NW	1846.2	506736	31.99	0.0160	63021	Mountain basin
sub_basin1_gr 89	32°30'31.39"N, 78°05'17.97"E		52l	NE	1199.2	369457	28.01	0.0100	60021	Mountain

sub_basin1_gr 90	32°30'22.29"N, 78°02'38.77"E		52l	NW	3490.7	1844594	52.32	0.0960	63021	Mountain basin
sub_basin1_gr 91	32°31'22.92"N, 78°02'06.31"E		52l	NW	2887.6	1361067	46.80	0.0640	63021	Mountain basin
sub_basin1_gr 92	32°30'51.79"N, 78°01'09.80"E		52l	NW	5244.9	4203786	70.20	0.2950	62021	Mountain basin
sub_basin1_gr 93	32°31'24.62"N, 78°00'37.49"E		52l	SW	379.6	81094	13.52	0.0010	64021	Cirque
sub_basin1_gr 94	32°31'49.24"N, 78°00'40.34"E		52l	NW	1564.4	761522	37.49	0.0290	63021	Mountain basin
sub_basin1_gr 95	32°33'02.95"N, 78°01'06.43"E		52l	NE	1668.4	386094	28.64	0.0110	63021	Mountain basin
sub_basin1_gr 96	32°33'25.74"N, 78°00'44.66"E		52l	SE	325.0	67853	12.55	0.0010	37021	Ice Cap
sub_basin1_gr 97	32°33'14.23"N, 78°00'42.55"E		52l	SE	245.6	53402	10.26	0.0010	37021	Ice Cap
sub_basin1_gr 98	32°32'59.88"N, 78°00'36.66"E		52l	S	645.8	107969	16.01	0.0020	64021	Cirque
sub_basin1_gr 99	32°32'23.07"N, 78°00'08.99"E		52l	NE	1846.5	600353	34.15	0.0210	63521	Mountain basin
sub_basin1_gr 100	32°32'45.83"N, 77°59'28.37"E		52h	NW	3284.7	2165700	55.55	0.1210	62021	Mountain basin
sub_basin1_gr 101	32°34'11.90"N, 77°59'37.92"E		52h	NW	649.0	153032	18.68	0.0030	60021	Mountain
sub_basin1_gr 102	32°34'34.27"N, 77°59'02.50"E		52h	N	487.9	60356	11.47	0.0010	65021	Niche
sub_basin1_gr 103	32°34'51.51"N, 77°58'55.91"E		52h	NW	907.0	207754	21.87	0.0050	60021	Mountain
sub_basin1_gr 104	32°34'07.93"N, 77°58'38.93"E		52h	S	801.0	158828	19.27	0.0030	64021	Cirque
sub_basin1_gr 105	32°33'49.98"N, 77°59'16.11"E		52h	SW	911.2	188516	20.88	0.0040	60021	Mountain
sub_basin1_gr 106	32°33'41.51"N, 77°58'12.77"E		52h	NE	3348.4	1822202	52.11	0.0950	62021	Mountain basin
sub_basin1_gr 107	32°33'53.17"N, 77°57'40.00"E		52h	S	1667.7	706328	36.50	0.0260	63021	Mountain basin
sub_basin1_gr 108	32°35'26.52"N, 77°56'54.35"E		52h	NW	794.1	241859	23.22	0.0060	64021	Cirque
sub_basin1_gr 109	32°35'59.32"N, 77°56'39.27"E		52h	NW	196.1	46250	10.26	0.0010	37021	Ice Cap
sub_basin1_gr 110	32°35'15.78"N, 77°56'06.05"E		52h	NE	2659.5	1720625	51.04	0.0880	63021	Mountain basin
sub_basin1_gr 111	32°35'43.06"N, 77°55'31.05"E		52h	NE	845.5	360534	27.69	0.0100	60021	Mountain
sub_basin1_gr 112	32°36'15.38"N, 77°54'29.16"E		52h	SW	365.7	46791	10.26	0.0010	65021	Niche
sub_basin1_gr 113	32°37'44.95"N, 77°54'51.90"E		52h	S	451.7	139230	18.06	0.0030	37021	Ice Cap
sub_basin1_gr 114	32°36'56.26"N, 77°54'28.67"E		52h	S	2316.8	723359	36.71	0.0260	63021	Mountain basin
sub_basin1_gr 115	32°36'18.86"N, 77°53'07.30"E		52h	NW	3736.2	4521603	72.01	0.3260	61021	Mountain basin
sub_basin1_gr 116	32°36'48.44"N, 77°52'36.73"E		52h	SW	552.5	105196	16.01	0.0020	64021	Cirque
sub_basin1_gr 117	32°37'16.03"N, 77°52'29.66"E		52h	N	604.0	124592	16.74	0.0020	64021	Cirque
sub_basin1_gr 118	32°37'40.11"N, 77°52'53.97"E		52h	SW	641.2	206799	21.87	0.0050	60021	Mountain
sub_basin1_gr 119	32°38'37.80"N, 77°52'50.78"E		52h	SW	2338.6	912217	40.20	0.0370	63021	Mountain basin
sub_basin1_gr 120	32°39'07.08"N, 77°54'31.63"E		52h	NW	283.2	27214	7.19	0.0000	65021	Niche
sub_basin1_gr 121	32°39'05.44"N, 77°54'13.49"E		52h	NW	956.9	234653	22.78	0.0050	63021	Mountain basin
sub_basin1_gr 122	32°39'19.84"N, 77°53'45.53"E		52h	NW	1209.6	509886	31.99	0.0160	63021	Mountain basin

sub_basin1_gr 123	32°39'11.13"N, 77°53'10.78"E		52h	N	915.4	203254	21.38	0.0040	37021	Ice Cap
sub_basin1_gr 124	32°39'11.82"N, 77°52'40.17"E		52h	NW	2788.2	998346	41.68	0.0420	63521	Mountain basin
sub_basin1_gr 125	32°39'42.82"N, 77°52'02.36"E		52h	N	3775.2	2138750	55.27	0.1180	63021	Mountain basin
sub_basin1_gr 126	32°40'50.16"N, 77°53'29.20"E		52h	S	1386.8	938996	40.71	0.0380	60021	Mountain
sub_basin1_gr 127	32°40'25.26"N, 77°52'42.14"E		52h	NE	1070.2	225596	22.78	0.0050	63021	Mountain basin
sub_basin1_gr 128	32°40'15.10"N, 77°51'38.16"E		52h	NE	1551.9	717641	36.71	0.0260	63021	Mountain basin
sub_basin1_gr 129	32°38'53.68"N, 77°51'07.52"E		52h	S	1140.2	286660	25.24	0.0070	63021	Mountain basin
sub_basin1_gr 130	32°38'46.90"N, 77°50'24.88"E		52h	x	603.4	82241	13.52	0.0010	37021	Ice Cap
sub_basin1_gr 131	32°38'40.10"N, 77°51'01.58"E		52h	x	364.9	22322	5.07	0.0000	37021	Ice Cap
sub_basin1_gr 132	32°38'35.92"N, 77°51'33.64"E		52h	SW	541.2	92851	14.42	0.0010	63021	Mountain basin
sub_basin1_gr 133	32°38'12.81"N, 77°52'10.77"E		52h	W	1337.0	475612	31.21	0.0150	60021	Mountain
sub_basin1_gr 134	32°37'43.55"N, 77°51'59.05"E		52h	S	837.0	238670	23.22	0.0060	60021	Mountain
sub_basin1_gr 135	32°36'38.59"N, 77°51'35.16"E		52h	S	2580.8	1939141	53.34	0.1040	63021	Mountain basin
sub_basin1_gr 136	32°37'16.98"N, 77°50'49.88"E		52h	NE	1278.4	414244	29.24	0.0120	37021	Ice Cap
sub_basin1_gr 137	32°36'54.83"N, 77°50'21.59"E		52h	NE	1082.7	393814	28.64	0.0110	63021	Mountain basin
sub_basin1_gr 138	32°36'49.28"N, 77°50'01.03"E		52h	S	885.9	184988	20.37	0.0040	37021	Ice Cap
sub_basin1_gr 139	32°36'39.97"N, 77°49'07.46"E		52h	NE	2211.5	1728522	51.15	0.0890	63021	Mountain basin
sub_basin1_gr 140	32°36'12.07"N, 77°48'29.68"E		52h	S	642.6	124564	16.74	0.0020	37021	Ice Cap
sub_basin1_gr 141	32°37'37.64"N, 77°47'54.22"E		52h	x	1468.9	399531	28.94	0.0120	60021	Mountain
sub_basin1_gr 142	32°37'08.90"N, 77°47'41.85"E		52h	S	1602.3	376953	28.33	0.0110	63021	Mountain basin
sub_basin1_gr 143	32°36'52.37"N, 77°46'44.71"E		52h	S	3663.9	3247031	64.16	0.2090	63021	Mountain basin
sub_basin1_gr 144	32°37'01.41"N, 77°45'45.76"E		52h	N	477.0	95703	15.24	0.0020	60021	Mountain
sub_basin1_gr 145	32°37'15.89"N, 77°45'21.04"E		52h	NW	3383.5	1819844	52.11	0.0950	63021	Mountain basin
sub_basin1_gr 146	32°37'53.33"N, 77°44'40.96"E		52h	NE	3499.0	1747605	51.37	0.0900	63021	Mountain basin
sub_basin1_gr 147	32°37'44.15"N, 77°43'56.09"E		52h	NE	1586.0	503553	31.73	0.0160	60021	Mountain
sub_basin1_gr 148	32°38'31.16"N, 77°43'25.97"E		52h	NW	2772.7	1944622	53.34	0.1040	63021	Mountain basin
sub_basin1_gr 149	32°39'00.13"N, 77°43'13.45"E		52h	SW	3802.3	1763212	51.48	0.0910	60021	Mountain
sub_basin1_gr 150	32°39'30.43"N, 77°43'40.37"E		52h	N	1397.1	369386	28.01	0.0100	60021	Mountain
sub_basin1_gr 151	32°39'38.90"N, 77°43'57.88"E		52h	SW	577.2	74755	12.55	0.0010	64021	Cirque
sub_basin1_gr 152	32°39'45.72"N, 77°43'15.27"E		52h	NW	1045.2	266406	24.46	0.0070	60021	Mountain
sub_basin1_gr 153	32°40'05.66"N, 77°42'59.40"E		52h	NW	1113.9	238349	23.22	0.0060	60021	Mountain
sub_basin1_gr 154	32°40'19.02"N, 77°42'50.98"E		52h	NW	1730.3	457891	30.67	0.0140	63021	Mountain basin
sub_basin1_gr 155	32°42'27.07"N, 77°43'17.66"E		52h	NE	975.8	182812	20.37	0.0040	63021	Mountain basin

sub_basin1_gr 156	32°42'17.27"N, 77°43'01.18"E		52h	NE	479.0	67891	12.55	0.0010	60021	Mountain
sub_basin1_gr 157	32°40'55.89"N, 77°45'48.01"E		52h	S	2856.0	2176942	55.64	0.1210	63021	Mountain basin
sub_basin1_gr 158	32°40'51.89"N, 77°47'08.24"E		52h	N	620.0	89063	14.42	0.0010	37021	Ice Cap
sub_basin1_gr 159	32°41'30.90"N, 77°47'35.13"E		52h	NE	381.3	95078	15.24	0.0020	60021	Mountain
sub_basin1_gr 160	32°41'15.01"N, 77°46'58.09"E		52h	NW	1538.7	728450	36.91	0.0270	60021	Mountain
sub_basin1_gr 161	32°41'35.36"N, 77°47'03.68"E		52h	NW	405.3	70391	12.55	0.0010	64021	Cirque
sub_basin1_gr 162	32°41'48.44"N, 77°46'46.17"E		52h	NW	980.7	209531	21.87	0.0050	63021	Mountain basin
sub_basin1_gr 163	32°42'48.85"N, 77°46'32.48"E		52h	SW	431.8	57996	11.47	0.0010	65021	Niche
sub_basin1_gr 164	32°42'48.99"N, 77°46'54.28"E		52h	NE	903.2	267422	24.46	0.0070	63021	Mountain basin
sub_basin1_gr 165	32°43'07.05"N, 77°46'30.36"E		52h	NE	912.1	244012	23.22	0.0060	60021	Mountain
sub_basin1_gr 166	32°42'45.08"N, 77°46'16.70"E		52h	S	642.1	153239	18.68	0.0030	60021	Mountain
sub_basin1_gr 167	32°42'19.57"N, 77°45'46.28"E		52h	NE	2974.7	2225944	56.10	0.1250	63521	Mountain basin
sub_basin1_gr 168	32°42'18.94"N, 77°45'09.20"E		52h	N	626.8	84141	13.52	0.0010	60021	Mountain
sub_basin1_gr 169	32°42'42.50"N, 77°44'46.97"E		52h	NW	2899.8	1345391	46.67	0.0630	63521	Mountain basin
sub_basin1_gr 170	32°43'46.14"N, 77°44'43.88"E		52h	SW	1158.3	301641	25.61	0.0080	63021	Mountain basin
sub_basin1_gr 171	32°44'06.43"N, 77°45'04.45"E		52h	SW	1455.0	696945	36.30	0.0250	60021	Mountain
sub_basin1_gr 172	32°44'27.83"N, 77°45'25.94"E		52h	SE	887.0	134238	17.42	0.0020	60021	Mountain
sub_basin1_gr 173	32°44'15.09"N, 77°49'20.50"E		52h	SW	1109.3	377344	28.33	0.0110	60021	Mountain
sub_basin1_gr 174	32°43'53.24"N, 77°49'01.95"E		52h	SW	371.4	49766	10.26	0.0010	37021	x
sub_basin1_gr 175	32°43'59.63"N, 77°48'39.52"E		52h	NW	706.0	227266	22.78	0.0050	60021	Mountain
sub_basin1_gr 176	32°44'18.03"N, 77°48'17.86"E		52h	NW	669.1	110234	16.01	0.0020	60021	Mountain
sub_basin1_gr 177	32°45'03.01"N, 77°48'12.59"E		52h	S	384.9	45331	10.26	0.0010	37021	Ice Cap
sub_basin1_gr 178	32°44'48.53"N, 77°48'02.82"E		52h	SE	528.6	87340	14.42	0.0010	37021	Ice Cap
sub_basin1_gr 179	32°45'55.76"N, 77°46'24.05"E		52h	NW	923.7	198672	21.38	0.0040	60021	Mountain
sub_basin1_gr 180	32°46'25.45"N, 77°45'57.31"E		52h	NE	666.9	213584	21.87	0.0050	60021	Mountain
sub_basin1_gr 181	32°46'38.38"N, 77°45'35.23"E		52h	S	500.2	99883	15.24	0.0020	60021	Mountain
sub_basin1_gr 182	32°45'58.89"N, 77°45'27.89"E		52h	x	193.3	34462	7.19	0.0000	37021	Ice Cap
sub_basin1_gr 183	32°44'53.71"N, 77°46'10.57"E		52h	S	1691.3	861864	39.34	0.0340	63021	Mountain basin
sub_basin1_gr 184	32°44'49.38"N, 77°45'19.97"E		52h	S	1894.4	887236	39.86	0.0360	63021	Mountain basin
sub_basin1_gr 185	32°44'37.81"N, 77°44'59.00"E		52h	S	1596.4	758571	37.49	0.0290	63021	Mountain basin
sub_basin1_gr 186	32°43'09.78"N, 77°44'13.76"E		52h	NE	2743.8	772344	37.68	0.0290	63021	Mountain basin
sub_basin1_gr 187	32°43'18.34"N, 77°43'33.59"E		52h	SW	703.0	108368	16.01	0.0020	60021	Mountain
sub_basin1_gr 188	32°43'42.63"N, 77°43'34.43"E		52h	NE	1458.2	725250	36.91	0.0270	60021	Mountain

sub_basin1_gr 189	32°44'40.27"N, 77°42'58.92"E		52h	NW	316.3	37845	8.86	0.0000	60021	Mountain
sub_basin1_gr 190	32°46'18.41"N, 77°43'08.42"E		52h	NE	1193.1	504511	31.73	0.0160	60021	Mountain
sub_basin1_gr 191	32°45'46.50"N, 77°42'42.52"E		52h	S	908.8	326598	26.68	0.0090	60021	Mountain
sub_basin1_gr 192	32°44'28.71"N, 77°42'31.75"E		52h	NE	2126.1	1252891	45.35	0.0570	63051	Mountain basin
sub_basin1_gr 193	32°45'17.95"N, 77°42'02.80"E		52h	NE	729.1	88427	14.42	0.0010	63021	Mountain basin
sub_basin1_gr 194	32°44'33.58"N, 77°41'56.37"E		52h	N	1129.6	256641	24.06	0.0060	60021	Mountain
sub_basin1_gr 195	32°44'57.43"N, 77°41'40.28"E		52h	SW	501.0	56709	11.47	0.0010	37021	Ice Cap
sub_basin1_gr 196	32°45'17.36"N, 77°41'28.30"E		52h	NW	1279.0	283477	24.86	0.0070	60021	Mountain
sub_basin1_gr 197	32°50'55.99"N, 77°42'56.55"E		52h	NE	930.1	337847	27.03	0.0090	60021	Mountain
sub_basin1_gr 198	32°50'14.32"N, 77°41'41.54"E		52h	NE	623.9	132033	17.42	0.0020	60021	Mountain
sub_basin1_gr 199	32°50'10.63"N, 77°41'28.67"E		52h	S	747.3	204882	21.38	0.0040	60021	Mountain
sub_basin1_gr 200	32°49'47.46"N, 77°41'20.61"E		52h	S	545.8	143598	18.06	0.0030	60021	Mountain
sub_basin1_gr 201	32°48'36.83"N, 77°40'55.19"E		52h	S	843.6	249171	23.65	0.0060	60021	Mountain
sub_basin1_gr 202	32°51'28.82"N, 77°39'18.60"E		52h	x	347.3	53815	10.26	0.0010	37021	Ice Cap
sub_basin1_gr 203	32°44'01.35"N, 77°42'52.42"E		52h	SE	729.1	126972	17.42	0.0020	60021	Mountain
sub_basin1_gr 204	32°43'36.70"N, 77°43'05.92"E		52h	x	344.8	46505	10.26	0.0010	37021	Ice Cap
sub_basin1_gr 205	32°43'15.59"N, 77°42'53.86"E		52h	S	2023.9	1239572	45.21	0.0560	60021	Mountain
sub_basin1_gr 206	32°42'08.06"N, 77°40'40.89"E		52h	NW	2630.4	2616425	59.44	0.1560	62021	Mountain basin
sub_basin1_gr 207	32°42'57.36"N, 77°39'40.27"E		52h	SE	760.3	137500	18.06	0.0030	60021	Mountain
sub_basin1_gr 208	32°42'33.21"N, 77°39'18.60"E		52h	NE	1069.5	193672	20.88	0.0040	63021	Mountain basin
sub_basin1_gr 209	32°42'03.43"N, 77°39'08.26"E		52h	S	618.8	111641	16.01	0.0020	60021	Mountain
sub_basin1_gr 210	32°41'49.95"N, 77°38'22.66"E		52h	NW	4426.8	4541996	72.12	0.3270	63021	Mountain basin
sub_basin1_gr 211	32°44'06.44"N, 77°39'18.19"E		52h	SW	465.6	47344	10.26	0.0010	37021	Ice Cap
sub_basin1_gr 212	32°43'57.05"N, 77°38'40.86"E		52h	SW	409.8	57422	11.47	0.0010	37021	Ice Cap
sub_basin1_gr 213	32°43'07.80"N, 77°38'02.12"E		52h	NE	1806.0	453928	30.39	0.0140	63021	Mountain basin
sub_basin1_gr 214	32°42'45.92"N, 77°37'26.68"E		52h	NE	1237.0	655976	35.47	0.0230	60021	Mountain
sub_basin1_gr 215	32°42'16.06"N, 77°36'40.55"E		52h	NW	3650.2	2063501	54.51	0.1120	63021	Mountain basin
sub_basin1_gr 216	32°43'06.48"N, 77°35'41.55"E		52h	SW	2614.1	1527266	48.89	0.0750	60021	Mountain
sub_basin1_gr 217	32°43'38.25"N, 77°36'19.13"E		52h	NW	413.5	44922	8.86	0.0000	37021	Ice Cap
sub_basin1_gr 218	32°43'49.63"N, 77°36'00.36"E		52h	NW	1922.1	550675	32.98	0.0180	63021	Mountain basin
sub_basin1_gr 219	32°44'21.66"N, 77°35'39.33"E		52h	SW	1401.6	467922	30.94	0.0150	63021	Mountain basin
sub_basin1_gr 220	32°45'01.33"N, 77°35'40.70"E		52h	SW	1087.5	326484	26.68	0.0090	60021	Mountain
sub_basin1_gr 221	32°45'14.29"N, 77°38'04.31"E		52h	SW	351.0	59013	11.47	0.0010	64021	Cirque

sub_basin1_gr 222	32°45'09.36"N, 77°37'24.53"E		52h	NW	1079.3	239457	23.22	0.0060	63021	Mountain basin
sub_basin1_gr 223	32°45'12.41"N, 77°36'33.21"E		52h	NE	2154.8	722824	36.71	0.0260	60021	Mountain
sub_basin1_gr 224	32°45'26.54"N, 77°35'52.87"E		52h	N	724.3	136463	18.06	0.0030	37021	Ice Cap
sub_basin1_gr 225	32°44'05.25"N, 77°34'48.21"E		52h	NW	4038.1	2054043	54.42	0.1120	63021	Mountain basin
sub_basin1_gr 226	32°44'36.11"N, 77°34'08.34"E		52h	NW	1228.7	349274	27.36	0.0100	60021	Mountain
sub_basin1_gr 227	32°45'04.62"N, 77°33'56.57"E		52h	N	998.1	182375	20.37	0.0040	63021	Mountain basin
sub_basin1_gr 228	32°45'33.80"N, 77°34'04.97"E		52h	SW	469.3	68102	12.55	0.0010	60021	Mountain
sub_basin1_gr 229	32°45'46.34"N, 77°34'21.31"E		52h	SW	946.0	153685	18.68	0.0030	64021	Cirque
sub_basin1_gr 230	32°46'20.39"N, 77°34'11.89"E		52h	SW	242.9	29287	7.19	0.0000	60021	Mountain
sub_basin1_gr 231	32°46'20.19"N, 77°34'22.33"E		52h	SE	372.3	39801	8.86	0.0000	60021	Mountain
sub_basin1_gr 232	32°47'14.22"N, 77°35'33.41"E		52h	S	800.3	221477	22.33	0.0050	60021	Mountain
sub_basin1_gr 233	32°47'31.50"N, 77°35'28.03"E		52h	W	537.5	147266	18.68	0.0030	60021	Mountain
sub_basin1_gr 234	32°48'22.42"N, 77°35'00.88"E		52h	SW	468.9	70736	12.55	0.0010	60021	Mountain
sub_basin1_gr 235	32°47'48.26"N, 77°35'07.05"E		52h	S	818.6	316719	26.33	0.0080	60021	Mountain
sub_basin1_gr 236	32°47'14.90"N, 77°34'47.77"E		52h	NE	3188.9	1392794	47.18	0.0660	62021	Mountain basin
sub_basin1_gr 237	32°48'13.50"N, 77°34'05.26"E		52h	N	317.8	35589	8.86	0.0000	60021	Mountain
sub_basin1_gr 238	32°48'32.02"N, 77°33'31.81"E		52h	NE	1600.7	582292	33.69	0.0200	60021	Mountain
sub_basin1_gr 239	32°48'29.05"N, 77°32'54.80"E		52h	NE	374.1	54297	10.26	0.0010	60021	Mountain
sub_basin1_gr 240	32°50'35.46"N, 77°30'43.25"E		52h	SE	1428.8	350547	27.36	0.0100	60021	Mountain
sub_basin1_gr 241	32°51'00.55"N, 77°33'30.90"E		52h	S	324.1	35707	8.86	0.0000	37021	Ice Cap
sub_basin1_gr 242	32°51'09.80"N, 77°32'57.22"E		52h	NW	2579.1	1692814	50.72	0.0860	60021	Mountain
sub_basin1_gr 243	32°51'53.50"N, 77°32'26.46"E		52h	NW	655.6	195303	21.38	0.0040	60021	Mountain
sub_basin1_gr 244	32°50'54.33"N, 77°32'01.89"E		52h	S	570.8	85616	14.42	0.0010	65021	Niche
sub_basin1_gr 245	32°51'51.39"N, 77°30'33.76"E		52h	N	328.6	25962	7.19	0.0000	65021	Niche
sub_basin1_gr 246	32°52'14.39"N, 77°30'20.28"E		52h	NE	1214.9	928203	40.54	0.0380	60021	Mountain
sub_basin1_gr 247	32°50'57.68"N, 77°30'34.09"E		52h	NW	592.5	84042	13.52	0.0010	60021	Mountain
sub_basin1_gr 248	32°51'02.73"N, 77°30'22.11"E		52h	NW	277.9	21641	5.07	0.0000	65021	Niche
sub_basin1_gr 249	32°51'17.00"N, 77°30'08.39"E		52h	SE	339.4	35168	8.86	0.0000	60021	Mountain
sub_basin1_gr 250	32°51'07.54"N, 77°30'02.98"E		52h	W	883.1	137656	18.06	0.0030	60021	Mountain

Inventory of Glaciers of Taklingla River basin

Number of Glaciers= 55 Area of Glaciers= 32.02 km^2 Total Ice Reseerve= 0.9 km^3

Glacier Number	Latitude Longitute	Glacier Name	Map code	Orientation	Length(m)	Area	ThicknessH	Iice reserve	Classification	Glacier Type
sub_basin2_gr 1	32°12'54.60"N, 78°29'53.84"E		52l	N	655.9	262588.37	24.06	0.00	60021	Mountain
sub_basin2_gr 2	32°12'22.13"N, 78°29'17.63"E		52l	N	1581.3	625047.80	34.82	0.00	60021	Mountain
sub_basin2_gr 3	32°12'31.44"N, 78°28'48.15"E		52l	NE	1172.4	249224.03	23.65	0.00	60021	Mountain
sub_basin2_gr 4	32°12'47.10"N, 78°29'06.51"E		52l	NE	980.1	133138.43	17.42	0.00	60021	Mountain
sub_basin2_gr 5	32°12'51.31"N, 78°28'35.37"E		52l	NE	629.3	355804.38	27.69	0.00	60021	Mountain
sub_basin2_gr 6	32°12'39.67"N, 78°27'53.29"E		52l	NE	1880.2	859831.52	39.34	0.00	60021	Mountain
sub_basin2_gr 7	32°12'07.73"N, 78°27'22.34"E		52l	N	1177.8	646075.75	35.25	0.00	60021	Mountain
sub_basin2_gr 8	32°11'53.40"N, 78°26'27.43"E		52l	NE	3105.4	2242615.86	56.19	0.10	63021	Mountain basin
sub_basin2_gr 9	32°12'44.87"N, 78°25'21.64"E		52l	NE	1954.1	516731.11	32.24	0.00	60021	Mountain
sub_basin2_gr 10	32°13'12.69"N, 78°25'14.74"E		52l	NE	1526.2	424298.86	29.54	0.00	60021	Mountain
sub_basin2_gr 11	32°13'46.54"N, 78°25'34.15"E		52l	E	566.9	66419.59	12.55	0.00	60021	Mountain
sub_basin2_gr 12	32°13'53.14"N, 78°25'26.49"E		52l	NE	451.1	68037.07	12.55	0.00	60021	Mountain
sub_basin2_gr 13	32°13'58.24"N, 78°25'01.70"E		52l	NE	1797.5	423563.90	29.54	0.00	60021	Mountain
sub_basin2_gr 14	32°15'23.81"N, 78°27'38.67"E		52l	NE	2586.4	814560.16	38.43	0.00	63021	Mountain basin
sub_basin2_gr 15	32°15'05.17"N, 78°25'31.28"E		52l	NE	3829.9	1453331.94	47.93	0.10	63021	Mountain basin
sub_basin2_gr 16	32°15'52.48"N, 78°25'55.08"E		52l	E	1734.3	791768.96	38.06	0.00	60021	Mountain
sub_basin2_gr 17	32°16'11.39"N, 78°24'53.29"E		52l	NE	4704.2	2312905.12	56.81	0.10	63021	Mountain basin
sub_basin2_gr 18	32°16'21.94"N, 78°23'57.83"E		52l	S	809.7	127111.37	17.42	0.00	60021	Mountain
sub_basin2_gr 19	32°16'29.05"N, 78°24'16.06"E		52l	SE	706.7	146780.85	18.68	0.00	60021	Mountain
sub_basin2_gr 20	32°17'23.32"N, 78°25'06.69"E		52l	SE	730.8	209254.23	21.87	0.00	60021	Mountain
sub_basin2_gr 21	32°17'34.72"N, 78°25'25.21"E		52l	S	837.0	256610.34	24.06	0.00	60021	Mountain
sub_basin2_gr 22	32°17'42.74"N, 78°25'48.50"E		52l	S	944.6	290594.75	25.24	0.00	60021	Mountain
sub_basin2_gr 23	32°17'34.99"N, 78°27'08.00"E		52l	SE	1032.1	237593.14	23.22	0.00	60021	Mountain

sub_basin2_gr 24	32°17'43.97"N, 78°26'40.82"E		52l	SE	710.3	134161.93	17.42	0.00	60021	Mountain
sub_basin2_gr 25	32°18'15.53"N, 78°26'43.30"E		52l	SE	2949.9	1858258.76	52.53	0.10	63021	Mountain basin
sub_basin2_gr 26	32°18'08.88"N, 78°27'24.74"E		52l	SE	1159.3	421427.21	29.54	0.00	60021	Mountain
sub_basin2_gr 27	32°19'06.80"N, 78°27'09.09"E		52l	SE	773.2	202008.70	21.38	0.00	60021	Mountain
sub_basin2_gr 28	32°19'21.27"N, 78°27'40.93"E		52l	E	605.5	94942.95	14.42	0.00	60021	Mountain
sub_basin2_gr 29	32°20'32.71"N, 78°29'16.31"E		52l	SE	380.2	111430.44	16.01	0.00	60021	Mountain
sub_basin2_gr 30	32°20'17.57"N, 78°28'34.31"E		52l	N	1551.6	881390.63	39.69	0.00	63021	Mountain basin
sub_basin2_gr 31	32°20'33.92"N, 78°28'05.91"E		52l	S	1115.8	247731.92	23.65	0.00	60021	Mountain
sub_basin2_gr 32	32°22'00.22"N, 78°27'36.21"E		52l	E	1023.5	370929.82	28.01	0.00	60021	Mountain
sub_basin2_gr 33	32°22'15.64"N, 78°28'00.15"E		52l	SE	389.3	65604.59	12.55	0.00	60021	Mountain
sub_basin2_gr 34	32°22'13.01"N, 78°28'32.20"E		52l	SE	1456.8	474274.42	30.94	0.00	63021	Mountain basin
sub_basin2_gr 35	32°22'14.12"N, 78°29'13.17"E		52l	SE	1234.7	725766.38	36.91	0.00	63021	Mountain basin
sub_basin2_gr 36	32°22'00.42"N, 78°30'22.22"E		52l	S	1861.0	872534.02	39.51	0.00	60021	Mountain
sub_basin2_gr 37	32°22'31.97"N, 78°29'54.63"E		52l	NE	3626.4	941058.07	40.71	0.00	60021	Mountain
sub_basin2_gr 38	32°22'58.87"N, 78°29'57.31"E		52l	SE	1526.4	467773.56	30.94	0.00	60021	Mountain
sub_basin2_gr 39	32°23'16.59"N, 78°30'19.79"E		52l	SE	641.8	210084.84	21.87	0.00	60021	Mountain
sub_basin2_gr 40	32°23'34.51"N, 78°30'50.13"E		52l	SE	331.1	69792.50	12.55	0.00	64021	Cirque
sub_basin2_gr 41	32°23'35.93"N, 78°30'30.63"E		52l	SE	444.9	65469.76	12.55	0.00	65021	Niche
sub_basin2_gr 42	32°23'50.45"N, 78°30'49.99"E		52l	S	608.4	65705.55	12.55	0.00	37021	Ice Cap
sub_basin2_gr 43	32°24'13.14"N, 78°31'08.85"E		52l	NE	1070.6	317838.79	26.33	0.00	60021	Mountain
sub_basin2_gr 44	32°24'25.92"N, 78°30'37.80"E		52l	NE	829.0	144307.09	18.06	0.00	60021	Mountain
sub_basin2_gr 45	32°23'11.18"N, 78°29'22.84"E		52l	N	1695.8	795699.32	38.25	0.00	60021	Mountain
sub_basin2_gr 46	32°22'52.26"N, 78°28'30.04"E		52l	NE	4434.3	2915041.82	61.78	0.20	63021	Mountain basin
sub_basin2_gr 47	32°23'40.04"N, 78°27'57.41"E		52l	NE	3898.1	1287220.35	45.89	0.10	63521	Mountain basin
sub_basin2_gr 48	32°23'47.56"N, 78°28'23.89"E		52l	N	673.2	237593.15	23.22	0.00	60021	Mountain
sub_basin2_gr 49	32°24'18.40"N, 78°28'04.65"E		52l	SE	284.8	40476.50	8.86	0.00	64021	Cirque
sub_basin2_gr 50	32°24'26.44"N, 78°28'11.82"E		52l	SE	591.8	109954.63	16.01	0.00	60021	Mountain
sub_basin2_gr 51	32°24'48.13"N, 78°28'21.57"E		52l	NE	629.2	96161.17	15.24	0.00	60021	Mountain
sub_basin2_gr 52	32°24'36.16"N, 78°27'25.39"E		52l	NE	4706.4	3602838.35	66.51	0.20	53012	Valley glacier
sub_basin2_gr 53	32°26'00.83"N, 78°26'22.16"E		52l	SE	1507.0	391248.51	28.64	0.00	60021	Mountain
sub_basin2_gr 54	32°26'07.41"N, 78°26'52.42"E		52l	NE	391.6	88419.55	14.42	0.00	60021	Mountain
sub_basin2_gr 55	32°27'42.65"N, 78°25'09.70"E		52l	S	687.7	199989.06	21.38	0.00	64021	Cirque
						32021021.87		0.9		

Inventory of Glaciers of Bhagirathi River basin

Number of Glaciers= 43 | Area of Glaciers= 43.05 km^2 | Total Ice Reseerve= 2.43 km^3

Glacier number	Latitude Longitude	Glacier Name	Map code	Orientation	Length(m)	Area	Thickness	Ice reserve	Classification	Glacier type
sub_basin3_gr 1	31°09'16.54"N, 78°50'34.27"E		53i	SE	2403.5	2653145.46	59.68	0.1580	63021	Mountain basin
sub_basin3_gr 2	31°10'37.30"N, 78°49'48.29"E		53i	E	2672.5	1695482.77	50.83	0.0860	60021	Mountain
sub_basin3_gr 3	31°11'44.61"N, 78°49'28.54"E		53i	SE	1532.7	592347.70	33.92	0.0200	60021	Mountain
sub_basin3_gr 4	31°12'08.51"N, 78°49'35.97"E		53i	E	662.6	197488.08	21.38	0.0040	60021	Mountain
sub_basin3_gr 5	31°11'59.80"N, 78°50'15.66"E		53i	NE	701.9	254060.99	23.65	0.0060	60021	Mountain
sub_basin3_gr 6	31°12'37.22"N, 78°49'20.36"E		53i	SE	3711.8	2724171.26	60.24	0.1640	63021	Mountain basin
sub_basin3_gr 7	31°12'54.95"N, 78°48'56.87"E		53i	NE	1652.6	671708.14	35.68	0.0240	60021	Mountain
sub_basin3_gr 8	31°13'23.85"N, 78°50'01.96"E		53i	SE	774.8	342023.08	27.03	0.0090	64021	Cirque
sub_basin3_gr 9	31°14'09.49"N, 78°49'55.29"E		53i	SE	4173.9	3644804.19	66.77	0.2430	60021	Mountain
sub_basin3_gr 10	31°14'54.36"N, 78°49'39.12"E		53i	NE	3482.2	3055971.60	62.81	0.1920	60021	Mountain
sub_basin3_gr 11	31°15'52.60"N, 78°48'22.73"E		53i	SE	4011.2	5049096.50	74.83	0.3780	60021	Mountain
sub_basin3_gr 12	31°16'21.60"N, 78°49'01.77"E		53i	SE	1257.1	206743.54	21.87	0.0050	63021	Mountain basin
sub_basin3_gr 13	31°16'42.27"N, 78°48'47.70"E		53i	SE	1417.7	378053.04	28.33	0.0110	63021	Mountain basin
sub_basin3_gr 14	31°17'17.85"N, 78°48'35.02"E		53i	SE	2062.1	2023571.90	54.13	0.1090	60021	Mountain
sub_basin3_gr 15	31°17'25.88"N, 78°49'37.69"E		53i	SE	1850.1	562316.15	33.22	0.0190	63021	Mountain basin
sub_basin3_gr 16	31°18'04.71"N, 78°48'55.65"E		53i	SE	2491.2	2206706.47	55.91	0.1240	60021	Mountain
sub_basin3_gr 17	31°18'22.95"N, 78°50'18.96"E		53i	SE	1422.2	609229.62	34.38	0.0210	63021	Mountain basin
sub_basin3_gr 18	31°19'27.17"N, 78°50'52.36"E		53i	S	1714.7	797639.52	38.25	0.0310	63021	Mountain basin
sub_basin3_gr 19	31°20'04.19"N, 78°50'32.00"E		53i	NE	1240.1	509045.19	31.99	0.0160	60021	Mountain
sub_basin3_gr 20	31°20'14.25"N, 78°51'30.18"E		53i	NW	1278.8	409153.70	29.24	0.0120	63021	Mountain basin
sub_basin3_gr 21	31°21'08.27"N, 78°51'13.69"E		53i	N	2788.6	1882327.63	52.73	0.0990	63021	Mountain basin
sub_basin3_gr 22	31°21'52.05"N, 78°50'35.28"E		53i	N	780.5	278365.63	24.86	0.0070	60021	Mountain

sub_basin3_gr 23	31°21'13.89"N, 78°50'39.14"E		53i	N	563.6	106319.85	16.01	0.0020	65021	Niche
sub_basin3_gr 24	31°19'15.84"N, 78°49'33.24"E		53i	N	3965.3	5048999.74	74.83	0.3780	63021	Mountain basin
sub_basin3_gr 25	31°23'11.68"N, 78°48'49.42"E		53i	N	683.2	274227.36	24.46	0.0070	37021	Ice Cap
sub_basin3_gr 26	31°22'35.19"N, 78°48'34.15"E		53i	NW	784.7	164392.41	19.27	0.0030	60021	Mountain
sub_basin3_gr 27	31°22'02.61"N, 78°48'02.83"E		53i	NW	490.5	100062.70	15.24	0.0020	37021	Ice Cap
sub_basin3_gr 28	31°20'44.83"N, 78°48'17.63"E		53i	W	660.9	141917.42	18.06	0.0030	37021	Ice Cap
sub_basin3_gr 29	31°19'46.28"N, 78°48'03.77"E		53i	NE	1832.8	2648748.05	59.68	0.1580	60021	Mountain
sub_basin3_gr 30	31°19'37.97"N, 78°46'50.28"E		53i	N	2149.6	1821974.54	52.11	0.0950	60021	Mountain
sub_basin3_gr 31	31°20'07.74"N, 78°46'12.69"E		53i	NE	665.6	137612.56	18.06	0.0030	60021	Mountain
sub_basin3_gr 32	31°20'20.03"N, 78°46'08.44"E		53i	NE	838.5	148581.01	18.68	0.0030	60021	Mountain
sub_basin3_gr 33	31°20'25.50"N, 78°45'50.44"E		53i	NE	544.8	130437.94	17.42	0.0020	63021	Mountain basin
sub_basin3_gr 34	31°21'05.46"N, 78°45'53.48"E		53i	E	493.6	108869.36	16.01	0.0020	60021	Mountain
sub_basin3_gr 35	31°21'35.30"N, 78°45'18.71"E		53i	NE	191.2	28955.14	7.19	0.0000	64021	Cirque
sub_basin3_gr 36	31°22'10.23"N, 78°45'35.93"E		53i	E	576.6	106024.15	16.01	0.0020	60021	Mountain
sub_basin3_gr 37	31°25'47.93"N, 78°47'37.49"E		53i	NE	898.7	235651.53	23.22	0.0060	37021	Ice Cap
sub_basin3_gr 38	31°25'30.66"N, 78°46'53.53"E		53i	NE	768.3	166150.61	19.83	0.0030	60021	Mountain
sub_basin3_gr 39	31°22'28.19"N, 78°45'29.57"E		53i	N	1159.4	546468.02	32.98	0.0180	60021	Mountain
sub_basin3_gr 40	31°22'42.02"N, 78°45'01.08"E		53i	N	617.0	163008.38	19.27	0.0030	60021	Mountain
sub_basin3_gr 41	31°22'55.53"N, 78°44'41.51"E		53i	E	574.1	129169.97	17.42	0.0020	60021	Mountain
sub_basin3_gr 42	31°23'59.87"N, 78°44'49.41"E		53i	NE	460.5	64939.19	11.47	0.0010	65021	Niche
sub_basin3_gr 43	31°24'17.62"N, 78°44'48.14"E		53i	E	442.6	37568.75	8.86	0.0000	65021	Niche

Inventory of Glaciers of Pabbar River basin

Number of Glaciers= 24 Area of Glaciers= 6.36 km^2 Total Ice Reseerve= 0.19 km^3

Glacier Number	Latitude Longitude	Glacier Name	Map code	orientatin	Length(m)	Area	Thickness	Ice reserve	Classification	Glacier Type
sub_basin4_gr 1	31°23'57.59"N, 77°57'32.32"E		53E	S	1735.2	562483.73	33.27	0.01900	64021	Cirque
sub_basin4_gr 2	31°23'40.73"N, 78°00'52.45"E		53I	SE	271.2	48703.26	10.13	0.00100	64021	Cirque
sub_basin4_gr 3	31°24'33.22"N, 78°02'44.17"E		53I	S	409.6	116440.24	16.45	0.00200	64021	Cirque
sub_basin4_gr 4	31°25'03.61"N, 78°05'13.17"E		53I	S	1134.3	268964.64	24.42	0.00700	37021	Ice Cap
sub_basin4_gr 5	31°23'55.78"N, 78°04'51.91"E		53I	SW	3588.8	1005442.58	41.76	0.04200	37021	Ice Cap
sub_basin4_gr 6	31°23'54.34"N, 78°05'10.97"E		53I	S	340.8	54434.48	10.76	0.00100	64021	Cirque
sub_basin4_gr 7	31°25'03.32"N, 78°05'32.18"E		53I	S	328.1	41222.32	9.01	0.00000	64021	Cirque
sub_basin4_gr 8	31°24'03.66"N, 78°07'20.79"E		53I	S	821.0	210459.62	21.87	0.00500	60021	Mountain
sub_basin4_gr 9	31°23'27.92"N, 78°07'35.84"E		53I	S	385.0	53088.91	10.64	0.00100	64021	Cirque
sub_basin4_gr 10	31°22'55.43"N, 78°09'31.45"E		53I	S	400.4	50212.52	10.26	0.00100	64021	Cirque
sub_basin4_gr 11	31°22'35.91"N, 78°09'31.58"E		53I	S	583.3	191467.27	20.93	0.00400	64021	Cirque
sub_basin4_gr 12	31°21'52.81"N, 78°09'01.47"E		53I	SW	1923.3	756466.30	37.41	0.02800	37021	Ice Cap
sub_basin4_gr 13	31°20'42.94"N, 78°09'44.65"E		53I	S	394.0	97419.86	15.00	0.00100	60021	Mountain
sub_basin4_gr 14	31°19'56.50"N, 78°11'15.36"E		53I	S	353.9	50957.71	10.38	0.00100	60021	Mountain
sub_basin4_gr 15	31°19'07.83"N, 78°17'18.33"E		53I	W	458.0	89992.69	14.42	0.00100	60021	Mountain
sub_basin4_gr 16	31°18'46.47"N, 78°17'34.76"E		53I	W	723.7	260750.05	24.10	0.00600	60021	Mountain
sub_basin4_gr 17	31°18'19.76"N, 78°17'24.30"E		53I	W	1296.2	881185.41	39.70	0.03500	60021	Mountain
sub_basin4_gr 18	31°17'46.89"N, 78°17'19.51"E		53I	W	775.8	518059.40	32.19	0.01700	60021	Mountain
sub_basin4_gr 19	31°16'58.83"N, 78°18'06.14"E		53I	SW	574.8	278223.69	24.78	0.00700	60021	Mountain
sub_basin4_gr 20	31°16'39.88"N, 78°18'26.53"E		53I	NW	529.6	328543.14	26.65	0.00900	60021	Mountain
sub_basin4_gr 21	31°16'16.22"N, 78°16'18.75"E		53I	NW	652.5	206861.88	21.72	0.00500	60021	Mountain
sub_basin4_gr 22	31°14'47.07"N, 78°14'33.94"E		53I	N	567.2	133474.06	17.62	0.00200	60021	Mountain

sub_basin4_gr 23	31°14'55.70"N, 78°14'14.62"E		53I	N	458.0	102902.60	15.48	0.00200	60021	Mountain
sub_basin4_gr 24	31°15'23.25"N, 78°13'54.55"E		53I	N	305.4	59283.06	11.35	0.00100	60021	Mountain

Inventory of Glacial Lakes of Beas River basin

Number of Glacial Lakes= 74 Area of Glacial Lakes= 237.70 km^2

Lake Number	Latitude Longitude	Lake Name	Area (m2)	Length (m)	Map Code	Orientation	Associated Glacier Number	Distance to glacier (m)	Lake Type
beas_gl 1	32°13'55.34"N, 76°54'19.47"E		17581.21	301.4	52d	SW	beas_gr 21	303	Morain dammed
beas_gl 2	32°13'45.57"N, 76°54'32.06"E		11513.91	211.9	52d	SW	beas_gr 22	0	Morain dammed
beas_gl 3	32°20'28.75"N, 77°04'02.60"E		37590.74	294.9	52h	SW	beas_gr 41	149	Blocked
beas_gl 4	32°20'38.18"N, 77°04'12.45"E		23072.92	206.2	52h	SW	beas_gr 41	0	Lateral moraine dammed
beas_gl 5	32°20'24.04"N, 77°04'35.95"E		13800.49	175.6	52h	S	beas_gr 41	406	Erosion
beas_gl 6	32°20'07.73"N, 77°04'36.65"E		16842.53	196.4	52h	SW	beas_gr 41	752	Erosion
beas_gl 7	32°19'40.84"N, 77°03'38.99"E		39811.81	300.6	52h	SW	beas_gr 42	0	Valley
beas_gl 8	32°17'54.74"N, 77°03'23.27"E		6628.32	105.9	52h	S	beas_gr 44	153	Erosion
beas_gl 9	32°25'07.60"N, 77°12'06.27"E		12579.37	137.5	52h	SE	x		Erosion
beas_gl 10	32°13'03.22"N, 77°18'56.97"E		4826.28	97.9	52h	W	beas_gr 75	3970	Valley
beas_gl 11	32°12'14.54"N, 77°21'18.77"E		19549.07	211.5	52h	SW	beas_gr 76	245	Cirque
beas_gl 12	32°12'17.27"N, 77°21'31.50"E		4628.58	89.9	52h	SW	beas_gr 76	0	Morain dammed
beas_gl 13	32°12'12.17"N, 77°21'38.85"E		15543.50	211.8	52h	NW	beas_gr 76	0	Morain dammed
beas_gl 14	32°11'51.04"N, 77°18'05.43"E		10883.08	157.2	52h	NE	beas_gr 80	1671	Erosion
beas_gl 15	32°11'29.25"N, 77°17'32.69"E		34978.51	286.1	52h	NE	beas_gr 82	108	Morain dammed
beas_gl 16	32°11'14.37"N, 77°17'00.98"E		62916.37	440.2	52h	NW	beas_gr 84	344	Morain dammed
beas_gl 17	32°10'27.44"N, 77°23'53.89"E		11976.03	98.5	52h	S	beas_gr 97	67	Blocked
beas_gl 18	32°09'46.97"N, 77°23'34.82"E		2565.71	89.9	52h	NW	beas_gr 97	0	Supraglacial
beas_gl 19	32°09'42.65"N, 77°23'44.02"E		3667.89	127.3	52h	W	beas_gr 97	0	Supraglacial
beas_gl 20	32°04'51.26"N, 77°25'14.33"E		14365.64	229.4	52h	S	beas_gr 118	2093	Valley
beas_gl 21	32°08'57.05"N, 77°26'03.10"E		56963.44	345.3	52h	SE	beas_gr 124	475	Morain dammed
beas_gl 22	32°09'49.77"N, 77°26'33.62"E		8133.99	157.4	52h	NE	beas_gr 125	0	Lateral moraine dammed
beas_gl 23	32°10'06.87"N, 77°25'43.88"E		13535.07	199.0	52h	N	beas_gr 125	28	Cirque
beas_gl 24	32°10'31.50"N, 77°25'49.19"E		28843.21	244.2	52h	SE	beas_gr 126	313	Erosion

beas_gl 25	32°12'59.92"N, 77°28'28.42"E		51859.75	367.3	52h	SE	beas_gr 128	0	Lateral moraine dammed
beas_gl 26	32°12'43.79"N, 77°28'59.37"E		4740.78	174.9	52h	E	beas_gr 128	166	Blocked
beas_gl 27	32°10'23.66"N, 77°27'59.45"E		165848.87	1200.0	52h	S	beas_gr 128	0	Supraglacial
beas_gl 28	32°13'21.67"N, 77°30'52.07"E		12387.50	164.3	52h	SW	beas_gr 130	0	Supraglacial
beas_gl 29	32°08'47.34"N, 77°28'04.12"E		2472.22	70.0	52h	SW	beas_gr 136	453	Morain dammed
beas_gl 30	32°08'05.00"N, 77°35'48.80"E		375639.28	2996.6	52h	SW	beas_gr 146	0	Supraglacial
beas_gl 31	32°07'49.24"N, 77°35'47.49"E		99431.60	1045.1	52h	SW	beas_gr 146	0	Supraglacial
beas_gl 32	32°04'34.08"N, 77°40'09.14"E		9260.26	177.4	52h	SE	beas_gr 175	61	Erosion
beas_gl 33	32°04'46.72"N, 77°40'16.17"E		18537.14	192.0	52h	E	beas_gr 176	0	Supraglacial
beas_gl 34	32°04'56.86"N, 77°40'05.80"E		11445.21	180.4	52h	SE	beas_gr 176	0	Supraglacial
beas_gl 35	32°04'38.97"N, 77°40'30.09"E		329243.47	2678.8	52h	S	beas_gr 176	0	Supraglacial
beas_gl 36	32°03'56.17"N, 77°41'03.75"E		34511.15	210.8	52h	SW	beas_gr 180	0	Supraglacial
beas_gl 37	32°04'02.75"N, 77°42'06.00"E		502365.97	2659.2	52h	W	beas_gr 180	0	Supraglacial
beas_gl 38	32°02'32.84"N, 77°40'40.57"E		14770.44	203.7	52h	NW	beas_gr 185	24	Morain dammed
beas_gl 39	31°59'59.32"N, 77°41'16.06"E		19198.07	204.0	53e	N	beas_gr 189	0	Morain dammed
beas_gl 40	31°53'15.75"N, 77°48'59.40"E		39920.85	288.2	53e	SW	beas_gr 215	924	Valley
beas_gl 41	31°52'18.64"N, 77°47'09.87"E		12618.53	225.1	53e	W	beas_gr 220	381	Valley
beas_gl 42	31°51'34.12"N, 77°48'19.16"E		2773.89	102.4	53e	NW	beas_gr 230	0	Morain dammed
beas_gl 43	31°51'39.19"N, 77°47'05.06"E		9387.70	165.2	53e	N	beas_gr 230	0	Supraglacial
beas_gl 44	31°51'48.49"N, 77°46'59.24"E		18662.09	253.0	53e	N	beas_gr 230	0	Supraglacial
beas_gl 45	31°52'07.21"N, 77°47'00.54"E		8286.49	143.0	53e	N	beas_gr 230	0	Supraglacial
beas_gl 46	31°52'11.46"N, 77°46'51.12"E		30966.99	364.3	53e	N	beas_gr 230	0	Supraglacial
beas_gl 47	31°52'52.92"N, 77°46'20.34"E		28298.21	254.0	53e	SE	beas_gr 233	1131	Valley
beas_gl 48	31°53'07.48"N, 77°46'14.96"E		61977.49	481.9	53e	S	beas_gr 233	1274	Blocked
beas_gl 49	31°56'55.55"N, 77°35'13.67"E		3693.72	88.4	53e	NW	beas_gr 264	0	Supraglacial
beas_gl 50	31°55'11.22"N, 77°32'10.00"E		9435.54	230.5	53e	N	beas_gr 272	0	Morain dammed
beas_gl 51	31°55'01.49"N, 77°31'51.84"E		20166.21	237.1	53e	NE	beas_gr 273	0	Morain dammed
beas_gl 52	31°55'11.86"N, 77°31'40.44"E		13761.00	334.9	53e	NE	beas_gr 273	358	Morain dammed
beas_gl 53	31°54'54.25"N, 77°31'32.29"E		16756.95	178.2	53e	NE	beas_gr 273	0	Morain dammed
beas_gl 54	31°54'57.44"N, 77°31'08.62"E		22511.61	273.4	53e	NE	beas_gr 273	124	Morain dammed
beas_gl 55	31°56'22.40"N, 77°26'22.77"E		4972.38	124.1	53e	NE	beas_gr 285	185	Erosion
beas_gl 56	31°57'19.54"N, 77°24'37.23"E		6199.48	142.7	53e	N	beas_gr 287	413	Erosion
beas_gl 57	31°57'05.47"N, 77°23'57.29"E		4006.84	75.8	53e	NE	beas_gr 287	1015	Erosion

beas_gl 58	31°54'27.52"N, 77°29'41.24"E		70094.87	396.1	53e	W	beas_gr 294	194	Morain dammed
beas_gl 59	31°52'22.31"N, 77°35'06.74"E		4099.31	120.6	53e	S	beas_gr 307	203	Morain dammed
beas_gl 60	31°52'23.39"N, 77°35'15.79"E		9407.01	129.8	53e	SE	beas_gr 307	112	Morain dammed
beas_gl 61	31°51'43.58"N, 77°37'57.35"E		8510.81	130.1	53e	S	beas_gr 310	610	Erosion
beas_gl 62	31°48'01.37"N, 77°38'37.84"E		2576.18	48.4	53e	N	x		Erosion
beas_gl 63	31°47'54.14"N, 77°38'38.94"E		8645.28	121.0	53e	NW	x		Erosion
beas_gl 64	31°43'55.34"N, 77°40'05.29"E		11307.57	169.1	53e	NE	beas_gr 332	193	Morain dammed
beas_gl 65	31°46'19.33"N, 77°39'19.26"E		3700.69	75.1	53e	N	beas_gr 336	888	Erosion
beas_gl 66	31°40'11.08"N, 77°37'13.93"E		43027.58	449.8	53e	NE	beas_gr 354	69	Morain dammed
beas_gl 67	31°40'14.89"N, 77°36'12.07"E		13351.09	148.5	53e	NE	beas_gr 356	0	Morain dammed
beas_gl 68	31°40'23.91"N, 77°36'04.10"E		4944.80	109.7	53e	NE	beas_gr 356	343	Morain dammed
beas_gl 69	31°40'15.43"N, 77°35'57.62"E		24658.73	410.5	53e	N	beas_gr 356	0	Morain dammed
beas_gl 70	31°40'16.02"N, 77°35'31.67"E		27062.27	311.2	53e	NE	beas_gr 357	52	Morain dammed
beas_gl 71	31°39'37.25"N, 77°05'06.97"E		1664443.59	9628.0	53e	NE	x		Valley
beas_gl 72	31°30'53.43"N, 76°53'54.01"E		422839.92	1795.6	53e	NE	x		Valley
beas_gl 73	31°37'11.23"N, 76°50'34.99"E		41404.02	264.8	53e	NE	x		Erosion
beas_gl 74	31°59'40.53"N, 76°03'09.38"E		232901222.55	34129.8	53e	SE	x		Valley

Inventory of Glacial Lakes of Chenab River basin

Number of Glacial Lakes= 53 Area of Glacial Lakes= 3.90 km^2

Lake Number	Latitude Longitude	Lake Name	Area (m2)	Length (m)	Map Code	Orientation	Associated Glacier Number	Distance to glacier (m)	Lake Type
chenab_gl 1	33°06'59.08"N, 76°41'40.84"E		11263.63	174.1	52c		Chenab_gr 28	338.0	Morain dammed
chenab_gl 2	33°06'51.22"N, 76°41'43.97"E		15178.72	189.2	52c		Chenab_gr 28	521.0	Morain dammed
chenab_gl 3	33°00'31.81"N, 76°48'19.47"E		5951.54	112.3	52c		Chenab_gr 117	0.0	Supraglacial
chenab_gl 4	33°00'18.14"N, 76°47'58.99"E		6971.81	113.0	52c		Chenab_gr 117	0.0	Supraglacial
chenab_gl 5	33°00'12.61"N, 76°47'25.45"E		18777.72	197.4	52c		Chenab_gr 117	0.0	Supraglacial
chenab_gl 6	33°09'23.10"N, 76°46'31.95"E		10456.31	176.2	52c		Chenab_gr 140	134.0	Morain dammed
chenab_gl 7	32°45'25.14"N, 76°54'38.57"E		8362.42	126.4	52d		Chenab_gr 212	1162.0	Morain dammed
chenab_gl 8	32°45'30.53"N, 76°54'40.23"E		8935.52	158.8	52d		Chenab_gr 212	1009.0	Morain dammed
chenab_gl 9	32°52'57.10"N, 76°59'18.07"E		6264.20	183.2	52d		Chenab_gr 273	140.0	Morain dammed
chenab_gl 10	32°50'05.82"N, 77°09'17.65"E		32804.25	318.0	52h		Chenab_gr 319	138.0	Morain dammed
chenab_gl 11	32°49'35.19"N, 77°12'51.77"E		7196.19	206.0	52h		x		Valley
chenab_gl 12	32°45'53.94"N, 77°19'38.00"E		4771.45	97.5	52h		Chenab_gr 335	563.0	Erosion
chenab_gl 13	32°45'42.38"N, 77°19'38.04"E		3409.64	90.2	52h		Chenab_gr 335	369.0	Erosion
chenab_gl 14	32°46'28.36"N, 77°18'38.81"E		51777.44	335.7	52h		Chenab_gr 335	1674.0	Erosion
chenab_gl 15	32°46'39.34"N, 77°18'04.53"E		6553.06	98.4	52h		Chenab_gr 336	418.0	Morain dammed
chenab_gl 16	32°47'42.46"N, 77°17'19.74"E		43983.91	280.3	52h		Chenab_gr 336	0.0	Supraglacial
chenab_gl 17	32°41'42.67"N, 77°16'13.00"E		45689.00	328.4	52h		Chenab_gr 347	942.0	Supraglacial
chenab_gl 18	32°41'20.32"N, 77°17'25.72"E		7238.30	119.9	52h		Chenab_gr 348	0.0	Supraglacial
chenab_gl 19	32°42'00.82"N, 77°19'26.39"E		5086.25	91.0	52h		Chenab_gr 348	0.0	Supraglacial
chenab_gl 20	32°34'58.10"N, 77°11'15.66"E		564939.98	1461.7	52h		Chenab_gr 400	0.0	Morain dammed
chenab_gl 21	32°33'44.14"N, 77°13'14.50"E		25065.67	343.5	52h		Chenab_gr 400	0.0	Supraglacial
chenab_gl 22	32°31'40.61"N, 77°05'58.78"E		38757.96	504.7	52h		x		Valley
chenab_gl 23	32°28'45.68"N, 77°16'54.36"E		9164.65	149.8	52h		Chenab_gr 423	2246.0	Erosion
chenab_gl 24	32°26'24.22"N, 77°17'02.77"E		11720.51	251.4	52h		Chenab_gr 426	266.0	Erosion
chenab_gl 25	32°32'39.56"N, 77°32'55.89"E		35861.68	499.8	52h		Chenab_gr 467	2752.0	Blocked

chenab_gl 26	32°33'03.81"N, 77°31'26.00"E		911042.63	2029.1	52h		Chenab_gr 467	0.0	Morain dammed
chenab_gl 27	32°44'29.19"N, 77°24'50.79"E		30255.86	269.4	52h		Chenab_gr 487	951.0	Cirque
chenab_gl 28	32°45'38.49"N, 77°24'00.46"E		349673.77	1717.6	52h		Chenab_gr 491	950.0	Valley
chenab_gl 29	32°46'52.93"N, 77°23'45.23"E		138540.67	1027.0	52h		Chenab_gr 493	1175.0	Valley
chenab_gl 30	32°47'33.36"N, 77°22'32.24"E		119537.22	534.2	52h		Chenab_gr 494	60.0	Morain dammed
chenab_gl 31	32°47'47.75"N, 77°22'01.69"E		8601.25	135.8	52h		Chenab_gr 495	868.0	Morain dammed
chenab_gl 32	32°47'38.57"N, 77°21'42.22"E		9449.16	121.9	52h		Chenab_gr 495	301.0	Morain dammed
chenab_gl 33	32°47'31.43"N, 77°20'49.55"E		124631.20	429.2	52h		Chenab_gr 495	0.0	Morain dammed
chenab_gl 34	32°47'41.35"N, 77°20'26.83"E		5509.60	110.1	52h		Chenab_gr 496	0.0	Morain dammed
chenab_gl 35	32°52'18.78"N, 77°25'02.89"E		14332.64	149.1	52h		Chenab_gr 506	625.0	Cirque
chenab_gl 36	32°49'39.75"N, 77°24'10.42"E		11822.07	166.5	52h		Chenab_gr 508	133.0	Morain dammed
chenab_gl 37	32°49'00.73"N, 77°24'32.81"E		12616.52	149.8	52h		Chenab_gr 509	74.0	Morain dammed
chenab_gl 38	32°47'55.57"N, 77°25'42.07"E		129218.53	614.8	52h		Chenab_gr 510	0.0	Supraglacial
chenab_gl 39	32°47'30.23"N, 77°24'45.49"E		414316.92	1475.3	52h		Chenab_gr 510	0.0	Blocked
chenab_gl 40	32°48'03.43"N, 77°30'34.70"E		3801.21	109.5	52h		Chenab_gr 516	781.0	Erosion
chenab_gl 41	32°48'12.27"N, 77°30'47.27"E		10121.44	133.7	52h		Chenab_gr 516	1154.0	Morain dammed
chenab_gl 42	32°44'04.41"N, 77°32'12.21"E		6228.40	87.9	52h		Chenab_gr 532	448.0	Morain dammed
chenab_gl 43	32°43'26.90"N, 77°27'56.03"E		1248.17	57.0	52h		Chenab_gr 541	398.0	Morain dammed
chenab_gl 44	32°43'23.71"N, 77°28'05.30"E		6260.94	104.6	52h		Chenab_gr 541	173.0	Morain dammed
chenab_gl 45	32°41'59.55"N, 77°33'40.69"E		7099.10	157.7	52h		Chenab_gr 533	0.0	Blocked
chenab_gl 46	32°41'52.22"N, 77°34'25.23"E		2549.71	103.8	52h		Chenab_gr 543	378.0	Morain dammed
chenab_gl 47	32°41'17.75"N, 77°34'43.01"E		10814.40	135.9	52h		Chenab_gr 547	0.0	Supraglacial
chenab_gl 48	32°39'56.99"N, 77°35'10.56"E		25216.90	230.9	52h		Chenab_gr 549	0.0	Morain dammed
chenab_gl 49	32°32'07.12"N, 77°35'25.93"E		518301.87	1939.7	52h		x		Blocked
chenab_gl 50	32°20'40.74"N, 77°33'18.68"E		6842.52	198.7	52h		Chenab_gr 595	2890.0	Blocked
chenab_gl 51	32°20'29.76"N, 77°33'41.87"E		3739.96	99.3	52h		Chenab_gr 595	2447.0	Blocked
chenab_gl 52	32°15'46.22"N, 77°35'02.31"E		18160.21	209.9	52h		Chenab_gr 595	0.0	Supraglacial
chenab_gl 53	32°25'10.33"N, 77°13'50.59"E		18816.09	237.7	52h		x		Erosion

Inventory of Glacial Lakes of Satluj River basin

Number of Glacial Lakes= 50

Area of Glacial Lakes= 136.62 km^2

Lake Number	Latitude Longitude	Lake Name	Area (m2)	Length (m)	Map Code	Orientation	Associated Glacier Number	Distance to glacier (m)	Lake Type
Satluj_gl 1	31°37'52.96"N, 78°00'54.93"E		41626.01	258.9	53i	S			Valley
Satluj_gl 2	31°43'32.25"N, 77°52'29.19"E		2785.85	76.7	53e	SE	satluj_gr 44	113.0	Morain dammed
Satluj_gl 3	31°43'57.41"N, 77°51'54.33"E		12422.25	173.3	53e	S	satluj_gr 45	493.0	Blocked
Satluj_gl 4	31°45'01.94"N, 77°50'41.39"E		1786.76	71.1	53e	SE	satluj_gr 15	0.0	Supraglacial
Satluj_gl 5	31°43'18.45"N, 78°03'02.38"E		9703.08	126.7	53i	S	satluj_gr 83	0.0	Supraglacial
Satluj_gl 6	31°38'43.50"N, 78°05'11.11"E		7118.52	106.0	53i	E	satluj_gr 100	1853.0	Valley
Satluj_gl 7	31°45'35.28"N, 78°06'51.22"E		3844.88	77.8	53i	S	satluj_gr 115	361.0	Morain dammed
Satluj_gl 8	31°45'44.73"N, 78°06'44.25"E		27779.21	262.1	53i	S	satluj_gr 116	571.0	Morain dammed
Satluj_gl 9	31°47'29.66"N, 78°15'20.07"E		40454.92	260.2	53i	SE			Cirque
Satluj_gl 10	31°47'47.47"N, 78°17'49.37"E		4488.92	92.9	53i	NE	satluj_gr 142	538.0	Cirque
Satluj_gl 11	31°45'45.02"N, 78°22'53.26"E		20030.53	214.7	53i	SW	satluj_gr 151	145.0	Erosion
Satluj_gl 12	31°49'15.85"N, 78°17'17.33"E		30980.78	194.6	53i	SW			Morain dammed
Satluj_gl 13	32°00'37.86"N, 78°23'24.62"E		58659.48	384.6	53i	S	satluj_gr 183	139.0	Morain dammed
Satluj_gl 14	31°58'09.14"N, 78°17'37.09"E		26006.92	491.3	53i	NW	satluj_gr 195	924.0	Valley
Satluj_gl 15	31°59'54.34"N, 77°47'15.28"E		8892.50	157.0	53e	NW	satluj_gr 307	0.0	Supraglacial
Satluj_gl 16	32°26'34.09"N, 78°05'20.10"E		13489.77	176.5	52l	S	satluj_gr 565	288.0	Morain dammed
Satluj_gl 17	32°24'49.38"N, 78°06'56.68"E		4745.20	112.3	52l	NW			Erosion
Satluj_gl 18	32°24'45.84"N, 78°06'23.80"E		25009.78	116.5	52l	NW			Erosion
Satluj_gl 19	32°15'57.63"N, 78°23'03.14"E		34503.64	325.9	52l	NE	satluj_gr 692	69.0	Morain dammed
Satluj_gl 20	32°15'51.44"N, 78°22'02.65"E		6499.57	105.2	52l	SE	satluj_gr 694	864.0	Morain dammed
Satluj_gl 21	32°15'58.47"N, 78°21'54.26"E		9663.64	157.2	52l	NE	satluj_gr 694	1141.0	Morain dammed
Satluj_gl 22	32°15'51.41"N, 78°21'45.55"E		17167.43	238.2	52l	SE	satluj_gr 694	1258.0	Morain dammed
Satluj_gl 23	32°14'12.05"N, 78°22'31.67"E		3525.90	109.3	52l	E	satluj_gr 718	1125.0	Valley
Satluj_gl 24	31°57'51.19"N, 78°40'17.04"E		52705.76	457.4	53i	SE	satluj_gr 739	0.0	Erosion
Satluj_gl 25	31°58'12.71"N, 78°40'19.90"E		6660.48	120.7	53i	SE	satluj_gr 739	224.0	Erosion

Satluj_gl 26	31°58'49.17"N, 78°39'47.02"E		2411.30	70.5	53i	SE	satluj_gr 739	1443.0	Morain dammed
Satluj_gl 27	31°58'56.27"N, 78°39'53.29"E		10588.04	219.4	53i	SE	satluj_gr 739	1423.0	Morain dammed
Satluj_gl 28	31°59'01.48"N, 78°39'47.20"E		2499.19	78.3	53i	SE	satluj_gr 739	1719.0	Morain dammed
Satluj_gl 29	31°58'54.93"N, 78°39'39.28"E		1224.12	54.8	53i	SE	satluj_gr 739	1722.0	Morain dammed
Satluj_gl 30	31°59'01.37"N, 78°39'22.73"E		2492.51	69.7	53i	SE	satluj_gr 739	2177.0	Morain dammed
Satluj_gl 31	31°59'10.69"N, 78°39'14.45"E		11442.23	141.7	53i	SE	satluj_gr 739	2493.0	Morain dammed
Satluj_gl 32	31°56'59.52"N, 78°41'05.17"E		6957.40	98.6	53i	E	satluj_gr 740	0.0	Supraglacial
Satluj_gl 33	31°56'34.51"N, 78°44'23.79"E		23912.69	285.4	53i	SW	satluj_gr 745	1068.0	Morain dammed
Satluj_gl 34	31°57'42.75"N, 78°45'10.56"E		12064.92	204.9	53i	NW	satluj_gr 747	198.0	Morain dammed
Satluj_gl 35	31°58'23.19"N, 78°45'12.68"E		29426.83	232.4	53i	NW	satluj_gr 749	0.0	Morain dammed
Satluj_gl 36	31°44'59.80"N, 78°43'04.38"E		22800.36	186.8	53i	NE	satluj_gr 756	59.0	Morain dammed
Satluj_gl 37	31°44'26.10"N, 78°41'55.83"E		6324.63	98.4	53i	SE	satluj_gr 757	225.0	Blocked
Satluj_gl 38	31°34'29.33"N, 78°43'15.95"E		15010.15	177.3	53i	S	satluj_gr 773	313.0	Morain dammed
Satluj_gl 39	31°32'48.50"N, 78°43'06.20"E		28861.81	268.3	53i	SW	satluj_gr 769	920.0	Morain dammed
Satluj_gl 40	31°29'22.99"N, 78°26'35.61"E		4660.89	104.4	53i	SW	satluj_gr 844	0.0	Supraglacial
Satluj_gl 41	31°30'23.39"N, 78°24'52.07"E		8288.07	133.7	53i	SW	satluj_gr 849	0.0	Supraglacial
Satluj_gl 42	31°30'38.45"N, 78°25'06.12"E		16936.49	209.1	53i	SW	satluj_gr 849	0.0	Supraglacial
Satluj_gl 43	31°27'50.18"N, 78°21'25.23"E		5760.85	149.4	53i	S	satluj_gr 858	1503.0	Blocked
Satluj_gl 44	31°24'50.84"N, 78°24'47.92"E		44869.67	332.9	53i	N	satluj_gr 865	152.0	Morain dammed
Satluj_gl 45	31°20'51.67"N, 78°39'17.33"E		8147.41	197.9	53i	NE	satluj_gr 875	191.0	Morain dammed
Satluj_gl 46	31°25'12.44"N, 78°04'00.60"E		10073.39	157.0	53i	SW	satluj_gr 934	97.0	Cirque
Satluj_gl 47	31°28'59.24"N, 77°57'28.32"E		24081.33	270.4	53e	S	satluj_gr 936	3016.0	Valley
Satluj_gl 48	30°27'11.96"N, 77°32'48.01"E		28200.24	261.9	53f	NW			Erosion
Satluj_gl 49	30°27'32.47"N, 77°32'11.38"E		32874.23	226.8	53f	N			Erosion
Satluj_gl 50	31°23'37.97"N, 76°29'19.19"E		135794074.50	77369.5	53a	E			Valley

Inventory of Glacial Lakes of Ravi River basin

Number of Glacial Lakes= 45 — Area of Glacial Lakes= 9.86 km^2

Lake Number	Latitude Longitude	Lake Name	Area (m2)	Length (m)	Map Code	Orientation	Associated Glacier Number	Distance to glacier (m)	Lake Type
Ravi_gl 1	32°54'06.09"N, 76°18'39.49"E		7381.58	156.35	52d	NE	Ravi_gr 14	830.0	Erosion
Ravi_gl 2	32°39'36.34"N, 76°00'10.25"E		8849821.38	12613.24	52d	SE	x		Valley
Ravi_gl 3	32°40'58.07"N, 76°32'46.44"E		59214.56	582.24	52d	S	Ravi_gr 25	1664.0	Erosion
Ravi_gl 4	32°40'59.42"N, 76°32'57.61"E		19472.96	194.67	52d	SW	Ravi_gr 25	2027.0	Erosion
Ravi_gl 5	32°39'46.64"N, 76°33'15.49"E		19248.99	194.90	52d	NW	Ravi_gr 27	411.0	Cirque
Ravi_gl 6	32°36'58.31"N, 76°37'39.30"E		4960.90	92.41	52d	SE	Ravi_gr 39	51.0	Morain dammed
Ravi_gl 7	32°34'22.94"N, 76°43'44.24"E		4060.94	144.88	52d	SE	Ravi_gr 47	1984.0	Erosion
Ravi_gl 8	32°34'18.40"N, 76°43'47.57"E		4023.61	141.93	52d	SE	Ravi_gr 45	1206.0	Erosion
Ravi_gl 9	32°34'59.40"N, 76°44'56.90"E		19798.10	320.17	52d	SW	Ravi_gr 51	0.0	Supraglacial
Ravi_gl 10	32°34'37.39"N, 76°47'14.78"E		10635.87	120.55	52d	S	Ravi_gr 54	308.0	Cirque
Ravi_gl 11	32°34'18.15"N, 76°47'41.00"E		2888.37	34.55	52d	S	Ravi_gr 54	1134.0	Erosion
Ravi_gl 12	32°34'14.80"N, 76°47'45.19"E		4614.75	135.16	52d	SW	Ravi_gr 54	1287.0	Erosion
Ravi_gl 13	32°34'07.08"N, 76°47'42.21"E		15238.63	246.63	52d	SW	Ravi_gr 54	1423.0	Erosion
Ravi_gl 14	32°27'51.33"N, 76°49'39.04"E		20711.85	218.59	52d	SW	Ravi_gr 100	98.0	Erosion
Ravi_gl 15	32°25'02.38"N, 76°40'38.66"E		7864.91	124.18	52d	NE	Ravi_gr 78	118.0	Valley
Ravi_gl 16	32°26'02.46"N, 76°37'21.82"E		24244.74	314.23	52d	NW	Ravi_gr 81	0.0	Blocked
Ravi_gl 17	32°26'00.25"N, 76°37'08.49"E		6127.01	94.93	52d	NW	x		Cirque
Ravi_gl 18	32°26'25.52"N, 76°37'07.63"E		7197.40	109.03	52d	NW	Ravi_gr 81	298.0	Morain dammed
Ravi_gl 19	32°23'08.90"N, 76°58'06.12"E		16448.35	211.35	52d	NW	Ravi_gr 123	1579.0	Valley
Ravi_gl 20	32°22'27.28"N, 76°59'40.15"E		22542.56	175.94	52d	E	Ravi_gr 123	0.0	Blocked
Ravi_gl 21	32°15'17.79"N, 77°01'05.39"E		13562.05	133.83	52h	S	Ravi_gr 148	498.0	Erosion
Ravi_gl 22	32°15'01.29"N, 77°01'07.44"E		4689.45	114.44	52h	SW	Ravi_gr 148	1106.0	Erosion
Ravi_gl 23	32°14'46.83"N, 77°01'01.49"E		22750.05	171.27	52h	SW	Ravi_gr 148	1446.0	Erosion
Ravi_gl 24	32°14'30.29"N, 77°01'20.35"E		33158.14	204.03	52h	W	Ravi_gr 149	589.0	Erosion
Ravi_gl 25	32°16'26.70"N, 76°46'26.77"E		15935.83	140.37	52d	N	Ravi_gr 176	1229.0	Valley

Ravi_gl 26	32°14'55.05"N, 76°46'04.59"E		37105.78	246.02	52d	E	Ravi_gr 177	358.0	Cirque
Ravi_gl 27	32°15'40.69"N, 76°44'24.84"E		57512.82	278.46	52d	NW	Ravi_gr 184	76.0	Valley
Ravi_gl 28	32°14'10.33"N, 76°44'00.10"E		575.94	48.07	52d	W	Ravi_gr 187	274.0	Valley
Ravi_gl 29	32°17'26.42"N, 76°29'03.80"E		4680.97	92.02	52d	NE	Ravi_gr 190	709.0	Valley
Ravi_gl 30	32°17'47.49"N, 76°28'36.38"E		10144.42	189.54	52d	NE	Ravi_gr 190	729.0	Valley
Ravi_gl 31	32°18'28.40"N, 76°27'28.96"E		14411.95	123.58	52d	NE	x		Valley
Ravi_gl 32	32°17'11.52"N, 76°27'51.27"E		3721.66	72.22	52d	NW	Ravi_gr 190	283.0	Erosion
Ravi_gl 33	32°17'41.18"N, 76°24'58.64"E		16314.78	265.90	52d	NE	x		Erosion
Ravi_gl 34	32°17'49.50"N, 76°24'59.27"E		44221.86	308.08	52d	E	x		Erosion
Ravi_gl 35	32°20'33.10"N, 76°21'34.48"E		43041.74	222.58	52d	E	x		Erosion
Ravi_gl 36	32°22'01.15"N, 76°20'32.36"E		44658.54	301.10	52d	NE	Ravi_gr 198	485.0	Erosion
Ravi_gl 37	32°22'38.80"N, 76°19'59.30"E		22317.53	197.75	52d	NE	x		Cirque
Ravi_gl 38	32°22'54.13"N, 76°19'15.35"E		13775.12	196.53	52d	NE	x		Cirque
Ravi_gl 39	32°21'47.88"N, 76°19'53.70"E		26677.39	326.63	52d	NW	x		Erosion
Ravi_gl 40	32°22'01.11"N, 76°19'11.28"E		246566.38	1410.60	52d	NW	x		Erosion
Ravi_gl 41	32°22'28.92"N, 76°18'46.87"E		14299.67	211.05	52d	NW	x		Erosion
Ravi_gl 42	32°22'29.37"N, 76°18'33.75"E		4439.00	88.31	52d	NW	x		Erosion
Ravi_gl 43	32°22'27.92"N, 76°18'09.98"E		25060.68	171.41	52d	NW	x		Erosion
Ravi_gl 44	32°22'33.01"N, 76°17'54.35"E		6878.00	200.11	52d	NW	x		Erosion
Ravi_gl 45	32°22'38.34"N, 76°17'29.53"E		15981.10	357.43	52d	NW	x		Erosion

Inventory of Glacial Lakes of Taklingla and Bhagirathi River basins

Number of Glacial Lakes= 7

Area of Glacial Lakes= 0.177 km^2

Lake Number	Latitude Longitude	Lake Name	Area (m_2)	Length (m)	Map Code	Orientation	Associated Glacier Number	Distance to glacier (m)	Lake Type
sub_basin_2 1	32°12'31.98"N, 78°27'16.29"E		46676	414.7	52l	N	Sub_basin_2 7	0	Morain dammed
sub_basin_2 2	32°13'05.47"N, 78°26'01.32"E		52793	513.8	52l	NE	Sub_basin_2 9	96	Morain dammed
sub_basin_2 3	32°24'11.10"N, 78°30'13.36"E		17142	190.3	52l	SW	Sub_basin_2 44	375	Morain dammed
sub_basin_2 4	32°24'09.77"N, 78°29'40.85"E		12850	194.3	52l	NW			Blocked
sub_basin_2 5	32°23'47.80"N, 78°29'21.88"E		23172	235.1	52l	NE	Sub_basin_2 45	303	Blocked
sub_basin_2 6	32°25'39.62"N, 78°28'03.30"E		9382	137.4	52l	NE	Sub_basin_2 52	0	Supraglacial
sub_basin_3 1	31°23'27.68"N, 78°47'00.13"E		15524		53i	N	Sub_basin_3 26	2375	Valley