

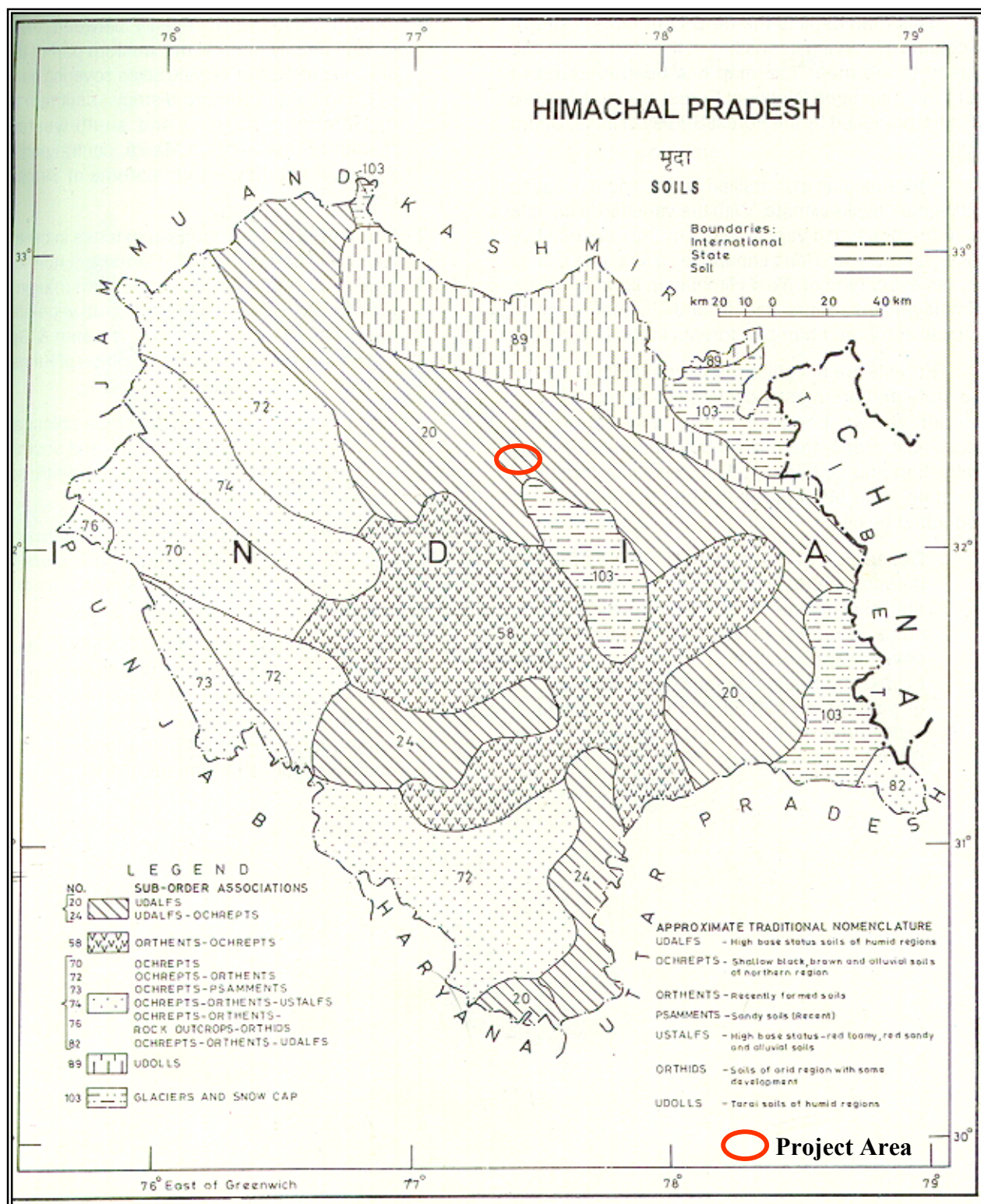


Figure 4.4: Geological map of Himachal Pradesh showing soil type in the Project Area

Table 4.23: Soil sampling and Analysis Results

Sample code	PH	Electrical Conductivity	Ca	Mg	Na	K	HCO ₃	Cl	N- avail able	T. Phosph orus	O- Phosph orus	Org.C	ESP	Mos Con.	Ni	Zn	Cu
	-	µmhos/cm					mg/100g						%			mg/100g	
SL-1	7.72	94.54	206.01	9.23	5.15	18.85	1.46	7.0	0.263	6.37	1.89	5.76	0.00515	13.64	40	114	73
SL-2	6.42	61.92	122.25	4.88	9.35	5.75	0.12	5.0	0.182	11.96	2.70	2.26	0.00935	28.85	45	82	44
SL-3	5.68	52.11	218.44	19.52	3.25	11.8	0.12	5.0	0.131	13.69	3.10	5.27	0.00325	59.90	50	80	32
SL-4	6.19	57.12	192.39	28.06	2.55	41.3	0.12	5.0	0.163	13.20	3.06	4.07	0.00255	43.44	66	81	33
SL-5	5.39	72.69	192.39	28.06	2.85	9.25	0.12	7.0	0.462	11.60	2.80	4.37	0.00285	52.42	67	84	28
SL-6	6.02	96.57	360.5	28.06	3.95	26.05	0.12	7.0	0.372	27.82	8.34	4.37	0.00395	33.19	55	131	40
SL-7	5.61	159.8	408.82	48.8	2.2	40.65	0.12	5.0	0.693	5.90	0.98	9.034	0.0022	32.69	35	86	60
SL-8	6.24	180.1	881.76	84.18	7.1	47.85	0.12	6.0	0.431	2.23	0.56	11.14	0.0071	43.19	1350	82	41
SL-9	7.91	91.31	332.65	29.28	5.55	15.45	0.24	7.0	0.130	11.05	2.80	2.26	0.00555	26.80	35	93	29
SL-10	5.92	133.0	246.49	24.4	5.1	37.45	0.12	6.0	0.179	9.66	1.85	4.52	0.0051	16.81	36	116	32
SL-1 Vill. Jagat Sukh, near GW-1 Location.									SL-6 Vill. Sethan near Residence of Sh. Karma								
SL-2 Vill. Jagat Sukh, near Proposed Colony Site									SL-7 Proposed Dump Site on Dhuhangan River								
SL-3 Vill. Hamta, Surge shaft Site									SL-8 Beraj Site, on Dhuhangan River								
SL-4 Two Kilometer from Vill. Sethan, Proposed Plant Site									SL-9 Near Switch Yard Site, Vill. Prini								
SL-5 Bhuj Dhar, Intake point river Allain									SL-10 Village Prini								

4.5 DESCRIPTION OF BIOLOGICAL ENVIRONMENT – ECOLOGY OF THE STUDY AREA

4.5.1 Introduction

The state of Himachal Pradesh has diverse climatic conditions, which are capable of supporting a wide range of forest ecosystems.

An ecological assessment of the proposed project area has been done with the primary objective of ascertaining biodiversity aspects of floral and faunal species and to identify any special feature related to them, including any region of biosensitivity.

4.5.2 Approach and Methodology

A participatory and consultative approach was followed for executing the assignment. A team of consultants visited the project catchment near Manali and conducted the ecological survey of the area in March 2003. Meetings were also held during the ecological survey with forest officials, officers from the fisheries department and local villagers, as part of public consultations.

During the survey period, the project catchment area was facing winter season. Climatologically, fresh snowfall and rains were experienced during ecological survey, due to late start of snowfall this year. As a result of fresh snowfall, the higher reaches of the project catchment area were snow bound. The temperature during the survey period ranged approximately from 2°C to 17°C. About eight hours of continuous rainfall was experienced. The temperature of the Allain and Duhangan streams were recorded at 5°C to 6°C and 7°C to 8°C respectively during the survey period.

4.5.3 Identification and Mapping of Forest Types

Forest types were closely observed and identified, as also vegetation types were sampled for assessing their ecological status. The forest types are based on the composition of the forests and the dominant species found in them. The identified forest types have been confirmed from published and authenticated sources. The identified forest types were mapped, for which a trace print of the project area was developed for depicting the various forest types on it.

4.5.4 Phytosociological Survey

The vegetation was sampled by employing standardised field ecological survey methods. Random sampling was employed for enumerating the phytosociological characteristics of the various elements of the vegetation. The study area was divided into four Transects based on the location of survey. These transects are given below in *Table 4.24* along with their locations within the project catchment.

Table 4.24: *Sampled Transects and their location within the project catchment*

Transect	Location within Study area
Transect 1	Region encompassing the area covered along the Upstream of Duhangan stream
Transect 2	Region encompassing the area covered along the route from Prini to Sethan village, via Hamta village, Surge shaft site.
Transect 3	Region encompassing the area covered along the Pahali stream, from Prini Village
Transect 4	Region encompassing the area covered along the Allain stream, and adjoining areas where the proposed switchyard and magazine-site (near powerhouse) would come up.

At each Transect, for the purposes of surveying the vegetation, a line transect was taken on both sides of which quadrants were laid to record phytosociological features of the vegetation. Detailed notes on ecological features, including the habitat types were also taken. Depending on the terrain, the available trail was taken as the line transect and quadrants were taken randomly along the sides of the line transect. Based on the vegetation type, the quadrants were of two sizes. For tree-dominated forests, the quadrants measured 100 m² and for grasslands and pastures or herb-dominated patches of vegetation, the quadrant size was 1 m². These are recommended quadrant sizes for such vegetation types and have been variously used in many studies worldwide. A total of 80 quadrants were taken for the ecological survey of the project catchment. Twenty-five quadrants each were taken at Transect 1 and 2 and 15 quadrants each were taken at Transect 3 and 4.

Quadrant analysis was then performed and phytosociological parameters were worked out. These parameters include frequency, density and abundance.

Three phytosociological parameters, namely, frequency, density and abundance are measured to determine the distribution and ecological aspects of the species. Frequency is expressed in percentage and is a reflection of the probability of encountering the species within the sampled area. It is calculated by dividing the number of quadrants of occurrence by the total number of quadrants taken. Density is a measure of how dense is the distribution of an individual species within a given area. It is calculated by dividing the number of individual of a species by the total number of quadrants taken. This is an absolute value without units. The third parameter, Abundance, is a reflection of how evenly the species is distributed within the sampled area. It is calculated by dividing the number of individuals of a species by the total number of quadrants in which that species is present. It is an absolute value without any units.