

Reconnaissance Survey of
Environmental & Social
Assessment of Proposed
Power Transmission Line

CONTENTS

1	RECONNAISSANCE ENVIRONMENTAL AND SOCIAL ASSESSMENT OF TRANSMISSIONLINE CORRIDOR	1
1.1	INTRODUCTION	1
1.2	SCOPE OF STUDY	1
1.3	OBJECTIVES OF THE STUDY	1
1.4	METHODS OF STUDY	2
1.5	LIMITATIONS	2
2	REGULATORY AND LEGAL FRAMEWORK	3
2.2	FOREST (CONSERVATION) ACT, 1980	3
2.3	THE INDIAN TELEGRAPH ACT, 1885	4
2.4	THE INDIAN ELECTRICITY ACT, 1910	5
2.5	THE INDIAN ELECTRICITY RULES, 1956	6
2.6	APPLICABLE R&R GUIDELINES FOR TRANSMISSION LINES OF POWER PROJECTS	7
2.7	RELEVANT IFC GUIDELINES & POLICIES	8
3	BASELINE SOCIO-ECONOMIC PROFILE OF THE PROJECT AREA	11
3.1	PROJECT AREA	11
4	TRANSMISSION LINE ROUTE DESCRIPTION	19
4.1	ROUTE DESCRIPTION	19
5	POTENTIAL ENVIRONMENTAL IMPACTS IDENTIFIED IN THE RECONNAISSANCE SURVEY	25
5.1	ENVIRONMENTAL ISSUES DUE TO PROJECT LOCATION AND DESIGN	25
5.2	ENVIRONMENTAL PROBLEMS DURING CONSTRUCTION PHASE	28
5.3	OPERATIONAL IMPACTS	30
6	POTENTIAL SOCIAL IMPACTS IDENTIFIED IN THE RECONNAISSANCE SURVEY	31
6.1	INITIAL ROUTE SELECTION	31
6.2	POTENTIAL IMPACTS	31
7	PROPOSED MITIGATION MEASURES FOR ENVIRONMENTAL IMPACTS	34
8	PROPOSED MITIGATION MEASURES FOR POTENTIAL SOCIAL IMPACTS	37
8.1	STAKEHOLDER IDENTIFICATION & CONSULTATION	37
8.2	COMPENSATORY ARRANGEMENTS	37
8.3	ESTABLISHING GRIEVANCE REDRESSAL MECHANISM	39
8.4	MONITORING & EVALUATION	39

List of Abbreviations

RSWML -	Rajasthan Spinning and Weaving Mills Limited
ADHEP-	Allain Duhangan Hydroelectric Project
MOU-	Memorandum of Understanding
EIA-	Environmental Impact Assessment
SIA-	Social Impact Assessment
CcoF-	Chief Conservator of Forests
MoEF-	Ministry of Environmental Forests
FOW-	Right of Way
IFC-	International Finance Corporation
ICNIRP-	International Commission on Non Ionizing Radiation Protection
ACGIH-	American Conference on Government and Industrial Hygienist

1 RECONNAISSANCE ENVIRONMENTAL AND SOCIAL ASSESSMENT OF TRANSMISSION LINE CORRIDOR

1.1 INTRODUCTION

RSWML the flagship company of LNJ Bhilwara Group is proposing to develop a 192 MW hydroelectric project, the Allain Duhangan Hydroelectric Project in Kullu district of Himachal Pradesh. As a part of the project a 220 kv transmission line (of approximately 185 kms) will evacuate the power to the state grid.

Allain Duhangan Hydroelectric Project will feed the power to the Northern Grid comprising the states of UP, Rajasthan, Haryana, Punjab, Himachal Pradesh, Jammu & Kashmir, Delhi and Union Territory of Chandigarh. The power generated from this project is intended to meet the growing power requirements of Himachal Pradesh as well as the Northern Regional Grid of the Indian Power Supply system. The project is proposed to be operated as a peaking station for power absorption in the Northern Grid and will mitigate short fall in peak load availability and demand in the Northern Grid. The state of Delhi has been identified as the beneficiary of power from ADHEP, for which an MoU has been signed between the Delhi Vidyut Board and the Rajasthan Spinning and Weaving Mills Limited.

1.2 SCOPE OF STUDY

The scope of the Transmission Line study includes the undertaking of a reconnaissance environmental and social assessment survey. The exact route of the power transmission line is yet to be finalised; the proposed corridor is approximately 185 km connecting the project powerhouse with the northern grid at Nalagarh. A detailed environmental and social impact assessment will be conducted at a later stage once the feasible route of the transmission line has been finalised. At this stage a preliminary environmental and social reconnaissance survey of the corridor was undertaken by ERM for identification of potential impacts. On the basis of the survey a framework for assessing social and environmental impacts has also been developed.

1.3 OBJECTIVES OF THE STUDY

- To assess the proposed transmission lines including the route description;
- To assess the key environmental and social impacts of the project based on the available secondary data and reconnaissance visits made by ERM;
- To present all potential significant adverse environmental and social impacts and hazards associated with the project based on a reconnaissance survey; and
- To identify measures to mitigate potential adverse environmental and social impacts

1.4

METHODS OF STUDY

During the course of study, ERM consultants went to the project region, travelling the proposed transmission line linear length. The study is based on

- survey of the proposed route
- Review of relevant available secondary data like state statistical abstract, district census handbooks, village directories etc.
- consultations with the client's technical experts

1.5

LIMITATIONS

It needs to be noted that the impact assessment and mitigation procedures elaborated are based on review of readily available secondary data and field observations made along the transmission lines route. No route profile has been provided except for a stretch of around 65 km of the proposed transmission line between the switchyard near the Power house (located in Prini village) and Bajaoura. No physical survey of the site was carried out earlier for the power transmission line.

The study is thus based on field observations and the assessment of the potential impacts are only indicative.

There is no legal requirement for undertaking an Environmental Impact Assessment (EIA) or for obtaining any environmental clearance/ permitting under the current Indian rules and regulations in order to establish or operate a power transmission line. However, depending upon individual activities, some of the Indian environmental laws might be applicable. The significant environmental regulations in force in India are:

Water

- The Water (Prevention and Control of Pollution) Act, 1974 and Rules, 1975
- The Water (Prevention and Control of Pollution) Cess Act 1977 and Rules, 1978, 1991
- The River Boards Act, 1956
- The Indian Fisheries Act, 1987

Air

- The Air (Prevention and Control of Pollution) Act, 1981 Rules and Amendment, 1982, 1983, 1987
- The Factories Act and Amendment, 1948, 1987
- The Motor Vehicles (Amendment) Act, 1986

General

- The Environment (Protection) Act and Rules, 1986
- The Environmental Impact Assessment Notification, 1994
- Hazardous Waste Management and Handling Rules, 1989
- Manufacture, Storage and Import of Hazardous Chemicals Rules and Amendment, 1989, 1994
- The Public Liability Insurance Act, Rules, and Amendment, 1991, 1992
- National Environment Appellate Authority, Act 1997
- The Ancient Monuments and Archaeological Sites and Remains Act, 1958

2.2

FOREST (CONSERVATION) ACT, 1980

The Forest (Conservation) Act, 1980 as amended from time to time checks the indiscriminate diversion of forestland for non-forest purposes. The State Governments/ Union Territories are required to submit formal proposals to the Central Government (Ministry of Environment and Forests) for diversion of forest land for non-forest purposes in prescribed proforma along with such details as flora, fauna, compensatory afforestation proposed, *etc.* As the Government of India does not favour any diversion of forestland for non-forest purposes, clearances under the Forest Act are difficult to obtain.

All projects requiring clearing of naturally grown trees in a forest area (more than 20 hectares) require forest clearance from the MoEF. In case of projects requiring less than five hectares of forest land, the CCoF of the concerned regional office of MoEF can take decisions (except in respect of proposals for

regularisation of encroachments and mining). In respect of proposals involving forest land above five hectares and up to 20 hectares, proposals are considered by the CCoF in consultation with an advisory group. The views of this Group are sent to the Secretary, MoEF by the CCoF for final decision.

The MoEF in October 1992 issued the following guidelines for laying transmission lines through forest areas:

- Where routing of transmission lines through the forest areas can not be avoided, these should be aligned in such a way that it involves least amount of tree cutting;
- As far as possible, the route alignment through forest areas should not have any line deviation;
- The maximum width of Right of Way (RoW) for 400 kV transmission lines shall be 52 m;
- Below each conductor, width clearance of 3 m would be permitted for taking the tension stringing equipment. The trees on such strips would have to be felled but after stringing work is completed; the natural vegetation should be allowed to come up. Felling, pollarding and pruning of trees will be done with the permission of the local forest officer whenever necessary to maintain electrical clearance. One outer strip shall be left clear to permit maintenance of the transmission line;
- In the remaining width of RoW up to maximum 52 m (for 400 kV lines) trees will be felled or lopped to the extent required, for preventing electrical hazards by maintaining minimum clearance of 5.5 m between conductors and trees;
- The sag and swing of the conductors are to be kept in view while working out minimum clearance;
- In case of transmission lines to be constructed in hilly areas, where adequate clearance is already available, trees will not be cut; and
- Where the forest growth consists of coconut groves or similar tall trees, widths of RoW more than 52m for 400 kV lines may be permitted, in consultation with the CEA.

Similar procedures have been stipulated by the State Governments for Social forestry, strip plantation along the road, railway and canal crossings.

2.3

THE INDIAN TELEGRAPH ACT, 1885

The Indian Telegraph Act, 1885, empowers the Telegraph authorities to use the land / property for telegraph lines without having any ownership or right in the property even for the land occupied by the telegraph line supports or belts covered by overhead wires and the only obligation of the telegraph authority is to compensate for the actual loss / damage to the owner for the property. The relevant section of the Act is as under:

“The telegraph authority may, from time to time, place and maintain a telegraph line under, over, along or across, and posts in or upon, any immovable property:

Provided that:

- (a) the telegraph authority shall not exercise the powers conferred by this section except for the purpose of a telegraph established or maintained by the Central Government or to be so established or maintained;
- (b) the Central Government shall not acquire any right other than that of user only in the property under over along across in or upon which the telegraph authority places any telegraph line, or post; and
- (c) except as hereinafter provided, the telegraph authority shall not exercise those powers in respect of any property vested in or under the control or management of any local authority, without the permission of that authority; and
- (d) in the exercise of the powers conferred by this section, the telegraph authority shall do as little damage as possible, and when it has exercised those powers in respect of any property other than that referred to in Cl. (c) shall pay full compensation to all persons interested for any damages sustained by them by reason of the exercise of those powers."

2.4

THE INDIAN ELECTRICITY ACT, 1910

Three sections of the Indian Electricity Act, 1910 are relevant to the laying (and repairs) of transmission lines for the supply of energy. These sections are:

- *Section 12*, which details the provisions for opening and breaking up of streets, railways and tramways for the purpose execution of the works, which includes electric supply line and any building, plant, machinery, apparatus and any other thing of whatever description required to supply energy.
- *Section 13*, which contains the provisions for the exercise of any of the powers of the licensee in relation to the execution of any works in, under, over, along or across any street, part of a street, railway, tramway, canal or waterway.
- *Section 18*, which lays out the requirements for construction of overhead lines. Subsection (1) states that, "save as provided in section 13, sub section (3), nothing in this part shall be deemed to authorise or empower a licensee to place any overhead line along or across any street, railway, tramway canal or waterway unless and until the State Government has communicated to him a general approval in writing of the methods of construction he proposes to adopt:

Provided that the communication of such approval shall in no way relieve the licensee of his obligation with respect to any other consent required by or under this act."

Subsection (3) also provides the requirement for removal of trees standing or laying near an overhead line or where any structure or other object which has been placed or has fallen near an overhead line, interrupts or interferes

with, or is likely to interrupt or interfere with, the conveyance or transmission of energy or the accessibility of any works. It also specifies the requirement to pay appropriate compensation for removal of the trees or other objects.

- *Section 51*, which provides that “Notwithstanding anything contained in sections 12 and 16 (both inclusive) and sections 18 and 19, the Central Government in the case of inter-State transmission system and the State Government in the case of intra-State transmission system, as the case may be, may, by order in writing, for placing of electricity supply-lines, appliances and apparatus for the transmission of energy or for the purpose of telephonic or telegraphic communication necessary for the proper co-ordination of works, confer upon any public officer, Central Transmission Utility, State Transmission Utility, licensee, transmission licensee or any other person engaged in the business of transmission or supplying energy to the public under this Act, subject to such conditions and restrictions (if any) as the Central Government or the State Government, as the case may be, may think fit to impose, and to the provisions of the Indian Telegraph Act, 1885 (3 of 1885), any of the powers which the telegraph-authority possesses under the Act, with respect to placing of telegraph-lines and posts for the purposes of a telegraph established or maintained by the Government or to be so establishment or maintained.
- *Section 57* in the Indian Electricity Act, 1910 is an amendment to the Land Acquisition Act of 1894. In the two sub-sections of section 57, the following points are clarified:

In section 40, sub-section (1), clause (b), and section 41, sub-section (5), of the Land Acquisition Act, 1894 (1 of 1894), the term “work” shall be deemed to include, electrical energy supplied, or to be supplied, by means of the work to be constructed.

The State Government may, if it thinks fit, on the application of any person, not being a company, desirous of obtaining any land for the purposes of his undertaking, direct that he may acquire such land under the provisions of the Land Acquisition Act 1894 (1 of 1894), in the same manner and on the same conditions as it might be acquired if the person were a company.

2.5

THE INDIAN ELECTRICITY RULES, 1956

In exercise of the powers conferred under Section 36A of the Indian Electricity Act, 1910, the Central Electricity Board framed the Indian Electricity Rules, 1956 for the whole or any part of the territories to which the Act extends, to regulate the generation, transmission, supply and use of energy, and generally to carry out the purposes and objects of the Act.

In particular and without prejudice to the generality of the forgoing power, such rules may prescribe the form of applications for licences and the payments to be made in respect thereof; regulate the publication of notices; prescribe the manner in which objections with reference to any application are to be made; provide for the protection of persons and property from injury by reason of

contact with, or the proximity of, or by reason of the defective or dangerous condition of any appliance or apparatus used in the generation, transmission, supply or use of energy.

The Rules specify the general safety requirements for construction, installation, protection, operation and maintenance of electricity supply lines and apparatus. It also contains general conditions relating to supply and use of energy, the requirements for electricity supply lines, systems and apparatus for low, medium, high and extra-high voltages. It specifies the requirements for overhead lines, underground cables and generating stations, including material strength, factors of safety, clearances required above the ground for the lowest conductor, clearances from buildings of low, medium, high and extra-high voltage lines and service lines; as well as conditions for transporting and storing of material near overhead lines.

2.6 *APPLICABLE R&R GUIDELINES FOR TRANSMISSION LINES OF POWER PROJECTS*

2.6.1 *National Guideline for R & R*

To date, there are no approved national guidelines for dealing with resettlement and rehabilitation issues within projects in different sectors in India. A national policy of resettlement and rehabilitation has been drafted and is being debated in various forums. It has however not yet been approved by the Parliament, and therefore does not have a legal status.

2.6.2 *The Land Acquisition Act, 1894*

The **Land Acquisition Act, 1894** is the most relevant national act that has implications for project. The Act lays down in detail, the procedure for :

- Acquisition of land, including notification, payment for damages, hearing of objections, declaration of the intended acquisition, enquiry into measurement, values and claims and award by the Collector and finally taking possession of the land
- Objection to be lodged within 30 days of the notification and the provision for hearing of all objections.
- Reference to court if award is not accepted and hearing in court.
- Apportionment of compensation and dispute settlement regarding the same.
- Payment of compensation for land value, trees and structures including 30% solatium and 12% p.a. interest for delayed payment.
- Temporary Occupation of Land
- Acquisition for companies.

2.6.3 *Applicable Guidelines for Indigenous People*

There is also no separate national policy or guidelines for Indigenous People as far as resettlement & rehabilitation is concerned. The Constitution of India (Part X) however outlines the process for creation of Scheduled Areas, which are regions notified as having predominantly tribal population, referred to in India

as Scheduled Tribes (ST). The Fifth Schedule of the Constitution {Article 244 (1)} gives details on the provisions as to the administration and control of Scheduled Areas and Scheduled Tribes, while the Sixth Schedule outlines provisions for administration of Tribal Areas in the selected states of Assam, Meghalaya , Tripura and Mizoram.

Part XVI of the Indian Constitution lays out the special provision relating to certain classes, including the Scheduled Casts and the Scheduled Tribes. Some of these provisions are reservation of seats in services and posts.

In a recent amendment {Section 4, clause (I) of the Provisions of the Panchayat (Extension of the Scheduled Areas) Act 1996}, lists out a separate procedure to be followed for the acquisition of land and organising resettlement and rehabilitation in 5th Scheduled Areas. The one important procedure required for the land requiring agency is that they have to get a separate certificate from the concerned Gram Sabha or village councils, consenting in writing to the acquisition proposal. It also lays down dispute settlement procedures and obligatory monitoring of the R & R by the State Government.

2.7 RELEVANT IFC GUIDELINES & POLICIES

2.7.1 IFC's Environmental and Social Safeguard Policies

OP 4.01 Environmental Assessment

IFC policy on environmental assessment (EA) states that all projects proposed for IFC financing require an EA to ensure that they are environmentally and socially sound and sustainable. Various instruments are used to perform the EA depending on the complexity of the project. They include environmental impact assessment (EIA), an environmental audit, a hazard or risk assessment, and an environmental action plan (EAP). The policy requires that all IFC projects be classified into category 'A', 'B', 'C' and 'FI'.

The current project is a Category A classified project.

OP 4.04 Natural Habitats - This policy affirms IFC's commitment to promote and support natural habitat conservation and improved landuse, and the protection and rehabilitation of natural habitats and their functions in project financing. IFC does not support projects that involve significant conversion or degradation of critical natural habitats.

World Bank OD 4.20 Indigenous Peoples - Pending finalisation of its own operational policy, IFC projects must comply with the World Bank OD 4.20 on Indigenous Peoples, as appropriate in a private sector. If there are any significant social or environmental impacts on people belonging to the Scheduled Tribes, the World Bank OD 4.20 will be adhered to.

World Bank OD 4.30 Involuntary Resettlement – The OD 4.30 lays down the policy and procedures on involuntary resettlement associated with World Bank and IFC financed projects. The OD provides guidelines for mitigating the adverse

effects of development projects including social and environmental impacts such as land acquisition, relocation, loss of occupations and income sources, productive assets as well as community resources. The project will not however resettle any families.

World Bank OPN 11.03 Cultural Property- Pending finalisation of its own operational policy, IFC projects must comply with the World Bank OPN 11.03 Cultural Property, as appropriate in a private sector.

2.7.2 Public Consultation and Disclosure

Public Consultation - During the EA process for Category A projects the project sponsor is required to conduct meaningful consultation with relevant stakeholders including affected groups, non-governmental organisations (NGOs) and local authorities about the project's environmental and social aspects and take their views into account. The project sponsor initiates such consultations as early as possible. For meaningful consultations, the project sponsor provides relevant information in a timely manner and in form and language that are understandable and accessible to the groups being consulted.

For Category A projects the project sponsor consults the relevant stakeholders at least twice:

- a) during scoping and before the terms of reference for the EA is finalised and
- b) once a draft EA report is prepared

Following the public consultation on the draft EA, the project sponsor supplements the EA by adding details of the public consultation process, including the sponsors responses to concerns raised by the various stakeholders and details of measures taken to incorporate these concerns into project design and implementation. The project sponsor continues to consult with relevant stakeholders throughout the project construction and operation, as necessary, to address EA related and other issues that affect them. IFC requires the sponsor to report on ongoing consultations as part of its annual reporting requirements.

Disclosure of Information -For Category A projects the sponsor gives public notification and makes draft EA report available at a public place accessible to the project stakeholders as early as possible and no later than 60 days prior to Board consideration, closing date or management approval date. The document should include all supplement to the A report requested by IFC and the responses to public consultation process. In addition, non-technical EA report summary in the local language shall be proactively disseminated to the local stakeholders.

2.7.3 Guidance Notes

Within the environmental and social policies and procedures and guidelines of the IFC, there are guidance notes, which need to be followed. The relevant guidelines for this project are as follows:

- Guidance note A - This contains a checklist of potential Issues for an EA that need to be addressed.

- Guidance Note B - This outlines the content of an Environmental Impact Assessment Report.
- Guidance Note C - This guidance note had an outline for an Environmental Action Plan. Every IFC category A project must have an EAP. An EAP consists of a set of mitigation, management, monitoring and institutional measures to be taken during implementation and operation to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels.
- Guidance Note F - This contains the guidance for preparation of a Public Consultation and Disclosure Plan.
- Environmental, Health and Safety Guidelines for Electric Power Transmission and Distribution.
- Environmental, Health and Safety Guidelines for Polychlorinated Biphenyls (PCBs).

3.1 PROJECT AREA

The transmission line route traverses through four districts in Himachal Pradesh.

- Kullu
- Mandi
- Bilaspur
- Solan

The route traverses through and in the vicinity of a number of villages, settlements and small towns in the four districts. The following sections present a profile of the four districts.

3.1.1 Physiography

Boundaries

Kullu district is bounded on the north east by Lahul and Spiti on the south by Simla district and on the south by Mandi district.

Mandi is an entirely hilly district with some fertile valleys in between. The main hill ranges are Dhauladhar, Gagardhar, Sikndradhar and Dhar Vaikot.

Bilaspur district is bounded on the north by Mandi and Hamirpur districts, on the south by Solan district. Altitudes in the district vary from 1944 metres to 305 metres. Seven low ranges and deep valleys cut across the territory, these ranges are locally called Dhars. The principle Dhar is Naina Devi. Which is situated in the north western end of the range.

Solan has mainly mountainous terrain except some valleys. The mountains of lower elevation are found in western and southern parts comprising of Nalagarh and Arki tahsil while the higher ranges start from the central region and extend up to the north eastern corner of the district.

Climate and Rainfall

The climate of Kullu district is cool and dry and there are three broad seasons, from October to February, from March to June and rainy season from July to September. The district receives moderate rainfall and snowfall generally occurs in December and January at high elevations.

In Mandi district, due to the hilly terrain, the climate varies according to the altitude of the place. The climate is temperate and in the upper regions the climate remains cold throughout the year. Tattapani and Dehar are the hottest places in the district where river Sutlej is responsible for hot months.

The climate of Bilaspur district ranges from temperate to sub tropical. Summers can be hot rising to 42 ° C in some places. The places situated at higher elevations like Swarghat , Namhol are cooler climes. Rainfall recorded in the district in December 1988 was 377.6mm as per the *District Census Handbook 1991*.

The climate in Solan district is sub tropical in the lower reaches and moist temperature in the upper reaches. The rainy season commences from the first week of July and continues till end of August. Snow is received in January/ February mainly around Chail, Kasauli and Karol but occasionally also comes down to lower reaches. There are temperature variations due to varying altitudes and minimum temperature goes down to 0° in higher reaches and maximum temperature exceeds 40°C in lower reaches during summer.

River systems

Beas is the main river of Kullu district, Sutlej however touches the fringes of the district. The river Beas originate from a small spring of Pir Panjal ranges at Rohtang pass and flows southward till it reaches Larjee. The river is joined by many tributaries especially Parvati.

Beas and Sutlej are the main rivers in Mandi district and there are rivulets which serve as tributaries of these rivers. The Beas enters the district from the eastern side at Largi. A dam has been constructed at Pandoh on Beas river to divert its water to Sutlej. Sutlej river forms the boundary of the district in the east and south. There are three main lakes in the district known for their religious and tourist importance Rewalsar, Parshar and Kamrunag.

The main river that passes through Bilaspur district through the middle from east to west is Sutlej. It enters the district from Kasol in the north east. It is joined by several tributaries, the main ones are Alikhad, Gamrola Khad and Seer Khad.

Solan district is covered by catchment of three important rivers mainly Sutlej, Yamuna and Ghagar. Tributaries of the three rivers include Kaushalya, Kuthar Nadi etc. Sirsa is the main stream in Nalagarh district. Quite a few of these water sources have been tapped and there is a number of irrigation water supply schemes in the district.

Geology

Kullu district forms a transitional zone between the lesser and greater Himalayas and presents a typical rugged mountainous terrain with moderate to high relief. Rock types found are phyllite, slate, quartzite, granite. The minerals found in the area include Limestone, Copper, Kyanite.

Mandi district lies partly on rocks belonging to central Himalayan zone and partly on tertiary shale and sand stone. The rock formations found in Mandi district are in continuity with those found in Shimla Himalayas and can be classified into sub-Himalayan series. In northern Mandi there are some red slaty shale known as Urla red shale. The district is rich in mineral wealth and has a lot of salt mines.

Most of the area of Bilaspur district is covered by comparatively new strata of the Tertiaries and Quaternary rocks and it is only in the eastern part that older rock formations are found. The geological features include Alluvium sand beds, older alluvium, gravel terraces, middle sandstones and clay, olive green shales, pink limestone, purple sandstone and purple and dark clays etc.

According to the *District Census Handbook, 1991* of Solan some 1200 to 1500 million years ago this area was a part of the sea called Tethys . The sandstone, shale or limestone were deposited as thin layers of rock formation. The sea had volcanoes that erupted lava flows which got layered with the rocks and are classified as Mandi Darla volcanoes within Sundar Nagar.

3.1.2 *Population, Density and Geographical Area*

Mandi has the largest population amongst the four districts and it is 14.83% of the total population of the state while Bilaspur has the lowest 5.60%.

Table 3.1 *Population , Density and Geographical area of Project Districts*

District	Geographical area Sq. Kms	Density per Sq Km	Total	Rural	Urban	%age of distt. Population to State
Bilaspur	1167	292	340735	318786	21949	5.60
Kullu	5503	69	379865	349772	30093	6.25
Mandi	3950	228	900987	840029	60958	14.83
Solan	4936	258	499380	408205	91175	8.22
Himachal	55673	109	6077248	5482367	594881	100.00

Source: District in Figures 2001, Deptt. of Economics & Statistics, HP

Himachal Pradesh has predominantly rural population and 90.21% of the population by the 2001 census is reported to be rural. All the four districts have above 80% rural population and Bilaspur has maximum 93.56% rural population. Density of population is high in Bilaspur and low in Kullu at 69. In terms of geographical area Kullu has the largest area among the four districts, comprising 9.88% of total state area. Taking into account the low density as well as low population figures in Kullu this may indicate that the terrain is very mountainous and inhabitable compared to the other districts.

3.1.3 *Decadal Growth Rate and Sex Ratio*

The growth rate for the state as well as all the four districts has been higher for the period of 1981-1991 than 1991 to 2001.

Table 3.2 *Decadal Growth Rate and Sex Ratio*

State/Distt.	Percentage decadal growth rate		Number of females per 1000 males)	
Year	1981-91	1991-01	1991	2001
<u>Himachal Pradesh</u>	+20.79	+17.53*	976	970*
Kullu	+26.68	+25.60	920	928
Mandi	+20.40	+16.05	1013	1014
Bilaspur	+19.41	+15.35	1002	992

State/Distt.	Percentage decadal growth rate		Number of females per 1000 males)	
Solan	+26.02	+30.64	909	853

Source : Census of India, 2001

The growth rate is positive in all the districts and among the four districts is highest in Kullu as against the state average of +20.79 from 1981-91. However from 1991 to 2001 the highest growth rate among the districts has been in Solan. Bilaspur has shown the lowest growth rate among the four districts for both the periods of time.

The state shows a decline in the sex ratio from 1991 to 2001. However amongst the four districts Kullu and Mandi show an improvement in the sex ratio from 1991 to 2001 while Bilaspur and Solan show a negative trend and an unfavourable sex ratio as there is a great reduction in the number of females per thousand males for the same period of time. There could be many reasons for this and one of them could be greater in-migration of male population from other areas because of more employment opportunities in these districts.

3.1.4 Literacy

Literacy rates show a positive trend in each of the four districts and they have increased from 1991 to 2001. Kullu has shown the maximum improvement in literacy rates from 1991 to 2001. Bilaspur and Solan show literacy rates higher than the state average in 2001.

Table 3.3 Literacy Rates

State/ District	Literacy rate					
	Persons		Males		Females	
Year	1991	2001	1991	2001	1991	2001
Himachal Pradesh	63.86	77.13*	75.36	86.02*	52.13	68.08*
Kullu	54.82	73.36	69.64	84.55	38.53	61.24
Mandi	62.74	75.86	76.65	86.67	49.12	65.36
Bilaspur	67.17	78.80	77.97	87.13	56.55	70.53
Solan	63.30	77.16	74.67	85.35	50.69	67.48

Source : Census of India, 2001

There has been an improvement in female literacy in the state as well as the four districts. Kullu district has shown a greater improvement in the female literacy rates from 1991 to 2001 as compared to the other four districts. Female literacy rate in 2001 is the highest in Solan among the four districts.

3.1.5 Scheduled Caste and Scheduled Tribes

All the four districts have scheduled tribe population. Kullu has the highest scheduled tribe population comprising 5% of total tribal population of the state while Solan has a negligible proportion at 1.12%. Scheduled caste population is negligible in Bilaspur 0.59% and highest in Mandi at 17.17%.

Table 3.4 SC & ST Population

District	SC Population	ST Population
Bilaspur	7681	7983
Kullu	87489	10914
Mandi	224998	9417
Solan	119527	2449
Himachal	1310296	218349

Source: District in Figures 2001, Deptt. of Economics & Statistics, HP

3.1.6 Occupation

It is seen that for the state as a whole the percentage of non workers is higher than the total working force. However in the districts of Kullu, Solan and Mandi total workers is higher than non workers but this difference is only marginal except in the case of Kullu where the gap is wider. In Bilaspur the percentage of non workers is higher than total working population.

Table 3.5 Occupational Profile

State /District	Total workers (%)	Main workers (%)	Marginal workers (%)	Non-Workers (%)
Kullu	57.05	43.96	13.09	42.95
Solan	52.70	34.57	18.13	47.30
Mandi	50.44	29.89	20.55	49.56
Bilaspur	48.95	32.52	16.43	51.05
Himachal	49.28	32.36	16.92	50.72

Source: Census of Himachal Pradesh, 2001

All the four districts have marginal worker population higher than the state average.

Table 3.6 Occupational Profile in Urban & Rural areas

State /Districts	Urban			Rural		
	Main workers	Marginal workers	Non-workers	Main workers	Marginal workers	Non-workers
Kullu	36.76	2.57	60.67	44.58	14	41.42
Solan	44.19	1.66	54.15	32.41	21.82	45.77
Mandi	29.91	3.99	66.10	29.89	21.75	48.36
Bilaspur	34.43	3.34	62.23	32.38	17.34	50.28
Himachal	34.40	2.49	63.11	32.14	18.49	49.37

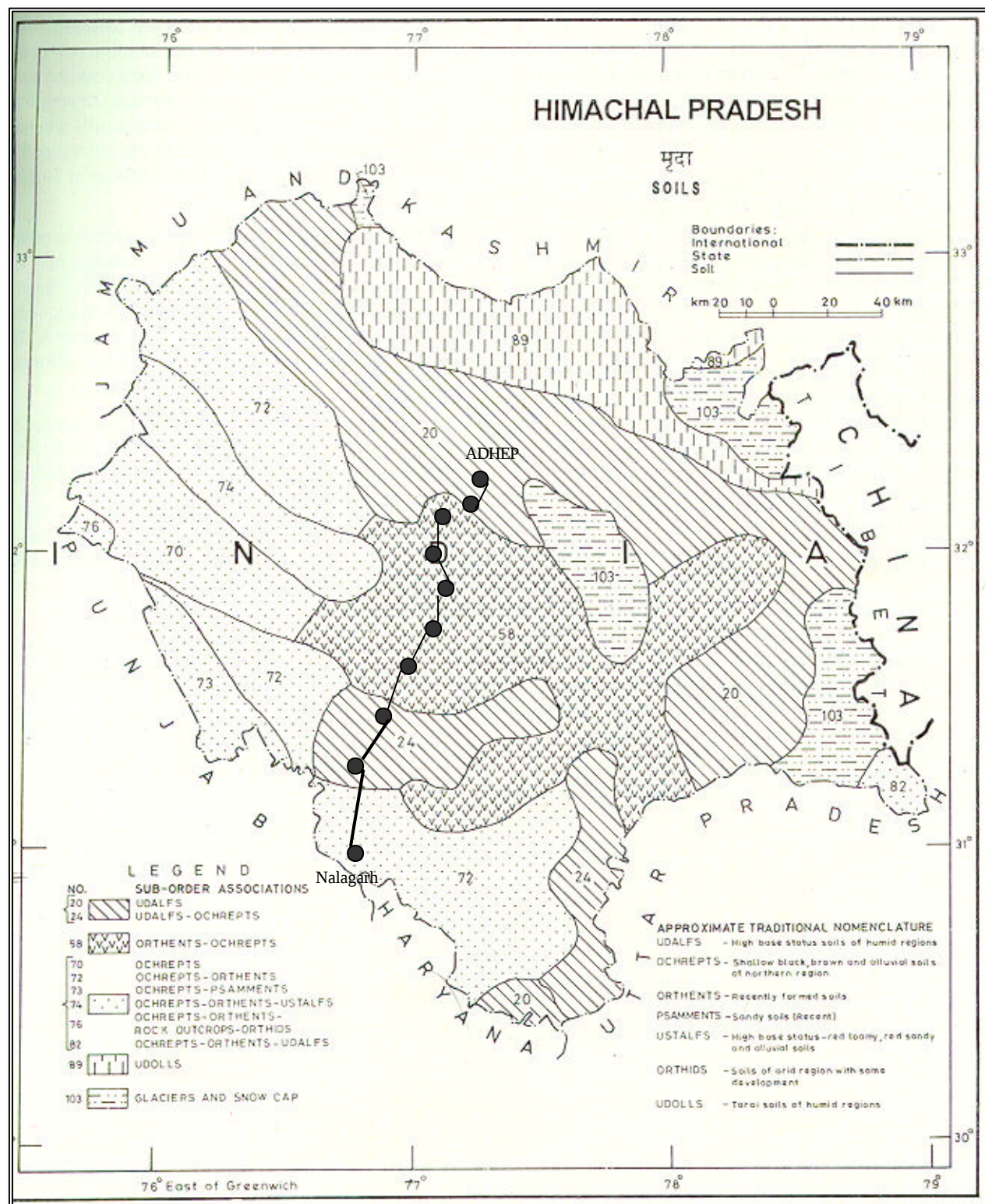
Source: Census of Himachal Pradesh, 2001

It is seen that in the state in the urban areas there is a high percentage of non workers. In the four districts too the urban non workers are more than the total worker population.

The rural scenario is however different and workers including main and marginal are higher than the non working population in all the four districts and state.

3.1.7 Land Utilisation

Land use in the state shows 32.91% under permanent pastures and other grazing lands and 24.11% under forests. Mandi has the largest percentage of



—● **Proposed Route of Transmission Line**

