Initial Environmental Examination

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India: Uttarakhand Power Sector Investment Program - Tranche 4

Prepared by Power Transmission Corporation of Uttarakhand Ltd.

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ABBREVIATIONS

ADB	–	Asian Development Bank
ACSR	–	Aluminium Conductor Steel Reinforced
BOD	–	Board of Directors
CEA	–	Central Electricity Authority
CPCB	–	Central Pollution Control Board, Government of India
DC or D/C	–	double circuit
DPR	–	Detailed Project Report
EA	–	Executing Agency
EARF	–	Environmental Assessment and Review Framework
EIA	–	Environmental Impact Assessment
EMoP	–	Environmental Monitoring Plan
EMP	–	Environmental Management Plan
EHV	–	Extra High Voltage
EMSD	–	Environment Management and Social Department
EPC	–	Engineering, Procurement and Construction
GHG	–	Green House Gases
GIS	–	Gas Insulated Switchgear
GoU	–	Government of Uttarakhand
GoI	–	Government of India
GRM	–	Grievance Redressal Mechanism
IA	–	Implementing Agency
IEE	–	Initial Environmental Examination
LILO	–	Line – in- Line- out
MFF	–	Multi-tranche Financing Facility
MOEF	–	Ministry of Environment and Forests, Government of India
MoP	–	Ministry of Power
NTPC	–	National Thermal Power Corporation
NH	–	National Highway
PCB	–	Poly Chlorinated Biphenyl
PGCIL	–	Powergrid Corporation of India Limited
PTCC	–	Power Telecom Co-ordination Committee
PTCUL	–	Power Transmission Corporation of Uttarakhand Limited
PMO	–	Project Management Office
RoW	–	Right of Way
RP	–	Resettlement Plan
SJVNL	–	Satluj Jal Vidyut Nigam Limited
SF_6	–	Sulphur Hexafluoride
THDC	–	Tehri Hydropower Development Corporation
UED	–	Uttarakhand Energy Department
UERC	–	Uttarakhand Regulatory Commission
UJVNL	–	Uttarakhand Jal Vidyut Nigam Limited
UPCL	–	Uttarakhand Power Corporation Limited
UEP&PCB	–	Uttarakhand Environment Protection & Pollution Control Board

WEIGHTS AND MEASURES

ha (hectare)	–	10,000 sq m
km (kilometer)	–	1,000 m
kV	–	kilovolt (1,000 volts)
kW	–	kilowatt (1,000 watts)
kWh	–	kilowatt-hour
MW	–	Mega Watt

EXECUTIVE SUMMARY

1. ADB is proposing to extend USD 165.08 million loan to India to be implemented by Power Transmission Corporation of Uttarakhand Limited (PTCUL), the Implementing Agency (IA), under Tranche 4 of the Uttarakhand Power Sector Investment Program (UPSIP) towards development of a robust transmission system to evacuate 5,000 MW power from existing and new hydropower plants in the state of Uttarakhand. The program supports commercialization of hydropower resource and strengthening of the in-state grid for evacuation to national grid. The executing agency of the project is Government of Uttarakhand Energy Department (UED).

2. The Tranche 4 transmission components of UPSIP include:

Tranche 4 Project Component Costs

COMPONENT	Name of Work	Cost in INR Million
A	400/220 kV GIS sub-station (S/S) at Pipalkoti	2,355.5
B	400 kV double circuit (DC) Srinagar – Kashipur transmission line	9,880.2
	Total	12,235.7

3. The first Detailed Project Report (DPR) was prepared for the whole transmission network component by Powergrid Corporation of India Ltd. (PGCIL) under contract to PTCUL whereas the Initial Environmental Examination (IEE) reports have been prepared by the IA directly. The details for the previous Initial Environmental Examinations (IEEs) for UPSIP are as follows:

- The Environmental assessments for the whole MFF were finalized in August 2005 as per the Notification in the Gazette of India, Extraordinary Part II and section 3, sub–section (II), Ministry of Environment and Forest dated 14 September 2006. Summary Environmental Impact Assessment (SEIA) was done in February 2005. Translation of SEIA into the local language (Hindi) was done in February 2005.
- IEEs for project components under Tranche 4 were updated in August 2009 and finalized together with Environmental Management Plans (EMPs) in April 2010. IEE Reports and the EMP are posted in PTCUL website (http://www.ptcul.org/iee_reports.html) and ADB website (http://www.adb.org/Documents/Environment/Ind/37139/default.asp).

4. The proposed site for the 400/220 kV Gas Insulated Switchgear (GIS) Pipalkoti substation site is located on 1.6 hectares of barren and plain government civil revenue land located at village Naurakh near National Highway (NW) 58 and 17 km from Chamoli. The proposed land earmarked for Pipalkoti GSS was leased to PTCUL by the Government of Uttarakhand in 2010. There is no permanent or temporary structure on the land provided by the State Government. The local public activists have recently filed a public interest litigation to convert the land use for using it as trade fair grounds etc. for which PTCUL has initiated appropriate legal process. No forest compensation required as it is uncultivated barren land with no trees.

5. The proposed alignment for 400 kV Double Circuit (DC) Srinagar-Kashipur 152.8 km transmission line is situated in a highly hilly terrain in the Pauri, Almora, Nainital and Udham Singh Nagar districts passing through towns - Srikot, Baingwari, Kalon, Birgam, Manchula, Pratappur. The proposed transmission line route alignment will start at 400 kV Srinagar substation and it will pass near villages Girgaon, Khandha, Malli, Palligaon, Salana, Bajwar, Kaloun, Patoti, Adalikhal and Salmahadev in Pauri district. The route alignment is near the Pauri-Ramnagar road and passes near village Marculla in district Almora, and villages Motipur, Lalitpur and Pipalsana in district Nainital, and villages Partappur, Patherinala and Rampura in Udham Singh Nagar district. Transmission line passes through mostly civil, reserve forest and agricultural areas between Srinagar and Kashipur. Near the Jim Corbett National Park, the NH-121 lies between the transmission line and the boundary of Jim Corbett National Park and does not traverse through any ecologically sensitive area. Considering the ecological sensitivities, the Corbett National Park has been avoided from the alignment thereby making the line longer by 12 km and more expensive. Broad gauge railway line and dense population have been avoided by selecting the route alignment that runs parallel to NH 121 from Pauri, village Marculla in district Almora, Kashipur via Ramnagar; and between Srinagar to Pauri along NH-119.

6. Impacts are manageable and can be managed cost effectively - environmental impacts are likely to result from the proposed project development. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures for candidate project components have been specified to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts, that could not be specified or identified at this stage are taken into account and mitigated where necessary. Those impacts can be reduced through the use of mitigation measures such as correction in work practices at the construction sites, or through the careful selection of sites and access routes.

7. Following are some of the impacts on the existing environment from the proposed project:

- Positive Impact due to improvement in quality and reliability of electricity supply to project area.
- Negative Impact - removal of trees along the transmission line in the proposed project area.
- Short term negative impacts - environmental pollution due to cut and fill operations, transportation of construction materials, disposal of debris, disturbance to the farming activities, nuisance from dust, noise, vehicle fumes, black smoke, vibration etc.
- Short term negative impacts - there will be loss of agricultural productivity due to the construction and reduction in the land available for agriculture at tower bases for which PTCUL shall pay only the crop compensation. The right of way shall be utilised as per the Indian Telegraphic Act 1885, a practise widely followed by all transmission companies in India to set up power transmission lines.

8. Benefits far outweigh negative impacts - the project will contribute to the economic development of Uttarakhand from the hydro resource revenues and local employment generation, and to the power deficit northern region of India through the supply of clean energy at competitive prices. Overall, the major social and environmental impacts associated with transmission projects are limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures and by best engineering and environmental practices.

9. Various mitigation measures to be taken prior to the project activities are listed in the project's IEE. Potential adverse environment impacts associated with transmission line have been avoided or minimised through careful route selection. The transmission line alignment has been selected away from major settlements, whenever possible, to account for future urban expansion. Forest areas and thick vegetation areas are avoided wherever possible; however, route alignment passes through approximately 50 km of reserve forest, 75 km of civil and soyam forests, and 28 km long stretch of agricultural fields. Detailed field surveys will be undertaken by the Engineering, Procurement and Construction (EPC) contractor who will assess the physical and biological environment of the site and prepare the forest case for clearance to meet the regulatory requirements. The alignment avoids the wetlands and geologically unstable areas, which can also pose foundation related problems. No land acquisition will be made for placing transmission towers on private land. However, any damage to the crops during the construction phase of the project will be compensated. Associated impacts on agricultural land will be restricted to the construction phase and will be temporary in nature. Agricultural land will not be lost permanently at the base of the transmission tower. After construction, agricultural land within the transmission corridors can be used again for farming purpose.

10. Since the project does not involve activities that have significant adverse impact, an initial assessment has been done to determine the extent of impact as per the guidelines in ADB's *Safeguard Policy Statement 2009*. Accordingly, the environmental classification for proposed project is categorised as "Category B". The IEE report conforms to the Ministry of Environment and Forest guidelines and regulations and are consistent with ADB Operations Manual F1/BP and F1/OP (2003), Environment Policy, and Environmental Assessment Guidelines (2003)[1] and the *ADB Safeguard Policy Statement 2009*.

[1] ADB 2003: Operations Manual, Environment Policy, Environmental Guidelines for Selected Industrial and Power Projects, and Environmental Assessment Guidelines, Manila.

1.0 INTRODUCTION

1.1 Background

1. The projected demand-supply gap in power generation in India has been large; hence there has been an extensive potential for hydropower development. Hydropower generation capacity has lagged behind particularly during the last two decades. Since 1975, the share of hydropower generation capacity has come down to a level of 25% against a desired level of 40%. Therefore, hydropower development is being given priority to improve hydro/thermal mix for optimizing the efficiency of country's power system and usage of resources for sustainable power generation in an environment friendly manner. Apart from being an environmentally clean source of power, hydropower would also provide a peaking power option for the country. The government is showing strong commitment towards hydropower projects and has launched a 50,000 MW Hydro Electric Initiative.

2. Uttarakhand state is endowed with tremendous hydro power potential. At present there is an urgent necessity for constructing a power evacuation system of the order of 6,000 to 6,500 MW of generation projects in Yamuna, Bhagirathi, Alaknanda and Sharda basin. Under the Uttarakhand Power Sector Investment Program (UPSIP), the Government of India (GOI) and Asian Development Bank (ADB) propose development of a robust transmission system to evacuate 5,000 MW power from existing and new hydropower plants in the state of Uttarakhand. The program supports sector reforms, commercialization of hydropower resource and strengthening of the in-state grid. Uttarakhand state's Energy Department (UED) is the Executing Agency (EA), whereas Power Transmission Corporation of Uttarakhand Ltd. (PTCUL) is the Implementing Agency (IA) for the transmission component.

3. PTCUL is a state government power transmission utility company that was established to facilitate transfer of power and to improve the transmission of electricity system within the state, thus leading to the formation of the state power grid. The main objective of UPSIP is to evacuate the power from Yamuna, Bhagirathi, and Alaknanda and Sharda river basins to the national northern grid.

4. The ensuing Asian Development Bank's loan program will provide optimized power system expansion of the northern grid and increase the pace of economic development in less-developed regions in Uttarakhand State. The program supports the Government goal of providing affordable universal power service by 2020. The need of the hour is to ensure equitable distribution of energy, augmentation of existing transmission capacity, put an integrated robust transmission system in place within cost, quality and time parameters and maintain grid discipline within the frame work of the prescribed grid code. PTCUL's response is a balanced combination of reliability, security, and economy. PTCUL believes that these guiding principles must match rising expectations of a cleaner, safer, healthier environment and of people, both affected and benefited by its activities.

5. The $300 million Uttarakhand Power Sector Investment Program (UPSIP) supported by Asian Development Bank (ADB) since 2006. This Multi-Tranche Financing Facility (MFF) loan supports the economic development in State of Uttarakhand through expanded power supplies from clean energy sources and supports a sustainable state electricity sector in the state. The proposed Tranche 4 project components located in Garhwal and Kumaon regions in Uttarakhand are listed in Table 1. The table also gives the investment component costs for Tranche 4.

Table 1: Tranche 4 Component Costs

COMPONENT	Name of Work	Cost in INR Million
A	400/220 kV GIS sub-station (S/S) at Pipalkoti	2,355.5
B	400 kV double circuit Srinagar – Kashipur transmission line	9,880.2
	Total	12,235.7

6. The proposed transmission system has been envisaged in consultation with Central Electricity Authority (CEA), Ministry of Power (MOP), Northern Regional Power Committee (NRPC) and other beneficiary constituents for the reliable evacuation of more than 2,500 MW hydropower from 400 kV sub-station at Srinagar to 400 kV sub-station Kashipur. This transmission line will evacuate the power generated from the proposed generations of Lata Tapovan NTPC (171MW), Badrinath GMR (300MW), Vishnugad NTPC (520MW), Pipalkoti THDC (444MW), Nanda Prayag Langrasu UJVNL (100 MW), Bawala Nandprayag UJVNL (300MW), Rambhara (76MW), Singoli Bhatwari L&T (99MW), Phatabyung (76MW), Devsari SJVNL (252 MW) & Srinagar HEP(330MW) all totalling to about 2,668MW.

7. The proposed Pipalkoti 400/220 kV substation being at hill region - availability of land for substation is limited, hence a GIS substation is proposed. The substation will step up approximately 600 MW power to 400 kV voltage level supplied from Joshimath (at 220 kV level from M/s NTPC - 117 MW at Lata Tapovan) and 444 MW from M/s THDC at Pipalkoti. Approximately 520 MW power from Vishnugad (M/s NTPC) at 400 kV will also be connected at Pipalkoti substation. This power will be transmitted through 400 kV D/C Pipalkoti - Karanprayag lines to 400/220 kV Karanprayag Substation then further to 400/220 kV sub-station at Srinagar.

8. The Tranche 4 project components are estimated to cost INR 12,235.7 million (including IDCs and contingencies). UED is the Executive Agency (EA) and PTCUL is the Implementing Agency (IA) for the project, Project Management Office (PMO), headed by Project Director, is established at UED at Dehradun who will be assisted by corresponding personnel from various functions – Chief Coordinator, Chartered Accountants cum Financial Analyst, HRD Specialist as well as the Project Supervision and Construction Management Consultant based in PMO which will provide Planning and Design (P&D), Contracts and Procurement (C&P), Environment and Social Department and Project Implementation (PI) assistance to PTCUL and UED. Project Implementation Units (PIUs) at divisional level are headed by Deputy General Managers at various project sites in the state.

9. The first Detailed Project Report (DPR) was prepared for the whole transmission network component by Powergrid Corporation of India Ltd. (PGCIL) for PTCUL whereas the Initial Environmental Examination (IEE) reports have been prepared by the IA directly. The details for the previous IEEs, and Indigenous Peoples Program (IPP) and Resettlement Plan (RP) for UPSIP are as follows:

i. Safeguards frameworks were incorporated in the Framework Financing Agreement (FFA), approved by GOI, GOU, and ADB on 5 December 2005. Resettlement Framework (RF), Resettlement Plan, and Indigenous Peoples Development Framework (IPDF) have been prepared during 2005 which covered the components under Tranche 4.
ii. The Environmental assessments for the whole MFF were finalized in August 2005 as per the Notification in the Gazette of India, Extraordinary Part II and section 3, sub – section (II), Ministry of Environment and Forest dated 14 September 2006. Summary Environmental Impact Assessment (SEIA) was done in February 2005. Translation of SEIA into the local language (Hindi) was done in February 2005.
iii. IEEs for project components under Tranche 4 were updated in August 2009 and finalized together with EMPs in April 2010. IEE Reports and EMPs are posted on PTCUL website

(http://www.ptcul.org/iee_reports.html) and ADB website (http://www.adb.org/Documents/Environment/Ind/37139/default.asp).

10. The Environmental Categorization for entire Tranche 4 project is proposed as Category B. The IEE report conforms to the Ministry of Environment & Forests (MoEF) guidelines and regulations and is consistent with ADB Operations Manual F1/BP and F1/OP (2003), Environment Policy, and Environmental Assessment Guidelines (2003).

1.2 Scope of Work and Methodology Adopted

11. A team of PTCUL officials, led by qualified and experienced engineers specially assigned for this work has carried out the preliminary work done for the IEE prepared in 2009 for this project. This team conducted reconnaissance survey to identify the major environmental issues. Accordingly, field surveys were also undertaken to assess physical and biological environment. Detailed assessment of the baseline environment was conducted for the distance up to 5 km. on the either side of proposed alignment and data collection from secondary source was done to support the findings of the field survey. The field studies were supported by data collected from secondary sources such as internet, forest atlas of India, and statistical handbook for Uttarakhand district maps, national atlas and thematic mapping organization, geological survey of India, published GoI's data from 2001 population census statistics data, as well as from authorities such as Uttarakhand Environment Protection and Pollution Control Board (UEP&PCB), forest and other departments.

12. An IEE has been prepared for Tranche 4 project components funded under UPSIP. This IEE requires identification of potential environmental issues associated with the projects and appropriate mitigation measures to be put in place to minimize the environmental Impact. The broad scopes of the IEE are as follows:

i) To conduct field visits to collect data relevant to the study area and also collect secondary data so as to establish the baseline environmental status of the study area;
ii) To assess the impacts on environmental attributes due to the location, design, construction and operation of the proposed Project;
iii) To prepare an EMP outlining the measures for mitigating the impacts for protecting the environment including institutional arrangements;
iv) To identify critical environmental parameters required to be monitored subsequent to the implementation of the proposed Project;
v) To carry out consultation with local people to identify public perception regarding the project; and
vi) To establish an Environment Monitoring Plan (EMoP) for PTCUL to submit environmental monitoring reports to ADB at regular intervals.

13. This IEE report comprises of baseline data on existing conditions of physical, ecological, economic, and social aspects, together with the anticipated environmental impacts and proposed mitigation measures. The consultant team visited the proposed transmission line tower locations, as well as in and around the proposed premises for new substation during 24-26 May 2012. Route visited was based on the alignments considered feasible by PTCUL in 2009-2010. The alignment of the transmission line may slightly vary after the exact demarcation of tower locations. A few sample public consultations with the project affected communities, stakeholders, and government officers focussing on existing environmental conditions around the proposed transmission line/ substation and the potential impacts that could happen due to project implementation were done during the visit. Since the UPSIP does not involve activities that have significant adverse impacts, the present IEE has been prepared to determine the

impact of power transmission aspects as per ADB's *Safeguard Policy Statement (SPS) 2009* and Environmental Assessment Guidelines (2003)[2]. This IEE document is based on the data contained in the Environmental and Social Impact Assessment Report submitted by PTCUL on 01 February 2005 and the revised IEE report of 2010 prepared by PTCUL. Accordingly, the environmental classification for the Tranche 4 projects is "Environment Category B".

14. Detailed field surveys will be undertaken by the EPC contractor who will assess the physical and biological environment of the site as well as the meet the regulatory requirements. Detailed assessment of the baseline environment will be conducted for the entire route of the proposed alignment and data collection from primary sources will be done to support the findings of the field survey.

1.3 Applicable Environmental Policies and other Legislations

15. As per GoI's Environment Impact Assessment (EIA) Notification 2009, Power transmission projects are not listed as environmental sensitive projects and hence no clearance is required from Uttarakhand Environment Protection & Pollution Control Board (UEP&PCB) or Ministry of Environment and Forests (MoEF), GoI. Clearance from Uttarakhand Forest Department is required only in cases where project components are constructed on forest land or requires cutting of forest trees. Moreover, National Environmental Policy 2006 of GoI and ADB's *Safeguard Policy Statement 2009* and procedures and guidelines as listed in Annexure 1 thereto apply to all project components funded by ADB.

16. The MoEF, GoI, vide its Notification no. S.O. 1533 dated September 14, 2006, reengineered the EIA process in India, also decentralized some powers, and made provision to constitute the State Level Environment Impact Assessment Authority (SEIAA) and the State Level Expert Appraisal Committee (SEAC) for performing functions under the said Notification. The MoEF, GoI vide notification NO.S. O. 899 (E). dated 21-04-08 constituted State Environment Impact Assessment Authority (SEIAA) for the state of Uttarakhand. State Expert Appraisal Committee has been constituted by Government of India for examination of the project and recommendations to SEIAA. In addition, the UEP&PCB guidelines for project proponents apply to all Uttarakhand state projects.

[2] ADB 2003: Operations Manual, Environment Policy, Environmental Guidelines for Selected Industrial and Power Projects, and Environmental Assessment Guidelines, Manila.

2.0 DESCRIPTION OF THE PROJECT

2.1 Type of Project

17. The project involves construction of new 400 kV GIS sub-station at village Naurakh near Pipalkoti in district Chamoli. The location map of this substation is shown in Figure 1. The proposed 152.8 km long 400 kV DC transmission line from Srinagar sub-station to Kashipur sub-station will pass through approximately 50 km long reserve forests, 75 km civil and soyam forests and 28 km of flat agricultural land. The route map of this transmission line is shown in Figures 1 and 2.

18. The selected project components have been examined by PTCUL for their technical, economic, and financial feasibility and approved for implementation by Uttarakhand Energy Department (UED), MoP and CEA, GoI. ADB's consultants and appraisal mission also visited the sites, reviewed all available reports, and undertook a comprehensive due diligence assessment including safeguard aspects of the project components.

2.2 Category of Project

19. The proposed Tranche 4 project components are:
   a) Component A: 400/220 kV GIS Substation (GSS)at Pipalkoti,
   b) Component B: 400 kV DC transmission line from Srinagar to Kashipur (Quad Bersimis conductor).

2.2.1 400/220 kV GIS substation at Pipalkoti

20. At 400/220 kV GIS substation Pipalkoti, 2 nos. 315 MVA, 400/220 kV transformers are proposed. The sub-station will step up approximately 600 MW power to 400 kV voltage level supplied from Joshimath (at 220 kV level from M/s NTPC - 117 MW at Lata Tapovan) and 444 MW from M/s THDC at Pipalkoti. Approximately 520MW power from Vishnugad (M/s NTPC) at 400KV will also be connected at Pipalkoti substation.. This power will be transmitted at 400 kV voltage level through 400 kV DC Pipalkoti – Karanprayag transmission line (45 km) to 400 kV substation Karanprayag. This power will be further evacuated to 400/220 kV substation Srinagar of PTCUL through 400 kV DC Karanprayag – Srinagar transmission line.

2.2.2 400 kV DC Srinagar – Kashipur Transmission line

21. This line is being constructed to evacuate power generated by proposed incoming generations of Lata Tapovan NTPC (171MW), Badrinath GMR (300MW), Vishnugad NTPC (520MW), Pipalkoti THDC (444MW), Nanda Prayag Langrasu UJVNL (100 MW), Bawala Nandprayag UJVNL (300MW), Rambhara (76MW), Singoli Bhatwari L&T (99MW), Phatabyung (76MW), Devsari SJVNL (252 MW) & Srinagar HEP (330MW), all totalling to 2,668MW. This power will be accumulated at 400 kV sub-station Srinagar. The proposed 400 kV DC transmission line from Srinagar to Kashipur will have capacity to carry about 2,500MW power. The pooled power from 400 kV Kashipur pooling substation will be evacuated through Interstate Transmission Network to the national grid.

Comment [T1]: This to be replaced

Figure 1: Uttarakhand Power Sector Investment Program Tranche 2-4 projects

Figure 2: Location map of the proposed 400 kV Srinagar – Kashipur line

Comment [T2]: This to be removed

Comment [T3]: This to be removed

2.3 Need for the Project

22. The proposed 400 kV DC Srinagar-Kashipur transmission line and the 40020 kV Piplakoti GIS substation has been envisaged in consultation with CEA, which is a GOI nodal agency for energy planning, MoP and other beneficiary constituents for the reliable evacuation of more than 2,500 MW of hydropower through 400 kV sub-station Srinagar to 400/220 kV sub-station Kashipur for further transmission to national grid. The proposed hydropower capacities in Alaknanda basin are shown in Table 2 below:

Table 2: Hydropower Capacities in Alaknanda Basin in Uttarakhand

S. No.	Tranche Component	Project	Capacity
1	400/220 kV Pipalkoti GSS	Lata Tapovan NTPC	171 MW
2	400/220 kV Pipalkoti GSS	Badrinath of GMR Energy	300 MW
3	400/220 kV Pipalkoti GSS	Vishnugad NTPC	520 MW
4	400 kV Srinagar-Kashipur	Pipalkoti THDC	444 MW
5	400 kV Srinagar-Kashipur	Devsari SJVNL	252 MW
6	400 kV Srinagar-Kashipur	Langrasu UJVNL	100 MW
7	400 kV Srinagar-Kashipur	Bawala Nandprayag of UJVNL	300 MW
8	400 kV Srinagar-Kashipur	Srinagar P/H GVK	330 MW
9	400 kV Srinagar-Kashipur	Rambhara Lanco	76 MW
10	400 kV Srinagar-Kashipur	Phatabyung Lanco	76 MW
11	400 kV Srinagar-Kashipur	Singolibhatwari L&T	99MW

19. A unified transmission system having regional/state level collaboration for power evacuation from these projects would be shared by Uttarakhand and other Northern region states such as Delhi, Himachal Pradesh, Punjab, Rajasthan, Haryana and Uttar Pradesh. These will be connected through the proposed Intra-State transmission system and through existing lines/interconnection to other regions. Techno-Economic clearance of the proposed project has been obtained from CEA vide letter no. 12A/G/2006-SP&PA/39 dated 09/01/2007(enclosed) and proposal has been examined by MoP, GoI and found in order vide letter no. 11/5/2004-IC dated 4th May 2007. This project has been approved by the Board of Directors (BOD) of PTCUL on 29.09.05 and Detailed Project Report of this project has been approved by the CEA vide letter number 12A/G/SP&PA-08/572 dated 24/06/09.

2.4 Location

23. Uttarakhand state can be divided into four basins namely - Yamuna basin, Bhagirathi basin, Alaknanda basin and Sharda basin. These main rivers and their associated rivers have abundant water which can be utilized very effectively for the generation of electricity. Large capacity hydro powers and medium and small capacity hydro powers can be constructed based on the reservoir and run of the river technology. The whole study area along the alignment is underlain by discontinuous aquifers with porous formation. The project falls mainly under the Chamoli, Pauri, Nainital and Udham Singh Nagar districts of Uttarakhand.

2.4.1 **Component A: 400/220 kV GIS substation at Pipalkoti.**

24. The work involves construction of new 400/220 kV substation at Pipalkoti in the Chamoli district of Uttarakhand. The substation is proposed to be constructed on government land identified and allotted to PTCUL by GOU. Table 3 given salient features of the site.

Table 3: Details of 400 kV Pipalkoti GSS site

S No	Feature	Description
1	Area of land	1.6 hectares
2	Geographical coordinates	$30^0$25'42" N $79^0$25'37"E
3	Village / town	Pipalkoti (Gopeshwar)
4	Ownership of land	Government
5	Name of owner	PTCUL was allotted the Land in 2009 by GoU
6	Slope/Plain Land	Partially plain & sloping
7	Kind of Land	Barren
8	River (if any)	Alaknanda River to the south side
9	Permanent feature nearby if any	Adjoining to National Highway (NH)-58

25. There has been a minor change in the capacity of the substation since 2005 study. Based on the capacity of generators and load flow study, now it is proposed to have 2x315 MVA transformers while initially the proposed transformer capacity was 2x240 MVA. However, there had been no changes in the physical condition and location, land acquisition; forest land etc. as mentioned in the report prepared in Feb 2005 and the substation will be constructed at the same land.

26. The work involves construction of a new 400/220 kV sub-station and capacity of 2 x 315 MVA at Pipalkoti (Naurakh) which is 17 km from Chamoli district of Uttarakhand. The land is classified as a "civil revenue land" and land is on lease to PTCUL by the Government of Uttarakhand. The estimated cost for this sub-station is INR 12,235.7 million. The project falls under the Chamoli district of Uttarakhand. The most optimal project location of the 400/220 kV Pipalkoti GIS station is shown in Figure 5.

Figure 5: Location map of the proposed 400/220 kV GIS Pipalkoti sub-station

2.4.2 400 kV Srinagar – Kashipur Transmission Line

27. Overview of the transmission line is provided in Table below.

Table 4: Transmission Line Details

S No	Detail	Description
1	Line Length estimated	152.8 km
2	Total Tower locations	337 no.
	Total no. of river crossings	10
3	Total nos. of Railway Crossing	0 no
4	Total nos. of road crossings	134
5	Total nos. of EHV/HT/LT line crossings	133
6	No. of forest trees to be cut	25,000 approximately
7	No of fruit trees to be cut	(Mostly forest trees - inclusive above)
8	Distance from nearest Wildlife sanctuary/ National Park	1 km aerial distance from Corbett National Park

28. The most optimal project location of the 400 kV Pipalkoti GIS station is shown in **Figure 5**. The Corbett National Park, broad gauge railway line and dense population have been avoided by selecting the route alignment from village Marculla (district Almora) situated on National Highway (NH)-21 to Kashipur via Ramnagar, length of route alignment is slightly more (approx 12 km.) but the terrain will remain the same as shown in **Figures 6 and 7**. The work involves construction of 400 kV DC transmission line, the estimated cost of this line is INR 12,235.7 million.

Figure 6: Route Map of 400 kV DC Srinagar - Kashipur transmission line showing the alternatives out of which alternative one is best suitable.

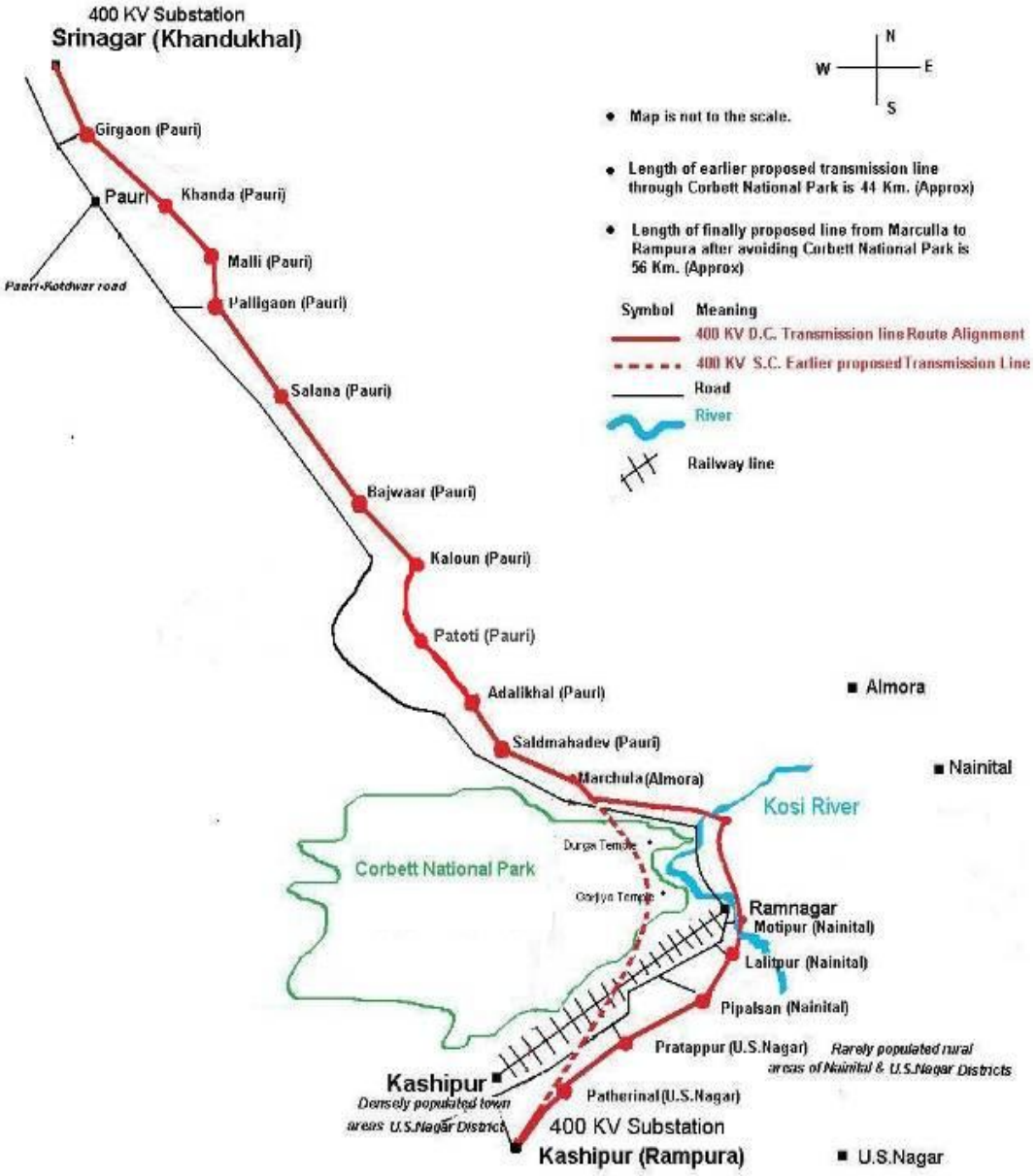


Figure 7: Schematic route Map of 400 kV DC Srinagar - Kashipur transmission line
The final alignment of transmission line is marked in red

2.5 Size and Magnitude of the Operation

29. The IEE report describes the environment in the state of Uttarakhand, where the proposed transmission project is to be located, and various measures that will be taken by PTCUL during design, construction, and maintenance stages altogether to avoid and mitigate the effects on environment of various construction activities.

30. **Component A: 400/220 kV GIS sub-station Pipalkoti** comprises of:

a. 2 nos. 315 MVA, 400/220 kV transformers
b. 400 kV – 6 nos. feeder bays, 2 nos. transformer bays and 1 no. bus coupler.
c. 220 kV – 4 nos. feeder bays, 2 nos. transformer bays and 1 no. bus coupler.
d. Bus configuration will have a main bus scheme equipped with latest Sub-station Automation and Supervisory Control and Data Acquisition (SCADA) system.

31. **Salient Features of the Construction.** The land identified for the substation has been provided by the Govt. of Uttarakhand.
a) The control room shall accommodate all the bay modules as per the scope.
b) The substation has been designed with SCADA system as per latest practices and standards. For example, finite element analysis will be used to design the earth mats.
c) Sub-station switchyard will comprise of terraces to accommodate equipment and bays which will reduce land development cost.

32. **Component B: 400 kV DC Srinagar-Kashipur transmission line:**
a) Line length approximately 152.8 km
b) The line will be constructed on self-supporting latticed type steel towers with Aluminium Conductor Steel Reinforcement (ACSR) Bersimis conductor in bundle of four conductors per phase. Due to corridor constraints and surge impedance loading consideration and quantum of power of 2,500 MW in (N-1)[3] condition, Quad bundle conductor has been selected.
c) Tower body extensions of +3, +6, +9 meter & leg extensions of +1.5, +3, +4.5 meter are envisaged.
d) The leg extensions will result in reduced benching and excavation volumes.
e) The Geographical Information System (G.I.S.) survey route alignment, soil investigation; tree enumeration etc. along the line route has been completed by PTCUL. The survey have been used for the cost estimate of the line.
f) The system power flow study for the evacuation plan has been carried out by the PTCUL on Mi-power software.
g) The tower, body, leg extension and foundation designs for normal, wet/SFR, DFR & HR for ACSR Quad Bersimis conductor have been completed.

2.6 Implementation Plan

Component A: 400/220 kV Gas Insulated Switchgear (GIS) substation (GSS) at Pipalkoti.

33. The selected GIS substation site is located on 1.6 hectares barren and plain government civil revenue land leased for 30 years to PTCUL located at village Naurakh near to NW 58 and 17 km from Chamoli. There is no permanent or temporary structure on the land provided by the state government hence there is no resettlement-this alternative does not affect any population. The proposed Pipalkoti GSS land was leased to PTCUL by the Government of Uttarakhand in 2010. The local public activists have recently filed a public interest litigation to convert the land use to trade fair grounds etc. for which PTCUL has initiated appropriate legal process. No forest compensation required as it is uncultivated barren land.

34. The total project cost is INR 12,235.7 million for the construction of new 400/220 kV GIS sub-station. The land has been provided by the state government. Tender for supply of equipment and erection of sub-station equipment, testing and commissioning is being initiated and the project is proposed to be completed within 30 months from the date of award of contract. The proposed completion date is September 2015. The Implementation Bar Chart is attached as Table 5.

Component B: 400 kV DC Srinagar-Kashipur transmission line

35. The proposed route for 152.8 km transmission line is situated in a highly hilly terrain in the Pauri, Almora, Nainital and Udham Singh Nagar districts passing through towns - Srikot, Baingwari, Kalon, Birgam, Manchula, Pratappur. The proposed transmission line route alignment

[3] The N-1 criterion expresses the ability of the transmission system to support power flow without causing an overload failure elsewhere for a specified duration.

will start at 400/220 kV Srinagar substation and it will pass near to the villages Girgaon, Khandha, Malli, Palligaon, Salana, Bajwar, Kaloun, Patoti, Adalikhal and Salmahadev in Pauri district. The route alignment is nearby to the Pauri-Ramnagar road and passes near village Marculla in district Almora, villages Motipur, Lalitpur and Pipalsana in district Nainital, and villages Partappur, Patherinala and Rampura in Udham Singh Nagar district. The access road to the proposed transmission line is poor and unbuilt at the most of the places. Since this area faces heavy rainfall, full construction activity will be possible during mid-September to mid-June. Transmission line passes through mostly civil, reserve forest and agricultural areas between Srinagar and Kashipur. Near the Jim Corbett National Park, the NH-121 lies between the proposed transmission line and the boundary of Jim Corbett National Park and does not traverse through any ecologically sensitive area. The Corbett National Park has been avoided in transmission line alignment thereby making it longer by 12 km and more expensive. Broad gauge railway line and dense population along the RoW has been avoided by selecting the route alignment that runs parallel to NH-121 from Pauri, village Marculla (district Almora) Kashipur via Ramnagar; and between Srinagar to Pauri along NH-119.

36. Forest compensation for all reserve and civil forest trees will be decided after detailed survey by the contractor. Reserve and Soyam forest area covers 75-83% of total line length; however the actual number of trees shall be determined after the detailed survey. The number of trees cut can be significantly reduced by using flexible tower placement, conductor height, and using hilltop-hilltop route. Crop damage will be evaluated during detailed survey by the contractor.

37. The project would involve survey work, forest case and clearance, design and engineering of hardware, tender for procurement, civil work related to 152.8 km line, erection of towers, line stringing and testing and commissioning. All the above work is expected to take about 30 months. The total project cost is INR 12,235.7 million. The project is proposed to be completed within 30 months from the date of award of contract. The proposed completion date is September 2015. The implementation bar chart is attached as Table 6.

Table 5: Component A: 400/220 kV Pipalkoti GIS Sub-station Project Implementation Plan

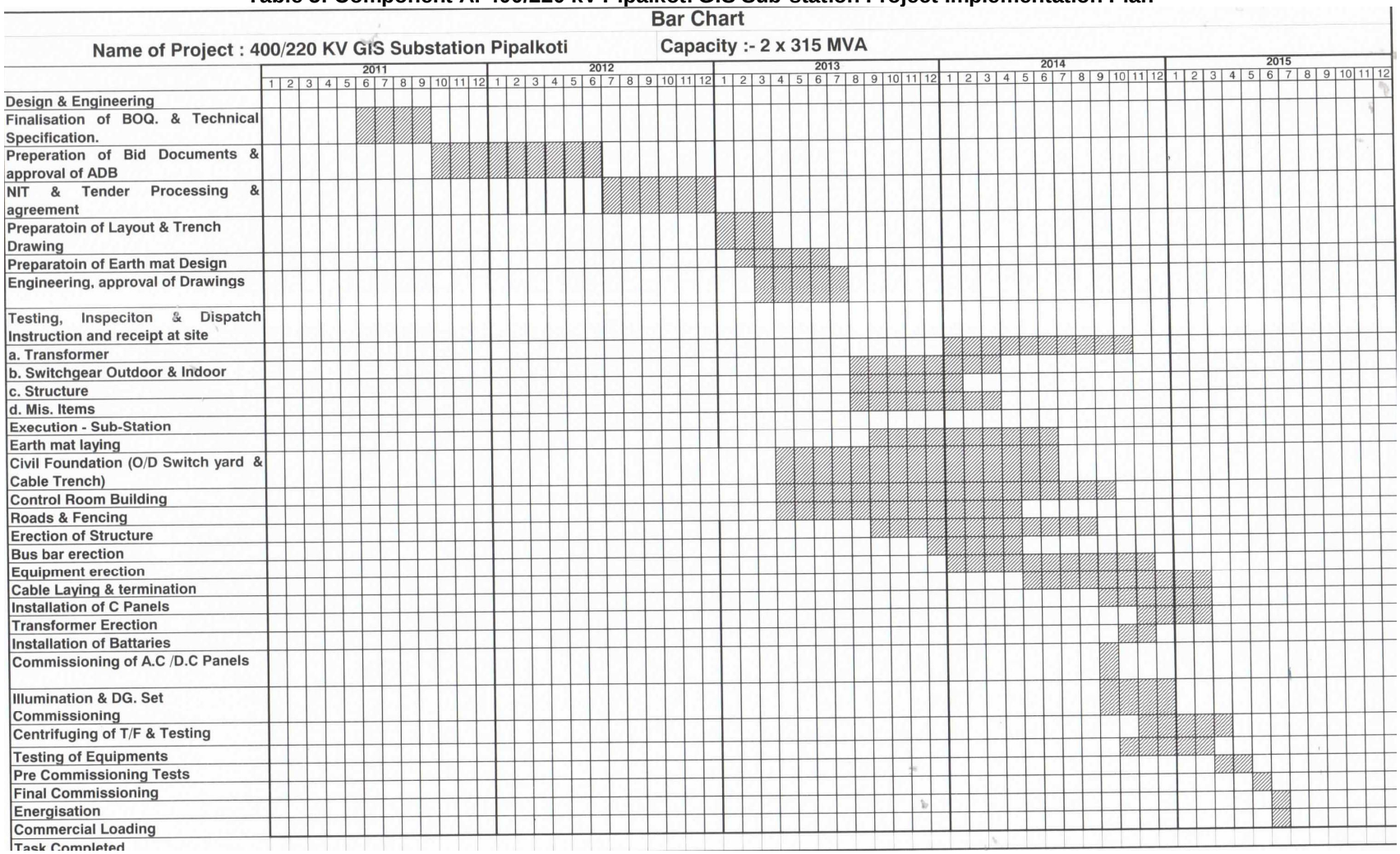
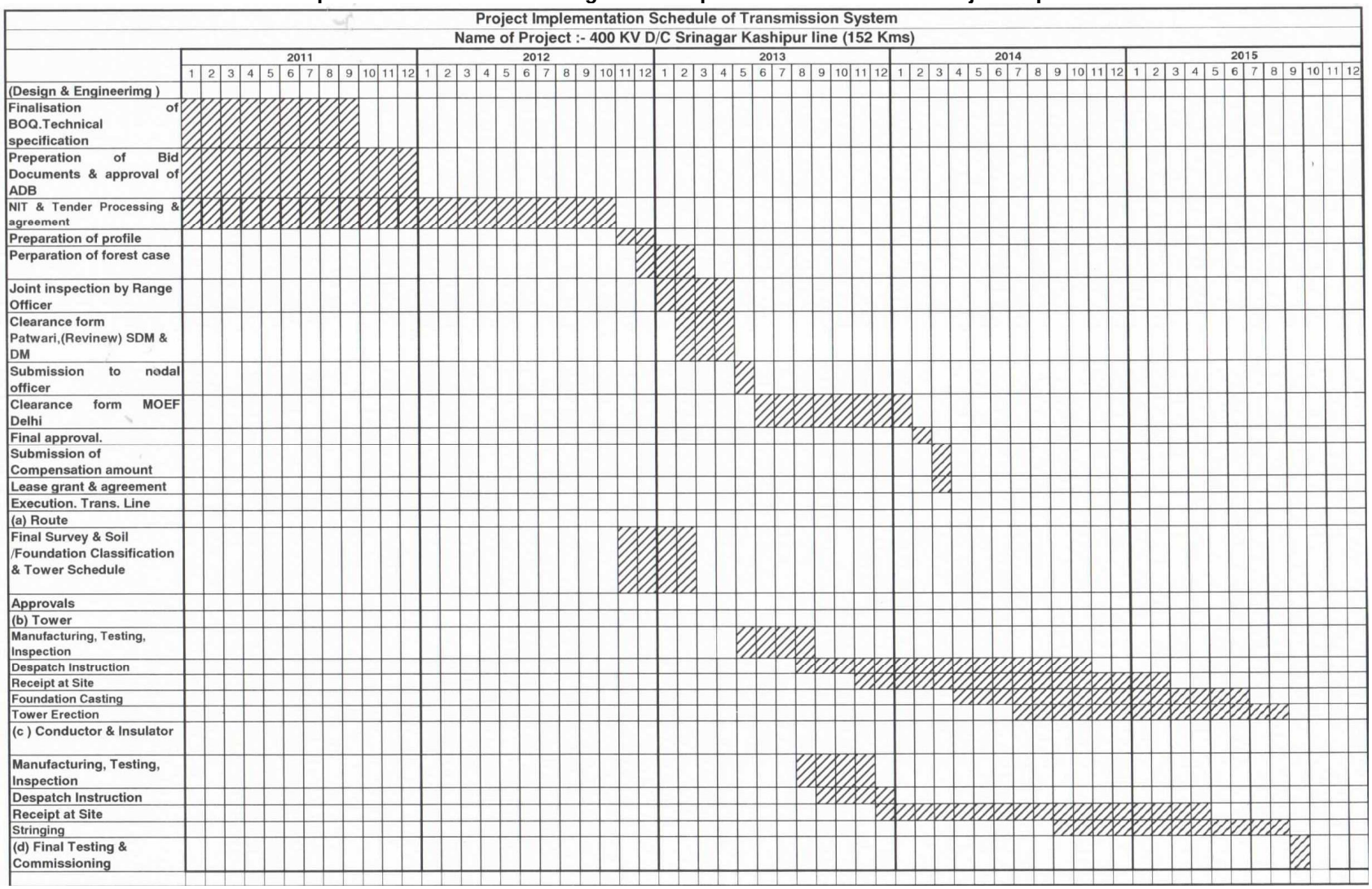


Table 6: Component B: 400 kV DC Srinagar – Kashipur Transmission Line Project Implementation Plan



3.0 DESCRIPTION OF ENVIRONMENT

3.1 Physical Resources

3.1.1 Uttarakhand – Study Area

38. Uttarakhand is one of the most beautiful and enchanting regions of northern India. Nature has endowed this land with so much beauty and spiritual bliss that it is also known as Dev Bhoomi, the Land of Gods. Ganga, Yamuna, and scores of other rivers originate in Uttarakhand. Among them Ganga is the most holy and prominent as she represents the soul of India, her rich culture, history and civilization. In Sanskrit 'Himalaya' means Abode of Snow, truly characterizing the vast permanent snow fields above the snowline. In the heart of these majestic mountains lies the state of Uttarakhand with Kumaon region in its east and Garhwal in the west. Uttarakhand came into existence on 9th November 2000 as the 27th state of the Republic of India. It was carved out of Uttar Pradesh. The state has been granted status of special category state by Union Cabinet on 2nd May 2001[4]. Uttarakhand is a border state bordering China and Nepal. Geographically Uttarakhand is situated between 77^0 34' to 81^0 2' East longitude and 28^0 4' to 31^0 27' North latitude. Uttarakhand is predominantly a hilly state with 88% of hilly area. The climate of the state varies from subtropical in valleys to temperate on higher slopes. Total area of Uttarakhand is 53,483 sq. km, which is 1.73% of the total area of India. The state is very rich in natural resources specially forest and water, as it has many glaciers, dense forests, mountain peaks and a network of mighty rivers viz., Ganga, Yamuna, Ramganga, Kosi etc. A total of 64.6% of the area is under forest cover.

39. **Figure 8** gives the details of the administrative set-up of the state of Uttarakhand.[5]

Divisions – 2
Districts – 13
Tehsils – 78
Development Blocks – 95
Municipal Areas – 71
Nyay Panchayat – 670
Gram Panchayat – 7,227
Villages – 16,826

Figure 8: Administrative Map of Uttarakhand State

40. The description of the surrounding environmental conditions around the proposed project area is given briefly in following sections.

41. The study area comprises of mainly scrub, bushes and trees. The temperature varies between maximum of 36°C to minimum of 0°C. The average rainfall in the area is 1,547 mm. The soil in the study area is yellowish in colour with loamy texture. The geology consists of mixed alluvium and sandstone shale grit and conglomerate. The region consists of entirely medium to

[4] A special category state gets preferential treatment in federal assistance and tax breaks. The special-category states get significant excise duty concessions, and that helps these states attract large number of industrial units to establish manufacturing facilities within their territory. In the special-category states, 90% of centrally-sponsored schemes and external aided assistance is given as grants, and only 10% as loans.
[5] Since limited provisional data is available for Census 2011, data from Census 2001 is used in the report.

high grade metamorphic rocks and is intruded by volcanic rocks. The study area is not a flood prone area.

42. The area along the proposed transmission line runs into series of ridges and valleys in hill area and cultivated and uncultivated area in plain area. The terrain is mountainous consisting of high rise ridges, hills and plateaus in Pauri district and terrain is in flat land in Nainital and Udham Singh Nagar. The soil found is alluvial soil. The transmission line route alignment will cross the Kosi River and its tributes. The transmission line route alignment will cross the Kosi River near village Amarpur, Garjiya and Ramnagar in district Nainital. Most of the terrain in Chamoli and Pauri district is mountainous consisting of high rise ridges, hills and plateaus and flat pieces of land. Most of the terrain in Nainital and Udham Singh Nagar is plain land which is mostly agricultural. The population in the study area consists of mostly farmers and workers.

3.1.1.1 Pauri District

43. The Pauri City which is situated at an altitude of 1,814 Meters above the sea-level on the northern slopes of Kandoliya hills is the headquarters of the district Pauri Garhwal and the Garhwal Division. Headquarters of all Govt. departments are located in the city Pauri. The district of Pauri-Garhwal is one of the blessed regions of Uttarakhand. It is abundantly blessed with nature's bounty like snow-capped Himalayan peaks, dense forests, winding rivers, and extremely warm people with a rich culture and tradition. Pauri also provides a panoramic view of the snow covered Himalayan peaks of Nandadevi & Trisul, Gangotri Group,Thalaiya-Sagar, Neelkanth, Bandar Poonch, Swarga-Rohini, Kedarnath, kharcha Kund, Satopanth, Chaukhamba, Ghoriparvat, Hathiparvat and Sumeru etc.

44. Pauri Garhwal has a diverse topography varying from the foothills of the Tarai of Kotdwara to the sprawling meadows of Dhanaulti. It covers an area of 5,230 sq km and is divided into nine tehsils. Pauri Garhwal is surrounded by the districts of Chamoli, Dehradun, Bijnor, Nainital, Haridwar, Rudraprayag and Tehri Garhwal. The two important rivers of this district are Alaknanda and Nayyar River. Pauri experiences a sub-temperate climate which remains pleasant throughout the year except during winters when it gets extremely cold. Pauri is famous for its several tourist spots.

45. The snow-capped mountains of Khisru offer the tourists a wonderful view of the Himalayas and is reason enough to attract hundreds of tourists in Pauri. Located at a height of 3,100 m above sea level, Dhoodhatoli is covered with dense forests. 114 kms from Pauri is Binsar, set amidst dense forests of Rhododendron, Oak and Deodar. About 2 kms from Pauri is Kandoliya, a beautiful area also surrounded by forests. The Kandoliya Devta temple dedicated to the local god Bhumi-Devta is also located here.

46. The nearest airport for Pauri is Jolly Grant while the nearest railway head is Kotdwara. Pauri is also well connected to Rishikesh, Dehradun and Kotdwara. The district headquarters is Pauri, total district area is 5,438 sq. km; total population: 6,97,078 having a literacy percentage of 77.99%

3.1.1.2 Nainital District

47. Nainital is a beautiful lake resort that nestles amidst seven hills in a lush valley at an altitude of 1,938 meters. Located at a height of 6,358 feet above sea level, Nainital probably derives its name from Naini Lake, a prominent tourist spot of Nainital. Nainital is located in the Kumaun region and is popularly known as the lake district of India. Some of the important places in the district of Nainital are Haldwani, Kaladhungi, Ramnagar, Bhowali, Ramgarh, Mukteshwar, Bhimtal, Sattal and Naukuchiatal.

48. Nainital enjoys a temperate climate with the maximum reaching 27º C and the minimum at 10 º C. Nainital is also famous for its various schools and research facilities. The Observatory or the Aryabhatta Research Institute of Observational Sciences (ARIES) is located 9 kms from Nainital on Manora Peak and is the Center for Astronomical Studies and Optical Tracking of artificial satellites. It also proudly houses many renowned schools some from the British period.

Important schools include Sherwood College, St Joseph's College, and Sainik School. Nainital is also one of the campuses of Kumaun University. The total district area is 3,853 sq km, total population: 7,62,909 and literacy: 79.60%.

3.1.1.3 Udham Singh Nagar District

49. Udham Singh Nagar district was carved out of Nainital district in October 1995 and was named after Saheed Udham Singh, a great freedom fighter, who killed General Dyer and took revenge for the Jalianwala Bagh massacre. The prosperous district is endowed with very fertile land. Agriculture is the mainstay and there are several agriculture related activities and industries located here. Along with establishment of industries there has been an equal growth of agriculture as well. The fertile lands and weather conditions are a perfect blend for agriculture in Udham Singh Nagar. One of the most important centers of learning in India, Pantnagar University is located here. It is one of the leading educational institutions in India in the fields of agriculture and technology. Some of the important places of tourist interest are Nanak Matta Dam and Dronasagar. Two melas in Udham Singh Nagar, the Atariya Mandir mela and Chaiti mandir mela display local traditions and folk culture. The district headquarters is Rudrapur and total area is 2,912 sq. km, total population is 12,35,614 and literacy is 65.76%.

3.1.1.4 Chamoli District.

50. Chamoli lies in the Central Himalaya and constitutes a part of the celebrated 'Kedar Kshetra'.The district Chamoli is surrounded by Uttarkashi in North-West, Pithoragarh in south-west, Almora in south east, Rudraprayag in south-west and Tehri Garhwal in west. The geographical area of the district is around 7520 sq kms. Chamoli district is the second largest district of Uttarakhand state of India. It is bounded by the Tibet region to the north, and by the Uttarakhand districts of Pithoragarh and Bageshwar to the east, Almora to the south, Garhwal to the southwest, Rudraprayag to the west, and Uttarkashi to the northwest. The administrative headquarters of the district is Gopeshwar. Chamoli hosts a variety of destinations of pilgrim and tourists' interest - Badrinath, Hemkund Sahib, valley of flowers and Auli. The district is also inhabited by Bhotiya ethnic group who adhere to Hinduism.

51. The project site is forest land, civil forest land and uncultivated barren. The proposed site is 21 km away from the NH-58 connecting Haridwar to Rudraprayag and Chamoli districts. All the major utilities like fire station, hospital, police station, schools, colleges etc. are available in the Chamoli district.

3.1.2 Topography, Geology and Soil

3.1.2.1 Soils and Topography

52. Soil is the thin upper most layer of the earth's crust. It supports all forests, grass lands and crops from which all living creatures on earth derive their food. In the hilly mountainous Himalayan region the soils found are mountain soils. These soils include peat, meadow, forest and hill soils. The soils found at the project site are entisols comprising mainly a combination of younger alluvial and old alluvial soil. The soil of the area is basically the product of fluvial process of the river Alaknanda and its tributaries. The alluvial soil of the area is dry, porous, sandy, faint yellow and consists of clay and organic matter. It is slightly acidic in reaction. The new alluvial is less acidic as compared to the old alluvial. Its pH value varies from 5.5 to 9.0. the old alluvial on the other hand occurs in the upper and middle parts of the valleys. These deposits contain alternating beds of pebbles, gravel or boulder with loose sand and clays. The old alluvial have relatively high percentage of acid and soluble Mg accompanied by Ca. The pH value ranges between 4.2 and 5.5. In certain parts, both the old and new alluvial are so combined that it is difficult to distinguish them.

3.1.2.2 Geology and Minerals

53. A fairly thick group of sedimentary rocks occurs ranging in age between Eocene and Pieistocene period of geological succession. The most part along the alignment and the valley portion along the Bhagirathi river area are covered by thick alluvial deposits belonging to sub-recent and recent periods. The thick sedimentary rocks of the tertiary period have been observed on patches along the alignment and found to be over thrust due to the tectonic forces. Overall the

study area along the alignment is dominated by mainly the unconsolidated sedimentary deposits consisting of alluvial soil. The study falls under Zone IV which is equivalent to seismic intensity VIII on modified mercalli intensity scale. This is not the most severe seismic zone and is referred as medium damage risk zone.

3.1.2.3 Minerals

54. The mainly minerals found in Pauri, Nainital and Udham Singh Nagar districts are Sandstone, Lime stone and Sulphur.

3.2 Climate and Meteorology

3.2.3.1 Climate

55. The area experiences heavy monsoon climate with chilling winter and summer. The average annual rainfall in the study area is 1500 mm. The climate in the study area is classified into four seasons: (a) winter, (b) pre-monsoon (summer), (c) monsoon and (d) post monsoon. The average maximum temperatures are 35°C (Pauri), 48^{o}C (Nainital) and 41°C (Udham Singh Nagar) in pre-monsoon (March to mid-June) and average minimum temperatures are 5°C (Pauri), 0^{o}C (Nainital) and 1.7°C (Udham Singh Nagar) in winter season (November to February). The months of mid-June to mid-September constitute monsoon season. The occurrence of thunderstorms is the most conspicuous characteristics of the monsoon weather. Non monsoon rains also occurs during rest of the year in the area. During the winter snowfall occurs in Pauri and Nainital district of the project area.

3.1.3.2 Temperature

56. Due to variation in altitudes, the temperature varies considerably. Minimum temperature in the higher reaches often touches sub-zero degrees centigrade during the winter months. The maximum temperature in the lower areas often exceeds 40 degrees centigrade during the summer months.

3.1.3.3 Rainfall

57. Besides the seasonal variations, the climate of Uttarakhand varies at different altitudes. The average rainfall is 1523 mm.

3.1.3.4 Air Quality

58. As per Annual Report 2009–10 of UEP&PCB, monthly mean average values of all the three air quality parameters, SO_2, NO_x, and RSPM were observed and value of SO2, and NOx are found well below the permissible limits however, value for RSPM was found to be above National Ambient Air Quality Standards (NAAQS) for Annual and 24 hour average.

3.1.3 Water Resources

3.1.4.1 Surface Water

59. Richly endowed with perennial rivers that flow down steep gradients in mountain catchments, Uttarkhand has a vast amount of water resources. These resources meet drinking water and irrigation requirements as well as supplying hydroelectric power to a large population. Drinking and irrigation requirements are also catered to by numerous springs. The use of ground water sources for irrigation is common in Uttarakand.

60. Uttarakhand has snow fed perennial rivers and rivulets flowing in almost all parts of the State. Ganga, with its important tributaries of Alaknanda, Bhagirathi flow through various parts of Uttarakhand. Uttarakhand is drained by streams/rivers forming part of the drainage basins of the Ganga and the Yamuna, the Pabbar and Tons rivers. However, major part of the district is drained by tributaries of Ganga River. In general, the density of drainage is moderate to high and is not uniform all over the district.

3.1.4.2 Ground Water

61. In both regions, due to poor potentialities in hilly hard rock areas and sloping hilly terrain, groundwater development is low. However, in these areas, major water supply and sources of

water are ground water based - perennial springs, bowries and hand pumps. Springs are tapped at the source so that the water can be supplied under gravity. All major towns and villages are supplied water from ground water sources.

3.1.5 Earthquake Zone:

62. The study area falls under Zone IV and slightly above on modified Mercalli Intensity Scale, where the maximum intensity could reach VIII which is not the most severe seismic zone and is referred to as Medium Damage Risk Zone. According to USHAP data, the state of Uttarakhand falls in a region of high to very high seismic hazard. As per the 2002 Bureau of Indian Standards (BIS) map, Uttarakhand also fall in Zones IV & V. Historically, parts of this region have experienced seismic activity in the M6.0-7.0 range.

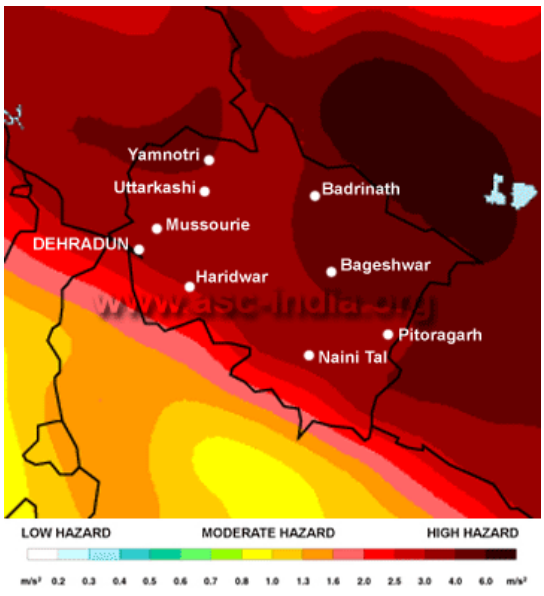


Figure 9: Earthquake Zone of Uttarakhand
Source: Amateur Seismic Centre, Pune, 2012

63. The transmission towers and the substation sites falls in high damage risk Seismic Zone IV area (High Damage Risk Zone – MSK[6] VIII). Therefore, PTCUL is required to take adequate measures while erecting transmission lines to ensure least damage during earthquake. The proposed route alignment passes through Zone IV. Similarly, the proposed substations also fall in Seismic Zone – IV and therefore PTCUL needs to take adequate measures while designing and installation of project components to avoid damage during earthquake.

3.2 Ecological Resources

3.2.1 Terrestrial Ecology

3.2.1.1 Forests

64. The recorded forest area of the State is 34,662 km^2, which constitutes 64.79% of its geographic area. By legal status, reserved forests constitute, 71.08% protected forest 28.51% and unclassed forests 0.41% of the total area.

65. Major forest types occurring in the state are tropical moist deciduous, tropical dry deciduous, sub-tropical pine, Himalayan moist temperate, Himalayan dry temperate, sub alpine and alpine forest. Forests are largely distributed throughout the state with conifers and sal being the major forest formations. The state has 6 national parks and an equal number of wildlife sanctuaries covering an area of 0.71 million ha, which constitutes 13.35% of its geographic area. The famous Corbett National Park is located in the state covering an area of 0.13 million hectares Nanda Devi Biosphere Reserve, having an area of 0.59 million ha. is also located in this state.

66. The forest cover of the state, based on satellite data of October – December 2004, is 24,442 sq.km, which is 45.70% of the geographic area. Very dense forest is 4,002 sq.km. moderately dense forest 14,396 sq.km. and open forest 6,044 sq.km.

67. According to recent estimates, there are 6,069 Van Panchayats managing 405,426 hectares of forests (13.63% of total forest area) in the state. Most of these have been carved out of civil (protected) forests under the jurisdiction of the Revenue Department. The area under each Van Panchayat ranges from a fraction of a hectare up to over 2,000 hectares.

[6] Medvedev-Sponheuer-Karnik (MSK) intensity broadly associated with the various seismic zones is VI (or less), VII, VIII and IX (and above) for Zones II, III, IV and V, respectively

3.2.1.2 Flora

68. **Ferns**: over 120 species of fern grow in damp ravines, covered rocks and tree trunks. Fueli Ferns grow abundantly in the monsoon months of July, August and September. The forest of the district can be divided into the botanical divisions listed below-

69. **Himalayan Sub-tropical Pine**: These forests are wound between the heights of 910 m. to 1,825 m. throughout the district. The trees which are commonly found in these forests are *Anyar*, *Caryoptexis wallichii, Rubus Ellipticus, Rhus Semialata* and *Desmodiumsamuense* on the northern aspect of the hills.

70. **Moist Temperate Seral Forests**: These forests are found between the altitudes of 1,200 m. to 2,150 m along the streams and newly formed beds with undergrowth of *Sarococca preuniformus spp. Barberis spp.* and *Ainslea aptera* especially in western part of the Joshimath and the eastern part of Karnprayag tehsils.

71. **Banj Oak Forests**: These are found between the heights of 1,825m and 2,450 m but at place their limits ascent up to 2,600 m. on the southern aspect and descend to 1,200 m. on the northern aspect of the hills. Trees commonly met with in these forests are Buras, anyar, carpinus, *viminea* and *Ilex odorala*.

72. **Oak Scrub Forests**: These forests are found in the localities of banj oak forests near the habitations. Sometimes due to excessive damage, banj oak is replaced by scattered bushes of *Barberis Chitriya, Basiatice* and *Cretaegus cronulata*.

73. **Tilonj Forests**: These forests are found between the same altitudes as those of the oak and are associated with the *lauraceous, ilex, betula alnoides*, etc. The shrubby under growth consist of *Robus spirea, indigofera* and *Ainslea aftera*.

74. **Lower Blue Pine Forests:** These forests are found between the heights of 1,825 meters and 2,600 meters especially in tehsils Chamoli and Karnprayag having *Euscholtzia polistachya, Vibumun foctens, Rosa microphylla, Vibumun cotonifoliun, Exaecarea acerifolia*, etc. as shrubby under growth.

75. **Dry Coniferous Forests:** On deep soil between the altitude of 1,825 meters and 2,600 meters over a small area on all aspects except the steep southern slopes with quartzitic sub soil, mainly Deodar is found associated with Kharasu, Akhrot, Kharif, Syan and Maira, The under growth consist of shrubs such as *Aveliatryflora, Sumiperous, Macropoda, Prunus jacqumontii, Ribes grosulaia* and *Rosa scricea*, the shrubby under growth consisting of *Achyranthes bidentata* and *Aralia cissifolia*

76. **Moist Temperate Deciduous Forests:** These forests are found on deep moist soils between the heights of 1,825 meters and 2,750 meters along hill stream. The top canopy consist of pangar, kanchula, maira sour, akhrot, dalla and kabasi, the shrubby under growth consisting of *viburum spirea, sorbiflora barberis supp. Strodilanthas wallichii* , etc.

77. **Cypress Forests:** These forests are found between the heights of 2,125 meters and 2,600 meters on rocky slopes and precipitous ground mixed with *tilong, kali, Corpinus ninerea, Eunonimus pendulus, Ilex, Machilusdutti*, etc.

78. **Kharasu Forests:** The Kharasu forests are found between the heights of 2,450 meters and 3, 00 meters mixed with kanchula, pangar, Saur and burans. The shrubby undergrowth consists of *Rosa scricea, Rosa macrephylla, Viburum foeten, Contoneaster ocuminate, Ribes glaciaia* and *ringals.*

79. **Western Oak Forests:** These forests are commonly found on the southern aspect of hills between the altitudes of 2,450 meters and 2,900 meters mixed with *Kharasu, tilonj, pangar,*

kanchula, kabasi, etc. the chief undergrowth being *Rhamnus purpurrea, Wickstroemia cancacenda, Rosa macrophylla, Skimmia bursola, Rubus niveus*. Among creepers which are found here are Vitis *semicordata, Schizandras grandiflora* and *Hedera helix*.

80. **Dry Temperate Deciduous Forests:** These forests consisting of kabasi trees are found between the heights of 2,450 meters and 2,750 meters in the northern part of the district, *Lonicara spp.* and *Rosa serecea,* being the shrubby undergrowth.

81. **Temperate Hippophae Scrub Forests:** These forests consisting of ames scrubs, are found between the heights of 2,275 meters and 3,200 meters n gravel beds along the banks of the streams mixed with *gadbhains*.

82. **Kharak Forests:** The forests are found above the altitude of 2,215 meters and have practically no tree growth except the *Rumex nepalensis* undergrowth.

83. **Ringal Forests:** These occur above the height of 2,425 meters mixed with high level *oak* and *coniferous* trees.

84. **Alpine Fir Birch Forests:** These grow better between the heights of 2,900 meters and 3,500 meters in all aspects of the hills except in the moist areas. The plants growing in these forests are fir, birch and Rhododendron. The undergrowth consists of *Pyrus folilosa, Cotoneaster acuminata, Rosa sericea, Ribes glaciala, Ribes rubrum, Lonicera spp.* and *Smilex vaginate.*

85. **Birch - Rhododendrons Forests:** These forests are found between the altitudes of 2900 meters and 4125 meters and in them are found the stunted Bhuj and rhododendrons with *Pyrus foliolose* as 90 percent of the undergrowth. Other plants which grow here are *Rubus niveus, Swilax vaginate, Cotoneaster spp. Lonicera spp.* and *Pologorum vaccinifolium*.

86. **Alpine Scrub Forests:** Between the altitudes of 3,350 meters and 4,275 meters and with a rainfall above 1,016 mm. evergreen scrubs are found consisting of *Rhododendron asthopogen, Junipexus recurva, J. communis, Lonicera parviflora,* etc. In the dry inner ranges having a rainfall less than 255 mm grow exeophytic dwarf shrubs consisting of *Eurotia ceratoides, junipexus pseudosabina, J. communis* and *Caranga sp. ad Artimisia spp.*

87. **Alpine Pastures:** Between the heights of 2,050 meters and 2,975 metres on the northern aspect of the hills and between the altitudes of 2,500 meters and 4,425 meters on the southern aspect of the hills the land is covered with short grasses and herbs, which are used as pasture where professional graziers bring their cattle.

88. **Other Forests:** In the warm valleys of the extreme southern part of the district some species of the trees of the plains such as mango, jamun, pipal, banyan and shisham grow here up to an altitude of about 915 meters. The 'Sal' which is found up to a height of 1,220 meters, is seldom seen north of the river Pindar but it is usually not allowed to stand near cultivated tracts because it is said to attract white ants. The Tun and the Kharik, or Kharak are to be seen growing up to an elevation of about 1,250 meters which is also suitable for the growth of haldu and dhauri. Carefully protected by the cultivator on the pugar (terrace wall of the field), the leaves of the bhyunl tree afford excellent fodder for the cattle.

89. In the Alaknanda valley, the bases, slopes, gorges and tops of the hills up to the height of 1,067 meters are well wooded with high trees such as catechu, bahera, har (or harara), amaltas, bel, kachnar and dhak. A large variety of creepers some of which have broad green leaves also thrive in the vicinity of the trees.

90. From about 1,220 meters to 1,829 meters, Chir abounds and above this level oak and chimul are found, the former being a hard wood, is used for making agricultural implements and the latter for fuel. The Chir wood is commonly used for building purposes in the district, and its logs and sleepers are floated down the Alaknanda to the plains. Chir is also tapped for resin but

quantity of turpentine produced in the district is small.

91. Above an elevation of 3,439 meters Moru or Tilonj and Kharasu grow and their timber is also used for manufacturing agricultural implements. The pangar or horse chestnut and the maple are found up to a height of 3,048 meters, especially in the Riniganga valley. The wood of the latter is used for making drinking vessels and bowls known as lahauri-doba.

92. Spruce, silver-fir, kail and kharasu, oak and some trees of small economic value are the principal trees found in the forests of the upper Himalayas (above 3,048 meters). Fine forests of silver-fir, kail and pine occupy the slopes on the left bank of Alaknanda from Pipalkoti to Joshimath. The Surai of Himalaya sypress and the Himalayan cedar forests which lie along the Alaknanda in patti Talla Painkhanda and the Neoza pine forests near Tapovan along the Dhauli, are fairly extensive and have trees of thuner (yew), papari (boxwood), Kharasu and deodar. The birch grows up to an elevation of about 3,658 meters above which lies an expance covered wih bush and grass variegated in summer by Alpine forests of many colours. The places of richest vegetation are between the elevation of 2,134 meters and 3,658 meters where the epiphytic form of flora, ferns, mosses, creepers and many varieties of flowers make the region beautiful especially after the rainy season. *Colquhounia* is abundant on the main Badrinath and Trishul ranges and ringals form the undergrowth of the forests up to an altitude of 2,286 meters

93. Many medicinal blooms, herbs and plants, greatly valued in Ayurveda grow in the district. Most of the flowers and plants come up during the rains but wither away from October to May, imparting the characteristic brown colour to the countryside during the winter. In these parts *Senecio rufinervis*, a perennial herb forms dense undergrowth to the exclusion of most other plants. Aromatic plants are found in abundance at higher altitudes. The groves in the district covering an area of 430.72 hectares are mostly in the warm deep southern valley and consist of chiefly of mango, guava, banana, papaya and jackfruit trees. Fruits like apple, pear, peach, plum, apricot, cherry, chestnut, mulberry, strawberry, litchi and loquat also flourish. Other cultivated trees of the district include species of citron of which the chief is Malta, lime, and sweet-lime and orange which, though thriving in the warm valleys, can also be grown up to a height of about 1,677 meters The vine is raised in groves where the rains are not too heavy.

94. The chief varieties of timber trees found in the groves of the district are pine, tun, deodar and many varieties of walnut. The timber of the deodar tree is considered to be sacred and is noted for durability and resisting insect, pest and dry rot. It is great demand for making doors and roof at temples. In the past a very fine grove of deodars surrounded the Binsar temple in the south-western extremity of Tehsil Karanprayag.

3.2.1.3 Fauna

95. The district is rich in fauna and has been the habitat, from time immemorial of large variety of mammals, various species of bird, reptiles, and fish. About the middle of the nineteenth century many villages were deserted because of the dread of wild animals. Tigers are found up to an elevation of about 3,048 meters and in the past haunted the big forests of Chandpur and Dudhatoli, occasionally reaching the thick forests of Vasuki and Tungnath. The number of wild animals has considerably decreased on account of their destruction and thinning of the forests.

96. Among the animals of the district are the tiger, leopard, panther, snow-leopard, himalayan black bear, brown bear, deer, wild dog, Chutraila or pine marten and Himalaya weasel. The first is found throughout the district and is extremely dangerous when it becomes a man-eater. The snow-leopard which is met at higher altitudes above the tree line, some 3,658 meters to 3,963 meters above sea level, hunts at night, preying on wild sheep and goats, musk deer and marmots. Like other beasts of prey its movements are regulated by those of its prey. It is hunted for its valuable fur. The black Himalayan bear is common in the district and is found up to a height of 915 meters It frequently plunders wild beehives, for their honey and is a serious menace for the crops and occasionally becomes carnivorous killing goats and sheep and even cattle. The brown bear is rare and is known to live in the bare open peaks high above the tree line in the watershed of the Nandakini and Kailganga. Wild dogs are generally seen in the forests of Pindar valley and

Dudhatoli. The otter (ud) is found in waters of the Pindar.

97. Other wild animals seen in the district are Hyaena, jungle cat, wolf, jackal, porcupine and mountain fox. The wild bear is widely distributed in the district and is found up to a height of 2,743 meters, chiefly in oak forests. The goral or himalayan chamois, serow and thar are widely distributed between the elevation of 2,134 meters and 3,658 meters The flesh of animals which have thorn, especially that of male is valued by the hill people.

98. The bharal which lives on grassy slopes between the heights of 3,048 meters and 4,572 meters. The Himalayan marmot of the seiuriod family is one of the mammals that lives at the highest altitudes usually favoring an elevation between 3,963 meters and 5,487 meters and is valued for its fur. Among the deer tribe the Sambar or jarao, kakar (barking deer) and kastura (musk deer) are the only members of the cervidae family which are represented in the district.

99. **Birds:** The district is particularly rich in avifauna and the birds found here are mostly of the same kind as those occurring throughout the Himalayan region. Birds of prey such as eagles, falcons, hawks and vultures are very common. Among the game birds, the most common are the ban titar, kala titar and chakor, the last named found right up to the snowline. The junguria or karmonal (snow partridge), which is found above the tree line and below the snowline on steep and rocky ground breeds throughout the altitudes it inhabits between 3,048 meters to 4,572 meters above sea level. The horned pheasant, which is really more a partridge than a pheasant, is represented by the lungi or lunji and the jawar. Both the species which breed in May and June at elevations between 2,439 meters and 3,353 meters, have magnificent males with beautiful plumage. Others important birds of this family are the chir or chir pheasant, pukras, pokras or koklas locally called kaleej or murga. The last, occurring up to an altitude of about 2,439 meters is the commonest of all.

100. Among the protected non-game birds, the chief are the common king-fisher, white breasted king-fisher, pied king-fisher, blue-jay or Indian roller, black-headed oriole, small cuckoo, Indian cuckoo and european cuckoo. The Indian scarlet minivet which is an unprotected non-game bird belonging to the pericrocotidae family. A rare member of the phononodidae family, seen near Amsor in tehsil Karnprayag in Feb. 1966 was perhaps a white bulbul, the most attractive mong the bulbul species, and, perhaps a migratory bird. Others birds which are commonly found in the district are common swallow, pied wagtail, ashy wren-warbler, Indian wren-warbler, alpine swift, house swift, parakeet, rock-pigeon and himalayan woodpecker.

101. **Reptiles:** Snakes are somewhat rare in the district but the cobra and the Russel's viper or necklace snake are common and they may be found up to a height of 1,829 meters the latter being viviparous and nocturnal in its habits. The only hill snake found above 2,439 meters is Ancistrodon Himalayans which attains a length of about 62 cm. and is venomous though its bite is not fatal. Among the non-venomous snakes the charao (rock snake) which may grow to a length to about 9 meters, although specimens over 6 meters, in length are rare, is occasionally seen on the rocky slopes of the lower hills. The python, a protected species, has been found as far up as the slopes below the Tungnath range in Ukhimath. The rat-snake, which attains a length of about 3 meters, is common. Non-poisonous snakes also sometimes occur in the tanks near the temple of Trijugi Narain and to be touched by them is considered auspicious by the Hindu pilgrims who bath in these tanks. About ten species of lizards inhabit this region and can been seen basking in the sun on rock. Of these the blood-sucker is harmless in spite of its name. The bull-frog and common toad, both amphibians, are met with throughout the district.

102. Large and varied groups of insects are found in the district and some, such as snow-fly, thrive in the glaciers. The leech, which is particularly active during the rains, is of common occurrence in the oak forests. In May and June swarms of flies are to be seen all along the route up to Gulabkoti, the mora, a small stinging fly, is also found in the district and causes small painful sores.

103. **Fish:** Fish abound in almost all streams of the district and riparian villages find in it an

important supplement to their ordinary food. The common species found here are asela or saul, mahasher, kalabans or karaunch and fucta or phar kata. Other species found in the district include Gadara, gadiyal or guluwa, tarra, symplu and nama, nawoo or japa.

3.2.2 National Parks and Sanctuary

3.2.2.1 Jim Corbett National Park

104. Jim Corbett National park is situated in the Nainital district of Uttarakhand. The present area of the Corbett National park is 1318.54 sq.km. including 520 sq.km. of core area of and 797.72 sq. km. of buffer area. The core area of the Corbett reserve forms the Corbett National Park while the buffer contains reserve forests (496.54 sq.km.). Jim Corbett National park is one of the renowned Wildlife Sanctuary in India. The park contains 488 different species of plants and wide variety of wild life and about 600 species of birds. Corbett National Park is one of the best managed and protected areas in the country and attracts thousands of Indian and foreign visitors each year. Corbett National park is in the foothills of Himalayan belt and has various geographical and ecological characteristics with splendid landscapes.

Zones in Corbett National Park

105. **Jhirna**: A densely wooded and grassland habitat, it makes for excellent bird viewing. The Great Hornbill is found in abundance here. Jhirna is home to a population of wild animals. A large grove of 'Flame of the forest' adds drama to Jhirna. A strong prey base of nilgai, cheetal, sambhar and the wild boar also makes it an attractive area for the big cats, while a resident wild elephant and sloth bear population offer great sighting opportunities.

106. **Bijrani**: These forests range from those of pure sal on the upper reaches, to deciduous mixed forests in the valley, along with three major grasslands. It sustains a variety of herbivores, and has a wide network of jungle roads. On Corbett's eastern boundary, Bijrani's forests are dense with a wide variety of vegetation: of pure Sal forests on the upper reaches and tropical moist, deciduous mixed forests in the valley and plains. Excellent water availability throughout the year and wide grasslands make it an exceptional habitat for a strong prey base and its predator.

107. **Dhikala**: This is the largest and most varied zone in Corbett, offering the best opportunities for overnight stays. Dhikala contains a diverse range of habitats: its higher reaches suit Ghoral, a goat antelope, while the Gharial and Maggars, as well as the great Mahaseer, and inhabit the rivers below. The hog deer is also exclusive to Dhikala. This block of forest has the Ramganga river stretch through its middle, emptying into a wide, multiple-necked reservoir.

108. **Phato**: This zone provides buffer forest to southern Corbett, comprising mostly of plantation forests.

3.2.2.2 Rajaji National Park

109. Rajaji National Park is an Indian national park that encompasses the Shivaliks, near the foothills of the Himalayas. It is spread over 820 km² and three districts of Uttarakhand: Haridwar, Dehradun and Pauri Garhwal. In 1983, three wildlife sanctuaries in the area namely, Chilla, Motichur and Rajaji sanctuaries were merged into one.

110. **Flora**. Rajaji National Park contains tropical and subtropical moist broadleaf forests, in particular those of the Upper Gangetic Plains moist deciduous forests ecoregion. The forest ecosystems of the Park are quite varied and diverse. Plants such as shorea, mallotus, adina, terminalia, bridelia, dalbergia, acacia, syzygium and Phoebe are found in the Park and studies have revealed some important associations between them.

111. **Fauna**. Rajaji National Park is predominantly formed from dense green jungles, and this environment forms a habitat for a number of animals. The park is at the north-western limit of distribution for both elephants and tigers in India, and has the largest population of elephants in Uttarakhand. 315 species of birds are found in the Park. The most prominent avian species include

pea fowl, woodpeckers, pheasants, king-fishers and barbets, supplemented by a number of migratory species during the winter months. The park is also home to the great pied hornbill, himalayan pied kingfisher and the fire tailed sunbird. This area is the first staging ground after the migratory birds cross over the Himalayas into the Indian subcontinent. The rivers which flow through the Park harbour species of fish such as trout and mahseer.

3.3 Human and Economic Development

112. This section discusses the baseline scenario of the socio-economic environment in the study area. The issues discussed are population, education, employment, community services and transportation. For assessing the baseline socio-economic data, information from secondary data sources i.e. the 2001 census data has been considered.

3.3.1 Population

113. The total population of the state is 8.48 million (Census 2001) of which over 5 million people live in the mountainous parts of the state. Below Poverty Line (BPL) population in hills is 44% and in the plains is 19%, thus, making the State average BPL population 36.5%. This means, as much as 36.5% of the population of the state lives under poverty line. Three hill districts, i.e., Chamoli, Tehri Garhwal and Uttarkashi have more than 45% of their population below poverty line while the other districts have around 30-40% of population below the poverty line. Another important aspect of poverty distribution is that poverty is more pronounced amongst some disadvantaged groups as scheduled castes and scheduled tribes, where 44% of families are below poverty line. Inequalities are also evident in other parameters of poverty, such as literacy and nutrition levels. For example, literacy rate is 84.01% for males and 60.26% for females. In case of urban areas male literacy is 87.21% against a female literacy rate of 74.78%. It is comparatively lower in the case of rural areas with figures of 82.74% and 55.52% for male and female respectively. Literacy rates in case of Scheduled Castes people are even further low with 46% and 20% for males and females respectively. The district wise population detail as per Census 2001 is given below in Table 7.

Table-7: District wise population detail (*in '000)*

S.No	District	Male	Female	Total	SC			ST		
					Male	Female	Total	Male	Female	Total
1	Hardwar	773.173	671.040	1444.213	131.652	111.006	242.658	1.128	0.898	2.026
2	Almora	293.576	336.870	630.446	63.269	65.033	128.302	0.530	0.386	0.916
3	Bageshwar	118.202	131.251	249.453	28.038	27.896	55.934	0.875	0.948	1.823
4	Nainital	400.336	362.576	762.912	60.704	53.972	114.676	1.739	1.653	3.392
5	US Nagar	649.020	585.528	1234.548	65.559	55.747	121.306	44.407	41.920	86.327
6	Pithoragarh	227.592	534.557	462.149	46.613	44.845	91.458	9.081	9.071	18.152
7	Champawat	110.916	11.545	224.461	16.393	14.715	31.108	0.254	0.193	0.447
8	Dehradun	675.549	603.534	1279.083	74.251	63.213	137.464	44.510	39.566	84.076
9	Uttarkashi	151.599	142.580	294.179	28.082	26.512	54.594	1.205	1.095	2.300
10	Pauri	331.138	365.713	696.851	45.046	45.636	90.682	0.859	0.641	1.500
11	Rudra prayag	107.425	120.036	227.461	4.868	4.821	9.689	0.006	0.001	0.007
12	Chamoli	183.033	186.165	369.198	29.297	28.258	57.555	4.873	5.212	10.085
13	Tehri	294.842	309.766	604.608	36.710	35.964	72.674	0.260	0.348	0.608
	Total	4316.401	4163.161	8479.562	630.482	577.618	1208.100	109.727	101.932	211.659
(Source: Census 2001)										

114. The district-wise population and forest details are given in Table 8 and Table 9.

Table 8: District wise Geographical Area, Population, Forest Area, Per Capita Forest Area, Forest Area as Percentage of Geographical

S.	Name of District	Geographical	Population (2001)	Forest Area (Sq. km.)							
				Under Forest	Under Revenue	Panchayat Forest under Van Panchayats	Under Private	Total Forest	Per capital	Forest area	Total Fores

						Area Completely recorded as Van Panchayat	Area under control of Van Panchayat but recorded in Reserved forest of Forest deptt.	Total					
1	Pauri	5,329	6,97,078	2,327.069	983.675	528.140	0.000	528.140	12.103	3,850.987	0.005524	43.67	**72.26**
2	Nainital	4,251	7,62,909	2,575.452	111.892	280.678	0.000	280.678	15.338	2,983.360	0.003911	60.58	**70.18**
3	U.S. Nagar	2,542	12,35,614	937.370	0.000	0.000	0.000	0.000	0.000	937.370	0.000759	36.88	**36.88**

(Uttarakhand Forest Statistics 2006-07)

Table 9: Analysis of Forest Based on the Satellite Imageries done by Forest Survey of India

S. No.	Name of District	Geographical Area (Sq. km.)	Very Dense Forests	Moderate Dense Forests	Open Forests	Total	Forest cover as percentage of Geographical Area	Recorded Forest Area as percentage of Geographical Area
1	Pauri Garhwal	5,329	450	2,065	756	3,271	61.38	72.26
2	Nainital	4,251	548	1,944	602	3,094	72.78	70.18
3	U.S. Nagar	2,542	144	256	177	577	22.7	36.88

(Uttarakhand Forest Statistics 2006-07)

3.4 Economic Scenario

115. Both Rabi as well as Kharif crops is harvested. The main Kharif crops are paddy, small millets and potato and Chief Rabi crops are wheat and barley. In the project area which falls under Pauri district, 88% of the land is either covered by forests or is barren and uncultivable. The land is low in fertility except in the valleys. Shorter agricultural season, low temperature, high altitude, smallness of land holding, perpetual problem of soil erosion due to steep gradients etc. are other inhibiting factors effecting agriculture. The cultivation in the Pauri district is carried on largely by making terraces on the sloping hillsides. Sheep rearing for production of wool and meat, orchard raising, spinning and weaving of wool and other cottage industries etc. are source of income but it does not have much potential. Horticulture is another source of income which has enough potential. In the summer's season, tourism is one of the sources of income.

116. Udham Singh Nagar is an agriculture prime area with at least 70% of the population relying on farming and related business for livelihood. Rudrapur is also famous for its premium quality rice.

3.4.1 Industries

117. Many new industries are setting up businesses at SIDCUL Industrial Estate established at Pantnagar and Sitarganj in the vicinity of Rudrapur. Industries such as Dabur, Bajaj Auto, Britannia, Nestle, Ashok Leyland, Zhandu Pharma, Tata Motors setting up base here, Rudrapur is set to become an industrial hub. There are approximately 41,216 small scale industries in state Uttarakhand and approximately 191 large scale industries. Industries are providing employment to the many people of state Uttarakhand about more than 50,802 people. Major industries of state Uttarakhand area include tourism, cement, pharmaceuticals, textile, food processing, and electrical engineering.

3.4.2 Employment

118. More than 37% of the people of Uttarakhand are defined as workers in relation to the rest of the population. There is a percentile increase in the proportion of marginal workers from six to 10% from 1991 to 2001 (and decline in the proportion of main workers). There is another aspect too; the highly qualified people of Uttarakhand leave the State for better employment/business opportunities. "This is adversely affecting the State in launching any ambitious scheme due to the paucity and unavailability of indigenous human resources." But now due to development of basis Infrastructure and Industrial Policies of GoU, the situation is reversing and rate of employment has increase. Moreover, 70% employment in the state industries has been reserved for the people of Uttarakhand. Table 10 and 11 gives the details.

Table 10: Total workers

District	Total Workers	Main Workers	Marginal Workers	Non-Workers
Pauri	269,871	171,647	98,224	427,207
Nainital	278,947	220,995	57,952	483,962
Udham Singh Nagar	392,156	300,141	92,015	843,458

Source: Census of India 2001

Table 11: Community services

District	Medical Facility	Primary Health Centers	Primary Health Sub-Centers
Pauri	392	19	18
Nainital	215	20	26
Udham Singh Nagar	186	18	28

Source: Census of India 2001

3.4.3 Infrastructure

3.4.3.1 Rural Roads and Communication System

119. The state is well linked by state highways, national highway and district roads. The state has broad gauge railway lines but only in the plain areas. Airports at Dehradun (Jollygrant) and Pantnagar are civil airports in the state.

120. **Transportation**. Pauri is about 109 km. from Rishikesh, NH-58 up to Devprayag and State Highway from Devprayag up to Pauri. There is an airport at Jollygrant which is 17 km. from Rishikesh. Nainital is connected to NH-87 by road. Its distance is 310 km from Delhi and 300 km. from Dehradun. Pantnagar, 70 kms from Nainital is the nearest airport. The head quarter of Udham Singh Nagar is Rudrapur and its distance is 78 km. from Nainital and 55 km. from Kashipur. The road network in the study area can be described as moderate. The road is in moderate condition as there are heavy rains in the project area. The villages in the study area are connected by branch roads and semi pucca roads. The road in hilly interiors is in bad condition and for some proposed tower erection sites do not have proper access roads.

3.4.4 Education

121. Pauri has an average literacy rate of 77.49%, higher than the national in average of 59.5%: male literacy is 90.91%, and female literacy is 65.70%. It is predominantly inhabited by the Bhotiya Jadh people. Nainital has an average literacy rate of 78.36%, higher than the national average of 59.5%: male literacy is 86.32%, and female literacy is 69.55%. Udham Singh Nagar has an average literacy rate of 64.86%, higher than the national average of 59.5%: male literacy is 75.22%, and female literacy is 53.35%. Table 12 gives the details.

Table 12: Educational Institutions

District	Primary Schools	Middle Schools	Secondary/Senior Secondary Schools	Degree Colleges	ITI/Polytechnic
Pauri	1,549	483	190	12	
Nainital	645	278	91	07	
Udham Singh Nagar	485	183	73	06	
Chamoli	979	223	126	7	6

Source: Census of India 2001

3.4.5 Health Environment

122. The project site is situated in hilly region in very good climatic condition; there is no air, noise, water, and industrial pollution. Health environment is very good as both men and women are hardworking by nature and fruits and herbs available locally are the part of their eating habits.

Table 13: Health Facilities in Chamoli

Name of	Health Centers

Dist.	Allopathic	Ayurvedic	Homeopathic	Primary Health Center	Family & Child welfare Sub center	T.B. Hospital
Chamoli	29	51	5	12	91	1

3.4.6 Land Use

123. The land use pattern of crops in Uttarakhand reflects a declining trend in the acreage of conventional crops like barley and at the same time increase in non-conventional crops like soyabean and other vegetable crops. Farmers are gradually shifting from low value crops to high value crops. The decline in the area under traditional crop has been relatively higher in the Kharif[7] season as compared to Rabi[8] season. During the Kharif season the farmers are putting a sizable land area under the production of offseason vegetables. The land under production of traditional Kharif crop has declined at 10 percent as against 8 percent for Rabi crop. Despite the small holdings most of the farmers who are relatively well connected to the market and have adequate irrigation facility have opted for a shift in production from low value food grains to high value commercial crops particularly vegetable and pulses.

124. The distinct geographical features of Uttarakhand with dominantly mountainous part, coupled with Bhabar and Terai regions makes it a unique region where it is possible to grow varieties of fruits, flowers and other horticultural crops. With altitude gradient varying from 250 meters above sea level to 7,187 meters above sea level, combination of geographical features determines the climatic condition favourable for many fruit crops, consequently, nearly all types of fruits ranging from tropical to temperate fruits can be grown easily.

125. Land will not be acquired for transmission line. The RoW will be utilised to erect the towers and only crop compensation will be paid to farmers. The EPC contractor shall prepare a forest diversion case for the line and PTCUL shall pay the forest department for compensatory afforestation and the net present value. The substation is already allotted to PTCUL by GoU. Total land affected for Tranche 4 project components is given in Table 14 below:

Table 14: Total land area affected by Tranche 4 project components

S No	Project	Total Land Area	Private Land	Forest	Civil/Soyam
1	400 kV Srinanagar-Kashipur transmission line	490.2 Ha	95.2 Ha*	170 ha**	225* Ha
2	400/220 kV GIS Pipalkoti substation	1.6 Ha***			1.6 Ha

Source: PTCUL 2012
* Only crop compensation paid to farmers etc.
** Forest Clearance case will be prepared by the Contractor and compensation paid to Uttarakhand forest department
*** Land allotted by GOU

3.5 Social and Cultural Development

3.5.1 Agriculture

126. Uttarakhand is a predominantly agricultural state with 75% of the people deployed in this sector. Uttarakhand has a tremendous potential and advantage in the herbal area and has been declared as a herbal state. Nearly all Ayurvedic and Homoeopathic medicines depend on Uttarkhand's plant sources and its biodiversity. Uttarakhand declares its Health & Population Policy in December 2002 to integrate the services of different medicinal systems such as Ayurveda, Homoeopathy and Unani. The National Rural Health Mission (2005-12) seeks to revitalize local health traditions and mainstream AYUSH into the public health system.

[7] Kharif crop refers to the planting, cultivation and harvesting of any domesticated plant sown in the rainy (monsoon) season on the Asian subcontinent. Such crops are planted for autumn harvest and may also be called the summer or monsoon crop in India. Kharif crops are usually sown with the beginning of the first rains in July, during the south-west monsoon season. In India the kharif season varies by crop and state, with kharif starting at the earliest in May and ending at the latest in January, but is popularly considered to start in June and to end in October. Examples include Millet, Paddy, etc.

[8] Rabi crops or Rabi harvest refers to agricultural crops sown in autumn and harvested in the winter season. The exact timing of the Rabi crop varies with the latitude and is influenced by the withdrawal of the monsoon, therefore it can be anywhere from September to April. Depending on the region, certain crops such as wheat, barley, peas, gram and mustard are better suited for growth during this season.

89. Udham Singh Nagar is an agriculture prime area with at least 70% of the population relying on farming and related business for livelihood. Rudrapur is also famous for its premium quality rice.

3.5.2 Horticulture

127. The cultivation in the Pauri district is carried on largely by making terraces on the sloping hillsides. Sheep rearing for production of wool and meat, orchard raising, spinning and weaving of wool and other cottage industries etc. are source of income but it does not have much potential. Horticulture is another source of income which has enough potential. In the summer season, tourism is one of the sources of income.

3.5.3 Animal Husbandry

128. The state supports about 4.75 million livestock population out of which about 21.3 lakh are cattle, 11.00 lakh are buffaloes, 3.60 lakh are sheep and 10.97 lakh are goats.

3.5.4 Tourism

129. Tourism is one of main source of income at Uttarakhand. The northern areas of Uttarakhand are part of the Great Himalayas range, with average heights up to 3,000-5,000 meters. The famous peaks are Nanda Devi (7,816 m), Trishul (7,120 m) and Panchchuli (6,910 m). Southern Uttarakhand has plains that are part of the Terai foothills, where temperatures are higher and towns more accessible. The state is not industrially developed and tourism is the mainstay of the economy. For the last 7 years, Dehradun, the largest town, has been its provisional capital. It has a well-connected railhead and a domestic airport.

130. To most travellers, Uttarakhand is associated with its ancient traditions of Hinduism that flourished in its high Himalayan reaches. The source of India's most revered and important rivers - Ganga as well as Yamuna respectively called Gangotri and Yamunotri, lies here. These two spots, along with the shrines of Badrinath and Kedarnath, make the four holy sites (Char Dham) that Hindus aspire to visit. Snow-bound for most of the year, these are open from May to October. Lower south, along the Ganges lay the sacred towns of Rishikesh (43 km from Dehradun) and Hardwar (connected by rail to Delhi).

131. Uttarakhand's popular hill stations include Mussourie (2,000 m; 35 km from Dehradun) and Nainital (2,000 m; 35 km from railhead Kathgodam). Corbett National Park is its noted wildlife sanctuary. The combination of mountains and rivers yields opportunities for trekking, river rafting, hiking, which the state is promoting now. Rishikesh is a hub of water adventure sports. There is also a skiing destination in Auli. Some of the important places of tourist interest in Udham Singh Nagar (Rudrapur) are Nanak Matta Dam and Dronasagar.

132. The most prominent of the lakes is Naini Lake ringed by hills. Nainital has a varied topography. Some of the important places in the district are Nainital, Haldwani, Kaladhungi, Ramnagar, Bhowali, Ramgarh, Mukteshwar, Bhimtal, Sattal and Naukuchiatal. Some of the important places of tourist interest in Udham Singh Nagar (Rudrapur) are Nanak Matta Dam and Dronasagar. Table 15 and 16 gives the tourism infrastructure and the statistics.

Table 15: Tourism Infrastructure

S. No.	Items	Year/ Period	Number
1.	Important Tourist Places	2006-2007	214
2.	Developed Tourist Places	2006-2007	124
3.	Tourist Rest Houses	2006-2007	174
4.	No. of Beds in Tourist Rest Houses	2006-2007	6,764
5.	Rain Baseras	2006-2007	32
6.	No. of Beds in Raien Basera	2006-2007	1,610
7.	No. of Hotels and Paying Guest Houses	2006-2007	2,312
8.	No. of Dharamshala	2006-2007	802

Table 16:Tourist Statistics

S. No.	Items	Year/ Period	Number
1.	In Tourist Places (including Pilgrims)	2007	2,26,00,000
	(i) Indian Tourist	2007	2,21,00,000
	(ii) Foreign Tourist	2007	1,06,000
2.	In Important National Parks	2007	1,99,043
	(i) Indian Tourist	2007	18,3481
	(ii) Foreign Tourist	2007	15,562

133. **Historical, Cultural, and Archaeology Sites/Places**: There are no archaeological, historical importance sites or protected monuments in the study area along the alignment.

4.0 SCREENING OF POTENTIAL ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

4.1 PTCUL Approach for Route Selection

134. Preliminary route selection for transmission line has been done by PTCUL based on walk over surveys, usage of tools such as the forest atlas, revenue papers and 1:50,000 Topographical maps of the area from Survey of India. It shall use modern tools like Geographical Information System (GIS)/Global Positioning System (GPS) for a precision in route alignment with the larger picture in view while finalizing the route. During route alignment, all possible efforts shall be made to avoid forest area or to keep it to the barest minimum. Whenever it becomes unavoidable due to the geography of the terrain or heavy cost involved in avoiding it, different alternative options shall be considered to minimize the requirement of forest area. The selected route should be easily accessible both in dry, rainy and winter (snow) seasons for maintenance purposes.

4.1.1 Methodology for Selection of Route

135. Route selection among alternatives considers environmental parameters, availability of logistics support during construction, operation, and maintenance of transmission lines and specific geographical condition to construct the lines along most feasible routes that were identified based on the relevant topographic maps and walkover surveys.

136. For selection of the optimum route, the following points are taken into consideration by PTCUL:

i. The transmission line avoids environmentally sensitive areas, eco sensitive zones, forests, sanctuaries national parks, biosphere reserves;
ii. The transmission line route impacts minimally on natural resources. To accomplish this, route selection of transmission line is undertaken in close consultation with representation of the State Forest, Environment and Revenue Departments. Site specific alterations are made to avoid environmentally sensitive areas and settlements at execution stage;
iii. The proposed transmission line bypasses human habitation by a safe distance;
iv. No monuments of cultural, archeological or historical significance are affected;
v. The proposed transmission line does not adversely impact any local community assets such as playground, hospitals, schools, places of worship etc.
vi. The proposed route of transmission line does not create any threat to the survival of any community with special reference to tribal community.
vii. Avoidance of mining protected and reserved forest, archaeological and other sensitive areas unstable ground feature, marshy low lying areas, river beds and earth slip zones.
viii. Minimizing number of crossing of major rivers/railway lines, national and state highways, overhead EHV power line, number of towers and communication lines.
ix. Routing is kept away from large habitations, densely populated areas, animal/bird sanctuaries, and utility pipelines to the extent possible and avoid areas reserved for planned and future development.
x. Restricted areas such as civil and military installations and air fields have been avoided.
xi. To minimize adverse impacts on natural habitats, human habitations efforts will be made to locate majority of towers on barren, waste or fallow agricultural lands.

137. In addition, PTCUL shall follow the principle of avoidance by avoiding the forestland unless it is inescapable and in such instances it shall obtain prior clearance from competent authorities. It shall abide by the relevant guidelines, including the directions of the Supreme Court from time to time.

4.1.2 Analysis of Alternatives

4.1.2.1 Component A: 400/220 kV GIS Pipalkoti Sub-station

138. For selection of appropriate site for substation, the following points are taken into consideration:

i) Site selection should consider seismicity and geography of the local area; the area should not be prone to landslide or be unstable.
ii) The substation site should be located away from area of natural resources.
iii) Construction activities do not adversely affect the population living near the proposed substations and does not create any threat to the survival of any community with special reference to tribal community etc.
iv) The location of sub-station does not affect any monument of cultural or historical importance.
v) No resettlement of households by the substation site, no loss of livelihoods, siting of transformers away from schools, hospitals and other sensitive receptors, with due consultation with the community and local government units concerned.
vi) Transformers and other equipment specifications compliant with GoI rules/regulations & International Electro-technical Commission (IEC) standards shall be followed.
vii) Construction techniques and machinery selection shall be made with a view to minimize ground disturbance.
viii) While planning for substations, drainage lines shall also be marked and studied so as to avoid seepage and leakage and pollution of water sources and springs etc.
ix) Sub-station location/design to ensure that noise will not be a nuisance to neighbouring properties. Provision of noise barriers near substation sites will be made.
x) Sub-station design will comply with the limits of electromagnetic interference within floor area. Security fences will be erected around substations. Warning signs shall be displayed.
xi) PTCUL shall adopt good practices and shall always strive for a high standard of house-keeping for its substations and ancillary facilities.
xii) PTCUL shall incorporate the best technical practices to deal with environmental issues in its working.
xiii) Design of substations shall be made so as to include modern fire control systems/firewalls. Provision of fire fighting equipment would be made to be located close to transformers, switchgears etc.

139. Keeping the above in mind, various alignments of the Loop-In – Loop Out (LILO) lines to the substations were considered and three alternatives of substation site for Pipalkoti site were considered. As such these three alternatives (as shown in Table 17) were studied by the PTCUL officials before being proposed to ADB for funding to arrive at most optimum site. For this site, PTCUL has already conducted a site survey and the detailed survey will be undertaken by the EPC contractor.

Table 17: Evaluation from alternate land locational analysis of 400/220 kV GIS substation Pipalkoti

SNo	Study Point	Alternative-I	Alternative-II	Alternative-III
1	Location	Kuwaripass	Joshimath	Pipalkoti
2	Village Name	Chumargaur	Joshimath	Naurakh
3	Size of Land	2.81 Hectare	2.62 Hectare	3.095 Hectare
4	Type of Land	Private/Govt.	Private	Govt.
5	General Geography of Area	Hilly	Hilly	Hilly
6	Agriculture/Cropping Pattern	One crop per year	One crop per year	Govt. land
i)	Main Types of Crops	Rice	Rice	-
ii)	Irrigation Facility	By Canal	By Canal	-
7	Socio-economic condition area:			
i)	Profession of existing population Agricultural (self-employment, Merchants, Manufacturer, Transporters & Handicrafts etc.	Agriculture & Labourers	Agriculture & Labourers	Agriculture & Labourers
ii)	Wages Earner (skilled/Unskilled labour)	Unskilled labour	Unskilled labour	Unskilled labour
iii)	Others if any	-	-	-
iv)	Natural resources base	Service/Agriculture	Service/Agriculture	Service/Agriculture
v)	Political influence	Moderate	Moderate	Moderate
8	No./Name of village effected			
i)	Party	NIL	NIL	NIL
ii)	Fully	NIL	NIL	NIL
9	Total Nos. of families likely to be effected	100 nos.	25 nos.	None
10	No. of families whose part holding	1 no.	-	-

SNo	Study Point	Alternative-I	Alternative-II	Alternative-III
	likely to be acquired			
11	No. of families whose total holding likely to be acquired			
a)	Land + Home	-	-	-
b)	Land only	100 nos.	25 nos.	None
c)	Home only			
12	Cast of PAPs/PAFs			
a)	GC	100 nos.	25 nos.	-
b)	OBC	-	-	-
c)	SC/ST	-	-	-
13	General Pattern of Cultivation i.e. by owner on lease (Registered/Un-registered)	By owner	By owner	Govt. land leased to PTCUL
14	Loss of structure House/shop along with the status of occupants (Owner/Tenant/Lease Holder/quarter)	NIL	NIL	NIL
15	Others	-	-	-
a)	Common property resources like school, Ponds Grazing Ground, Religious Places	-	-	-
b)	Drainage facility	Yes	Yes	Yes
16	Tree/Plantation/Orchards (Approx.)	-	-	-
17	Cost of land/lease cost	INR 200 million	INR 15 million	Transfer for Government of Uttarakhand
18	**Reasons for selection**	**-**	**-**	**Best suitable being least loss to general public**

140. **Land Selection Committee Recommendation:** Committee visited locations and considered various parameters for finalizing their recommendations that "Alternative III as best suitable land due to following reasons**"**

1- No tree cutting is involved.
2- Land is almost flat, but situated in hilly area.
3- Land is adjacent to the highway road hence construction of approach road required is minimum. Enough corridors are available for incoming and outgoing lines.
4- Common property resources like school, ponds grazing, grounds and religious place etc. have been avoided at the selected site.
5- All amenities like hospitals, post, telegraph, schools for children education etc. are available since Chamoli (Gopeshwar) is located near to this site.

141. Considering the reasons listed above, the proposed Site C was deemed as the best suitable option. It involves no population at the site and no cultivated area. However on April 2012, the local activists have moved a Public Interest Litigation (PIL) against the use of land for Alternative III. PTCUL has started the legal process for annulment of PIL.

4.1.2.2 Component B: 400 kV DC Srinagar – Kashipur Transmission Line

142. In order to achieve this, PTCUL has undertaken route selection for transmission line in close consultation with representatives from Land Acquisition Department, Departments of Forest, Department of Wildlife Conservation and the local community. Although under the national law, PTCUL has the right of way, yet it considers alternative alignments during site selection, with minor alterations to avoid environmentally sensitive areas and settlements at the implementation stage. PTCUL observes the following guidelines:

i. Minimum of three alternative routes were studied in detail using a set of techno-economical, environmental, ecological and social impact parameters to arrive at the most optimal alignment that is technically feasible, economically viable, socially just and environmentally safe.
ii. Right of Way (RoW) width depends on the line voltage. A maximum width of RoW for transmission lines on forestland and minimum clearances between conductors and trees to be adhered in route selection.
iii. Tower sites shall be located on mountain ridges so as to save trees in the RoW below the conductors on the valley side between two successive towers as found preferably technically feasible and permitted by the safety parameters.

iv. All efforts to minimize the involvement of trees falling in RoW shall be made. PTCUL shall minimize number of trees required to be felled even if their cost has been paid. Pruning of trees will be done wherever required instead of heavy lopping or felling.
v. To minimize damage to the environment, PTCUL shall use manual stringing in thick forest and on slopes wherever possible.
vi. Transmission line design shall comply with the limits of electromagnetic interference from overhead power lines.
vii. Visible pathways along the transmission line alignment shall be maintained for patrolling and maintenance purposes.

143. Keeping the above in mind, three alignments for the line were considered. As such these three alternatives (as shown in Figure 10 and description of alternatives in Table 18) were studied by the PTCUL officials before being proposed to ADB for funding to arrive at most optimum route which can be taken up for detailed survey and assessment of environmental and social impacts.

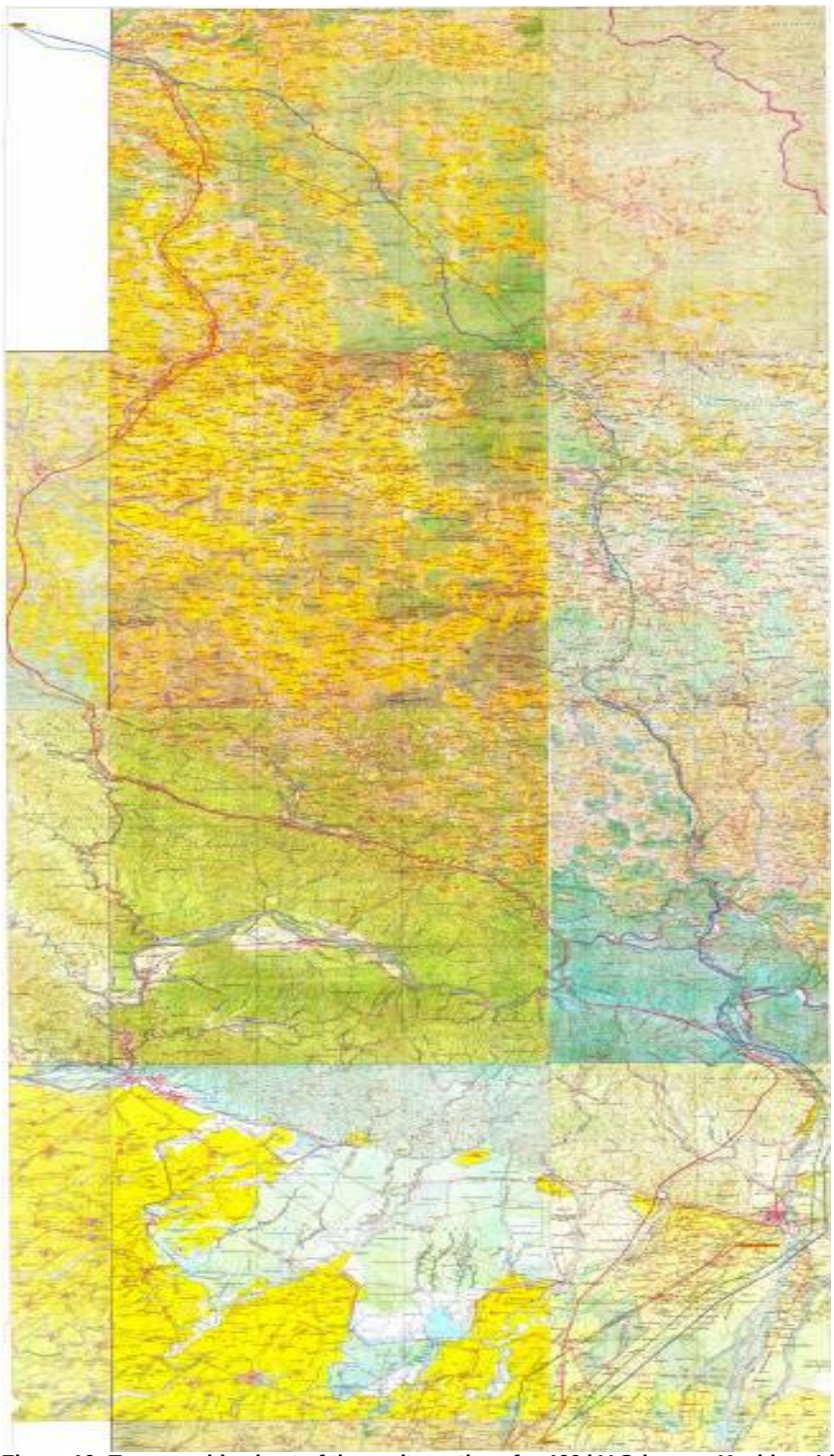


Figure 10: Topographic sheet of three alternatives for 400 kV Srinagar- Kashipur Line

Table 18: Evaluation of route alignment alternatives of 400 kV DC Srinagar sub-station to 400 kV Kashipur sub-station.

S No.	Description	Alignment-I	Alignment-II	Alignment-III
1	Route Particulars			
i)	Length	152.8 Kms	157 Kms	140.8 Kms
ii)	Terrain	100% Hilly	100% Hilly	100% Hilly
A	Hilly/ Plain In (Kms) %	60% / 40%	65% / 35%	70% / 30%
b)	Agriculture	20%	20%	15%
c)	Wet/ Marshy	_	_	_
d)	Estuarine	_	_	_
e)	Other type of land	_	_	_
2	Environmental Details			
i)	Name of District / District details (through which transmission line Pass)	Pauri - Nainital - U.S. Nagar	Pauri - Nainital - U.S. Nagar	Pauri - Nainital - U.S. Nagar
ii)	Population of district	697078 / 762909 / 1235614	697078 / 762909 / 1235614	697078 / 762909 / 1235614
a)	Details of poverty line (in INR)	INR 2800 / INR 2800 / INR 3700	INR 2800 / INR 2800 / INR 3700	INR 2800 / INR 2800 / INR 3700
b)	No. of People / Percentage of people below poverty line	37% / 35% / 32%	37% / 35% / 32%	37% / 35% / 32%
iii)	Town in Alignment (nearby)	Srikot, Baingwari, Kalon, Birgam, Manchula, Pratappur	Chodattakhal, Chamgaon, Birgam, Bironkahal, Dongri, Bhawanipur, Birpur	Uniyalgaon, Nauryagaon, Godiyalgaon, Chandriyon, Bhogpur, Pratappur
iv)	House with in RoW	Nil	Nil	Nil
v)	Forest in km. / Ha	62.48 Kms / 218.66 Ha	65 Kms / 227.5 Ha	68.6 Kms / 240.1 Ha
a)	Type of forest: Reserve / Protected / Mangrove / Wild life area / any other environment sensitive area	Reserve Soyam Private	Reserve Soyam Private	Reserve Soyam Private
b)	% of Forest	72.26&70.18&36.88	72.26&70.18&36.88	72.26&70.18&36.88
c)	Type of Fauna & Flora	Jungle fox, Cat, Bhutia Dog, Leopard, Jakol, Sambhar etc. Trees, Chir, Sal, Teak, Uttis etc.	Jungle fox, Cat, Bhutia Dog, Leopard, Jakol, Sambhar etc. Trees, Chir, Sal, Teak, Uttis etc.	Jungle fox, Cat, Bhutia Dog, Leopard, Jakol, Sambhar etc. Trees, Chir, Sal, Teak, Uttis etc.
d)	Endangered species if any	Nil	Nil	Nil
e)	Historical / Cultural monument	Nil	Nil	Nil
f)	Any other relevant information	Nil	Nil	Nil
3	Consumption cost			
i)	Crop	Extend of damage can be evaluated during detailed survey / construction.		
ii)	Forest (Approx. no. of trees)	17,000	17,500	17,750
4	No. of Crossing			
i)	Railway	No	No	1
ii)	Trans. Line	No	No	1
iii)	River Xing etc.	4	2	1
5	Construction Problem	Forest Clearance, no other specific problem	Forest Clearance, no other specific problem	Forest Clearance, no other specific problem
6	O&M Problem	Minimum	Moderate	Moderate
7	Overall Remarks	Best Suitable	-	-

144. Reasons for selection of final Route. Considering the various reasons based on information in the table Alignment – I is considered best suitable. Forests areas and thick vegetation areas are avoided wherever possible; however, route alignment passes through approximately 50 km reserve forests, 75 km civil and soyam forests, and 28 km long stretch of agricultural fields. It involves lesser forest (avoiding Corbett National Park) and minimum RoW problems, hence, selected for detailed survey as final route.

4.1.3 Reserve Forest/Protected Areas/National Park/Sanctuary

145. The transmission line passes through five reserve forests and buffer zone of the Corbett National Park which is about 1 km away from ecologically sensitive area.

4.2 Environment Impacts and Mitigation Measures

4.2.1 Environment Problems Associated with Project Location and Design

146. Potential adverse environment impacts associated with transmission lines have been avoided or minimised through careful route selection. The alignment is sited away from major

settlements, whenever possible, to account for future urban expansion. Forests areas and vegetation areas are avoided wherever possible; however the route alignment passes through shrub lands, cultivated and abandoned fields. Alignment in this project has avoided geologically unstable areas, which can also pose foundation related problems. Land acquisition is not required for placing transmission towers on private land. However, any damage to the crops during the construction phase of the project will be duly compensated. Associated impacts on agricultural land will be restricted to the construction phase and will be temporary in nature. After construction, agricultural land within the transmission corridors can be used again for farming purpose of crops less than 3 m in height.

4.2.2 Environmental Impacts Associated with Pre-Construction Stage

4.2.2.1 Acquisition of cultivable and non-cultivable lands

147. There may be marginal loss of agricultural productivity due to obstructions and reduced land availability. Thus the following measures will have to be taken prior to the project activities:

- Avoid farming season wherever possible for the project activities,
- Ensure existing irrigation facilities are maintained in working condition,
- Protect /preserve topsoil and reinstate after construction is completed,
- Repair /reinstate damaged bunds after construction is completed, and
- Pay compensation for temporary loss in agricultural production.

4.2.2.2 Impacts on temporary use of land

148. The construction equipment and construction materials will require proper space for storage, parking space for construction vehicles and equipment, construction material storage, and labour camp to avoid environmental impact and public inconvenience. These locations must comply with the local laws and regulations and need approval from authorities to utilise these facilities (access roads, telecommunication, and pipe borne water supply). It is important that selection of temporary lands is at least 500 m away, depending on practicability as per local site conditions from highly populated areas, water bodies, natural flow paths, agricultural lands, important ecological habitats, and residential areas. Removal of trees and green cover vegetation should be minimised during preparation of facilities.

4.2.3 Environmental Problems Associated with Construction and Operation Stage

149. The project activities during construction phase will involve clearing of trees along the route alignment wherever required, excavation for installation of towers, erection of towers, civil works related to transmission line and line stringing. For substations, it will involve excavation for building and equipment foundations, civil works and erection of equipment. During the operation phase, most of the construction phase impacts will get stabilised and the impacts will be restricted only to the operation and maintenance of the project.

150. The impacts on the environment from various activities of the project can be categorised as follows:

- Impact on Physical Resources
  - Impact on Topography
  - Impact on Climate
- Impact on Environmental Resources
  - Impact on Air Quality
  - Impact on Noise Levels
  - Impact on surface Water Quality
  - Impact on ground Water Quality
  - Impact on Soils and Geology
- Impact on Ecological Resources
  - Terrestrial Ecology
  - Wild Life
  - Aquatic Ecology
- Impact on Human Environment

- Health and Safety
- Agriculture
- Socio-economics
- Resettlement and Rehabilitation
- Cultural sites
- Traffic and Transport
- Interference with other utilities and traffic

- Waste Disposal
  - Solid waste disposal
  - Liquid waste disposal.

151. The impacts of the project activities on various environmental attributes are discussed in subsequent sections.

4.2.3.1 Impact on Physical Resources

Impact on Topography

152. During the construction of the transmission line and substation, the topography will change due to excavation and erection of tower, fill and cut for levelling the tower erection place. The most prominent impact on the surface topography will be due to the removal of trees at the tower erection site if required, and along the Right-of-Way (RoW). This will lead to change in the surface features. The impact will be irreversible as the present features along the RoW will be changed due to presence of the transmission line.

153. No topographical changes are envisaged during the operations phase of the transmission line and the substation. The existing access routes will be utilised during the operation and maintenance of the transmission lines.

Impact on Climate

154. The project area consists of both cultivated and uncultivated lands which grow predominantly single season crops during the monsoons. There will be no large scale removal of trees/cultivation as the transmission line will be strung from hilltop to hilltop. It is therefore expected that there will be no impact on the climate conditions from the proposed project both during the construction and operation phases.

Impact on aesthetics of landscape

155. The transmission lines do not look aesthetic with the scenic landscape of the area. The manmade transmission lines and substations cause visual pollution in pristine areas which are bestowed with resplendent nature and its beauty.

4.2.3.2 Impact on Environmental Resources

Impact on Air Quality

156. During the construction phase, the activity would involve excavation for the tower erection, movement of vehicles carrying the construction materials along the haul roads. At majority of tower locations, movement by vehicle is not possible from approach road to construction site and the material has to be head loaded. All these activities would give rise to emission of dust particles thereby affecting air quality marginally at the site. The impact will be transitory in nature and therefore is assessed as of low significance. Covering of stockpiles, minimising double handling and drop loads as well as sprinkling of water during excavation will reduce the dust emission to a great extent.

157. The construction of transmission line and the substation will not have any negative impact on the air quality of the region during the operation phase.

Impact on Noise Levels

158. During the construction phase, the major sources of noise pollution are movement of vehicles carrying the construction material and equipment to the site. Most of the access roads

along the alignment are motor-able and project traffic would be negligible. The major work of the construction is expected to be carried out during the day time. Apart from vehicles bringing in materials to the nearest road, construction works for the transmission line will not require powered equipment. As such, noise emissions will be minor. As the predominant land use along most part of the alignment is agricultural, there will be few residential areas exposed to noise generated during the construction phase and the noise produced during the construction period will have negligible impact on residents.

159. Following measures will help to keep noise and vibration in acceptable level during construction phase:

- Contractor shall preferably limit working time for activities that create noise within normal waking hours of the public except for construction site near public sensitive receptors. Construction related activities closer to sensitive receptors have to be scheduled in coordination with the relevant authorities and community.
- Noisy equipment such as generators should be sited away from residential areas.
- Contractor and suppliers of construction materials should strictly implement noise control regulations stipulated by the Noise Pollution (Regulation and Control Rules 2000) for all construction vehicles and equipment.
- At substation sites, contractor shall equip their heavy construction equipment and plants with exhaust silencers to limit the engine noise so as not to exceed 75 dB (compacters/rollers, loaders and cranes) and regularly maintain all construction vehicles and machinery that should meet the Central Pollution Control Board's (CPCB) Noise Standards.

Impact on Surface Water Quality

160. The construction and operation of the transmission lines will not have any major impact on the surface and ground water quality in the area. Contamination of water bodies may result due to spilling of construction materials and surface runoff from the construction site joining the water body. There may be increase in the turbidity levels temporarily where the proposed alignment is crossing a watercourse and if the surface runoff during construction meets the river. This can be avoided by careful selection of the tower site so that the surface runoff does not meet the river.

161. Proposed activities will create temporary impacts to the existing drainage system in the area including irrigation canals, natural flow paths and also earth and line drains. Thus incorporation of following measures will minimise anticipated impact due to obstruction of natural flow paths and existing drainage:

- Provisions of temporary drainage facilities and routing ponds to the particular locations if existing drains are obstructed due to construction activities
- Maintenance of all drainage paths by avoiding blockages at all times
- Contractor should minimise excavation of beds of any streams, irrigation systems, and other water resources available in the project area.
- Stagnant water should be cleared by the contractor.

162. Care shall be taken to locate the temporary construction worker sheds away from the water bodies. Adequate drinking water facilities, sanitary facilities, and drainage in the temporary sheds of construction workers should be provided to avoid the surface water pollution. Provision of adequate washing and toilet facilities should be made obligatory. This should from an integral component in the planning stage before commencement of construction activity by the contractor. Operation of transmission lines will not cause any release to the surface water bodies.

Impact on Hydrology and Water Resources

163. Water needs during construction of the Project would be limited to sanitary water and minimal amounts of water for construction (such as spraying for dust prevention). There would be a negligible impact on water resources. Operation of the lines would neither require any water nor pollute the water resources.

Impact on Ground Water Quality

164. Ground water pollution can take place, if chemical substances and oily waste get leached by precipitation of water and percolate to the ground water table. For transmission line construction activity, no chemical substance or oil is used hence there is no impact on ground water quality. The silt discharge from the earth work around water bodies, oil, grease and fuel release from the construction vehicles/equipment and spoil from construction and other construction related activities such as raw sewerage from worker accommodation sites may mix with runoff water. This situation will accentuate during the rainy season and could have a significant impact on surface and ground water. Thus following measures will be required in order to prevent deterioration of water quality from the construction and construction related activities:

- All construction vehicles and equipment should be maintained in proper conditions without any leakages,
- Contractors shall use silt traps and erosion control measures where the construction is carried out in close proximity to the water bodies to avoid entering of cement particles, rock, rubbles and waste water to the surrounding water bodies,
- Construction activities requiring digging should be preferably done in the dry season, and
- Waste oil should be collected properly and disposed to the approved recyclers.

Impact on Soil and Geology

165. Project activities including excavation, cut and fill operations, removal of trees and green cover vegetation will enhance the soil erosion during the rainy season. Removal of trees and green cover vegetation will reduce infiltration rate of rainwater. The impact on soils will be due to the soil erosion at the tower construction sites along the access routes. The excavation activity and land clearance in the erosion prone areas have to be minimised while conducting the site selection for towers. Revetment and stabilisation of tower construction sites will be done after completion of construction activity. Also increased acceleration of surface runoff will damage the topsoil. The impacts associated with excessive erosion and other civil works can be avoided or minimised by following mitigation measures:

- Maximum effort should be taken to minimise removal of trees and green cover vegetation.
- Minimise obstruction or destruction to natural drainage pattern of the surrounding area.
- Proper treatment of clearing and filling areas against flow acceleration.
- Turfing work should be taken prior to rainy season around the substation.
- Contractors shall follow proper muck disposal plan for cut and fill operation around sharp/deep slope areas.
- Piling activities will preferably be done in non-rainy season, as the piled materials will spread all over the area and contaminate close by water bodies.
- Top soil (2-3 cm from the top of the soil), which are removed during construction from the cultivated lands must be stored separately for future utilisation of cultivated lands near tower leg locations.

4.2.3.3 Impact on Ecological Resources

166. Since sub-station is constructed on vacant government/private land and transmission line is routed away from the inhabited areas, there is no displacement of people or animals. It is also not causing any disturbance to the life of people and local animals and birds movement. In transmission line construction, there is no dynamic equipment and moving machinery causing noise pollution, water and air pollution. There is no national wildlife park, wildlife sanctuary, bird sanctuary, wetland in the route alignment of the proposed transmission line. The ecological impacts are briefly described in the following sections.

Effect on Flora and Fauna

167. On visual inspection, it appears that some forest and fruit trees will need to be removed from the project area for the RoW after getting prior permission from competent authorities of GoU (34 m RoW for 400 kV line). None of the declared environmentally sensitive areas is located within the route alignment. It is not expected that any flora and fauna that are rare, endangered, endemic, or threatened will be affected. Migratory paths of small mammals and reptiles may be affected due to construction activities. However noise, vibration, and emission from construction vehicles, equipment will occur during construction and pre-construction stages in temporary manner. The

impacts related to above activities are temporary and can be mitigated through following measures:

- Strict attention on worker force regarding disturbance to surrounding habitats, flora and fauna including hunting of animals and fishing in water bodies,
- Selection of approved locations for material storage yards and labour camps away from the environmental sensitive areas, and
- Prevent entering of construction waste (cement particles, rock, rubble, and waste water) and sanitary waste to the surrounding water bodies.

Impact on Terrestrial Ecology

168. There is no sensitive ecological area/protected forest area such as national wildlife park, wildlife sanctuary, bird sanctuary crossing the proposed route alignment. The removal of herbaceous vegetation from the soil and loosening of the top soil generally causes soil erosion. However, such impacts would be primarily confined to the project site during initial periods of the construction phase and would be minimised through adoption of mitigation measures like paving and surface treatment and water sprinkling.

Removal of Trees

169. Removal of all fruit/non-fruit trees may not be required during the line construction. Table 19 gives the list of trees to be cut for Tranche 4 project components. The construction works along the transmission line alignment involves land clearance, cutting, filling, and levelling which will cause loss of vegetation. This is an irreversible impact. Care has been taken to avoid the thick plantations/vegetation as far as possible and tower locations are selected mostly in plain cultivable fields where the vegetation is thin. This will minimise the tree loss. Compensation will be paid to tree owners in the private areas as per GoU norms. Where the clearing of fields and forest area is unavoidable along the route alignment, the compensatory afforestation will be required for forest areas for which clearance will be obtained from the appropriate authority of the forest department; and for fruit and non-fruit trees in the fields, the amount for compensation for fields will be paid directly to the farmers.

Table 19: Number of trees need to be cut for Tranche - 4 project components

Project Component	Total Number of fruit tree to be cut	Total Number of Non fruit tree to be cut	Total Number of forest tree to be cut
400/220 kV GIS Pipalkoti GSS	Nil	Nil	Nil
400 kV Srinagar-Kashinagar	Negligible	Mostly forest	25,000

Effect on Local Road Network

170. Transformers, tower material, substation equipment, iron bars, concrete materials, piling equipment, will be transported through the provincial and local road network to the project site. Transporting of large quantities of materials using heavy vehicles could exceed the carrying capacity of the road. This would lead to physical damages to local road network. Thus, it will be necessary to obtain consent from Public Works Department (PWD) or National Highway Authority to use local/national highway roads prior to transportation. Also, contractor should properly maintain all road sections, which will be utilised for the construction related activities.

Disposal of Debris

171. As a result of construction related activities, spoil and debris will be generated during the construction stage. Improper disposal of the debris will have an impact on the surrounding ecology, public health and scenic beauty. Following measures will minimise the impacts associated with disposal of debris:

- Spoil materials (soil, sand, rock) generated from construction activities shall be used wherever possible for site levelling, back - filling. Dismantled and demolished structural materials, if any, should not be dumped at agricultural lands.
- Selection of the muck disposal site by excluding locations, which are closer to residential, commercial and public sensitive areas, is necessary by the contractor. Prior approval should be obtained for such dumping grounds / land fill sites from relevant local authorities
- Dumped materials will interfere with the drainage pattern of the area, any water bodies,

agricultural lands, marshlands and down slope or any environmental sensitive areas if not planned properly.

172. During operation phase, corridor along the alignment will be chopped of vegetation and lopping of trees will be done for maintenance purpose. This will also reduce the chances of fires due to electric sparks.

Wild Life
173. For selecting the route alignment, any wild life travel routes have been avoided as far as possible during the field visits. Rajaji National Park is situated about 60 km aerial distance from transmission line project and Corbett National park is separated by the NH-121 and the ecological sensitive area is about 1 km aerial distance from transmission line.

Impact on Aquatic Ecology
174. The proposed transmission line would cross over the Ramganga and Kosi rivers and small streams which are usually perennial in nature. No significant impacts on aquatic ecology of the river are envisaged, as there will be careful selection of the construction time and tower sites near the river, to avoid the river pollution and disturbance to the aquatic fauna of the area during the monsoon period.

4.2.3.4 Impact on Human Environment

Health and Safety
175. Project activities could impact the health and safety of the work force and of the general public, in particular, in terms of risk of accidents and exposure to electromagnetic fields along the alignment. The accidents may be caused due to electro-cutting, lightening, fires and explosions. To avoid this, houses or buildings will not be allowed within the RoW of the project.

176. Project activities may create accidental damage to general public and the construction workers. Therefore, contractors should take necessary action to enhance personal safety during the construction through following measures:

- Organise awareness programmes relevant to personal safety of the workers and general public in the area.
- Installation of warning signs to particular locations such as transverse points of local road network by transmission lines.
- Provide protective safety belts, footwear, helmets, goggles, eye-shields and clothes to workers depending on their duty.
- Arrangement of proper first aid unit and transport facilities to take injured people to the hospitals.
- Workers should be covered by the statutory workmen compensation as per GoI laws by the contractor.

Agriculture
177. As far as possible, the prime agricultural land will be avoided for tower erection and the construction will be done after crop harvesting. Permanent and temporary loss of agricultural land occurs due to transmission line at each tower location in the agricultural fields and loss of crops along the wire stringing and the access routes. For tower bases falling in agricultural area, PTCUL shall pay the crop compensation only. The right of way shall be utilised as per the Indian Telegraphic Act 1885, a practise widely followed by all transmission companies in India to set up power transmission lines. The government land at the Pipalkoti GSS has been allotted to PTCUL and therefore there is no acquisition of any land involved in the project.

Socio-Economics
178. Construction of transmission line will generate local employment, as number of unskilled labours (men/women) will be required at the time of construction activities. Local employment during this period will increase socio-economic standards.

Temporary Outage of the Electricity

179. Temporary disconnection of power supply will occur during the construction activities. Thus, general public and the industrial places, which are located in project-affected area, will face inconvenience for short periods of time. Thus following measures will have to be taken:

- Advance notice to the public about the time and the duration of the utility disruption, and
- Restore the utilities immediately to overcome public inconvenience.

Resettlement and Rehabilitation

180. For the construction of transmission line and one substation, land is required which is government land.

Cultural sites

181. There are no important archaeological, historical or cultural sites along the route alignment, hence no impact on these sites is envisaged. In the case of discovery of archaeological features during excavation/construction works, GOI's regulations shall apply and will be observed by contractors.

Traffic and Transport

182. During the construction phase, traffic disturbance needs to be minimised by avoiding high-density areas, using proper traffic signs, ensuring proper access roads and avoiding road blockage.

Interference with Other Utilities and Traffic

183. A standing committee - Power Telecom Co-ordination Committee (P.T.C.C.) has been constituted by Government of India to plan and implement the mitigating measures for the induced voltage, which may occur to nearby telecom circuits and suggest necessary protection measures to be adopted. The committee suggests measures like rerouting of the telecom circuits, conversion of overhead telecom circuits into cables etc. to minimize the interference. It is mandatory for PTCUL to seek clearance prior to construction from Telecommunications and wherever necessary from aviation authorities that are likely to be affected by the construction of transmission lines. The transmission lines affect nearby telecommunication circuits by causing electrical interference and induced voltage which may occur to nearby telecom circuit and suggested necessary protection measures will need to be adopted. This may require measures like rerouting of the telecom circuits, conversion of overhead telecom circuits into cables to minimise the interference. The exact cost to mitigate the impacts of induction in neighbouring telecom circuits would vary from case to case. In general, the system is planned and executed in such a way that adequate clearance is maintained between transmission lines on the one hand, and railways, civil aviation and defence installations on the other. Wherever the transmission lines passes near the airport, the towers beyond specified height are painted in alternate orange and white stripes for easy visibility and warning lights are placed on the top of these towers.

4.2.3.5 Waste Disposal

Solid Waste Disposal

184. The solid waste generation at the location of the tower erection site will mostly include metal scraps, wooden packing material. Waste will be minimised and recycled wherever possible. Final waste will be collected and disposed off in compliance with applicable GoI/GOU regulations and rules by the contractor.

Sanitary Waste Disposal at Construction Sites and Labour Camps

185. The labour camps at the site of tower erection will be temporary in nature and the human excreta will not be significant to cause contamination of ground water. Those places where most labour will be staying will be near hamlets which shall use the community services for solid waste, water and sanitation. Adequate drinking water facilities, sanitary facilities and drainage in the temporary sheds of the construction workers should be provided to avoid the surface water pollution. This should form an integral component in the planning stage before commencement of

construction activity.

186. Thus following measures are needed to protect and enhance the quality of environment during the construction stage:

- Provision of the solid waste disposal, sanitation and sewage facilities at all substation sites for the construction/labour camps to avoid or minimise health hazards and environmental pollution.
- Contractor should handle and manage waste generated from the construction/labour camps without contamination to natural environment and it will reduce risk to general public who stay close to sites. Also contractor should be responsible to enhance the quality of environment.
- Adequate supply of water should be provided to the urinals, toilets and wash rooms of the workers' accommodation at substation sites.

Liquid Waste Disposal

187. There will be no oil or chemical waste generated during the construction of transmission line, hence no mitigation is required.

4.2.4 Environmental Impacts Associated with Operations and Maintenance Stage

4.2.4.1 Electric Shock

188. This may lead to death or injury to the workers and public in the area. This can be minimised or avoided by:

- Security fences around substation.
- Establishment of warning signs,
- Careful design using appropriate technologies to minimise hazards.

4.2.4.2 Noise Generation

189. During the operation phase of the project, there may be corona noise from the conductors which will be felt only up to 15 to 30 m area, hence the ambient noise level will meet the CPCB standard for residential areas (55 dB(A) during daytime and 45 dB(A) during night time.

4.2.4.3 Maintenance of Transmission Line and Sub-station

190. Possible exposure to electromagnetic interference could occur during these activities. Design of transmission line should comply with the limits of electromagnetic interference from overhead power lines.

4.2.4.4 Oil Spillage

191. Contamination of water on land/nearby water bodies by the transformer oil can occur during operation due to leakage or accident. Sub-station transformers are normally located within secure and impervious areas with a storage capacity of 100% spare oil. Also proper drainage facilities will be constructed during the construction stage to avoid overflow or contamination with natural flow paths especially during the rainy season. PTCUL will maintain account of the usage of oil, using technical methods and procedures for oil monitoring mechanism, and will have mitigation plan for any oil spillage.

4.2.4.5 Sulphur Hexa fluoride (SF_6) Leakage

192. SF_6 is a non-toxic greenhouse gas used as a dielectric in circuit breakers, switch gear, and other electrical equipment. Very high grade sealing system and erection methodology is followed to keep the loss of SF_6 within 0.1% every year by each SF_6 gas insulated switchgear (GIS) manufacturer. SF_6 handling is part of each contract technical specifications, and required design and routine testing are done after manufacturing of the circuit breaker. SF_6 gas handling system for evacuation and storage is always used for the maintenance of the circuit breaker. SF_6 gas leakage records will be maintained in each substation. This allows tracking of any release of SF_6 gas to the atmosphere.

4.3 Environmental Management Plan

193. Based on the environmental assessment of the project activities, an Environment Management Plan (EMP) has been developed for the project to mitigate any adverse environmental impacts. The EMP discusses anticipated impacts and mitigation measures and monitoring requirements and responsible authorities to implement the EMP with respect to the following stages: (i) pre-construction, (ii) construction, and (iii) operation and maintenance. Detailed, site-specific mitigation measures and monitoring plans were developed and will be implemented during the project implementation phase.

194. The EMP for the project is attached as Annexure 3, which identifies feasible and cost-effective measures to be taken to reduce potential significant, adverse, impacts to acceptable levels. A summary of environmental impact matrix and the mitigation measures are in Table 20.

Table 20: Environmental Impact Matrix

Sl. N°	Environmental attribute	Potential impacts	Nature of impact	Magnitude of impacts			Mitigation measures	Implementation and Monitoring
				Low	Medium	High		
A.	**Physical Resources**							
1.	Topography	Change in the surface features and present aesthetics due to the construction of the project.	Direct/Local/ irreversible		X		The surface soil will be restored to normal slope after tower erection. If there is any excess soil, it shall be disposed off at suitable location. Any loss of vegetation will be attended by PTCUL as per existing GOU norms Within the substation, the excess soil will be disposed off in consultation with PTCUL as per EMP	During construction activity
2.	Climate	No impact on the climatic conditions	Direct/Local/ irreversible	X			No impact on the climatic conditions, hence no mitigation is required	
		Monitoring of SF_6 gas from Electrical Substations	Direct/Local/ irreversible	X			Proper record of all SF_6 leakages in substations kept for record	During Construction and Operation
B.	**Environmental Resources**							
1.	Air Quality	Project will have marginal impact on air quality during the construction period due to increase in the dust emission.	Direct/Local/ reversible	X			Water sprinkling at construction site, limited bare soils, maintenance of vehicles.	During construction activity
2.	Noise	Noise due to general construction activities.	Direct/Local/ reversible	X			Restriction of noise generating activities at night and use of personal protective equipment like ear plugs, mufflers.	During construction activity
		Noise arising from corona noise from conductors	Direct/Local/ reversible	X			Monitoring of possible corona noise to identify and correct problems.	During operational phase
3.	Surface and Ground Water quality	Runoff from the construction site	Direct/Local/ reversible	X			Careful sitting of towers, and access roads.	Before and during construction activity
		Domestic wastewater from construction sites	Direct/Local/ reversible	X			Domestic waste treatment by providing septic tank/soak pits at sub-station. For tower locations, it will be temporary sites.	During construction and operation
4.	Soils and	Soil erosion due to tower	Direct/Local/		X		Avoiding sites, which are prone to	During and after the

Sl. Nº	Environmental attribute	Potential impacts	Nature of impact	Magnitude of impacts			Mitigation measures	Implementation and Monitoring
				Low	Medium	High		
	Geology	erecting and clearing of vegetation in the RoW and access roads.	reversible				soil erosion. Levelling of tower construction sites. Use of few access roads. Rehabilitation and stabilisation of disturbed land at the substations.	construction activity
		Damage due to seismic activity	Direct/regional/ reversible	X			Site selection and proper tower foundation design considering the geological conditions and seismicity of the area.	Before the construction activity.
C.	**Ecological Resources**							
1.	Terrestrial Ecology	Loss of vegetation	Direct/Local/ irreversible		X		Location of towers on non-cultivable land area. Selection of few access roads. Compensation for crop and trees to villagers. The tree planting for forest land diverted to non-forest and trees felled will be done by the forest department and paid by PTCUL	Before the construction phase
2.	Terrestrial Fauna	Disturbance to the local fauna during construction	Direct/Local/ reversible	X			Wildlife routes and their habitats have been avoided as far as possible during the route selection. Minimise encroachments, and indirect impacts.	Before and during construction phase
	Avifauna	Disturbance to the local fauna during operation	Direct/Local/ reversible	X			Monitoring of line especially for bird strikes during the operation and use of deflectors if required.	During operation phase
3.	Aquatic Ecology	No significant impacts envisaged	Direct/Local/ reversible	X			Disposal of construction waste and other waste to avoid polluting the river and streams	Before and during construction phase
D.	**Human Environment**							
1		Fires, explosion and other accidents at the route alignment of transmission line.	Direct/Local	X			Use of personal protective equipment during construction. By lopping and chopping of trees fire hazards will be minimised during maintenance period. Regular inspection of lines for faults prone to accidents.	During construction and operation phase
2.	Health and	Exposure to	Direct/Local/	X			Alignment route away from the	Before and after the

Sl. Nº	Environmental attribute	Potential impacts	Nature of impact	Magnitude of impacts			Mitigation measures	Implementation and Monitoring
				Low	Medium	High		
	Safety	electromagnetic fields	continuous				settlement. No houses in the immediate vicinity and will be allowed in the RoW of the alignment. No further mitigation required.	construction phase.
3.	Agriculture	Permanent and temporary loss of agriculture land due to tower erection and due to access routes.	Direct/Local/ reversible	X			Avoid prime agriculture land. Assessment of land required and compensation. Construction activity after crop harvesting and selection of few access routes.	Before and during construction phase.
4.	Socio-economics	Beneficial impacts job opportunities during construction phase	Direct/regional		X		Unskilled labour and indirect benefits. Overall economic growth of the region.	During operational phase
5.	Resettlement	Resettlement of any house falling along the RoW.	Direct/Local/ reversible	X			Route alignment is selected in such a way that there is no resettlement issue.	Before the construction phase.
6.	Cultural sites	No archaeological, historical or cultural important sites are affected by the construction of the lines.	Direct/Local/ reversible	X			No archaeological, historical, or cultural important sites are affected.	--
7.	Traffic and Transportation	Traffic congestion due to movement of construction vehicles	Direct/Local/ reversible	X			Proper traffic signs at the construction site, ensuring availability and maintenance of proper access roads	During construction phase
8.	Solid Waste Generation	Probability of surface and ground water pollution	indirect/Local/ reversible	X			Minimisation, reuse and recycle whenever possible. Final wastes to be collected and disposed off in compliance with applicable regulations and rules.	During operation phase

5.0 INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PROGRAMME

5.1 Institutional Arrangements

195. The mitigation measures suggested requires monitoring of environmental attributes both during construction and operational phase of the project. PTCUL has set up an environmental cell headed by the Deputy General Manager (FRC) for dealing with the various environmental issues at both the corporate and field levels to monitor and implement environmental good practices. The Deputy General Manager (FRC) will give guidance to the personnel and contractors to adopt the environmental good practice while implementing the project.

196. The duties of the Environment Management and Social Department at the corporate level:

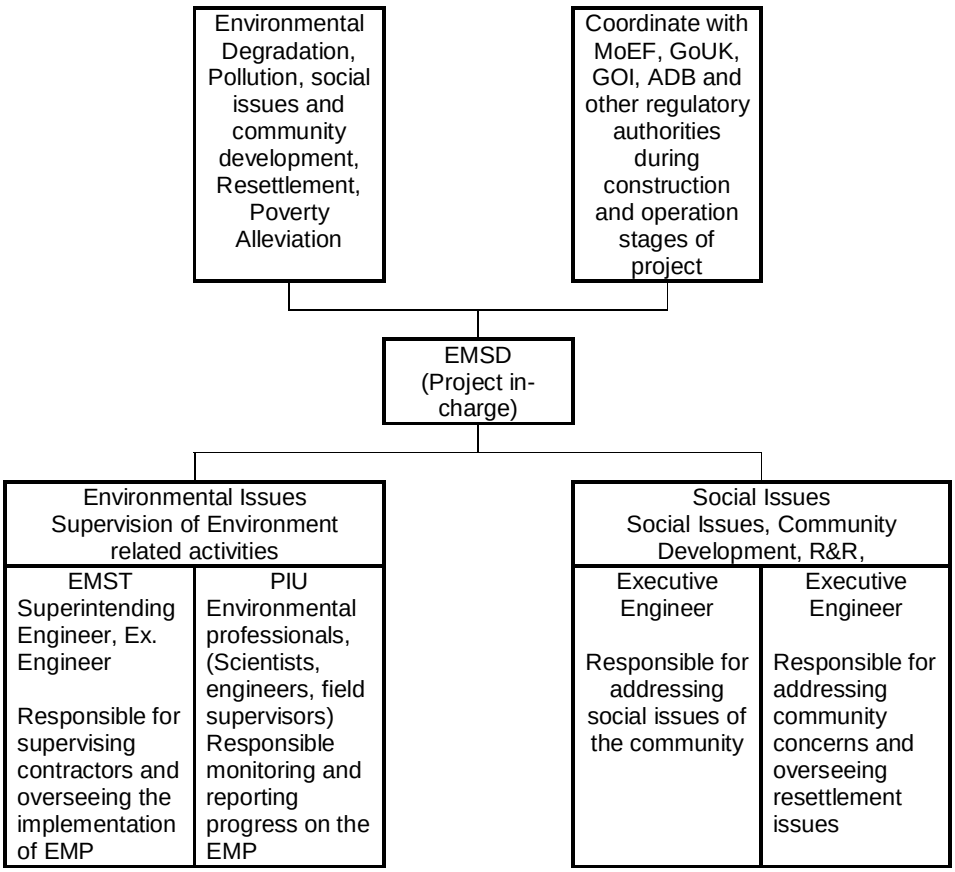
- Monitoring and implementation of mitigation measures during construction and operation phases of the project.
- Prepare suitable environmental management reports at various sites.
- Advising and coordinating field environmental management cells activity towards effective environment management.
- Liaise with the Ministry of Environment and Forest (MoEF), State Department of Environment, forest officers, State Pollution Control Boards and seek their help to solve the environment related issues of the project implementation.
- Advice to project planning cell on environmental and social issues while route selection of the alignment at the planning stage to avoid negative environmental impact.
- Provide training and awareness on environmental and social issues related to power transmission projects to the project staff.

197. The duties of the Environment Management and Social Department at the Field level:

- Implement the environment policy guidelines and environmental good practices at the sites.
- Advising and coordinating the field offices activity towards effective environment management.
- Liaise with the forest department and seek help of forest officers in resolving environment monitoring related issues.
- Carry out environmental and social survey in conjunction with project planning cell during route selection of the alignment at the planning stage to avoid negative environmental impact.
- Make the contractor staff aware on environmental and social issues related to power transmission projects so that EMP could be managed effectively.

198. The Figure 11 below depicts the institutional organization structure showing the various entities within PTCUL and their role vis-à-vis- other government agencies.

Figure 11: Institutional Structures and Responsibilities for EMP at PTCUL



EMSD = Environmental Management and Social Department, EMP = environmental management plan, EMST = Environmental Management and Social Team, MOEF = Ministry of Environment and Forests, PIU = Project Implementation Unit

5.2 Environmental Monitoring Plan (EMoP)

199. During the construction and operation phase of this project, the monitoring of the environmental aspects shall be done at the transmission line by a competent officer of the Deputy General Manager (FRC) at the corporate level and Executive Engineer at the field level offices.

200. During the construction phase, the contractor should ensure that activities like handling of earth works, disposal of debris, storage of materials, labour camps, putting proper traffic signals is done properly to have minimum impact. This in turn should be monitored by the Project Manager of the individual transmission line/sub-station project.

201. The PIU head will ensure that site engineers and contractors adhere and comply with all measures and procedures identified in the EMP. Activities to be monitored include: all planning, coordination and management activities related to the implementation of safeguard issues; the identification of corrective and preventive actions; records of health and safety matters and training activities; consultations with project affected people (as and when needed, particularly during the implementation); feedback, trouble shooting and project related grievances; preparation of progress and monitoring reports as required by the ADB; and verifying the projects overall compliance with safeguard measures and its progress towards achieving the intended loan

outcomes.

202. Mitigation measures related to construction as specified in the EMP will be incorporated into civil works contracts, and their implementation will be primarily the responsibility of the contractors. In addition, contractors will be required to submit monthly progress reports on the implementation of EMP measures to PIU/PMO. The PMO and the PTCUL will report to the ADB on progress achieved against the EMP activities and milestones on a half-yearly basis. Progress reports will include a description of implementable activities and their status; identify the responsible parties involved in their implementation; and provide project management schedules and timeframes for doing so, along with their associated costs.

203. In addition to the EMP, to ensure that project would not generate negative impacts to the overall environment quality, an Environmental Monitoring Report will be prepared. The monitoring activities of the project include site supervision, verification of permits, monitoring of water quality, soil, noise and air. Monitoring of the quality of water, soil, air and noise during the construction stage is a responsibility of the contractor by the approved government agency. The PIU will supervise the contractor. Other environmental good practices include sanitary waste management, noise abatement, maintaining hygienic conditions, maintenance of fire and safety equipment.

204. Project managers of PIUs will prepare and submit performance monitoring reports to the ADB twice yearly. This report will include the results of environmental monitoring to demonstrate that sound environmental management practices are applied, and the set environments targets are achieved. The environmental monitoring plan for the Project is summarised in Annexure 3. In case the implementation of EMP measures is not satisfactory, PTCUL may engage external qualified experts to verify monitoring reports and assess the significant impacts and risks. These external monitoring experts will recommend actions for PTCUL to enhance environmental compliance. ADB will continue to monitor project compliance with ADB safeguard plans and requirements on an on-going basis throughout the duration of the contract.

5.3 Environmental Management Plan Budget Costs

205. The environmental management plan (EMP) that was prepared for the project in 2005 was the basis for determining the anticipated impacts, monitoring requirements, and development of mitigation measures with respect to the following stages: (i) pre-construction, (ii) construction, and (iii) operation and maintenance. Detailed, site-specific mitigation measures and monitoring plans are developed and will be implemented during the project implementation phase. The detailed EMP is also attached in the Annexure- 2.

206. The main benefits of the environmental mitigation plan are (i) ensuring that environmental standards are met during design, construction, and operation of the project; (ii) providing offsets to negate project impacts especially ecological impacts, e.g., in the form of compensatory afforestation, greenbelt development and landscaping. Without such expenditures, the project might generate large environmental impacts, causing the biophysical environment in the area to deteriorate and indirectly depressing the economies of local communities. The compliance with the EMP has been prepared based upon optimum and reasonable costs that are derived upon minimization of mitigation measures on a “least-cost” basis. Cost estimate summaries for the implementation of environmental mitigation measures, and monitoring costs, independent audit costs for the project is provided in Table 21 for 400/220 kV Pipalkoti GSS during construction stage and in Tables 21 and 22 for 400 kV Srinagar-Kashipur transmission line during pre-construction and construction stage respectively.

207. EMP costs will typically include (i) compensation for private land and fruit trees for proposed RoW, (ii) compensation for crops in RoW and tower sites, (iii) PTCC cost, (iv) cost of compensatory afforestation and (v) Net Present Value (NPV) of forest land, (vi) cost for implementation of environmental mitigation measures, and (vii) costs towards monitoring costs, independent audit costs for the project. From the total project cost of INR 12,235.7 million

(including IDC and contingencies), INR 1,120.85 million has been included as the EMP costs.

5.3.1 Component A: 400/220 kV Pipalkoti GIS sub-station

Table 21: EMP Cost during Construction Stage

S. No.	Activity	Unit	Rate (INR)	Quantity	Amount in INR Lakhs
1	**Safety awareness program among the villagers and workmen.** The contractor will conduct Information Education and Consultation Communication (IEC) campaigns at least every other month, addressed to all site staff and labour to the immediate local community and project affected people about the project related environment management and social issues.	No.	-	at least every other month	Contractor shall implement the same as per clause 22.1 of Section 8 – Special Condition of Contract
2	Water sprinkling at haul road for suppression of dust due to vehicle movement near construction site for minimum 2-3 times. Per day minimum 1 hour sprinkling with water tankers/manually shall be done during construction days.	-	-	-	Contractor shall implement the same as per clause 22.1 of Section 8 – Special Condition of Contract
3	Personal Protective Equipment (PPE) such as safety helmets, gumboots, safety jackets, ear plugs & nose masks to workers working at construction site. The minimum no. of PPE shall be 75 each of define item at one time.	No.	-	75	The contractor will maintain a stock of at least 75 PPE's in his stores for uses as per clause no 22.2 of Section 8 - Special Condition of Contract.
4	Provision of sanitation facility around the camp site.	-	-	-	Contractor shall implement the same as per clause 22.2 of Section 8 – Special Condition of Contract
5	Construction stage monitoring of ambient air and ambient noise due to construction activity by approved monitoring agency - once in 3 months interval near habitation close to construction site. Payment will be made after the verification from the site engineer. A) Ambient Air monitoring B) Ambient Noise monitoring C) Drinking water monitoring at camp site	 No. No. No.	 15000 5000 10000	 12 12 12	 1.8 0.6 1.2
6	Green belt development inside the campus of sub-station		Lump sum		7.50
7	Environmental enhancement such as repairing, whitewashing of worship places and schools, provision of drinking water facilities, sitting benches, construction of toilets and additional rooms in the school of nearby villages, plantation in school and Panchayat Bhawan premises etc. and development of green belt along the worship place and schools, repairing of approach road and provision of bathing ghats close to project site. Distribution of books, copies, writing material to poor students of nearby areas. Detail plan with costing will be prepared by Implementing Agency and upon approval by Engineer/PTCUL, it will be executed. Upon verification of concerned Engineer, the payment shall be done.		Lump sum		41.40
8	Medical camps for workmen and society including checkup of Sexually Transmitted Infections (STI) and Sexually Transmitted Diseases (STD) including HIV/AIDS and health awareness program on monthly basis shall be done by the Contractor. Payment to the contractor for preparation and implementation of this program shall not exceed the provisional sum dedicated for this purpose (***Clause 22.2.7 of Section – 8 of Special Condition of Contract***)	No.	25000	30	7.50
Total EMP cost during construction stage					**60.00 lakhs (= INR 6 million)**

5.3.2 Component B: 400 kV Srinagar-Kashipur Line

Table 22: Transmission line EMP cost (Pre-construction)

Sl. No.	Item Description (Quantity of Mitigation measures)	Quantity	Amount in INR Lakhs
1.	**Pre-Construction stage**		
A.	Total Forest cost (Compensatory afforestation and Approval of forest land)-***Tree plantation shall be done by Forest Department for which necessary payment will be made by the PTCUL. PTCUL shall deposit the amount for the following;*** ***a.*** Plantation of trees ***b.*** Net Present Value (NPV) ***c.*** Lease Rent for 30 years	25000 trees to be planted for cutting of approximately 25000 of trees	10,122.50

Sl. No.	Item Description (Quantity of Mitigation measures)	Quantity	Amount in INR Lakhs
	d. Maintenance for 3-5 years ***e.*** Plantation of bonsai tree below the transmission line conductor		
B.	Centages and Contingencies for forest @8% of forest clearance		810.00
C.	Crop compensation	Exact crop compensation will be evaluated during final survey	50.00
D.	Power Telecom Co-ordination Committee (PTCC) clearance	Lump sum	1.00
Total EMP cost during pre-construction stage			**10,983.50 lakhs (=1,098.35 million)**

Table 23: Transmission Line EMP Cost during Construction Stage

S. No.	Activity	Unit	Rate (INR)	Quantity	Amount in INR Lakhs
1	**Safety awareness program among the villagers and workmen.** The contractor will conduct Information Education and Consultation Communication (IEC) campaigns at least every other month, addressed to all site staff and labour to the immediate local community and project affected people about the project related environment management and social issues.	No.	-	at least every other month	Contractor shall implement the same as per clause 22.1 of Section 8 – Special Condition of Contract
2	Personal Protective Equipment (PPE) such as safety helmets, gumboots, safety jackets, ear plugs & nose masks to workers working at construction site. The minimum no of PPE shall be 300 each of define item at one time.	No.	-	300	The contractor will maintain a stock of at least 300 PPE's in his stores for uses as per clause no 22.2 of Section 8 - Special Condition of Contract.
3	Environmental enhancement such as repairing, whitewashing of worship places and schools, provision of drinking water facilities, sitting benches, construction of toilets and additional rooms in the school of nearby villages, plantation in school and Panchayat Bhawan premises etc. and development of green belt along the worship place and schools, repairing of approach road and provision of bathing ghats close to project site. Distribution of books, copies, writing material to poor students of nearby areas. Detail plan with costing will be prepared by Implementing Agency and upon approval by Engineer/PTCUL, it will be executed. Upon verification of concern Engineer, the payment shall be done.	Lump sum			150.00
4	Medical camps for workmen and society including checkup of Sexually Transmitted Infections (STI) and Sexually Transmitted Diseases (STD) including HIV/AIDS and health awareness program on monthly basis shall be done by the Contractor. Payment to the contractor for preparation and implementation this program shall not exceed the provisional sum dedicated for this purpose (***Clause 22.2.7 of Section – 8 of Special Condition of Contract***)	No.	50000	30	15.00
Total EMP cost during construction stage					**165.00 lakhs (Rs. 16.5 million)**

5.4 Critical Environmental Review Criteria

5.4.1 Loss of irreplaceable resources

208. The transmission projects such as 400 kV lines would involve large scale excavation and land is lost to the extent of 225 m^2 for each tower foundation. Rest of the area under the tower continues to be under use by the land owner. Forest cover felled in the Right-of-Way (RoW) is allowed to regenerate with dwarf species or non-timber forest product (NTFP) in 34 m wide strips, after construction work is over. The compensatory afforestation to the extent of twice the area of forestland used would be undertaken as per MoEF regulations. The EMP includes compensation for the loss by minimising the impact of loss of vegetation as per existing norms of GOU and MoEF. Thus, there will be no net "Biodiversity Loss" due to project implementation due to felling of trees.

5.4.2 Accelerated use of resources for short-term gains

209. The project will not use any natural resources occurring in the area that is used by local communities during construction, operation and maintenance phases. The construction material such as tower parts, cement shall come from factories while the excavated soil shall be used for backfilling and revetment to restore the surface. Thus the project shall not cause any accelerated use of resources for short term gains.

5.4.3 Endangering of species

210. No endangered species of flora and fauna have been reported in IUCN Red List are found/reported in the project area as well as in the affected forest thus there seems to be no possibility of endangering/causing extinction of any species.

5.4.4 Promoting undesirable rural-to urban migration

211. The project will not cause any submergence or loss of land holdings that normally trigger involuntary migration. It also does not involve acquisition to the extent of any person becoming landless. Hence, there is no possibility of causing rural to urban migration.

5.4.5 Increase in affluent/poor income gap

212. The project will increase availability and reliability of power in state. It is well known that power is a key input to the economic development of any area. Past experience indicates that economic development leads to generation of more jobs which in turn should raise the living standards of poor. Thus, the project is expected to contribute in reduction of affluent/poor income gap by providing opportunities for employment and rural based economic activities.

5.5 Associated Facilities

213. The total proposed power evacuation by the 400 kV DC 400 kV Srinagar sub-station to the 400 kV Kashipur sub-station is more than 3000 MW. This transmission line will evacuate the pooled power of generators in the Alaknanda basin which are given below in Table 24:

Table 24: Hydropower projects on Alaknanda Basin

1.	Lata Tapovan of NTPC	171 MW
2.	Badrinath of GMR Energy	300 MW
3.	Vishnugad of NTPC	520 MW
4.	Pipalkoti of THDC	444 MW
5.	Devsari of SJVNL	252 MW
6.	Langrasu of UJVNL	100 MW
7.	Bawala Nandprayag of UJVNL	300 MW
8.	Srinagar of GVK	330 MW
9.	Rambhara of Lanco	76 MW
10.	Phatabyung of Lanco	76 MW
11.	Singolibhatwari of L&T	99MW

214. After the construction of 400 kV Srinagar-Kashipur line, the under construction 400 kV substation at Srinagar will become the hub of power. Presently Srinagar town and nearby areas are being fed in radial mode through single circuit 132 kV Rishikesh-Srinagar line. Whenever there is any breakdown or shutdown in this line there is no alternate supply on EHV system. This new proposed 400/220/132 kV sub-station Srinagar will be connected with existing 132 kV substation Srinagar, the EHV system will strengthen and reliability of the supply to the Srinagar town and its nearby areas will be more.

215. Similarly 400/220/132 kV sub-station Srinagar will be connected with 132 kV sub-station Simli (Karanprayag) and 132 kV sub-station Satpuli (Pauri), the EHV system will strengthen and more reliable supply to the Simli and Satpuli sub-stations. Reliability of the supply to the 132 kV sub-station Kotdwara, which is an industrial area, will also increase as it will be connected to

400/220/132 kV sub-station Srinagar through 132 kV sub-station Satpuli. This line will evacuate 3000 MW (approx. 9,855 MU per year).

216. In addition to the above justification, the overall power scenario of Uttarakhand as described below also justifies the construction of new substation. There is one existing 400 kV D.C. transmission line which is evacuating power from Vishnuprayag (400MW) HEP of M/s. JP Hydro to Muzaffarnagar of PGCIL for further transmission. The LILO of this existing transmission line is proposed at 400 kV GIS sub-station Pipalkoti to provide alternate path for power evacuation of 400 MW Vishnuprayag HEP in case of emergency. In the same way, the proposed LILO will provide an alternative path for the transmission of the accumulated generation of the Lata Tapovan, Vishnugad, and Vishnuprayag HEP's, hence power evacuation reliability will increase.

5.6 Health and Safety Management

5.6.1 Health and Safety Issues

217. To avoid/minimize inherent risks during construction, operation and maintenance, PTCUL must lay down safety guidelines for EHV substations and lines in operations and maintenance (O&M) and construction areas. Some other implications and mitigations from safety point of view are as follows:

Table 28: Safety Implication and Mitigation

S No	Implication	Mitigation
1	Electromagnetic effect	Adequate ground clearances are provided.
2	Mechanical	Factor of safety in tower structure, conductor, and insulator is provided.
3	Lightning stroke	Each tower is provided with ground wire and earthed. Earthing system for permissible step and touch potential in sub-station design.
4	Ground clearance infringement	No construction is permitted. Land is not allowed to be converted to Non-agriculture use. However, there is no restriction on movement of people.

5.6.2 Awareness Program

218. Some of the safety awareness activities such as:

1 Public awareness by meeting with villagers, builders, transporters, schools, NGOs/CBOs, and putting up safety posters, safety slogan and advertisement in media.
2 District Collector/ Electrical Inspector/ police department/local authority approached for removal/ prevention of unauthorized construction nearby EHV transmission lines violating Electricity Act 2003.
3 Education to workers on Personal Protective Equipment (PPE) and safety tools.

5.6.3 Safety Audits

219. Safety inspections are done at each circle in a regular way. Steps needed to follow:

1. Checking of safety tools -
   i. Availability and its present condition.
   ii. Utilization and testing.
2. Check for implementation of safety rules and safety instruction for all substation operation and maintenance activities.
3. Safety awareness and identifying hazards for various maintenance activities in the switch yard and the transmission lines.
4. Precaution to be taken while issuing permit for the work.
5. Operation of portable fire extinguishers and their healthiness.

6.0 PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

6.1 Information Disclosure

220. In line with ADB's Public Communications Policy, PTCUL is required to ensure that relevant project information about social and environment safeguard issues is made available during the initial stages to affected people and other stakeholders, including the general public at district headquarters where it is publicly accessible in English, Hindi and any other vernacular local language. ADB and PTCUL will also post the IEE on their respective websites.

221. Incorporation of the environmental concerns of affected persons (APs) through the public consultation in the decision making process will avoid or minimise conflict situations during the implementation process as well as enable them to provide meaningful inputs into the project design and its implementation. PTCUL can conduct public consultation and information disclosure through public meetings and notice.

6.2 Public Consultation

222. During the project formulation stage, PTCUL has conducted a project scoping exercise and reconnaissance survey of the existing system. Accordingly, during public consultation sessions, considerable dialogue had been held between PTCUL representatives, individuals, and groups from the community to make them aware of the proposed project.

223. The project-affected community residing beside the proposed transmission line has already gained a reasonable knowledge about the potential grievances, which may arise in the future. The community were also informed about the Grievance Redressal Mechanism (GRM), which will be followed by PTCUL for making complaints, including the place and the responsible person to contact in this regard.

6.3 Consultation Findings

224. Incorporation of environmental concerns of affected persons (APs) through the public consultation will help avoid or minimise conflict situations and enable them to provide meaningful inputs into the project design and implementation process. Consultations and group discussions were carried out along the project sites by the project safeguard consultants between May 25-27, 2012. The discussion was carried out in villages coming within 500 m vicinity of the alignment of transmission line. In Pipalkoti, public consultation was conducted with the local activists and the local NGO who have filed the Public Interest Litigation (PIL) on 4 April 2012 against the use of land for 400 kV sub-station Pipalkoti. Attached Annexure 4 lists detailed public consultations during the field survey by the team. Summary of people's perception of the project during the consultation is presented below.

6.3.1 Component A: 400/220 kV Pipalkoti GIS sub-station

225. The land selected for construction of Pipalkoti substation is adjacent to the NH-58 and it about 50 m away from scattered groups of houses. It is situated in Naurakh village near Piplakoti town of Chamoli district. Public consultation was carried out at Pipalkoti – a land that belongs to PTCUL, but a group of local activists and a local NGO have filed a public interest litigation in Nainital High Court again construction of a substation on account of high risk to the residents from overhead cables due to electromagnetic field (EMF) for which PTCUL has started legal process for annulment of this litigation.

226. According to them, the proposed substation- Land is situated on a 3.095 Ha land used for Fairs/Mela and as a playground. The government has approved land for 1.495 hectares for a youth stadium at one side of the land and 1.6 Ha has been set aside for PTCUL in April 2010. According to them, the local public will not support the project and the land allotted to PTCUL is divided by the NH-58. Table 1 in Annexure 4 lists participants for consultation in Pipalkot for GIS substation.

227. They suggested other locations where the land could be available - 1. Near Navodaya Vidhyala 500 meters from Navodaya School, 2. Kiroli Ka jungle/ Dadora Inter collage, 3. Adjacent

to proposed substation, down towards the river side.

6.3.2 400 kV DC Srinagar – Kashipur Transmission Line

228. The project area falls in Pauri, Nainital, Udham Singh Nagar, and Almora districts of Uttarakhand state. This area is situated in about 80% civil soyam and reserve forest area, where people of area showed a mixed reaction to the project. Maximum people accepted the project as an income generating national interest project at the same time some villagers were worried about losing potential agriculture land. Some people raised issue of possible harms and accidental disaster of the transmission line and asked PTCUL to take maximum care during the operation phase and give training for mitigation of possible harms and accidental disasters caused by the project. Villagers also showed their concern about landslide, soil erosion and dust generated during the construction activities and causing damage to the crop in nearby area and requested PTCUL officials to avoid construction activities during cropping seasons. People of the area requested PTCUL to give maximum employment and construction and labour works to the locals with first preference to project affected persons. On the whole, the people accepted the project by giving their assurance for supporting the project activities.

229. Table 2 in Annexure 4 lists participants for sample consultations along the route for 400 kV Srinagar-Kashipur transmission Line. The villages consulted enroute were Village Sainji in district Paudi, village Jiwai, a semi urban village area, Toliyoun, Kothila, Chulsia village under Tehsil-Thalisen Nagar, district- Pauri Garhwal. There is 100% electrification in the area, but there is a power cut of about 4-5 hours. People were aware for the project and were willing to work during construction, but they felt that the height of the line should be high as safety and security is the main issue and the trees have to be protected. They expressed desire that the PTCUL can also take the tower footing locations on long-term lease.

7.0 GRIEVANCE REDRESSAL MECHANISM

230. This Grievance Redressal Mechanism (GRM) would provide an effective approach for resolution of complaints and issues of the affected community. PMO shall formulate procedures for implementing the GRM. The PIU shall undertake GRM's initiatives that include procedures of taking/ recording complaints, handling of on-the-spot resolution of minor problems, taking care of complainants and provisions of responses to distressed stakeholders etc. paying particular attention to the impacts on vulnerable groups. The GRM would address affected persons' concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to the affected persons.

7.1 Grievance Redressal Committee

231. The information should include procedures of taking/ recording complaints, handling of on-the-spot resolution of minor problems, taking care of complainants and provisions of responses to distressed stakeholders. Grievances not settled as per the above standard mechanism will be brought to the Grievance Redress Committee (GRC). This GRC consists of the following persons listed in Table 29 below:

Table 29: Constitution of Grievance Redressal Committee

1	Superintending Engineer (FRC)	Chairman
2	Superintending Engineer (PI) concerned/Project Head	Member Secretary
3	Executive Engineer (PI)	Member
4	Executive Engineer (FRC)	Member
5	Local representative from Revenue Department	Member
6	Representative of contractor	Member

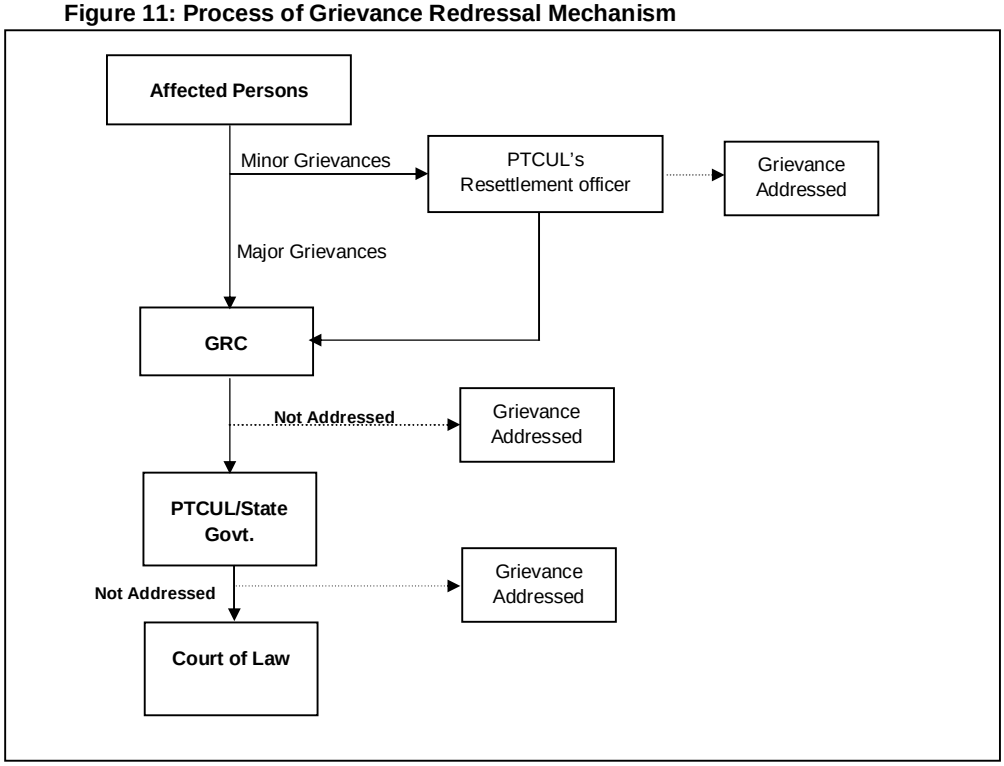
7.2 Functions of Grievance Redressal Committee

232. The main responsibilities of the GRC will be to: (i) provide support to Affected Persons (APs) on problems arising from right of way issues such as crop compensation and/or land/property acquisition; (ii) record AP grievances, categorize, and prioritise grievances and resolve them; (iii) immediately inform the EA/IA of serious cases; and (iv) report to APs on developments regarding their grievances and the decisions of the GRC and the PIU.

233. Other than disputes relating to ownership rights under the court of law, GRC will review grievances involving all resettlement benefits, compensation, relocation, replacement cost and other assistance. Periodic meetings of GRC can be conducted by the PIU so that all the problems and responses received by individuals in the GRC. The GRC will meet every month if grievances are brought to the Committee to determine the merit of each grievance, and resolve grievances within a month of receiving the complaint, failing which APs will have the right to address his grievance to appropriate legal authorities for redressal. Records will be kept for all grievances received, including: contact details of the complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were effected, as well as the final outcome.

234. The maximum financial power to the committee shall be INR 0.5 million only for each case from the EMP. The GRC will continue to function during the life of the Project loan including the defects liability period. Environmental and social grievances will be handled in accordance to the project's GRM. Open and transparent dialogue will be maintained with project affected persons as and when needed, in compliance with ADB safeguard policy requirements. The GRM for the project provides an effective approach for complaints and resolution of issues made by the affected community in reliable way. This mechanism will remain active throughout the life cycle of the project. GRM procedure is shown in Figure 11.

Figure 11: Process of Grievance Redressal Mechanism



8.0 FINDINGS AND RECOMMENDATIONS

236. Environmental impacts likely to result from the proposed transmission system development are manageable and can be managed cost effectively. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures for project components have been specified to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at this stage are taken into account and mitigated where necessary. Those impacts can be reduced through the use of proper mitigation measures listed in the EMP.

237. As already mentioned, new 400 kV DC transmission line from 400/220 kV Srinagar sub-station to 400/220 kV Kashipur sub-station will evacuate more than 2500 MW pooled power of Hydro-electric power projects in Alaknanda basin. This line will also inter-connect the two regions (Garhwal and Kumaon) of Uttarakhand and it will improve operational efficiency, quality of power, reliability of the system and at the same time will reduce losses. The 400 kV DC Srinagar to Kashipur transmission line will boost to the economic and industrial development of Uttarakhand state as state will get 12% free power as well as transmission charges.

238. The proposed project will have number of positive impacts and negative impacts to the existing environment as follows:

- State Government shall benefit largely from the large volumes for exportable surplus of power. The local people shall benefit due to improvement in quality and reliability of the electricity supply as well as funds that will flow into the area to provide them with better roads, health facilities due to higher allocations resulting from 12% free power from generation projects. Improvement in lifestyles of local people shall be the main positive impact of this project.
- There is will be removal of forest/fruit and non-fruit trees for the transmission line, which is the main negative impact to the proposed project area. However, the compensation for crop and trees shall be made as per Department of Forest, GoU's policy. Compensatory afforestation shall be carried out wherever forest land is used.
- Environment pollution due to cut and fill operations, transportation of construction materials, disposal of debris, disturbance to the farming activities, nuisance from dust, noise, vehicle fumes, black smoke, vibration as well as silt runoff due to construction activities are the short term negative impacts due to proposed project.
- There will be loss of agricultural productivity due to obstruction and reduce the land for agriculture at tower bases for which PTCUL shall pay only the crop compensation only. The right of way shall be utilised as per the Indian Telegraphic Act 1885, a practise widely followed by all transmission companies in India to set up power transmission lines.

239. No reliable baseline information of water, air and noise / vibration exists with respect to transmission line and substation location. Therefore, collection of baseline parameters of water, air, soil, and noise/vibration is recommended through sampling at specific locations as mentioned in EMoP. Establishment of baseline parameters is essential to monitor changes of the quality of water, air, soil and noise during the construction and operation periods.

240. Proper GRM will have to be implemented by PTCUL to overcome public inconvenience during the proposed project activities.

241. The IEE performed is adequate for purposes of project implementation. Based on the environmental assessment and surveys conducted for the project, the potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the mitigation measures identified in the EMP. Adequate provisions are being made in the project to cover the environmental mitigation and monitoring requirements, and their associated costs.

9.0 CONCLUSIONS

242. An environment and social analysis of the information available for state of Uttrakhand has been carried out looking at various criteria such as topology, air, noise, water resources and water quality, ecology, demography of the area, climate and natural habitat, community and employee health and safety etc. The impact analysis, found that due to careful consideration of environmental and social aspects during route and site selection by PTCUL, no major adverse impacts are expected. There is no adverse impact on the migration of habitat, existing land resources and no effect on regular lifestyles of the people. The environment and social impact associated with transmission line project is limited to the extent of construction phase and can be mitigated through a set of recommended measures and adequate provision for environment and social impacts which cover monitoring, measuring, and mitigation.

243. EMP has been prepared. Mitigation measures related to construction, as specified in the EMP, will be incorporated into civil works contracts, and their implementation will primarily be the responsibility of the EPC contractors. The PMO and PTCUL will be responsible for overall project implementation and auditing of site-specific EMPs.

244. Brief public consultations have been conducted along the transmission corridor. The results indicate broad support for the project based on perceived economic and social benefits. Most impacts are expected to occur during the construction phase and are considered to be of a temporary nature. The transmission corridor was carefully selected after undergoing an options assessment. This enabled the right of way alignment to minimise path through nearby reserve forest area, villages and important water supplies and resources. The main project impacts are associated with cutting of trees and excavation of soils.

245. No endangered or protected species of flora or fauna are reported at any of the project sites. The substation site proposed is located on land owned by PTCUL, characterized as mostly barren, uninhabited and unused land, but which is under public interest litigation (PIL) filed by local activists and NGO. Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts, along with their associated costs. Adverse impacts if noticed during implementation will be mitigated using appropriate design and management measures. The potential cumulative and residual impacts of the transmission project components as a whole indicate the project classifies as a category “B”, in accordance with *ADB’s Safeguards Policy Statement 2009*. The project is not considered highly sensitive or complex.

Annexure 1: Applicable Rules, Regulation, Policies, and Procedures

A. National Environmental Laws

1. The Environmental regulations, legislation, policy guidelines that may impact this project, are the responsibility of a variety of government agencies. The principal Environment Regulatory Agency in India is the Ministry of Environment and Forests (MoEF). MoEF formulates environmental policies and accords environmental clearances for different projects.

2. The Important environmental legislations in India are given below

(i) The Water (Prevention and Control of Pollution) Act, 1974, amended 1988
(ii) The Water (Prevention and Control of Pollution) Rules, 1975
(iii) The Air (Prevention and Control of Pollution) Act 1981, amended 1987
(iv) The Air (Prevention and Control of Pollution) Rules, 1982
(v) The Environment (Protection) Act, 1986, amended 1991 and including the following Rules/Notification issued under this Act.

- The Environment (Protection) Rules, 1986, including amendments
- The Municipal Solid Wastes (Management and Handling) Rules, 2000
- The Hazardous Wastes (Management and Handling) Rules, 2003
- The Hazardous Wastes (management, handling and transboundary movement) Rules 2009
- The Bio-Medical Waste (Management and Handling) Rules, 1998
- Noise Pollution (Regulation and Control) Rules, 2000,
- Wild Life (Protection) Amendment Act, 2002
- Ozone Depleting Substances (Regulation & Control) Rules, 2000.
- The Biological Diversity Act, 2002;
- The Environment Impact Assessment Notification, 1994; amended up to 2009;
- Batteries (Management & Handling) Rules, 2001
- The Environmental Clearance Notification, 1994
- Environmental Standards of CPCB

(vi) Noise Pollution (Regulation and Control) Rules, 2000
(vii) The Indian Wildlife (Protection) Act, 1972, amended 1993
(viii) The Wildlife (Protection) Rules, 1995
(ix) The Indian Forest Act, 1927
(x) Forest (Conservation) Act, 1980, amended 1988 (National Forest Policy, 1988)

- Forest (Conservation) Rules, 1981 amended 1992 and 2003
- Guidelines for diversion of forest lands for non-forest purpose under the Forest (Conservation) Act, 1980
- Scheduled Tribes and traditional forest dwellers in recognition of Forest Rights Act 2006.

(xi) The National Environmental Appellate Authority Act, 1997
(xii) The National Green Tribunal Act, 2010

B. State Government Policies

1. Some of the Uttarakhand Government policies that are applicable to the project components are:

- The Uttarakhand Hydropower Policy 2008;

C. Other Acts

The policy framework consists of following main regulations:

1. The Electricity Act, 2003
2. National Resettlement & Rehabilitation Policy, 2007 (NRRP) (MoRD, DoLR).
3. Right of Way and compensation under Electricity Laws.
4. Land Acquisition Act, 1894.
5. The Indian Telegraph Act (ITA), 1885.
6. Indian Treasure Trove Act, 1878 as amended in 1949.
7. Provisions of the Panchayats (Extension to the Scheduled Area) Act, 1996.

8. The Right to Information Act, 2005.
9. National Policy on HIV/AIDS and the World of Work, Ministry of Labour and Employment, GoI.
10. National Policy on Safety, Health and Environment at Work Place, Ministry of Labour and Employment, GoI.

D. Key Environmental Legislations

Name	Scope and Objective	Key Areas	Operational Agencies/Key Players
Water (Prevention and Control of Pollution Act, 1974)	To provide for the prevention and control of water pollution and enhancing the quality of water	Controls sewage and industrial effluent discharges	Central and State Pollution Control Board
Air (Prevention and Control of Pollution Act - 1981)	To provide for the prevention and control of air pollution	Controls emissions of air pollutants	Central and State Pollution Control Boards
Forest Act, 1927	To consolidate acquisition of common property such as forests	Regulates access to natural resources, state has a monopoly right over land, categories forests	State government, forest settlement officers
Forest Conservation Act, 1980	To halt India's rapid deforestation and resulting Environmental degradation	Restriction on de-reservation and using forest for non-forest purpose	Central Government
Wildlife Protection Act, 1980	To protect wildlife	Creates protected areas (national parks, sanctuaries) categories of wildlife which are protected	Wildlife Advisory Boards; Central Zoo Authorities
Environment Protection Act, 1986 Environmental Impact Assessment Notifications 1994 and amendments up to 2009	To provide for the protection and improvement of Environment	An umbrella legislation; supplement laws	Central government nodal agency MoEF; can deplete powers to state department of Environment
The Batteries (Management and Handling) Rules, 2001 as amended;	Provide safe disposal of lead acid and all other types of batteries	To control unsafe disposal of batteries contents by authorised recyclers	Central government nodal agency MoEF; can deplete powers to state department of Environment
The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules 2009	Movement, handling, of waste chemical oils in industries, commercial, other services	To control the disposal of hazardous chemicals, oils etc. into water , land and air	Central government nodal agency MoEF; can deplete powers to state department of Environment
The National Green Tribunal Act, 2010	Effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources including enforcement of any legal right relating to environment and giving relief and compensation for damages to persons and property and for matters connected therewith or incidental thereto	All civil cases where a substantial question relating to environment (including enforcement of any legal right relating to environment) is involved	Chairperson, National Green Tribunal

Annexure 2 Environnent Management Plan (EMP)

Project Activity	Potential Environmental Impact	Mitigation Action	Monitoring Scope	Standards/ Measurement/ Frequency	Institutional Responsibility	Implementation Schedule
Pre-construction						
A.	**Physical Resources**					
Equipment specifications and design parameters	Release of chemicals and harmful gases in receptors (air, water, land)	Chloro Fluorocarbons (CFCs), including Halons not used in transformers, project facilities or any other equipment.	Transformers other equipment specifications compliance with GoI rules/regulations & (International Electro-technical Commission) IEC standards	Exclusion of PCBs, CFCs stated in tender documents - Once.	PTCUL	Detailed design
B.	**Environment Resources**					
Location of land for substations/transmission towers	Impact to the existing surface water environment	Construction facilities should be placed at suitable distance from water bodies, natural flow paths, important ecological habitats and residential areas	Water and Air Quality	Air quality Standards and Water Quality standards – Once	PTCUL	Detailed design/Planning Stage
Sub-station location and design	Noise generation Exposure to noise, Nuisance to neighbouring properties	Sub-station location/designed to ensure noise will not be a nuisance to neighbouring properties.	Expected noise emissions based on substation design, noise levels	Noise control regulations Noise levels to be specified in tender documents	PTCUL	Detailed design/Planning Stage
Location of transmission towers and transmission line alignment and design	Impact on water bodies / land/ residences	Consideration of site location to avoid water bodies or agricultural land/orchards as much as possible. Careful site selection to avoid existing settlements	Site location, line alignment selection (distance to dwelling, water and/or agricultural land)	Consultation with local authorities and land owners, water quality standards- Once	PTCUL	Part of detailed project siting and survey and design
Interference with drainage patterns/Irrigation channels	Temporary flooding hazards/loss of agricultural production	Appropriate siting of towers to avoid channel interference	Site location and line alignment selection	Consultation with local authorities and design engineers	PTCUL	Detailed alignment survey and design
C.	**Ecological Resources**					
Encroachment into precious ecological areas	Loss of precious ecological values/ damage to precious species	Avoid encroachment by careful site and alignment selection and reconnaissance before final siting of activities.	Floral and faunal habitats loss	Enumeration of flora and fauna at site	EMSD of PTCUL	Detailed design/Planning Stage
D.	**Human Environment**					
Involuntary resettlement or land acquisition	Loss of lands and structures	Compensation paid for temporary/ permanent loss of productive land	Public complaints	Rates paid as per the Resettlement plan/Frame work for the project	EMSD of PTCUL	Prior to construction phase/Land Acquisition

Project Activity	Potential Environmental Impact	Mitigation Action	Monitoring Scope	Standards/ Measurement/ Frequency	Institutional Responsibility	Implementation Schedule
Encroachment into farmland	Loss of agricultural/horticultural productivity	Avoid siting new towers on farmland/orchards wherever possible Farmers compensated for any permanent loss of productive fruit trees that need to be trimmed removed along RoW.	Tower location and line alignment selection Statutory approvals for tree trimming /removal from competent authority Implementation of Crop and tree compensation (based on affected area)	Consultation with local authorities and design engineers in consonance with PTCUL	EMSD of PTCUL	Part of detailed alignment survey and design
Location and design of Sub-station	Disturbance to adjacent lands and the people due to cut and fill operations	Maintain adequate clearance, construction of retaining structures, minimise cut and fill operations adjoining to the dwellings	Transformers and specifications and compliance with setback distances ("as-built" diagrams)	Technical specification- Once Measure setback distances to nearest house structures – once	PTCUL	Detailed design/Planning Stage
Location of transmission towers and transmission line alignment and design	Exposure to safety related risks	Setback of dwellings to overhead line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites.	Tower location and line alignment selection with respect to nearest dwellings	Setback distances to nearest houses – Once	PTCUL	Part of tower siting survey and detailed alignment survey and design
Explosions/Fire	Hazards to life	Design of substations to include modern fire control systems/firewalls. Provision of fire fighting equipment to be located close to transformers, switchgear	Sub-station design compliance with fire prevention and control codes	Tender document to mention detailed specifications – Once	PTCUL	Part of detailed substation layout and design /drawings
Construction						
A. Physical Resources						
Site clearance	Soil erosion and surface runoff	Construction near seasonal rivers, erosion and flood-prone areas should be restricted to the non-rainy season. Provision and maintenance of drains and retention ponds. Treat clearing and filling areas against flow acceleration and construction work should be carefully designed to minimise obstruction or destruction to natural drainage.	Soil erosion	Visual inspection (Turbidity and sedimentation)	Contractor through contract provisions under supervision of PTCUL	Construction period
Removal or	Public inconvenience	Advance notice to the public about the time	Disruption to other	Technical	PTCUL and	Throughout

Project Activity	Potential Environmental Impact	Mitigation Action	Monitoring Scope	Standards/ Measurement/ Frequency	Institutional Responsibility	Implementation Schedule
disturbance to other public utilities		and the duration of the utility disruption Use of well trained and experienced machinery operators to reduce accidental damage to the public utilities Restore the utilities immediately to overcome public inconvenience	commercial and public activities / Public complaints	specification	Contractor through contract provisions	construction period
Equipment layout and installation	SF_6 leakage during storage and erection of Switchgear	Record of all substation switchgear, cylinders located within secure casings	Switchgear casings and sub-station bounding	As per (International Electro-technical Commission) IEC standards Once in year	PTCUL Contractor through contract provisions	Throughout construction/erection period
Surplus earthwork/soil	Runoff to cause water pollution, solid waste disposal	Any excess material will only be used as fill material offsite when the owner's agreement has been obtained and with the disposal site restored in a manner that prevents erosion and does not block any drainage path.	Location and amount (m^3) of fill disposal Soil disposal locations and volume (m^3)	Appropriate fill disposal and dispersal locations quarterly	Contractor through contract provisions under supervision of PTCUL	Construction period
B. Environment Resources						
Equipment layout and installation	Noise and vibrations	Selection of construction techniques and machinery to minimise ground disturbance.	Construction techniques and machinery	Minimal ground disturbance Monthly	Contractor through contract provisions under supervision of EMSD, PTCUL	Construction period
Sub-station construction	Loss of soil	Cutting and filling for the substation foundations obtained by creating or improving local drainage system.	Borrow area siting (area of site in m^2 and estimated volume in m^3)	CPCB norms Quarterly	Contractor through contract provisions under supervision of EMSD, PTCUL	Construction period
	Water pollution	Minimize construction activities involving significant ground disturbance (i.e. substation land forming) during the monsoon season. Provide drains and retention ponds if required.	Water Quality (pH, BOD/COD, Suspended solids, other) during major earthworks	GOI water quality standards, Timing of major disturbance activities - prior to start of construction activities	Contractor through contract provisions under supervision of EMSD, PTCUL	Construction period
Provision of facilities for	Contamination of receptors (land, water,	Construction workforce facilities to include proper sanitation, water supply and waste	Amenities for Workforce facilities	Presence of proper sanitation, water	Contractor through contract	Construction period

Project Activity	Potential Environmental Impact	Mitigation Action	Monitoring Scope	Standards/ Measurement/ Frequency	Institutional Responsibility	Implementation Schedule
construction workers	air)	disposal facilities.		supply and waste disposal facilities Once	provisions under supervision of PTCUL	
Mechanised construction	Noise, vibration and operator safety, efficient operation Noise, vibration, equipment wear and tear	Construction equipment to be well maintained. Construction techniques and Machinery selection to minimize ground disturbance. Proper maintenance and turning off plant not in use.	Construction techniques and equipment - estimated noise emissions and operating schedules	Technical specifications, safety regulations, Noise control regulations Quarterly	Contractor through contract provisions under supervision of PTCUL	Construction period
Construction of roads for accessibility for sub stations	Increase in airborne dust particles Increased land requirement for temporary accessibility	Existing roads and tracks used for construction and maintenance access to the site wherever possible. New access ways restricted to a minimum of single carriageway width.	Access roads, routes (length and width of access roads)	Use of established roads wherever possible Access restricted to a minimum of single carriageway width	Contractor through contract provisions under supervision of PTCUL	Construction period
C. Ecological Resources						
Site clearance	Vegetation	Marking of vegetation to be removed prior to clearance, and strict control on clearing activities to ensure minimal clearance.	Vegetation marking and clearance control (area in m^2)	Clearance strictly limited to target vegetation Once	Contractor through contract provisions under supervision of PTCUL	Construction period
Trimming/cutting of trees within RoW	Loss of vegetation and deforestation	Trees that can survive pruning to comply should be pruned instead of cleared. Felled trees and other cleared or pruned vegetation to be disposed of as authorised by the statutory bodies.	Species-specific tree retention as approved by statutory authorities (average and maximum tree height at maturity, in metres) Disposal of cleared vegetation as approved by the statutory authorities (area cleared in m^2)	Presence of target species in RoW following vegetation clearance.	PTCUL, Contractor through contract provisions under supervision of forest department	Construction period
Wood/ vegetation harvesting, cut and fill	Loss of vegetation and deforestation	Construction workers prohibited from harvesting wood in the project area during their employment.	Illegal wood /vegetation harvesting (area in m^2, number of incidents reported)	Complaints by local people or other evidence of illegal harvesting	PTCUL, Contractor through contract provisions	Construction period

Project Activity	Potential Environmental Impact	Mitigation Action	Monitoring Scope	Standards/ Measurement/ Frequency	Institutional Responsibility	Implementation Schedule
operations	Effect on fauna	Prevent work force from disturbing the flora, fauna including hunting of animals and fishing in water bodies. Proper awareness programme regarding conservation of flora, fauna including ground vegetation to all workers.	Habitat loss	Complaints by local people or other evidence of illegal hunting	PTCUL	Construction period
D. Human Environment						
Construction schedules for substation	Noise nuisance to neighbouring properties	Minimize construction activities undertaken during the night and local communities informed of the construction schedule.	Timing of construction (noise emissions, dBA)	Construction as per Scheduled timings only	PTCUL, Contractor through contract provisions	Construction period
Acquisition of cultivable lands	Loss of agricultural/ horticultural productivity	Avoid faming/harvesting season for field crops wherever possible for the project activities. Avoid construction/stringing during fruits season Ensure existing irrigation facilities are maintained in working condition Protect /preserve topsoil and reinstate after construction completed Repair /reinstate damaged bunds etc. after construction completed Compensation for temporary loss in agricultural production	Land area of agriculture loss Construction Schedule in non-fruiting season Usage of existing utilities Status of facilities (earthwork in m^3) Implementation of crop compensation (amount paid, dates, etc.)	Loss of crops-work in post-harvest period but before next crop – Once per site	PTCUL/ Contractor through contract provisions	Throughout construction period
Temporary use of land	Losses to neighbouring land uses/ values	Contract clauses specifying careful construction practices. As much as possible existing access ways will be used. Productive land will be reinstated following completion of construction Compensation will be paid for loss of production, if any.	Contract clauses Design basis and layout Reinstatement of land status (area affected, m^2) Implementation of Tree/Crop compensation (amount paid)	Incorporating good construction management, design engineering practices. Consultation with affected parties immediately after completion of construction and after the first harvest	Contractor through contract provisions under supervision of PTCUL	Construction period

Project Activity	Potential Environmental Impact	Mitigation Action	Monitoring Scope	Standards/ Measurement/ Frequency	Institutional Responsibility	Implementation Schedule
Transportation and storage of materials	Nuisance to the general public	Transport loading and unloading of construction materials should not to cause nuisance to the people by way of noise, vibration and dust Avoid storage of construction materials beside the road, around water bodies, residential or public sensitive locations Construction materials should be stored in covered areas to ensure protection from dust, emissions and such materials should be bundled in environment friendly and nuisance free manner	Water, Air Quality and Noise (dBA)	CPCB Emission standards and Water Quality standards - Quarterly	Contractor through contract provisions under supervision of PTCUL	Construction period
Temporary outage of the electricity	Loss of power supply to the local community when distribution lines crossing the new transmission line are switched off	Advance notice to the public about the time and the duration of the utility disruption Restore the utilities immediately to overcome public inconvenience	Power disruption to houses and commercial premises of power disruption	Regular monitoring during the period of strengthening the conductors	Contractor through contract provisions under supervision of PTCUL	Throughout the construction period
Health and safety	Injury and sickness of workers and members of the public	Contract provisions specifying minimum requirements for construction camps Contractor to prepare and implement a health and safety plan and provide workers with required PPE. Contractor to arrange for health and safety awareness programmes including on AIDS and sexually transmitted diseases (STD)	Contract clauses (number of incidents and total lost-work days caused by injuries and sickness)	PTCUL and ADB Health and safety standards - Monthly	Contractor through contract provisions under supervision of PTCUL	Construction period
Capacity Building	Improve standards of implementation and monitoring	Training of PTCUL Environment and Social Cell	Training schedules	Number of training program - Yearly	PTCUL	Construction period
Operation and Maintenance Phase						
A. Physical Resources						
Operation of Switchgear	Leakage of SF_6 gas	Record of all substation switchgear located within secure casings	Switchgear casings and substation bounding – Monthly	Ozone Depleting substances	PTCUL	Throughout the operation
B. Environmental Resources						
Soil Erosion at tower base of	Removal of top soil	Planting of buffer zone species suitable for hilly terrain	Turbidity of water (Visual Inspection)	Visual inspection (Turbidity and	PTCUL	Throughout the operations

Project Activity	Potential Environmental Impact	Mitigation Action	Monitoring Scope	Standards/ Measurement/ Frequency	Institutional Responsibility	Implementation Schedule
transmission line				sedimentation)		
Oil spillage	Contamination of land/nearby water bodies	Sub-station transformers located within secure and impervious bundled areas with a storage capacity of at least 100% of the capacity of oil in transformers and associated reserve tanks.	Sub-station bounding ("as-built" diagrams)- Monthly	Hazardous Waste (Management, handling, Trans-boundary Movement) Rules 2009	PTCUL	Throughout the operation
C. Ecological Recourses						
Trimming/cutting of trees within RoW	Fire hazards	Trees allowed growing up to a height within the RoW by maintaining adequate clearance between the top of tree and the conductor as per the regulations. Trees that can survive pruning should be pruned instead of cleared.	Species-specific tree retention as approved by statutory authorities (average and maximum tree height at maturity, in metres) - Quarterly	Presence of target species in RoW following vegetation clearance.	PTCUL, with forest department	Operation period
D. Human Environment						
Maintenance of Transmission line	Exposure to electromagnetic interference	Transmission line design to comply with the limits of electromagnetic interference from overhead power lines	Required ground clearance (metres) – Quarterly	Ground clearance, standards on EMF	PTCUL	Throughout the operation
Sub-station maintenance	Exposure to electromagnetic interference	Sub-station design to comply with the limits of electromagnetic interference within floor area	Required vibrations level, instrumentation – on public complaint	Technical specifications	PTCUL	Throughout the operation
Noise generation	Nuisance to the community around the site	Provision of noise barriers near substation sites	Noise level	Noise level (dbA)- Once a year	PTCUL	Throughout the operation
Electric shock	Death or injury to the workers and public	Security fences around substation Establishment of warning signs Careful design using appropriate technologies to minimise hazards	Proper maintenance of fences and sign boards Usage of appropriate technologies (lost work days due to illness and injuries)	Periodic maintenance Number of programmes and percent of staff/ workers covered	PTCUL	Throughout the operation
Training for Electric safety	Rising of awareness for electric safety	Training of PTCUL personals	Training schedules	Number of training program Yearly	PTCUL	Operation

EMSD –Environment Management & Social Department of PTCUL

Annexure 3: Environmental Monitoring Plan

Environmental component	Project stage	Parameters to be monitored	Location	Frequency	Standards	Rate (INR)	Implementation	Supervision
1.Air Quality	A. Pre-construction stage (The project once assigned to contractor)	PM_{10}, $PM_{2.5}$, SO_2, NOx, SPM, CO along with Meteorological data-temperature Humidity, wind speed, wind direction	Inside and outside (0.5 km) of the proposed substation	One time	National Air quality standards of CPCB	Per sample INR 15,000	Contractor by CPCB approved laboratory	Contractor/ PMO
	B. Construction Stage	PM_{10}, $PM_{2.5}$, SO_2, NOx, SPM, CO along with Meteorological data-temperature Humidity, wind speed, wind direction	Inside and outside (0.5 km) of the proposed substation	Quarterly	National Air quality standards of CPCB	Per sample INR 15,000	Contractor by CPCB approved laboratory	Contractor/ PMO
	C. Operation Stage	PM_{10}, $PM_{2.5}$, SO_2, NOx, SPM, CO along with Meteorological data-temperature Humidity, wind speed, wind direction	Inside and outside (0.5 km) of the proposed substation	One time	National Air quality standards of CPCB	Per sample INR 15,000	Contractor by CPCB approved laboratory	PMO
2.Water Quality	A. Pre-construction stage (The project once assigned to contractor)	EC, TSS, DO, BOD, P^H Oil and grease, Pb,	Nearest downstream spring/handpump wells (2 wells) around the substation	One time	National water quality standards of CPCB	Per sample INR 1,500	Contractor by CPCB approved laboratory	Contractor/ PMO
	B. Construction Stage	EC, TSS, DO, BOD, PH, Oil and grease, Pb	Nearest downstream spring/handpump wells (2 wells) around the substation	Quarterly	National water quality standards of CPCB	Per sample INR 1,500	Contractor by CPCB approved laboratory	Contractor/ PMO
	C. Operation Stage	EC, TSS, DO, BOD, P^H Oil and grease,	Nearest downstream	Yearly	National water quality standards of	Per sample INR 1,500	Contractor by CPCB approved	PMO

Environmental component	Project stage	Parameters to be monitored	Location	Frequency	Standards	Rate (INR)	Implementation	Supervision
		Pb	spring/handpump wells (2 wells) around the substation		CPCB		laboratory	
3.Noise/ Vibration	A. Pre-construction stage (The project once assigned to contractor)	Noise level (dB level)	Inside and outside (0.25 km) of the proposed substation	A single time	CPCB standards for Noise and vibrations	Per sample INR 6,000	Contractor by CPCB approved laboratory	Contractor/ PMO
	B. Construction Stage	Noise level (dB level)	Inside and outside (0.25 km) of the proposed substation	Quarterly	CPCB standards for Noise and vibrations	Per sample INR 6,000	Contractor by CPCB approved laboratory	Contractor/ PMO
	C. Operation Stage	Noise level (dB level)	Inside and outside (0.25 km) of the proposed substation	2 times/year	CPCB standards for Noise and vibrations	Per sample INR 6,000	Contractor by CPCB approved laboratory	PMO
4. Soil	A. Pre-construction stage (The project after assign to contractor)	PH, Sulfate (SO_3), Chloride, ORP, water Soluble salts EC, Organic Matter, Moisture Content	Inside and outside (just close to the proposed site, 2 locations) of the proposed substation	Single time	Technical specifications	Per sample INR 1,500	Contractor by CPCB approved laboratory	Contractor/ PMO
	B. Construction Stage	PH, Sulfate (SO_3), Chloride, ORP, water Soluble salts EC, Organic Matter, Moisture Content	Inside and outside (just close to the proposed site, 2 locations) of the proposed substation	Two times	Technical specifications	Per sample INR 1,500	Contractor by CPCB approved laboratory	Contractor/ PMO
	C. Operation Stage	PH, Sulfate (SO_3), Chloride, ORP, water Soluble salts EC, Organic Matter, Moisture Content	Inside and outside (just close to the proposed site, 2 locations) of the proposed substation	Single time	Technical specifications	Per sample INR 1,500	Contractor by CPCB approved laboratory	PMO

EMSD –Environment Management & Social Department of PTCUL

Abbreviations:

SO_2- Sulphur Dioxide; NO_2- Nitrogen Dioxide; CO- Carbon Monoxide; EC – Electric Conductivity;
Pb – Lead; $PM_{2.5}$ - Particulate Matter <2.5; PM_{10} - Particulate Matter <10; TSPM- Total suspended Particulate Matter;
EC - Electrical Conductivity; DO - Dissolved Oxygen; TSS - Total Suspended Solids;
BOD - Biological Oxygen Demand; NAAQS - National Ambient Air Quality Standards;
NWQS - National water Quality Standards; PTCUL –Power Transmission Corporation of Uttarakhand Limited
ORP – Oxidation Reduction Potential

Notes: Transport/Accommodation & Sample collection cost, VAT are not included for the EMoP.
Source for Rates: MoEF (CPCB) New Delhi, Notification Dated 15 June 2008

Annexure 4: Details of Public Consultations

1. Village wise list of the participants and their comments for the 400 kV Pipalkoti GIS sub-station is given below.

S. No.	Name of the Village	Date	Points	Name of People	
1	Pipal Koti Sub station	24-05-2012	• Siting of the project components to avoid impacts on land acquisition and resettlement • Awareness about the project and social impact • Benefits of the projects • Social and Environmental problems in the region • Presence of environmental sensitive areas in the region • Health and safety issues • Compensation payment mechanism initiatives for minimal environmental/social impacts • Presence of Indigenous People • Likely participation of the people for the future project implementation	• People are of the opinion that the proposed land for substation may be shifted as they think that the site can be used for other social activities. However, the land is in the possession of PTCUL. If unavoidable, people • Further consultation is required prior to the start of the work regarding the safety issues. • People have certain objection to the proposed site as they have their own plan for the land • Most of the people are aware about the project since PTCUL has initiated the consultation long back • No environment concern was highlighted by the people; however, they think that the substation may have some health problems and safety issues. PTCUL clarified their concern that the proposed substation will be a GIS substation which will be covered in a building with no adverse impacts on health and safety. • No tribal people live in the area	Mr. R.L Shah Mr. P.K. Bishnoi Representing the village Community in Pipalkoti which has filed the Public Interest Litigation

2. Village wise list of the participants and their comments for the 400 kV Srinanagar-Kashipur transmission line given below.

2	Transmission Lines: 1.Sainji village 2. Jiwai village 3. Toliyoun village 4. Kothila village 5. Chulsia village	25-05-2012 to 27-05-2012		• Most of the people are aware about the project • People in the villages are mostly depend on agriculture and daily wage • Drinking water is a problem since most of the people depend on river for the water. • People support the project and they wish that their current unreliable power supply with a minimum of 4 to 5 hours of power cut may be solved. • No tribal people live in the project area • People are of their views that local people should be encouraged to get involved in the project's construction activities and the contractor should hire local labor force to provide temporary employment • People are aware that the transmission lines will usually pass away from their habitats; however they also urge that the design should avoid agricultural land. Since, it is hilly terrain, therefore tower should be designed align through hill top to hill top to avoid any crop damage and loss of access to agricultural land. • If towers are to be placed in the agricultural land, suitable compensations should be given and the concerned farmers and villages should be consulted prior to the placing of towers. • They also suggested that construction activities and its timings may follow the off season period to avoid the loss of standing crops • No environment concern is foreseen however, the line will pass mostly through forest area. • People suggested that the towers should be properly fenced with iron wire so that nobody will be easily having the access to the towers • The foundations of the towers should be strong and the height of the lines should be sufficient enough so that people will not have the fear of having any exposure to high power transmission lines. PTCUL has assured that international design standard will be adopted and any dmage in this regard will be addressed suitably.	1.Sainji village • Pradhan-Smt. Bageswari Devi • Mr. Bikram Kumar • Mr. Shivanand Khandiyal • Mr. Satyabrata Badoni • Mr. Virender Singh Bhandani • Mr. Purshottam Prasad Khagriyal • Mr. Ravesh Singh Sahu • Mr. Kailash 2. Jiwai village • Mr. Pradhan- Ms. Manju Rawat • Mr. Kripal Singh • Mr. Yashpal Singh • Mr. Rajesh Singh Bisht 3. Toliyoun village • Pradhan- Smt. Rakhi Devi • Mr . Mahendra Singh Rawat • Mr. Prem Singh Rawat • Mr. Ram Singh Rawat 4. Kothila village • Ms. Pratibha Bisht • Mr. Brijpal Singh • Mukesh Bisht • Surya Prakash Sajon • Dhirendra Singh Rawat • Balvir Singh Bhist • Navin Singh Sajwan 5. Chulsia village Pradhan- Sumanlata Dhayni represting village community in Chulsia