

Himachal Pradesh State Roads Transformation Program

(Under Funding Assistance of the World Bank)

Mandi-Rewalsar-Kalkhar (Km 0.000 to Km 28.000)

Environment and Social Impact Assessment (Final Report)

October 2021

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**HIMACHAL PRADESH ROAD & INFRASTRUCTURE
DEVELOPMENT CORPORATION LIMITED**
(Government of Himachal Pradesh Undertaking)
(An ISO 9001:2008 QMS & ISO 14001:2004 EMS conforming company)

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ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
AAQ	Ambient Air Quality
ADT	Average Daily Traffic
ANM	Auxiliary Nurse Midwife
ASI	Archaeological Survey of India
BIS	Bureau of Indian Standards
BMTPC	Building Materials & Technology Promotion Council
BPL	Below Poverty Line
CAR	Contractor's All Risk Policy
CBO	Community Based Organization
CCTV	Closed Circuit Television
CD	Cross Drainage
CGWB	Central Ground Water Board
CGWA	Central Ground Water Authority
Ch	Chainage
CHS Plan	Community Health & Safety Plan
CMU	Construction Management Unit
COI	Corridor of Impact
CPCB	Central Pollution Control Board
CPRs	Common Property Resources
CPWD	Central Public Works Department
CRF	Central Road Fund
CSC	Construction Supervision Consultant
CTO	Consent to Operate
CTE	Consent to Establish
CTVC	Classified Traffic Volume Count
Cum	Cubic Meter
dB	Decibel Level
DEIAA	District Environment Impact Assessment Authority
DLP	Defect Liability Period
DoE	Department of Environment
DC	District Commissioner
DFO	Divisional Forest Officer
DLC	District Level Committee
DPR	Detailed Project Report
EBRD	European Bank for Reconstruction and Development
EHSGs	Environment Health and Safety Guidelines
EO	Environment Officer
ERP	Emergency Response Plan
ESIA	Environmental and Social Impact Assessment
ESF	Environment and Social Framework
ESS	Environment and Social Standards
E&S	Environment and Social
ESHS	Environment, Social, Health and Safety
ESMF	Environmental and Social Management Framework
EMP	Environmental Management Plan
ERoW	Existing Right of Way
ESMP	Environmental Social Management Plan
ESMU	Environment & Social Management Unit
ESCP	Environment and Social Commitment Plan
FPIC	Free Prior and Informed Consultation
FGDs	Focus Group Discussions

GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIIPs	Good International Industry Practice
GLC	Ground Level Concentration
GoI	Government of India
GoHP	Government of Himachal Pradesh
GPS	Global Positioning System
GRC	Grievances Redress Committee
GRM	Grievances Redress Mechanism
GBV	Gender Based Violence
Ha	Hectare
HDPE	High-density Polyethylene
HGV	Heavy Goods Vehicle
HIV	Human Immunodeficiency Virus
HPDOT	Himachal Pradesh Department of Transport
HPMVA	Himachal Pradesh Motor Vehicle Administration
HPPWD	Himachal Pradesh Public Works Department
HPRIDCL	Himachal Pradesh Road and Infrastructure Development Corporation Limited
HPSPCB	Himachal Pradesh State Pollution Control Board
HPSRTP	Himachal Pradesh State Road Transformation Project
HQ	Headquarters
HSO	Health and Safety Officer
IFC	International Finance Corporation
IM	Intermediary Organisations
IMD	India Meteorological Department
IPH	Irrigation and Public Health Department
IRC	Indian Road Congress
IS	Indian Standards
ISFR	India State of Forest Report
IUCN	International Union for Conservation of Nature
IVE	International Vehicle Emission
KLD	Kilo Litres Per Day
Km	Kilometre
LCC	Life Cycle Cost
LED	Light Emitting Diode
LHS	Left Hand Side
LPD	Litres Per Day
LPG	Liquefied Petroleum Gas
LMP	Labour Management Procedure
LoS	Level of Service
MDRs	Major District Roads
MoEF&CC	Ministry of Environment and Forests & Climate Change
MoRTH	Ministry of Road Transport & Highways
MSL	Mean Sea Level
MSIPs	Management Strategies and Implementation Plans
MPN	Most Probable Number
MT	Metric Tonne
NAAQS	National Ambient Air Quality Standards
NABL	National Accreditation Board for Testing and Calibration Laboratories
NGO	Non-Government Organization
NH	National Highway
NRSC	National Remote Sensing Centre

NOx	Oxides of Nitrogen
NTFP	Non-Timber Forest Product
OHS Plan	Occupational Health and Safety Plan
PAP	Project Affected Person
PAF	Project Affected Family
PAH	Project Affected Household
PCP	Project Contact Person
PD	Project Director
pH	Potential of Hydrogen
PIA	Project Influence Area
PMC	Project Management Consultant
PM	Particulate Matter
PMGSY	Pradhan Mantri Gram Sadak Yojana
PPE	Personal Protective Equipment
PUC	Pollution Under Control
PWD	Public Works Department
RAP	Resettlement Action Plan
RFCTLARR Act	Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act
RET	Rare, Endangered and Threatened
RHS	Right Hand Side
RPF	Resettlement Policy Framework
R&R	Resettlement and Rehabilitation
RoW	Right of Way
SC	Schedule Caste
SEP	Stakeholder Engagement Plan
SEIAA	State Environmental Impact Assessment Agency
SCRN	State Core Roads Network
SGRC	State level Grievance Redress Committee
SH	State Highway or Sexual Harassment
SIA	Social Impact Assessment
SME	Small & Medium Enterprises
SO2	Sulphur Dioxide
ST	Schedule Tribe
USEPA	United States Environmental Protection Agency
VGO	Vigilance Officer
VMS	Variable Messaging System
WB	The World Bank
WMM	Wet Mix Macadam

EXECUTIVE SUMMARY

1.0 HPSRTP – Background & Objective

1. The Project Development Objective of HPSRTP (Himachal Pradesh State Roads Transformation Program) is to enhance the efficiency of the transportation, logistics and road safety to stimulate horticulture and overall economic growth in Himachal Pradesh, through **Component 1: Building HP's Transport and Logistics Institutions, and Resilience; Component 2 - Improving fruit belts, stimulating HP's horticulture and overall economic growth, through upgrading priority target collector roads/ MDRs/ OSRs. Component 3: Enhancing road safety.**

Sub Project Roads under Tranche I - HPSRTP

2. Mandi – Rewalsar – Kalkhar (28 km) is one of the four corridors, which has been prioritized for widening and upgradation under Tranche I of HPSRTP. The other three corridors are (a) Baddi – Sai – Ramshahr (33.40 km) (b) Dadhol – Ladroul (13.50 km) and (c) Raghunathpura-Mandi-Harpura-Bharari (2.75 km). The cumulative length of 4 corridors under tranche I is 77.65 km.

Associated Facilities of Tranche I - HPSRTP

3. At present, four bridges (3 minor and 1 major bridge) are under construction along Mandi-Rewalsar-Kalkhar road by HPPWD, which qualify as 'Associated Facilities' but common approach for the assessment and management of environmental/social risks and impacts will not apply, as these are funded by GoI through Central Road Fund.

2.0 Sub-project Road– Mandi– Rewalsar- Kalkhar

4. The Mandi-Rewalsar-Kalkhar road, designated as MDR-26 starts from Mandi and ends at Kalkhar and traverses entirely within Mandi district. Some of the major settlement areas along the project road are Mandi, Panjethi, Talyahar, Ghera, Gaddel, Rattipul, Raghwanoo, Randhara, Gambharpul, Rewalsar, Kalkhar.

5. Rewalsar, an urban settlement along project road is a religious place of importance for Buddhists, Sikhs and Hindus, has 4 Monasteries, 1 Gurdwara and 3 Hindu temples and attracts several thousands of tourists every year. Every 12th year, a mahakumbh is celebrated at Rewalsar, which attracts several thousands of Buddhists and religious followers from all over India and abroad. Rewalsar also has a serene lake, which is considered as sacred by the Buddhists and is a tourist place of attraction. None of the settlements along the project road have any schedule V areas notified for Himachal Pradesh or tribal households that display characteristics, outlined under ESS 7.

6. The traffic surveys and traffic projection up to year 2038 indicate the project road warrant widening of the existing road to intermediate lane, in order to conform to the Level of Service (LoS) recommended by IRC. The widening of the project road is restricted to the available Right of Way (RoW) with no fresh land acquisition, while ensuring minimal environmental and social impacts. The project road widening, with a design speed of 30 kmph considers 16 typical cross sections with width of corridor of improvement (CoI) vary in between 8 to 11 meters, depending upon the geometric improvements at necessary locations and protection measures along identified stretches, which are prone to landslides. The project design considers construction of breast walls (12940m), retaining/ toe walls (6980m) and gabion walls (5672m) as protection works. The project road upgradation proposal include construction of 139 CD structures (35 box culverts, 97 pipe culverts, 5 slab culverts and 2 minor bridges) along with 14,980 meters of RCC cover drains and 11,010 meters length of 'V' shaped drawings along the road which will be connecting to the nearest culverts. The proposal also includes construction of 16 bus stops (11 new and re-modelling of 5 existing) with disabled friendly ramps and road safety components as per requirements.

3.0 Scope of ESIA

7. The scope of the ESIA is to: i) assess the existing baseline status of the environment and social attributes within the Corridor of Impact (direct impact zone) and Project Influence Area; ii) identify the probable adverse and positive E&S risk and impacts due to the planned project during its entire cycle i.e. from pre-construction to construction and operation & maintenance; iii) consider all ESHS likely in the project for further usage towards preparation of requisite mitigation plans, as may be required; iv) identify capacity constraint of HPRIDCL in respect of E&S management and propose commensurate capacity enhancement measures, among others.

4.0 Legal and Institutional Framework

8. Key GoI and GoHP provisions applicable to the sub-project of road include Environmental Protection Act, 1986; The Forest (Conservation) Act, 1980; Biological Diversity Act, 2002; Construction & Demolition Waste Management Rules, 2016; Air (Prevention and Control of Pollution) Act, 1981; Water (Prevention and Control of Pollution) Act, 1974; Noise Pollution (Regulation and Control Act) 1990; The Right to Information Act, 2005. Further, WB's Environment and Social Framework, 2016 and ESS 1, 2-6, 8 and 10 relevant to this sub-project.

5.0 Regulatory Clearances and Permissions for Project Road

9. Based on the present applicable regulatory framework, project road does not require prior environmental as well as forest clearances. However, project road upgradation will require tree felling permissions, consent to establish and operate camp sites, hot mix plants, concrete batch mix plants, WMM plants, work force camps etc., permits for sourcing construction water, labor permits among others, all of which does not pose as a significant regulatory risk.

6.0 Baseline Environment Profile

10. The baseline environmental and social profile assessment include key attributes like geology, hydrogeology, physiography, drainage, soil, land use, flora, fauna, forest/vegetation cover, climate, ambient air quality, water quality, ambient noise levels, hazards and vulnerability, socio economic and demographic profile, particularly for COI (25m on either side) and PIA (15km on either side) and Mandi district as a whole.

11. Geologically, rock formations occupying PIA as well as Mandi district range from pre-Cambrian to Quaternary period. Hydro-geologically, the stage of ground water development falls under "Safe" category and no area or block of the district has been notified for restricted groundwater development by Central Ground Water Authority. Project Road traverses through Dhuladhar range of Sutlej basin in hilly /mountainous area of Mandi District and with an average elevation of 1100 meters (range 700-1500 meters). The climate of the district is temperate to sub-tropical with an average annual rainfall of 1430 mm, minimum and maximum temperatures ranging between 3°C and 35°C respectively.

12. The soil fertility in the PIA is medium with low Nitrogen levels, high Phosphorus and medium Potassium levels. The project road does not get snowfall and has a visibility of 4-10 km for 208 days in a year during morning hours. As per wind hazard map of the district, the project road traversers in a moderate risk zone and experience a wind speed of 1-19 kmph during evening hours for 213 days in a year.

13. The ecological investigation along the corridor of impact of project road has not indicated presence of any endangered and /or threatened (RET) floral species, as per IUCN Red Data book of Indian plants. The road widening will require felling of 360 trees, which are within corridor of impact. The project road has forest areas, at eight locations adjacent to its right of way with a cumulative length of 4.255 km but will not require forest land diversion for project road widening. There are no National Parks, Wildlife Sanctuaries, Biosphere Reserve and/or any other notified sensitive/protected areas within 15km on either side of the project road. No wildlife crossing corridors are reported along the project road, except for sighting of a Leopard by local people near Manjhiyali village at Km 18+000. A variety of birds have been reported but there are no important bird areas in PIA or Mandi District. Rewalsar Lake is the only prominent surface water body within the PIA, considered sacred by

Buddhists, visiting the 4 monasteries at Rewalsar. The Lake is situated 50 meters away from the Project Road and predominantly has cultured common carp and some ornamental fishes among other species for tourist attraction, but fishing of all types has been prohibited by the fisheries department, GoHP.

14. The project region falls under very high-risk seismic zone (Zone V) and the Himachal Pradesh Disaster Management Authority has categorized the vulnerability status of the entire Mandi District, which include project road as 'High' for natural calamities like wind hazard, earthquake, landslides considerations. The project road is not prone to floods and the probable areas liable for flash floods are more than 100 kms from project road. Although, Himachal Pradesh experiences occurrences of several cloud burst every year, Mandi district has a statistical probability of one cloud burst occurrence, once in every four years and the project road has not experienced any cloud burst in last ten years.

15. The project road has no protected archeological or historical monuments within 300 meters on either side of its right of way. The four monasteries, 1 Gurudwara and 3 Temples at Rewalsar, although have religious importance but none of them are protected monuments under GOI regulations and are located at aerial distances ranging between 50 to 500 meters from project road. The project road has 6 natural water sources, 4 schools, 1 primary health center, and 24 temples/religious shrines (Peepal tree and platform), 14 hand pumps along the project road.

16. The baseline environmental monitoring carried out along project road and at Associated Facility locations for ambient air quality (parameters covering PM₁₀ and PM_{2.5}, CO, NO_x, Sox) and day and nighttime ambient noise levels indicate that all tested/measured values at all sampling locations are within the respective National Standards, which can be attributed to absence of any major emission sources related industrial activities, except for vehicular emissions. Similarly, the surface, ground water and soil samples collected along Project Road and at Associated Facility locations does not critically exceed and largely conform to the respective stipulated limits/standards.

7.0 Baseline Socio-Economic Profile

17. The project road upgradation/widening will impact 16 structures (encroachments/ illegal extensions) into the right of way, which belong to 18 families (PAFs). As part of the ESIA, all such households have been identified and surveyed for their socio-economic profile. The total population of these 16 affected structures belonging to 18 families are 79 (PAPs), with 33 males and 46 female population. All 18 PAFs follow Hindu religion (100%) and 16 PAFs belong to General caste (89%) and 2 households belong to SC (11%). Among the 18 PAFs, 7 are vulnerable HHs (2 SC HHs, 2 HHs with above 65 years age, 1 woman headed household (WHH) with above 65 years age, with 1 WHH with 65 years age and 1 handicapped family member and 1 household with chronically diseased family member.

18. Of these 18 PAFs, 7 are in joint family (38.88%), 9 are nuclear family (50%) and 2 households (11.11%) refused to provide complete details during the census and socioeconomic survey. Of the 18 PAFs, 3 (16.66%) households were women headed. The literacy levels of these 18 households are quite high (>80 with education levels ranging between primary school to post graduation, with the median education being intermediate or pre-degree level. Occupation wise, out of 79 PAPs, 14 (17.72%) are engaged in Govt. and Private Service, followed by 9 (11.39%) into trade /business, 5 in agriculture (6.33%), 14 in household family duties (17.72%) and rest are unemployed or students or old age people. Out of the 18 PAFs, annual income level of 11 families range between 1 to 2 lakhs (61.11%), 5 families/households have income between 2 to 5 lakh and 2 households have declined¹ to provide information during socioeconomic survey. The expenditure pattern of the 18 households indicates that nearly 88.88% of the households have a monthly expenditure between 5000 to 10,000 per month, which translates to 60,000 to 1 lakh per annum. Owing to the reasonably good income levels as well as good saving potential, majority of the families/households have modern consumer durables like TVs, Refrigerator (88.88% HHs), washing machines (55.55% HHs), two-wheeler (33.33% HHs), four-wheeler (38.88% HHs), mobile phones (100% HHs) and maintain minimum levels of standards. Out

¹ These households will be once again surveyed during verification of PAPs as part of RAP implementation.

of 18 households, only 4 households have availed loans from Banks and notably none of the surveyed households have borrowed from private money lenders².

8.0 Stakeholder Consultations

19. 16 Consultations with 212 participants (114 male, 98 female, 0 third gender) were held with communities at various settlement areas en-route the project road and specifically at locations, where common property resources are located and which are likely to be affected. Key queries and concerns posed during consultations were related to entitlement and extent of compensation provisions under the project; avoidance of impacts on CPRs such as temples, schools etc. Some were averse to shifting of religious shrines and majority of people have expressed willingness for relocation of the religious shrines to nearby adjacent locations for the purpose of road widening; suggestions were given to consider available open land, wherever it was available instead of impacting private structures and land; participants were aware of the several encroachments along the road but have not expressed serious concerns for removal/clearance for road widening purposes but expect advance information for such removal of encroachment.

20. 12 GBV consultations with 166 participants (109 females, 47 adolescent girl students, 10 lady teachers) which included 1 consultation at Rewalsar Police Station, were carried out along project road as part of ESIA during first week of Nov 2020. All women participants were sensitized about potential risks due to the presence of construction work force along roads during day as well as near the hot spots like marketplaces and liquor vends, among others in the evening hours and/or weekends. The women participants were also sensitized about the availability and use of women helpline numbers: 1100 and 1098 and were encouraged to use the same and involve the elderly community members under warranting situations.

9.0 Analysis of Alternatives

21. Three alternatives were evaluated to minimize environmental and social impacts as well as to consider resource efficiency and/or minimization of natural resources extraction namely i) No Project Scenario ii) Minimization of hill cut/excavation operations and reuse the cut materials for road construction and thereby minimize land required for disposal of muck/debris iii) Avoid/minimize environmental impacts (viz. avoid impacts on natural resources, sensitive receptors and religious places) and social impacts (viz avoid impacts on structures by encroachers/non-title holders).

22. The project design considers reuse of 2,73,343 cum out of 6,13,650 cum of excavated materials in embankment and subgrade construction, backfilling of protection works and reclamation of low-lying areas within RoW, which incidentally reduces the muck disposal land requirement by 44.54%. Similarly, the analysis of alternative options through review and modifications of design for project road have enabled to avoid and/or limit the social impacts from 44 to 16 and avoided impacts to 28 structures (64%) and 3 natural water resources, 1 sensitive receptor and 2 religious' shrines.

10.0 Assessment of E&S Risks and Impacts

23. The project road's likely environmental and social risks and impacts due to the project road widening and Associated Facilities have been assessed by each relevant standard (ESS 1, 2 to 6 and 8) and all required impact mitigation management measures are included in ESMP Volume, which is a standalone document to the ESIA and may be referred for details. The social impacts of the project road widening have been significantly reduced by considering the design modifications through alternative analysis (ref. Section 6 - Analysis of Alternatives) and a RAP has been prepared for all the impacted structures as per the provision of RPF under HPSRTP.

24. E&S risks on labor and working conditions (ESS 2): At this stage, it is estimated that the project road construction will require to engage 865 contract workers (including project managers, supervisors,

² Availing loan from banks indicate sustained incomes and availing loan from private lenders indicate desperation or lack of sustained incomes or collaterals to qualify for bank loans.

skilled and unskilled labor, etc.) The Risks include: Non-payment of wages by Employer; Non-payment of benefits (compensation, bonus, maternity benefits etc.) by Employer; Discrimination in Employment (e.g. abrupt termination of the employment, working conditions, wages or benefits etc.); Possibility of Gender based violence as the road shall traverse through sensitive locations such as settlement areas, schools and hospitals etc. that are near to habitations; Health risks of labour relating to HIV/AIDS and other sexually transmitted diseases.

25. HPRIDCL has a Labour Management Procedure that would be applicable for the project road and through this LMP all GoI /State Labour and Safety regulations will be complied. The responsibility of contractor to manage these risks would be clearly reflected in the contractual obligations of the Civil Works Contractor with appropriate mechanisms for addressing non-compliance. The bid documents for construction will incorporate requirements for Environment, Social, Health and Safety (ESHS) including list of applicable labor laws and provisions and the metrics for periodic reporting by contractors. The bidder's submission requirements as part of their technical bid include: i) ESHS strategy and implementation plan; code of conduct; ii) declaration of past ESHS performance. The successful bidder will be required to submit an ESHS Performance Security @ 2% of accepted contract value.

26. E&S risks and impacts relating to Resource Efficiency and Pollution Prevention (ESS 3): The assessment of impacts and risks due to road construction has considered sensitive receptors of physical, biological, social, and cultural environment. The project's impacts and risk would be of significance due to muck disposal(estimated quantity of muck for disposal is 340307 cu.m); slope stability and erosion, easing of flow across seasonal streams (139 CD structures across seasonal streams), construction water demand (324 KLD), stressing water sources used by community (absence of perennial water sources); liquid waste discharge (25488 LPD) (sewage/sullage from workforce camps and camp sites), emission from construction vehicles, equipment and plants; increased dust levels from operations like earth work excavation, hill cutting, transportation and stacking of materials; noise pollution at sensitive receptors/settlements along road; damage to structures on hill side/embankment due to vibration from movement of construction vehicles and equipment; handling of hazardous and non-hazardous wastes, management of borrow areas, muck disposal sites, stone quarries, stone crusher units, hot mix plants, concrete batch mix plants. The ESMP considers adequate measures to mitigate or reduce the impacts. The improved road will minimize GHG emissions to the extent of 73495 metric tonnes during its design life cycle (upto year 2038) due to the improved riding quality and pavement conditions.

27. E&S risks and impacts relating to Community Health and Safety (ESS 4): The project road will act as haul road for transporting construction materials and thus is likely to cause nuisance to both existing road users and pedestrians. The ESMP considers adequate mitigation measures to minimize the possible impacts and risks on community health and safety issues. In addition, polycarbonate sheets with rubber gaskets mounted on steel frames have been proposed as noise barriers at two school locations, which are adjacent to project road. The ESMP has been included as contractual obligations of the Civil Works Contractor with appropriate mechanisms for addressing non-compliance. The CSC will oversee the implementation of ESMP by the contractor.

28. E&S risks and impacts on land & assets (ESS 5): The project road widening will be restricted available right of way with no fresh land acquisition. Over the years, the right of way has been encroached by adjacent landowners through minor extensions, 16 of which will get affected by the project road widening. The social survey has identified all such 16 encroachments (structures) belonging to 18 families (PAFs) with 79 PAPs. Out of the 18 PAFs, 3 are having 50% and above impact and 1 tenant of a commercial structure will have temporary loss of income and therefore treated as physically and economically displaced PAFs. All the displaced PAFs have consented to shift to adjacent location of their choice, which have been identified and confirmed by themselves but expect/ need assistance. RAP has been prepared for all the PAFs in accordance with RPF under HPSRTP.

29. The project road widening will not have any adverse impacts on 7 vulnerable HHs and disadvantaged persons among PAPs, as they have been considered for assistance as per applicable RPF

provisions. All the 16 bus stops (11 new and re-modelling of 5 existing) will be provided with disabled friendly ramps in accordance with the Disability Act, 2016 in addition to road safety components.

30. E&S risks and impacts relating to Biodiversity & Living Natural Resources (ESS 6): Although the project road has forest areas adjacent to its right of way, at eight locations, Project Road up-gradation/widening will be confined to available/ existing right of way and no fresh forest land diversion will be required. There is no presence of rare, endangered and threatened flora species along project road. The ecological investigation along the project corridor has not indicted the presence of wildlife corridors except for a sighting of leopard by villagers at village Manjhiyali (Km 18+000), which incidentally has a natural water source and leopard may be visiting this location for water. Therefore, as part of ESMP, the conservation and enhancement of this water source with a trough, to facilitate drinking of water by wild animals/stray/grazing animals has been made. Further, the project road has 6 natural water sources along CoI and impact on two has been avoided due to project road widening through design review and modifications. All 6 natural water sources along CoI of project road have been considered for renovation as a natural resource conservation and enhancement measure to serve as a water source(s) for road users, local community as well as for grazing/stray cattle and wild animals.

31. E&S risks and impacts relating to Cultural Heritage (ESS 8): The project road does not have any ancient monuments, religious structures and/or archaeological site(s) protected by GoI/GoHP within 300 meters of the alignment. The project design includes relocation of two small roadside religious structures and renovation/beautification of 10 religious' shrines (Peepal tree with platforms) as cultural heritage enhancement measure under ESMP. The project road, near Rewalsar has 4 monasteries, 1 Gurdwara and 3 Temples and all of them are located away from road at an aerial distance ranging between 50 to 500 meters and segregated by settlement areas. Thus, such places of religious importance will not be directly exposed to construction works of project road. Further, measures like scheduling of works to avoid important religious celebrations, traffic diversions/traffic management, among others have been included in ESMP, to reduce the inconvenience to the visiting religious followers and tourists to Rewalsar.

E & S Risk and Impacts of Associated Facilities

32. The 4 bridges which are under construction since 2018-19 and qualifying as Associated Facilities, did not warrant any land acquisition for construction of approach roads, as per the information shared by the concerned division of HPPWD.

33. HPRIDCL is committed to undertake mitigation measures, if any warranted at all the 4 bridge locations, being constructed by HPPWD, which qualify as Associated Facilities, since these bridges are integral to the Mandi-Rewalsar-Kalkhar corridor. Such mitigation measures comprise river/stream bed clean up and profile restoration (up to 100 meters on both upstream and down steam sides), riverbank protection works through both engineering and nature-based bio-engineering solutions (up to 100 meters on both upstream and down steam side). All such measure is included as civil works items in the bid documents of the relevant contract packages of project road.

11.0 Environment and Social Management Plan

34. An ESMP has been prepared to mitigate Project's environmental and social risks and impacts. It includes mitigation measures, monitoring plan, capacity building, responsibilities and reporting system with a budgetary provision of INR 909.26 Lakhs (INR 90.92 million). The budgetary provisions also include for renovation and conservation of natural water sources, relocation and/or renovation of religious shrines, periodic monitoring of environmental parameters at work/operations sites, removal of invasive species and replantation with local species along project road corridor, among others. In addition, a GBV risk mitigation strategy will be implemented at project level. A separate Resettlement Action Plan has been prepared to address pre-construction social impacts, arising due to removal of encroachments within RoW, which will be implemented by NGO.

35. The ESMP obligates the contractor, upon mobilization, to prepare the C-ESMP, which shall be approved by CSC prior to the commencement of construction activities. The Contractor's C-ESMP will include OHS plan, Water and Waste Management Plan, Influx management Plan, Worker's camp

management plan, CHS Plan, Traffic management and road safety management Plan, Quarry/borrow area management plan, and Site restoration Plan among others in accordance with the GoI and IFC&WB workers accommodation guidelines. All such plans will be reviewed and approved by the CSC, prior to commencement of construction works. The approved C-ESMP shall be reviewed periodically (but not later than every three (3) months) and updated in a timely manner.

36. The budgetary provisions of under ESMP also include provisions for implementing nature based (bioengineering) solutions at muck disposal sites, cross drainage structures, protection work locations, reclaimed low-lying areas within RoW, land slide prone locations for slope stability improvement and landscaping of potential open areas within RoW for enhancement of aesthetics, among others.

12.0 Institutional Arrangements for Implementation of ESMP

37. The implementation of ESMP will be overseen by Construction Supervision Consultant (CSC) under the overall guidance of the Project Director (PD) cum Chief Engineer, HPRIDCL, who is also responsible for the successful implementation of all project activities under HPSRTP. The PD will be assisted by CSC for implementation of ESMP at each of the contract package levels. The CSC shall provide one Environmental Specialist, one Social Development Specialist and one Bio-diversity Specialist for implementation of ESMP and shall coordinate with the Environmental Specialist at HPRIDCL headquarters for the implementation of ESMP under the overall guidance of Project Director. At specific project road corridor or contract package level, the Contractor shall provide one Social cum Community Liaison Officer, one Health & Safety Officer and one Environmental Officer, who shall be responsible for implementation of ESMP at field level under the guidance of the CSC.

38. The HPRIDCL has appointed an NGO for implementation of RAP for the project road. The NGO will provide social development officer(s) and other field staff, and coordinate with revenue departments and district administration as well as with CSC implementing RAP provisions and ensure timely disbursement of compensation/ entitlements prior to clearing of encroachments. The NGO will also coordinate with CSC in timely handing over the encumbrance free stretches to the contractor for commencement of construction.

39. The ESMP implementation monitoring, and reporting shall be through daily, weekly and monthly progress reports. All operational areas as well as designated work camp sites, hot mix plants, material stack yards will be subjected to periodic environmental monitoring (ambient air quality, noise, water and soil) to ascertain the effectiveness of ESMP implementation. The checklists for monitoring the ESMP implementation shall be developed by CSC, based on the approved C-ESMP of the Contractor, prior to commencement of Construction works.

13.0 Grievance Redress Mechanism

40. HPRIDCL will establish GRM to redress the complaints relating to on-site verification of PAPs/PAFs, applicable entitlements, disbursements during implementation of RAP. The GRM will also be mandated for addressing the complaints received during the project construction phase, which could be mainly arising due to construction activities of contractor like loss of access, damage to some private or common property or utilities, vibration, noise and dust levels due to excavation works, traffic management, community safety and other similar issues/concerns. The GRM will be independent, will have institutional arrangements, procedure for receiving complaints, time limits for redressal of complaints and function under CMU/ HPRIDCL.

41. In addition, the contractor will be contractually obligated to set up another GRM, mainly to redress complaints relating to workforce, deployed for project road construction under HPSRTP.

14.0 Training and Capacity Building

42. As a training and capacity building initiative, designated HPRIDCL staff will be deputed for exposure visits to other similar road construction projects with good track record for RAP and ESMP implementation. The designated staff will also be sponsored for training courses conducted by accredited institutions in Resettlement and Rehabilitation (R&R) and ESMP implementation.

1 INTRODUCTION

1.1 HPSRTP – Background & Objective

1. GoHP's program for transforming state level transport institutions, improving mobility and logistics for horticulture and overall economic growth in HP, connecting HP to the Bharatmala network, and enhancing road safety, sets the goal for the institutional transformation envisaged to be implemented under the proposed HPSRTP (Himachal Pradesh State Roads Transformation Program). As such, HPSRTP will support launching of GoHP's program focusing on strengthening the institutional base for transportation infrastructure and logistics services administration, across the State.
2. The Project Development Objective of HPSRTP is to enhance the efficiency of the transportation, logistics and road safety institutions to stimulate horticulture and overall economic growth in Himachal Pradesh.
3. The HPSRTP comprises the following components and sub-components:

Component 1: Building HP's Transport and Logistics Institutions, and Resilience, including:

- **Sub-component 1.1:** Re-establishing the Himachal Pradesh Road and Infrastructure Development Corporation (HPRIDCL) with an objective to support GoHP's initiative to create a corporate entity responsible for the administration of HP roads and delivering safe, resilient and well performing roads supporting the horticulture and overall economic development of the State. This involves, re-establishing HPRIDCL as the road asset and other public infrastructure manager, responsible for the development and maintenance of all roads and other infrastructure under the jurisdiction of the HPPWD.
- **Sub-component 1.2:** Supporting the commercialization process of the direct labor operations and promoting competitive performance-based maintenance contracting. The objective is to support GoHP's initiative to improve the efficiency of road maintenance and reduce maintenance cost, by laying the ground for the full commercialization of HPPWD's direct labor operations.
- **Sub-component 1.3:** Establishing HP Motor Vehicle Administration (HPMVA), strengthening the Directorate of Transportation of HPDOT and developing logistics system and strategy. The objective is to deliver efficient customer services, as well as competitive, safe and clean/less pollutant transportation in HP.

Component 2: Improving fruit belts and stimulate HP's horticulture and overall economic growth including:

4. This component will finance upgrading priority target collector roads/MDRs. The upgrading of approximately 77.65 km of roads connecting small holding farmers production and primary processing clusters to wholesale markets/SME clusters.

Component 3: Enhancing Road Safety, including:

- **Sub-component 3.1:** Promoting the 'Safe System': This focuses on strengthening enforcement on state roads and critical accident spots along rural roads, by enhancing patrolling and establishing emergency response system.
 - **Sub-component 3.2:** Promoting the 'Safe Corridor initiative': The Safe Corridor initiative will support the state highway patrol by providing surveillance equipment (CCTV cameras for speed control, accident recording, etc.), variable messaging system (VMS), training the police, and establishing emergency response posts.
5. The implementation of the core initiatives of the HPSRTP is expected to result in: i) Improved efficiency of transport and logistics institutions; ii) Reduction in maintenance expenditure; iii)

Reduction in transport cost for transporting products from production clusters to SME/wholesale markets along the project roads; iv) Reduction in road accident fatalities per 100,000 population in pilot areas.

1.2 Sub Project Roads under Tranche I - HPSRTP

6. Under Tranche I, four road corridors with a cumulative length of 77.65 km are being considered for upgradation/widening in line with the objective of Component 2 of HPSRTP. The details of the four corridors are given in **Table 1-1**.

Table 1-1: Roads Proposed for Widening/Upgradation under Tranche I- HPSRTP

S. No	Name of the Road	District	Length (in Km)
1	Baddi – Sai – Ramshahr	Solan	33.40
2	Dadhol – Ladrou	Bilaspur	13.50
3	Mandi – Rewalsar – Kalkhar	Mandi	28.00
4	Raghunathpura-Mandi-Harpura- Bharari	Bilaspur	2.75
	Total		77.65

1.3 Associated Facilities of Tranche I - HPSRTP

7. At present four bridges (3 minor and 1 major bridge) are under construction since 2018-19 at different chainages along the 28 km long Mandi-Rewalsar-Kalkhar road by HPPWD and funded through the Central Road Fund (CRF) of Government of India (GoI). The Mandi Rewalsar Kalkhar is one of the four corridors under Tranche I and the four bridges, which are under construction meets all the three criteria set out in the ESF Policy of the World Bank to qualify as ‘Associated Facilities’.

8. Since the qualifying Associated Facilities, mentioned above is not under the funding by any other multi-lateral or bi-lateral funding agencies, requirement for a common approach for the assessment and management of environmental/social risks and impacts will not apply. Further, the ESF policy stipulate that the qualifying Associated Facilities shall meet the ESSs requirements, to the extent that the borrower (HPRIDCL) has control over such Associated Facilities.

9. The 4 bridges which are qualifying as Associated Facilities, did not warrant any land acquisition for construction of approach roads, as per the information shared by the concerned division of HPPWD.

10. HPRIDCL will undertake certain mitigation measures at all the Associated Facilities (4 bridge locations) since these are integral to the Mandi-Rewalsar-Kalkhar corridor. Such mitigation measures can comprise river/stream bed clean up and profile restoration (up to 500 meters on both upstream and down steam sides), riverbank protection works through both engineering and nature-based bio-engineering solutions (up to 100 meters on both upstream and down steam side) and road safety measures. Further, HPRIDCL will take up with other concerned departments to control over the discharge of untreated sewage/sullage directly into river/steam(s) and dumping of construction debris and/or municipal waste into river/streams at these Associated Facilities location by the local community from the nearby settlement areas, shops and establishments at all locations.

1.4 Purpose of ESIA

11. Based on the risks and impacts of the priority Tranche I corridors, the risk rating³ is revised to ‘Substantial’ and accordingly an ESIA has been prepared.

³ Initially, the overall project risk was categorized as ‘High’ as per an internal Environment and Social Risk Classification of the World Bank and ESIA's were prepared by an independent consultant.

12. The purpose of the ESIA is to use it as tool for decision-making on the sub-project road, so that there is sustainable development of the road construction. Specifically, the objective of the ESIA is:

- i. To identify, evaluate and manage the environment and social risks and impacts of the project road in a manner consistent with the ESSs.
- ii. To adopt a mitigation hierarchy approach to the project's E&S risks i.e., a) anticipate and avoid risks and impacts; b) minimize or reduce risks and impacts to acceptable levels, if not avoidable; c) once risks and impacts have been minimized or reduced, mitigate; and (d) where significant residual impacts remain, compensate for or offset them, where technically and financially feasible.
- iii. To help identify differentiated impacts on the disadvantaged or vulnerable and to identify differentiated measures to mitigate such impacts, wherever applicable.
- iv. To assess the relevance and applicability of environmental and social institutions, systems, laws, regulations and procedures in the assessment, development and implementation of projects, whenever appropriate; identify gaps, if any exist, and
- v. To assess borrower's existing capacity and identify areas for enhanced capacity towards management of E&S risks.

1.5 Scope of the ESIA

13. The ESIA requires conforming to the applicable environment and social legal and regulatory framework of Government of India and Himachal Pradesh as well as World Bank's Environmental and Social Framework Policy and relevant Standards.

14. The scope of the ESIA is to:

- i. assess the existing baseline status of the environment within Corridor of Impact and Project Influence Area.
- ii. identify the probable adverse and positive E&S risk and impacts due to the planned project during its entire cycle i.e., from preconstruction to construction to operation & maintenance.
- iii. identify stakeholders and various groups/institutions who are either affected or have an interest or a stake in the project, with additional emphasis on disadvantaged and vulnerable groups and to carry out consultations with stakeholders to help elicit their concerns, suggestions and support.
- iv. consider all ESHS likely in the project for further usage towards preparation of requisite mitigation plans, as may be required.
- v. conduct additional studies, if any, for the enhancement of the benefit to the local community and the road users.
- vi. identify capacity constraint of HPRIDCL in respect of E&S management and propose commensurate capacity enhancement measures; and finally
- vii. use inputs from the above to prepare appropriate mitigation measures and plans and their inclusion in cost estimates (including rate analysis), Drawings, Bill of Quantities, Technical specifications and other inputs that would be integrated with the bid documents.

1.6 Structure of ESIA Report

15. The ESIA report for the widening and up-gradation of the 28 km long Mandi Rewalsar Kalkhar road has been structured as hereunder:

- i. Environmental and Social Impact Assessment (ESIA) Report
- ii. ESIA Appendices

16. This report presents the Environmental and Social Impact Assessment (ESIA) of the road and has been structured into 8 sections. ESIA Appendices include the plan and profile of road, right of way demarcation report, drainage map, ecological investigations, environmental and social surveys/ investigations reports, Attendance sheets and photos of stakeholder and GBV consultations, bio-diversity management plan, climate change disaster management plan and similar background data/information referred in ESIA.

0. **Executive Summary**

1. **Introduction:** This section describes background of project and its components; need/requirement, objective and scope and structure of the ESIA report.
2. **Project Description:** This section summarizes the project road design consideration, present and projected traffic data, widening proposals, protection works, cross drainage structures, road safety features for the Mandi Rewalsar Kalkhar road under tranche I of HPSRTP.
3. **Legal and Regulatory Framework:** This section describes the environmental and social policies and regulations of Government of India, Govt. of Himachal Pradesh as well as the Environmental and Social Policy Framework (ESF), 2016 of the World Bank, which is applicable to the priority corridors under HPSRTP.
4. **Baseline Data:** This section describes baseline environmental and socio-economic profile of the direct corridor of impact as well as the project influence area (15 km on each side) of Mandi Rewalsar Kalkhar in Mandi district. The baseline environmental and social data have been assessed from both secondary data and supplemented by primary investigations, wherever required.
5. **Stake holder Consultations and Information Disclosure:** This section describes the stakeholder and GBV consultations conducted along the project corridor along with its outcome for ESIA.
6. **Analysis of Alternatives:** This section describes the alternatives evaluated for finalizing the widening and upgradation proposals of the project corridor, with a prime objective to minimize environmental and social impacts. The section also includes the outcome of stakeholder consultations to minimize the social impacts and improve road safety features.
7. **Environment and Social Risks, Impacts and Mitigation Measures:** This section identifies and evaluates the anticipated environmental and social risks, impacts and commensurate mitigation measures due to the proposed widening and upgradation of project corridor.
8. **Environmental and Social Management Plan:** This section describes an Environmental and Social Management Plan (ESMP), to minimize and/or avoid the risks and impacts of the widening and up-gradation of the project corridor as well as enhancement or conservation measures for natural water sources, CPRs along project corridor along with budgetary provisions.

The section also includes institutional arrangement for ESMP implementation supervision and monitoring mechanism for the project implementation phase as well as a GRM (grievance redress mechanism) to redress the concerns of PAPs as well as the construction related complaints from the local community during the construction phase.

2 PROJECT DESCRIPTION

2.1 Sub-Project Road: Mandi- Rewalsar- Kalkhar

17. The Mandi – Rewalsar- Kalkhar road is 28+000 Km and is designated as MDR-26 (Major District Road). The project road starts from Mandi town and ends at Kalkhar and traverses entirely within Mandi Tehsil of Mandi district. Project road connects to NH -154 at 0 km, NH-3 at Km 4.5 (Talyahar) and MDR 84/old SH 32 at Km 29 (**Figure 2-1 and 2-2**). The latitude and longitude of the project road at Mandi and Kalkhar are 31.707°N to 31.632°N and 76.930°E to 76.833°E respectively. The altitude of project corridor from Mandi to Kalkhar ranges between 850-1350 m above mean sea level (MSL).

18. Mandi district was formed after the merger of Mandi state (Mandi) and Suket, two princely states on 15 April 1948. The name Mandi may have derived from the common name ‘Mandi’ which means ‘market’ as it serves as commercial hub and trade center. Mandi is situated almost at the geographical center of the Himachal and lies along the left bank of the river Beas at the foot hill of Shavilik ranges. It is also known as “Choti Kashi” for its beautiful carved stone edifice temples like Trilokinath and Panchvaktra etc. Mandi serves as a transit junction for visitors to major tourist attractions of the state like Kullu, Manali, Lahaul and Spiti, Dharamsala etc. Mandi is also well known for its celebration of ‘Maha Shivarathri’ fair within Himachal Pradesh as well as adjoining states like Punjab, among others.

19. Some of the big settlement areas along the project road are Mandi town itself having historical importance, Panjethi, Talyahar, Ghera, Gaddel, Rattipul, Raghwanoo, Randhara, Gambharpul, Rewalsar, Kalkhar. Out of the total 28 km length, the built-up areas of the settlements extend to 9 km, which is about 32% of the road length. There are 16 junctions along the project road, out of which 3 are major junctions and the rest 13 are minor junctions and connects to nearby villages/settlements.

20. Rewalsar, which is along the project corridor at 22.5 Km, is a tranquil place with its lake surrounded by wooded area is stunningly beautiful and has 4 Monasteries namely Drikung Kagyu, Tso-Pema Orgyen Heru-Kai, Zigar Drukpa Kagyud, Nyingmapa monasteries, 3 Hindu temples and 1 Gurdwara. Naina Devi temple, is also another revered place of religious importance, situated on hilltop and at a distance of 10 Km from Rewalsar. Therefore, Rewalsar serves as an important tourist destination for Buddhism followers in India and abroad.

21. Rewalsar Lake, also known as Tso Pema, is a mid-altitude square shaped lake located in the midst of surrounding hilly/mountainous terrain spur and dense wooded vegetation. The lake is at about 1,360 m above MSL with a water spread area of 2.6 Ha, max depth of 6m and 735 meters long shoreline with a peripheral road surrounding the lake (ref 4.6 under Section 4 for more details on Rewalsar lake).

22. Rewalsar Lake is regarded as a sacred spot for Tibetan Buddhists for the Vajrayana practices of Padmasambhava and Mandarava and are credited for the lake's creation several centuries back and thus carries heritage value. The lake is also regarded as sacred for Hindus and Sikhs visiting the temples and Gurudwara at Rewalsar and is also a place of attraction place for enroute tourists, passing through Rewalsar.

23. The economy of the Mandi district is predominantly agrarian and people cultivate rice, pulses, millets, vegetable/horticulture crops, fruits, tea, and herbal products. It is also prominently known for cocoon cultivation (sericulture), silk, woolen and artificial thread-based industry and directly employees’ farmers. The region is also under apple cultivation and rural population of the district is actively engaged in livestock rearing like cattle, goat and sheep for their daily needs. The district has a diary unit run by the H.P. State Co-Operation-Milk- Federation at Chakkar, benefit small and marginal farmers in the region.

24. The Project Road do not have any Schedule - V areas or tribal households that meet the characteristics outlined in ESS 7⁴.

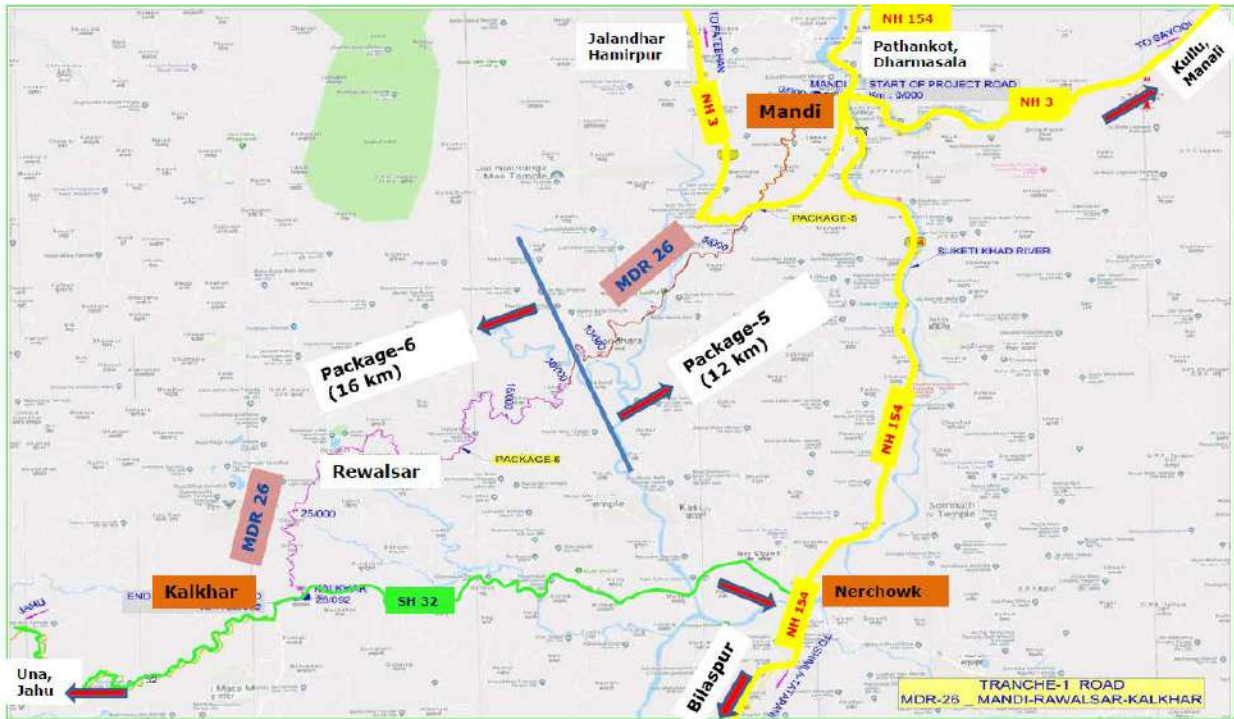


Figure 2-1: Location Map of Mandi -Rewalsar- Kalkhar Road



Start Point of Existing Road Km 0/000 (Mandi)



End Point of Existing road Km 28/444 (Kalkhar)

Figure 2-2: Start Point and End Point of Project Road

⁴ characteristics as outlined in ESS 7 – Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities

2.2 Present Pavement Condition & Carriageway Width

25. The existing pavement condition of the project road is in distress condition at several intermediate stretches, except for initial stretch of 2 km near Mandi. The pavement condition of the project road at different chainages are summarized in **Table 2-1**.

Table 2-1: Pavement Condition of Project Road

S. No	Existing Chainage		Length (Km)	Rutting (mm)	Pavement Distress				Other Distresses	Overall Condition
	From	To			Cracking (%)	Potholes (Nos)	Patching (%)	Ravelling (%)		
1	0	2	2	-	-	-	-	-	-	Good
2	2	8.2	6.2	Severe cracking, patching, undulations and ravelling. Bituminous layer fully deteriorated and Road significantly damaged						Poor
3	8.2	28	19.8	5	7.1	3	7.5	-	Less Undulations near end point	Good

26. As per the information available with the concerned PWD division, the existing right of way (RoW) along project road varies between 7 to 20m. However, the existing width of carriage way (flexible pavement/bituminous portion) varies between 3.1 m and 7.2 m as given in **Table 2-2**.

Table 2-2: Existing Carriageway width of Project Road

S. No	From Km	To Km	Width (m)
1	0/000	1/400	7.2
2	1/400	7/000	3.1
3	7/000	7/130	4.5
4	7/130	7/400	3.4
5	7/400	16/500	3.3
6	16/500	22/500	3.4
7	22/500	23/500	7.2
8	23/500	24/000	3.3
9	24/000	26/600	3.1
10	26/600	27/500	3.1
11	27/500	28/170	3.5

2.3 Accident Data

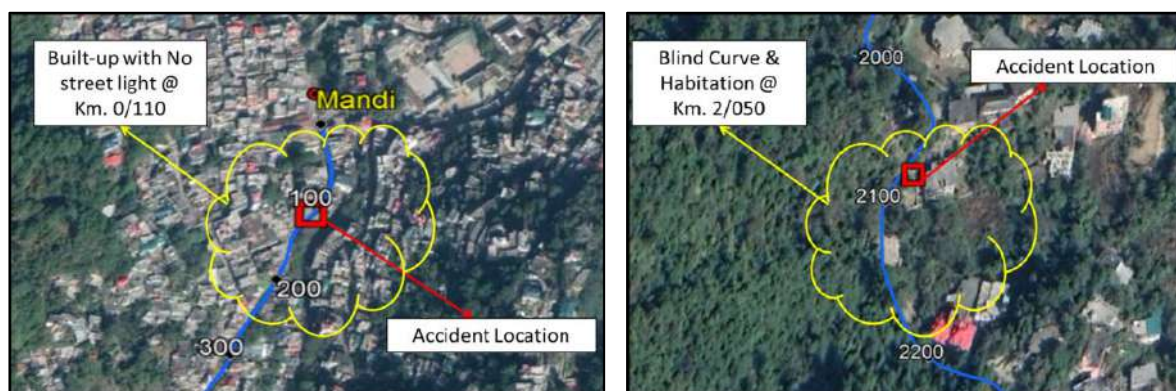
27. During project preparation, a road safety audit was carried out for the project road, which indicates that, there exists one black spot (at Km 0/110). Accident data available from Police Department for years 2016-2018 (**Table 2-3** and **Figure 2-3**) indicate occurrence of 13 accidents, and majority of accident classes are grievous and fatal, which are mainly due to over speed/rash or dangerous driving, turning without care supplemented with site conditions such as no lighting, blind curve, absence of traffic measures at junctions etc.

Table 2-3: Accident Data of Project Road

S. No.	Year	Chainage	Accident Class	Accident Cause	Collision Type
1	2018	0.1	Grievous	Speed	Hit pedestrian
2	2017	0.11	Fatal	Dangerous driving	Head on
3	2016	0.28	Grievous	Dangerous driving	Head on
4	2017	2.05	Fatal	Dangerous overtaking	Head on

S. No.	Year	Chainage	Accident Class	Accident Cause	Collision Type
5	2017	2.5	Injury needing hospitalisation	Over Speed	Hit on side
6	2017	9.82	Injury needing hospitalisation	Dangerous driving	Hit from rear
7	2018	11.33	Injury needing hospitalisation	Over Speed	Overtaken
8	2016	12.08	Injury needing hospitalisation	Dangerous driving	Skid off road
9	2017	19.7	Injury needing hospitalisation	Dangerous driving	Overtaken
10	2016	22.35	Injury needing hospitalisation	Dangerous driving	Hit pedestrian
11	2016	22.76	Damage Only	Dangerous driving	Hit parked vehicle
12	2016	26	Grievous	Turning without care	Skid off road
13	2016	28.178	Injury needing hospitalisation	Blind bend	Head on

Source: Police Department, GoHP.



Accident Location at Km. 0/110

Accident Location at Km 2/050

Figure 2-3: Accident Locations along Project Road

2.4 Traffic Surveys

28. As part of the project preparation, traffic surveys were conducted along the project road during August 2019. The schedule of traffic survey is given in **Table 2-4** and traffic volume count locations are shown in **Figure 2-4**.

Table 2-4: Traffic Survey Schedule

S. No	Road Name	Location	Ex. Chainage	Duration	Survey Schedule
Classified Traffic Volume Count (CTVC)					
1	Mandi - Rewalsar - Kalkhar	Kalkhar	At Km. 27/400	1 Day*	05th Aug 2019
Speed and Delay Surveys				3 Round each	From 3 rd August to 9 th August 2019

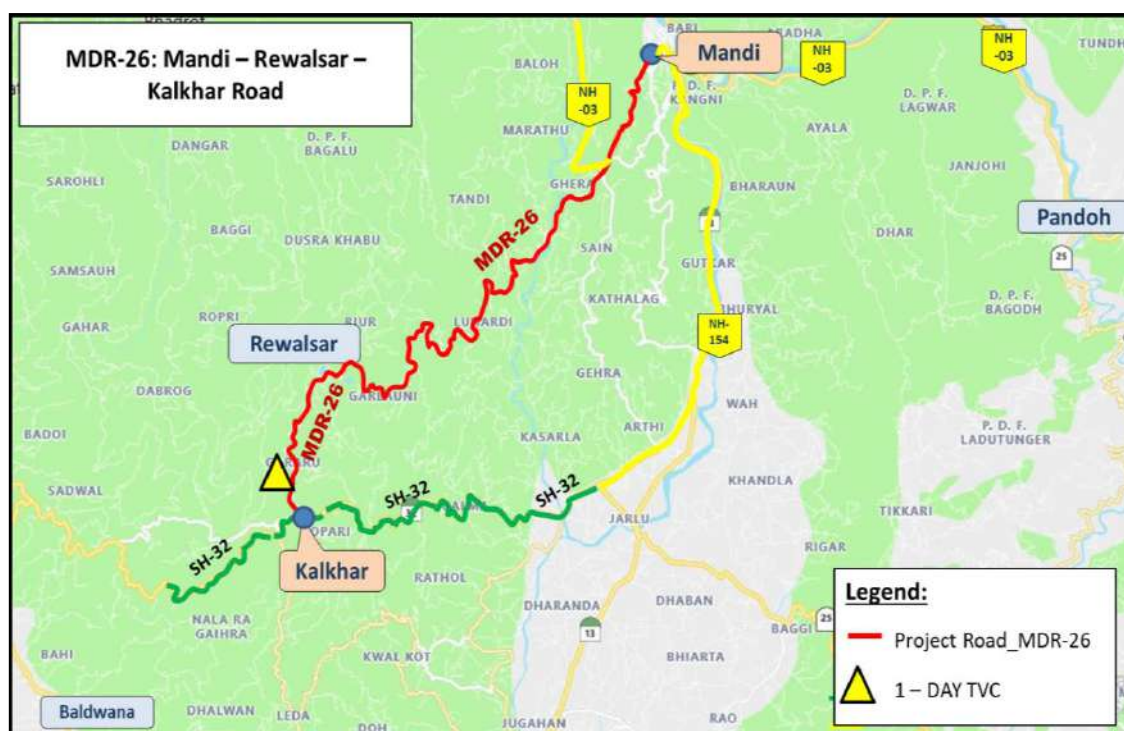


Figure 2-4: Traffic Volume Count Locations

2.5 Traffic Projections

29. Daily traffic volume by vehicle type and direction were aggregated and an average calculated for the entire survey duration to determine the average daily traffic (ADT) at each survey location. The daily traffic by each hour of the day over the survey period, the Day wise hourly traffic data by vehicle type at Traffic Volume count location is given in **Table 2-5**.

Table 2-5: Average Daily Traffic Values

TVC Location	2 W	3 W	Car/Jeep/Van	Bus	LCV	2-Axle Trucks	3-Axle Trucks	Multi Axle Vehicles	Tractor + Trailer	Cycle/Rick/ADV	Total Vehicles	Total PCU
Near Kalkhar	447	9	504	97	182	22	4	2	4	0	1272	1318

30. The projected traffic projections on project road up to year 2038 is given in **Table 2-6**. The growth potential of goods traffic is different from passenger traffic and directly related to zone's economic activity and production levels than its population and income growth patterns.

Table 2-6: Traffic Growth Rates and Traffic Projections for Project Road

Sl. No.	Years	Total Vehicle	Total PCU
1	2019 / AADT	1272	1318
2	2020 (Design)	1407	1448
3	2021 (Construction)	1558	1593
4	2022 (Construction)	1726	1752
5	2023 (Construction)	1912	1928
6	Induced + Diverted Traffic of 5%		
7	2024	2153	2177

Sl. No.	Years	Total Vehicle	Total PCU
8	2025	2351	2365
9	2026	2567	2568
10	2027	2804	2790
11	2028	3064	3032
12	2029	3305	3256
13	2030	3566	3497
14	2031	3848	3757
15	2032	4152	4036
16	2033	4481	4337
17	2034	4815	4650
18	2035	5174	4986
19	2036	5560	5347
20	2037	5975	5735
21	2038	6422	6151

2.6 Proposed Improvement for Project Road

31. Based on the traffic demand forecast and considering a Level of Service (LoS), as recommended by IRC, the lane configuration considered for the project road is given in **Table 2-7**. Based on traffic projections, the overlay design and flexible pavement design options adopted for project road, based on life cycle cost (LCC) analysis is given in **Table 2-8**. The pavement composition has been proposed as per IRC: 37-2018. The design criteria adopted for the project road is given in **Table 2-9**.

32. The widening proposal for the project road is restricted to the available right of way, for which the ownership status of land is readily available with the PWD and therefore no fresh land acquisition is required, with the exception of rectification of land title records in favor of HPPWD between Ch 3/350 to 4/200 as mentioned in previous para.

33. The existing RoW and the proposed corridor of improvement for widening and upgradation of corridor is given in **Appendix-3**.

Table 2-7: Lane Configuration of Project Road

Sl. No	From (m)	To (m)	Length (m)	Lane Configuration
1	0+0	1+700	1700	Intermediate Lane
2	1+700	4+370	2670	Two lanes
3	4+370	27+854	23483.82	Intermediate Lane
Total Length (m)			27854	

Table 2-8: Overlay Design and Flexible Pavement Design (15 years) Options for Project Road

Sl. No.	Chainage (km)		Length (km)	SL Adopted MSA	Design CBR (%)	Pavement Design				Remarks
	From	To				BC (mm)	DBM (mm)	WMM	GSB	
1	0	1.7	1.7	-	-	30	50	-	-	Overlay design

Sl. No.	Chainage (km)		Length (km)	SL Adopted MSA	Design CBR (%)	Pavement Design				Remarks
	From	To				BC (mm)	DBM (mm)	WMM	GSB	
2	1.7	27.854	26.154	7	9	30	50	250	150	Pavement Reconstruction on account of Geometrical improvements (horizontal and vertical)

*BC-Bituminous Concrete, DBM-Dense Bituminous Macadam, WMM-Wet Mix Macadam & GSB-Granular Subbase

Table 2-9: Design Criteria adopted for Project Road

Sl. No.	Design Parameter	Limiting Values
1.	Design Speed	30 kmph*
2.	Cross fall/ Camber	2.5% minimum
3.	Super elevation	7%
4.	Vertical alignment	7% all along road, with exception of 8% gradient in limited and short sections of road
5.	Sight Distance	Stopping sight distance-45m Intermediate sight Distance-90m

Note: * Design speed is restricted to 20 kmph at sharp curves and dense settlement areas (45 locations) with installed sign boards for speed limits.

2.7 Typical Cross-Sections

34. The Project Road design has been carried out in accordance with IRC-48 "Hill Road Manual" and IRC -52-2019 "Guidelines for Alignment Survey and Geometric Design of Hill Roads". The proposed improvement/widening scheme of project road comprises of 16 typical cross sections. The length of the project road under each of type of cross section is given in **Table 2-10** and the typical cross sections along with alignment Plan & Profile of the project road is given in **Appendix-1**. The proposed improvement/widening scheme of project road comprises concentric widening, eccentric widening and as well as geometric improvements at necessary locations, which also considers blind spots and areas prone to landslides locations along project road.

Table 2-10: Typical Cross Sections (TCS) along Project Road

S. No	Design Ch from	Design Ch To	Length (m)	Type of TCS
1	0	350	350	TCS-1 (CoI width 9m)
2	350	1700	1350	TCS-1 A (CoI width 9m)
3	4370	5590	1220	TCS-2 (CoI width 8m)
4	6300	6750	450	
5	7060	7540	480	
6	7920	8100	180	
7	8280	8850	570	
8	9330	9990	660	
9	11900	12100	200	
10	16000	16250	250	
11	21700	23250	1550	
12	5590	6300	710	
13	6750	7060	310	
14	7540	7920	380	
15	8100	8280	180	
16	8850	9330	480	

S. No	Design Ch from	Design Ch To	Length (m)	Type of TCS
17	9990	11900	1910	
18	12100	16000	3900	
19	16250	21700	5450	
20	23250	27854	4604	
21	1700	2100	400	TCS4 (CoI width 9.5m)
22	2850	3350	500	
23	4190	4370	180	
24	2100	2850	750	TCS-5A to 5F (CoI width 9.7 to 11m)
25	3350	4190	840	
			27854	

2.8 Available Right of Way

35. As per the information sourced from the concerned PWD division, the width of the existing right of way (RoW) along project road varies between minimum of 5.5m (Ch. 0+000 to 0+030) to 32m (Ch. 5+200 to 5+250), with an average width of 18.75m.

36. The ownership status of existing RoW along the project corridor has been verified through consultations and joint site inspection with concerned PWD division, revenue and forest departments and ground-truthing was done by checking on boundary pillars that demarcate existing RoW on ground, jointly by project preparation Consultants. The site demarcation report certifying the fixing of boundary pillars along the RoW is given in **Appendix-2**.

37. The project corridor has forest stretches at 8 locations adjacent to the RoW, over cumulative length of 4255meters (ref. Table 4-18 under Section 4 for details). The widening proposal of project road at all these 8 forest stretches is limited/confined to the existing /available right of way (RoW) and thus will not require additional land beyond RoW, which will warrant diversion of forestland and forest clearances thereof under forest conservation act,1980.

38. Based on the joint site inspection by the PWD and forest revenue and revenue departments and the submitted chainage wise RoW details of Mandi Rewalsar Road, the concerned Divisional Forest Officer (DFO), Mandi Forest Division, has communicated to the HPPWD that existing road area between Mandi- Rewalsar and Kalkhar, which includes 8 forest stretches has the status of 'gairmumkin sadak' and the ownership of GoHP under the physical possession of HPPWD and therefore issuance of 'No Objection Certificate' for the widening/upgradation of the road will not be warranted. Copy of communication issued by DFO, Mandi Forest Division is given in **Appendix-2**.

39. During the internal verification of revenue documents by HPPWD, the mutation of land title in favour of HPPWD, has been inadvertently left out in one stretch i.e., 850 meters between Ch 3/350 to 4/200 due to a clerical error, whereas the mutation of land title in all other 7 forest stretches has been completed in favor of HPPWD few decades back. The HPPWD, now has taken up this matter with the district administration with citing several justifications and currently efforts are underway to rectify to land title records in favor of HPPWD for chainage between Ch 3/350 to 4/200 and HPRIDCL expect to complete the left-out mutation, prior to award of civil works contract package. This RoW stretch of 850m length forms merely 3% of the total length of project road.

2.9 Existing and Proposed CD Structures

40. The project road has 111 existing CD structures as given below in **Table 2-11**.

Table 2-11: Existing Cross Drainage Structures along Project Road

S. No	Chainage	Existing Culverts		
		Pipe	Slab	Box
1	0 to 10 Km	19	14	0

S. No	Chainage	Existing Culverts		
		Pipe	Slab	Box
2	11 to 20 Km	27	11	0
3	21 to 28 Km	29	11	0
Total		75	36	0

41. In addition, 4 bridges are presently under construction (3 minor and 1 major bridge) by HPPWD through CRF (Central Road Fund), which qualify as Associated Facilities. The details of these are given in **Table 2-12**.

**Table 2-12: Under Construction Bridges along Project Road by HPPWD
(Associated Facilities - Tranche I HPSRTP)**

S. No.	Existing Chainage (Km)	Design Chainage (Km)	Coordinates	Bridge Type	Present Status
1	5/820	5+785	31°40'24.74" N 76°54'29.48" E	Minor Bridge	Under Construction
2	7/530	7+442	31°39'55.44" N 76°53'53.33" E	Major Bridge	Under Construction
3	8/120	7+909	31°39'43.31" N 76°53'47.89" E	Minor Bridge	Under Construction
4	11/475	11+148	31°39'15.05" N 76°52'50.61" E	Minor Bridge	Under Construction

42. As a part of upgradation, the project road will have 139 CD structures, which will include reconstruction, new construction, widening of existing CD structures, excluding the 3 minor and 1 major bridge, which qualify as Associated Facilities. The project design considers construction of 14,980 meters of RCC cover drains and 11,010 meters length of 'V' shaped drawings along the road which will be connecting to the nearest culverts (ref. **Appendix-1** for drainage map). The list of the CD structures along the project road is given in below **Table 2-13**. The chainage wise details of cross drainage structures are provided in **Appendix-4**.

Table 2-13: Cross Drainage Structures along Project Road

Type	Reconstruction	New Construction	Existing Retained	Widening of Existing
Box Culverts	34	4	0	0
Pipe Culverts	98	23	4	0
Slab Culverts	5	0	4	1
Minor Bridges	2	0	0	1
Total	139	27	8	2

43. All the proposed CD structures under the project road upgradation have considered provision for concrete/ stone (boulder) aprons on both upstream and downstream sides, to dissipate the velocity of water across the CD structures. Typical drawings of the CD structures showing the aprons are given in **Appendix-5**.

2.10 Protection Works

44. The project road design has considered 12940m long breast walls (height ranging 2 to 5m) along hill sides, 6980m long retaining walls/ toe walls (height ranging 1 to 4m) and 5672m long gabion walls (height ranging between 2 to 5m) along valley sides as protection works to prevent hills slides and/or reclamation of land on valley sides as given in **Table 2-14**. The chainage wise detail of these protection measures is given in **Appendix-6**.

Table 2-14: Protection Works along Project Road

Sl. No.	Protection Works	Height in meters		Total Length in meters	Remarks
		Minimum	Maximum		
1.	Breast Walls	2.0	5.0	12940	Breast walls with height up to 5 meters has been provided in few locations to protect buildings and roads at higher level on the Hill side
2.	Retaining Walls (PCC/ RCC)/ Toe Walls	1.0	4.0	6980	
3.	Gabion Walls	2.0	5.0	5672	

2.11 Bus stops/ Rain Shelter & Street Lighting

45. The project road has 5 existing bus stops between Km 0 to Km 28 and these are also locally known as rain shelters. Under the project road widening proposal, 4 bus stops/rain shelters are retained, 1 is reconstructed and 13 are newly proposed (refer **Table 2-15**). All the bus stops are to be provided with proper cross ventilation as well as arrangement to prevent entry of stray animals into the bus stop. All re-modeled bus stops shall have universal access (ramp) for physically challenged persons in accordance with rights of persons with disabilities act, 2016.

Table 2-15: Details of Bus stops/Rain Shelters along Project Road

S. No	Existing Chainage	Design Chainage	Side	Remarks
1	1535	1530	LHS	Reconstruction
2	2195	2185	RHS	New
3	3190	3180	LHS	New
4	4210	4190	LHS	Retained
5	5400	5350	LHS	New
6	6570	6420	RHS	New
7	7475	7320	RHS	Retained
8	9845	9460	RHS	Retained
9	11345	10945	RHS	New
10	13170	12710	RHS	New
11	16810	16270	RHS	New
12	18360	17820	LHS	New
13	19280	18730	LHS	New
14	23035	22460	LHS	New
15	23940	23360	RHS	New
16	24690	24110	LHS	New
17	27410	26815	LHS	New
18	28385	27785	RHS	Retained

46. In addition, the project road design also considers provision of 56 solar powered single arm street lighting, 265 conventional street lighting poles and 3 high mast lighting at required locations.

2.12 Road Safety Features

47. The project road design has considered rotary junctions for channelization of traffic with rumble strips for speed control, signages near schools and other sensitive receptor locations and similar requirements as per the relevant IRC guidelines. The project also considers safety features as per IRC35-2015 (road markings), IRC 67-2012 (road signs) IRC SP -1948 (Hill Road Manual) and IRC 99-2018(Traffic Calming Measures). The safety provisions also include rumble strips, double 'W' beam crash barriers (7390 meters length), 14,930 meters length of pedestrian guard railing for the safety of

road users including pedestrians, road markings and road signs as required. The project road has one blackspot from 0 to 0.150 km, where the improvements are proposed. Some of the measures considered are hereunder:

- Rotary junction developed with proper channelization (3 major junctions and 16 minor junctions).
- Rumble strips proposed on all the legs to control the speeds.
- Proper signs including School zone sign boards are proposed.
- Pedestrian/children movement is segregated from vehicle movements with Foot paths and Pedestrian Guard rails on both sides (wherever required).
- Raised Tabletop crossing provided to allow pedestrian and children to cross the road safely.

2.13 Project Road Construction Activities

2.13.1 Encumbrances

48. The corridor of improvement (COI) for the project road has 16 encroachments (impacted structures), 360 trees, 220 electric poles and 12 handpumps, which are to be cleared prior to commencement of construction activities (refer **Table 2-16**). The encroachments (impacted structures) will be cleared after the disbursal of the compensation in accordance with the RAP provisions. The electric poles and handpumps will be shifted by the respective line departments. The trees will be felled only after receiving permission from the forest department (ref. 4.5.7 under Section 4, for details on trees and impacted structures within the CoI).

Table 2-16: Details of Encumbrances along Project Road

Sl. No.	Chainage	No. of Electric Poles	No. of Handpumps	Impacted Structures	Trees
1.	0 to 28.44	220	12	16	360

2.13.2 Site Clearance

49. The site clearance within the corridor of improvement (COI) as per the widening proposal for project road will warrant clearance of about 14 Ha of land within the available right of way with an average width of 5 meters all along the 28 km long road, excluding the existing average 3.75 m wide roadway width (ref Table 2-2, Table 2-10 of Section 2 and Appendix-1). This activity involves clearance of all open areas within the right of way, which is also interspersed with commonly found roadside vegetation.

50. The clearance of the COI for the entire 28 km long road will be undertaken along prioritized stretches in accordance with the approved project implementation schedule. The COI stretches for site clearance will be prioritized after the removal of encumbrances, if any like utility shifting, tree felling by Forest Department, and removal of encroachments, post disbursal of compensation as per RAP provisions.

2.13.3 Earth Work Excavation

51. The road widening, construction of cross drainage structures and protection works like breast walls, retaining walls and toe walls will warrant earth work and/or rock excavation. The excavation requirement for road widening is estimated to be 613650 cu.m, out of which 273343 cu.m of excavated materials is expected to be reused in the back filling activities and balanced quantities of 340307 cu.m. will have to be disposed at identified muck/ debris disposal locations (ref. 7.3.3 under Section 7).

2.13.4 Construction Material Requirement

52. The estimated construction material requirement for project road construction, cross drainage structures and protection works comprising good earth (2751 cu.m), stone aggregates (191253 cu.m),

cement (23509 metric tonnes), sand (42436 cu.m), steel (1301 metric tonnes) and bituminous (682 metric tonnes) material (ref. 7.3.2 under Section 7).

2.13.5 Construction Water Requirement

53. The construction water demand for the widening of project road and its components is estimated as 324 KLD, spread over 24 months of construction schedule. The project region has no perennial surface water bodies and ground water is the only dependable source, which can meet the construction water demand. The ground water resources of Mandi district at present has less than 20% ground water development and do not have any restrictions for ground water development (ref. 7.3.5 under Section 7).

2.13.6 Debris Disposal

54. The earth work excavation for road, cross drainage structures and protection works will generate 340307 cu. m. of debris/muck, which needs to be disposed of at suitable locations to minimize the environmental and social impacts (ref. 7.3.3 under Section 7 for estimated debris from road widening).

55. During the project preparation, 13 potential locations have been identified for debris/muck disposal in the vicinity of project road with an estimated holding capacity of 1,72,600 cum. Brief features of debris disposal sites are given in **Table 2-17** and locations are shown in **Figure 2-5**.

56. The potential locations identified for muck disposal/ dump sites is adequate to dispose 50.71% of excess earth/rock cut material. During the construction phase, the contractor will have to identify additional muck disposal site as per requirements. The disposal of debris is likely to have environmental and social impacts and risk due to erosion, slides, clogging of drainage, drying of seasonal streams/spring, damage farmland, loss of soil productivity etc. if adequate mitigation measure are not implemented (ref. Figure 4-7 to 4-9 under Section 4, for soil fertility of the project region/ Mandi district).

Table 2-17: Potential Locations for debris/muck disposal along Project Road

S. No.	Location	Type of Land	Present Site Conditions	Holding Capacity in cum and Dimensions of Site	Protection/ Mitigation Measures	Remarks
1	7+900 (LHS)	Govt/ PWD Land	The site is in old alignment of the road very next to the ROW, in PWD land.	4,000m ³ (L=100m W=8m; H=5m)	Provision of gabion wall to avoid erosion during rainy season and to support the disposed debris. The boundary of the gabion wall needs to be followed the stream border.	It may give additional corridor for road widening and visibility to the vehicles coming from opposite side since the alignment is passing through the settlement areas.
2	8+900 (LHS)	Govt/ PWD Land	The site is near to habitation borrowed (valley)	3,600m ³ (L=80m; W=9m; H=5m)	Consultation with the local people needs to be carried prior to using the site and any operation will be done based on outcome of the consultation. Tree's replantation should be taken in up.	It might help to the local people to park own vehicles.
3	10+200 (LHS)	Govt/ PWD Land	The site is a barren land and near to the habitation and has few trees.	12,000m ³ (L=150mW=8m; H=10m)	Provision of gravity wall to support debris, and to avoid erosion. Provision of bioengineering measures to stabilise slope.	It will help to provide parking area to the road users. And also provide access to the drinking water structure next to this location.
4	11+000 (LHS)	Govt/ PWD Land	The site barren land located next to the khud and having shrubs and trees.	20,000 m ³ (L=200mW=10m; H=10m)	Dumping can be done in two layers with two levels and provide gravity/gabion walls to avoid erosion slipping into khud.	It helps in better visibility of bridge and vehicles coming opposite side to the road user.
5	12+350 (LHS)	Govt/ PWD Land	This land is having shrubs and small trees and if it is retaining filled or levelled it might be used for social activities.	6,300m ³ (L=70mW=15m; H=6m)	Dumping can be done in two stages and entire land is in PWD ownership. Dumping can be done with one stage of Gravity	The levelled land might be helpful to the PWD works at time of repair works and maintenance. There is a nala at a distance of 30 m from road.

S. No.	Location	Type of Land	Present Site Conditions	Holding Capacity in cum and Dimensions of Site	Protection/ Mitigation Measures	Remarks
	12+430 (LHS)			2,500 m ³ (L=50m; W=10m; H=5m)	wall and other layers with gabion or Gravity wall.	Dumping should be done by considering nala as boundary and without interfering with nala.
6	13+800 (LHS)	Govt/	This land is barren and having 4 trees and situated in curve.	2,400 m ³ (L=40mW=10m; H=6m)	Dumping can be done in two stages and entire land is in PWD ownership. Dumping can be done with one stage of Gravity wall and other layers with gabion or Gravity wall.	Helps to provide better visibility at curve section and can give additional area for bioengineering solutions.
	4,800m ³ (L=120mW=8m; H=5m)					
	1,600m ³ (L=40mW=8m; H=5m)					
7	17+850 (LHS)	Govt/ PWD Land	The land identified for debris disposal is barren. Has 5 trees along the boundary of the area. Adjacent to there is a nala coming from a natural drinking water source	50,000m ³ (L=80m; W=10m; H=6m)	Provision of gabion/gravity wall to support the debris, Provision of bioengineering measures to stabilise slope and aesthetics. Tree will not be impacted because these are along the periphery of the area.	Help to improve the road safety in future years and easy to expand muck disposal area. The dump should made by considering the nala as border and if necessary, extend the outlet to the end of dump boundary.
8	20+100 (LHS)	Govt/ PWD Land	It's an open land and having steep slope and trees.	50,000m ³ (L=100mW=25m; H=6m)	The area is already being used for dumping/disposing the landslides waste and the remaining area can be used for such muck disposal. The Bio-engineering solutions can help to improve the slope stability and aesthetics.	It may increase the safety of the road uses and the wall should be closed at down from end of nala.
9	25+500 (LHS)	Govt/P WD Land	The land is in ownership of PWD and having 7 tall trees, there is link road at downward side at a distance of 150 m.	2,000 m ³ (L=40m; W=10m; H=5m)	Provision of gabion wall to support debris, Provision of bioengineering measures to stabilise slope. And also, it helps to develop more green space.	Prior consultation is must to avoid public resistance from the users of downward side road.
10	25+650 (LHS)	Govt/ PWD Land	Open land valley side having a seasonal stream at bottom, 7 number of trees are situated which are more than 30 m tall.	2,000 m ³ (L=50m; W=10m; H=4m)	Provision of gabion/gravity wall to support debris, Bio-engineering provisions can help to improve the vegetation cover	It may increase the safety of the road and the wall should be closed at end of nala.
11	27+250 (LHS)	Govt/ PWD Land	Land ownership of PWD with 2 no of trees.	4,000 m ³ (L=100m; W=10m; H=4m)	Provision of gabion/gravity wall to support debris, Bio-engineering provisions can help to improve the vegetation cover	None
12	27+450 (LHS)	Govt/ PWD Land	Land ownership of PWD with 5 nos of trees.	2,560m ³ (L=80m; W=8m; H=4m)	Provision of gabion/gravity wall to support debris, Bio-engineering provisions can help to improve the vegetation cover	None
	27+550 (LHS)			2,800m ³ (L=100m; W=7m; H=4m)		
13	27+700 (LHS)	Govt/ PWD Land	Land ownership of PWD and there is a nala at curve and a Samshanghat (cremation facility) at downward side	2,100m ³ (L=70mW=5m; H=6m)	The dump should terminate next to the Samshanghat (cremation facility) and the nala need to extend till the wall to avoid overweight on wall duly monsoon.	Help to improve the safety in future years and easy to expand. The dump should made by considering the nala as border and if necessary, extend the outlet to the end of dump boundary The villagers need a proper access to the Samshanghat (cremation facility), which can be undertaken during site development works
Total estimated holding capacity at the identified muck disposal sites				1,72,600 cum		

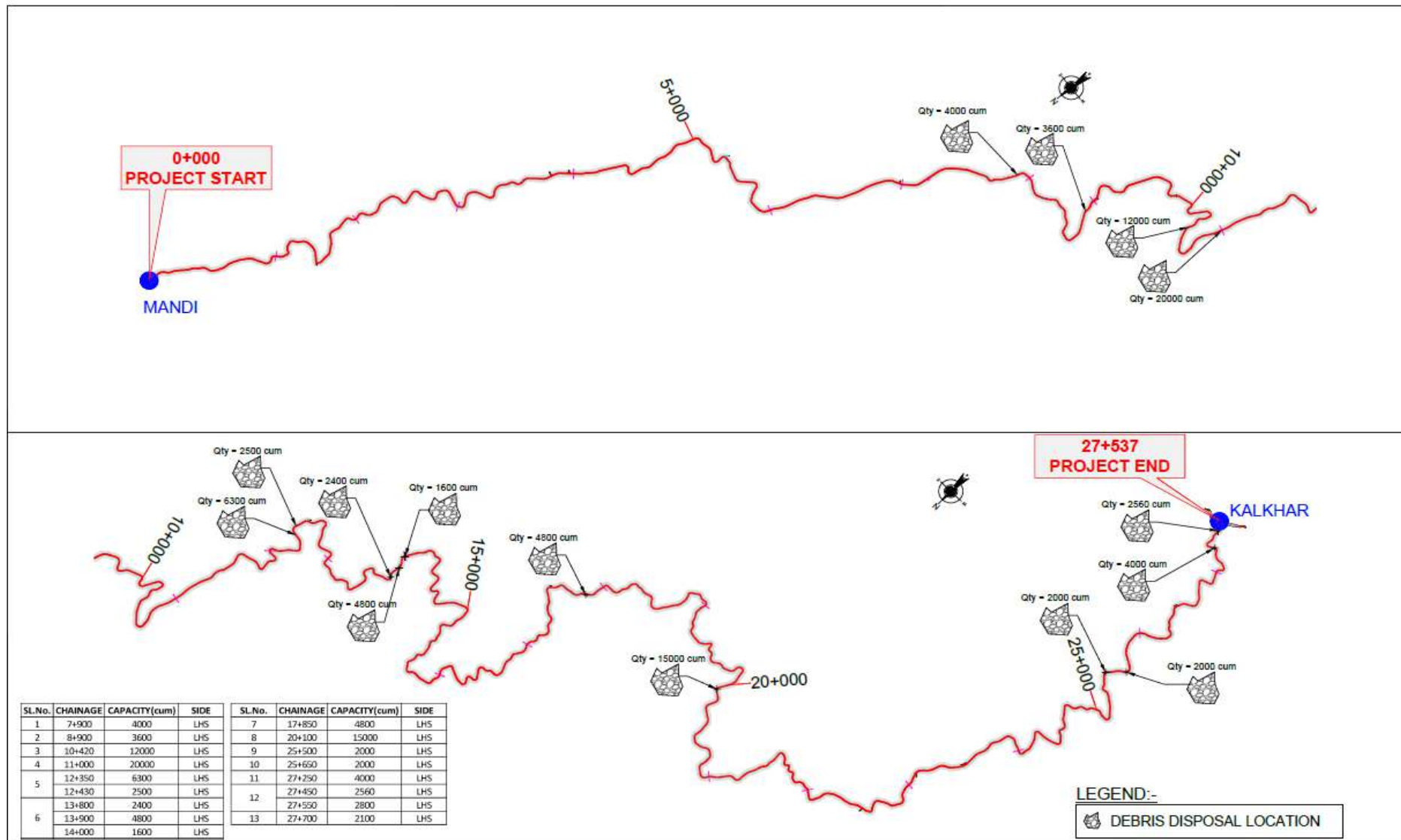


Figure 2-5: Potential Muck/ Debris Disposal Locations along Project Road

2.13.7 Establishment of Campsites and Workforce Camps

57. Considering the intended construction packages for project road widening, at least two campsites, each with an extent of 1.25 Ha of land will be required. Upon mobilization, the contractor will select the sites for establishment of campsites and workforce camps. The ESMP provides the criteria for selection of land for campsites and workforce camps (Ref Table 4-1 of ESMP Volume).

2.13.8 Traffic Diversions and Work Zone Safety

58. Prior to commencement of construction, the contractor will prepare a Work Management Plan for the prioritized encumbrance free stretches, in accordance with approved implementation schedule. In addition, the contractor will be contractually obligated to implement work zone safety arrangements confirming to the requirements of IRC: 67 and IRC: SP: 55: 2014, which include provision of PPEs, fixed/ mobile barricades between work area and pedestrian/ traffic. The requirements also include site specific traffic management plan for all types of works along with work zone safety check list. Commencement of any activity without prior approval of these requirements will be treated as “fundamental breach of contract”.

59. The responsibility of contractor to manage these risks would be clearly reflected in the contractual obligations of the Civil Works Contractor with appropriate mechanisms for addressing non-compliance. The bid documents for construction will incorporate requirements for Environment, Social, Health and Safety (ESHS) including list of applicable labor laws and community safety provisions for periodic reporting by contractors.

2.13.9 Bio-Engineering Solutions

60. Nature based bio-engineering provisions have been considered at all potential mud slip or land slide locations along the project road, all 13 debris disposal sites, cross drainage structures and protection works locations and other locations warranting slope stability due to hill cut operations (ref. 7.4.2 under Section 7).

2.13.10 Conservation and Enhancement Measures

61. Provisions for conservation and enhancement of 6 natural water sources and 13 religious’ shrines/small temples, which are located along the project road have been included under ESMP (ref. 4.6.6 of Section 4-Baseline Data and Section 3 and 8 of ESMP Volume). The enhancement/conservations which are to be carried out at each of all such locations are given in ESMP along with requisite budgetary provisions.

2.13.11 Road Safety Signs and Furniture

62. The project design includes the road furniture, road safety signages, traffic calming measures along settlement areas, sensitive receptor locations and at junctions as per the IRC guidelines and requirements (ref. 7.4 under Section 7 and **Appendix-22**).

2.14 Project Workers Requirement

63. The Mandi-Rewalsar-Kalkhar project road corridor improvement will require an estimated 825 skilled and unskilled construction workers. It is anticipated that out of 825 construction workers, nearly 70-80% (approx. 600) are likely to be migrant workers and the rest are likely to be sourced from nearby villages and settlements areas. The skilled and unskilled construction workers will be managed by the supervisory and managerial staffs. All these contract workers will be supervised and overseen by the Direct Workers of HPRIDCL. Based on the construction package sizes and the project implementation schedule, the estimated Project Workers for construction of project road is given in **Table 2-18**.

Table 2-18: Estimated Project Workers for Construction of Project Road

S. No	Project Workers	Nos.
1	Direct Workers (Common for Entire HPSRTP Tranche I)	30
2	Contract Workers deployed by HPRIDCL (Common for Entire HPSRTP Tranche I)	
2a	Consultants for preparation of DPR, ESIA, CSC, PMC Institutional Development strategy, Consultants for Specialist Studies during Project Implementation Phase like Bio-Engineering Specialists, NGO for RAP implementation, Bio-diversity Specialist, Environmental and Social Specialists among others.	200
3	Contract Workers deployed by Contractor (Specific to this Project Road)	
3a	Project Managers	2
3b	Highway Engineers	4
3c	Structural Engineers	2
3d	Material Engineers	2
3e	Geo-technical Engineers	2
3f	Quantity Surveyor	2
3g	Lab Manager/Technicians	4
3h	Mech/ Plant & Equipment Engineers	4
3i	Environmental Officers	2
3j	Social cum Community Liaison Officers	2
3k	Health & Safety Officers	2
3l	Skilled and unskilled workers (labors) including supervisors	825
3m	Other supporting staff	12
3n	Total of Contract Workers (3a to 3m)	865
4	Community Workers to be deployed by Project Road specific CMU	40

2.15 Institutional Framework of HPSRTP

64. The implementation of HPSRTP involves multiple institutions, namely: HPRIDCL, HPPWD, HPDOT and HP State Police Commission. HPRIDCL will be responsible for the overall coordination for implementation of HPSRTP. The road infrastructure improvement component will be implemented by HPRIDCL. HP State Police Commission will implement the Road Safety component.

65. Himachal Pradesh Road & Infrastructure Development Corporation Limited, a wholly owned Company of Government of Himachal Pradesh was incorporated on 10.06.1999 under the Companies Act, 1956,

66. HPRIDCL is an apex organization in Himachal Pradesh engaged in fostering the growth of infrastructure development in the State. Its objectives are to:

- a) Construct erect build, re-model, execute, repair, develop, improve, administer, manage, control, maintain, demolish, grade, curve, pave, macadamize, cement, Highways, Expressways, Roads, Paths, Streets, Bridges, Sideways, Bypasses, Tunnels, Pavements, Reclamation, Improvements, Road over Bridges, Road under Bridges, Underground Road, or any other structural or architectural work and also to do other similar construction, leveling or paving work at present being a part of the activity of the Himachal Pradesh Public Works Department;
- b) Facilitate and or undertake to construct, erect, build, renovate, develop, improve, manage, control maintain other infrastructure projects including those related to Power, Telecom Information and Technology, Transmission of Electricity, Water Supply Projects, etc.

- c) Act as a special purpose vehicle for resource mobilization on behalf of the State Government for all infrastructure projects

67. HPRIDCL is headed by the Managing Director (Principal Secretary of HPPWD) and governed by a Board of Directors chaired by the Chief Secretary of the State. HPRIDCL is currently the focal organization for the development of the state core roads network (SCRN) and for managing upgrading and major rehabilitation contracts. HPRIDCL has acquired experience from the implementation of HPSRP – I and concurrently built institutional capacity for procurement, financial management, contract administration and support staff necessary for the implementation of HPSRTP.

68. HPRIDCL has also engaged Environment and Social Safeguards Specialist and Project Management Consultant (PMC), Construction Supervision Consultant (CSC) and the institution together will be responsible for supervision, management of project implementation including quality assurance and monitoring.

69. HPRIDCL has established a mechanism to handle external complaints on procurement, fraud/corruption and construction quality. This system will include maintaining files to monitor status of follow up of each received complaints, suggestions and grievances. The implementation of the system will be monitored by Chief Vigilance Officer (VGO) of the HPPWD (who shall also act VGO for HPRIDCL). The mechanism will include provision for follow up investigations of substantial complaints to ensure independency and reliability of the system. For the complaint mechanism to function efficiently, the information concerning the alternative conduits for complaint (dedicated email address and physical mailing box) are publicized. Complaints, suggestions and grievances handling system are notified at HPRIDCL's website: <http://himachalservices.nic.in/hpridcl>. An Information Officer has been designated by HPRIDCL as a full-time Assistant Public Information Officer under the RTI Act and is responsible for updating the HPRIDCL's website on required basis.

70. HPRIDCL will redress all complaints during project implementation. Responding to Complaints on Construction Quality Complaints received directly from the public relating to the quality of a specific work, good or service shall be in writing. They will be received and then reviewed by CE-cum-PD or if applicable, concerned Executive Engineer of Construction Management Unit (CMU) and will be dealt with in the following way. i) The CE-cum-PD shall record all complaints, whether they are referred from other recipients or directly, in a register to be maintained in a secure location in his own office. The email and physical address of the CE-cum-PD is available on web site. ii) The CE-cum-PD shall, within 5 working days of receipt of complaint, acknowledge receipt in writing to the complainant indicating that the HPRIDCL is considering the issues raised and will discuss them with the concerned officers of the HPRIDCL. iii) The CE-cum-PD shall then consult with the relevant officers of the HPRIDCL and, after thorough review of the facts as well as interviewing of officers concerned as necessary, shall make a judgment as to the validity of the complaint. iv) Within 20 working days, the CE-cum-PD shall instruct the concerned officer to take remedial action as necessary. v) The CE-cum-PD shall write to the complainant within 30 working days of the receipt of such complaint as to the final decision of the competent authority. vi) In the event, that a complaint is received concerning an externally funded contract, the relevant funding agency shall be informed at each stage of the complaint handling process.

3 LEGAL AND REGULATORY FRAMEWORK

71. A review of the legal and regulatory framework related to the environmental and social in terms of their relevance and applicability to the project road is presented in this section. The section also presents the current institutional structure of HPRIDCL, the designated nodal agency for implementation of HPSRTP by GoHP.

3.1 Applicable Regulations of GoI/ GoHP

72. The Government of India has laid out various policy guidelines, acts and regulations pertaining to environment and social aspects. **Table 3-1** lists all the applicable GoI regulations and their relevance to this sub-project.

Table 3-1: Summary of Applicable E&S Regulations of GoI/ GoHP

S. No.	Act / Rules	Key provisions and purpose	Applicability to Project Road
1	Environmental protection Act, 1986 and subsequent amendments	The Act provides for mandatory public consultation for all listed projects and activities requiring prior Environmental Clearance (EC) and includes road and highways requiring further land acquisition. The Public Consultation shall ordinarily have two components comprising of: - (a) a public hearing at the site or in its close proximity- district wise, to be carried out in the manner prescribed, for ascertaining concerns of local affected persons; (b) obtain responses in writing from other concerned persons having a plausible stake in the environmental aspects of the project or activity.	Project road does not fall under the listed projects and activities, which requires prior environmental clearances from central or state levels and thus all provisions under the act are exempted/ not applicable.
2	Environmental Impact Assessment Notification-2006 ⁵ , notified on 14 th September 2006, as amended in 2009 and 2013	To regulate construction of new projects and/or expansion or modernization of existing projects and provide environmental clearance to new development activities following environmental impact assessment	No. (The project road is a Major District Road (MDR) and it does not fall under the category of state Highway (7f of the schedule, EIA notification) and thus is outside the preview of EIA, 2006 Notification). Therefore, no prior environmental clearances are required either from central or state levels. Applicability status for the project road does not change even the Draft EIA notification, 2020 comes into effect, since 7f of the schedule under the present notification remain unchanged and included under Sl. No. 38 of the Schedule of the Draft EIA notification, 2020.
3	MoEF Notification for use of fly ash, 28 th April 2016.	Reuse large quantity of fly ash discharged from thermal power plant to minimize land use for disposal	No. (No thermal power plant exists within 300 km of project road)
4	The Forest (Conservation) Act. 1980	To check deforestation by restricting diversion of forest areas into non- forest uses.	Project road widening/upgradation will be limited to existing/available right of way and therefore no additional diversion of forest land for widening purposes will be required, which will warrant forest clearances thereof under Forest Conservation Act,1980.

⁵ Draft EIA Notification, 2020 has been notified by MoEF & CC, Government of India, which will supersede the present EIA Notification, 2006, although the applicability of EIA notification to the Project Road does not change, even if the Final EIA Notification, 2020 is notified (Now has been re-scheduled due to COVID-19).

S. No.	Act / Rules	Key provisions and purpose	Applicability to Project Road
5	MoEF & CC circular (1998) on linear Plantation on roadside, canals and railway lines modifying the applicability of provisions of forest (Conversation) Act, to linear Plantation	Protection / planting roadside strip as avenue/strip plantations as these are declared protected forest areas.	Yes, permission for felling of 360 trees within the available RoW is required from the Forest Department. The project road widening is limited to available/existing RoW, but within which trees have grown over the years, which are required to be felled for road widening.
6	The Wildlife Protection Act, 1972	To protect wildlife such as National Parks and Sanctuaries	No (No wildlife Sanctuary or National Park is within 10 km of project road)
7	Biological Diversity Act, 2002	Disclosure of species survey	No, as per act, there is no presence of any rare, endangered, threatened species reported along the project road corridor.
8	Air (Prevention and Control of Pollution) Act, 1981	To control air pollution Pollutants	Yes (During construction phase, contractor will have to obtain CTE and CTO) to regulate air quality at construction sites
9	Water (Prevention and Control of Pollution) Act, 1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards	Yes (During construction phase, contractor will have to obtain CTE and CTO) to regulate air quality at construction sites
10	Noise Pollution (Regulation and Control Act) 1990	The standards for noise for day and night have been promulgated by the MoEF & CC for various land uses.	Yes (During construction phase, contractor will have to obtain CTE and CTO) to regulate air quality at construction sites
11	The Explosive Act 1984	Safe transportation, storage and use of explosive material	No (as explosive are prohibited to be used.)
12	The Mines and Minerals (Development and Regulation) Act 1957	For opening new quarry.	Yes (During construction only, if any new quarries are opened, contractor shall avail the permission/license from competent agencies)
13	The Ancient Monuments and Archaeological Sites and Remains Act 1958	Conservation of cultural and historical remains found in India	No. The project corridor (within 200 metres) does not have any such protected monument and archaeological sites.
14	National Resource Efficiency Policy, 2019 ⁶ (Draft)	To create a facilitative and regulatory environment to mainstream resource efficiency across all sectors by fostering cross-sectoral collaborations, development of policy instruments, action plans and efficient implementation and monitoring frameworks.	No. Becomes applicable only after its notification (During construction Phase). However, Project Road design considers

⁶ This is a draft Policy introduced in year 2019 and presently under the consideration of Government of India. Was earlier scheduled for Notification in June 2020 but likely to be rescheduled due to COVID-19.

S. No.	Act / Rules	Key provisions and purpose	Applicability to Project Road
			several resource efficiencies measures, to be consistent with ESS 3 of WB's, ESF, 2016
15	Municipal Solid Waste (Management & Handling) Rules, 2000 (MSW Rules)	Segregation, Handling & safe disposal of domestic solid waste	Yes (The work force camp and camp site shall have facility for collecting the waste, and access controlled to prevent the entry of stray animals for scavenging of waste.)
16	Hazardous Wastes (Management, Handling and Trans-boundary Movement) Rules, 2008.	Safe handling, storage, transportation & disposal of hazardous wastes	Yes (Applicable during construction phase, the contractor shall obtain the requisite licenses for handling and disposal of hazardous waste generated during construction phase.)
17	Occupational Safety, Health and Working Conditions, 2019 ⁷ (Draft Code)	Comprehensive Code on Occupational Safety, Health and Working Conditions, amalgamates 13 existing labour laws/acts relating to Safety, Health, working Conditions and Wages	No. Will become applicable, only after it is notified. However, till such time, the existing laws shall apply
18	Batteries (Management and Handling) Rules, 2001	Safe recycling of lead acid batteries	Yes (Applicable during construction phase, the contractor shall obtain the requisite licenses for handling and disposal of batteries during construction phase.)
19	Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules 1989	To check vehicular air and noise pollution	Yes (contractors' responsibility to obtain Pollution Under Control certificates during construction stage for all vehicles deployed for construction activities)
20	National Labour Act, 1970.	An Act to regulate the employment of contract labour in certain establishments and to provide for its abolition in certain circumstances and for matters connected therewith	Yes (This shall be contractors' responsibility for compliance)
21	Public Liability and Insurance Act 1991	To provide through insurance, immediate relief, by you who control or handle hazardous chemicals. Protection forms hazardous materials and accidents.	Yes (The contractor shall obtain the required insurance policy prior to commencement of construction)
22	Building and Other Construction Workers Act, 1998 and 2006	To regulate the employment and conditions of service of building and other construction workers and to provide for their safety, health and welfare measures and for other matters connected therewith or incidental thereto.	Yes (This shall be contractors' responsibility for compliance)

⁷ Draft Code on Occupational Safety, Health and Working Conditions, 2019 has already been introduced in Parliament, after a Standing Committee of Parliament submitted its recommendations in Feb 2020. The matter is on hold possibly due to COVID -19 and soon be notified.

S. No.	Act / Rules	Key provisions and purpose	Applicability to Project Road
23	Himachal Pradesh Building and Other Construction Workers Act, 2008	To regulate the employment and conditions of service of building and other construction workers and to provide for their safety, health and welfare measures and for other matters connected therewith or incidental thereto.	Yes (This shall be contractors' responsibility for compliance)
24	The Petroleum Rules, 2002	Safe use and storage of petroleum products and will need to be complied by the contractors.	Yes (contractors' responsibility to obtain PUC certificates during construction stage for all vehicles deployed for construction activities)
25	The E-Waste (Management) Rules, 2016,	This provides for management of E-wastes (but not covering lead acid batteries and radioactive wastes) aiming to enable the recovery and/or reuse of useful material from e-waste, thereby reducing the hazardous wastes destined for disposal and to ensure the environmentally sound management of all types of waste of electrical and electronic equipment.	No (Not anticipated during project road construction. However, it shall be the contractors' responsibility for compliance, if becomes during the construction period)
26	Plastic waste Management Rules, 2016	This provides for control and management of the plastic waste generated from any activity. Contractors will ensure compliance to this Rule.	Yes (Ordinarily not anticipated but it shall be contractors' responsibility for compliance during the construction period, if becomes applicable)
27	State Groundwater Acts and Rules (Himachal Pradesh Ground Water (Regulation and Control of Development and Management) Act, 2005	The Act provide for Regulation and Control of Development and Management of Ground water in any form within the entire Himachal Pradesh with effect from 29 th Nov 2019 beyond this date no ground water extraction in any form is allowed without prior permission of HP ground Water Authority	Contractors will need to obtain permission from the designated HP ground Water Authority and Irrigation and Public Health Department, GoHP for construction water sources (either surface or ground water) prior to abstraction and will have to ensure full compliance to all applicable rules and any conditions imposed in the permit by Irrigation and Public Health Department, GoHP /competent authority.
28	Construction & Demolition, Waste Management Rules, 2016	This rule shall be applicable to construction waste/debris resulting from road construction including RCC bridge and other protection works	<p>Yes. If the project is likely to generate more than 20MT waste per day and/or 300 MT in a month, a project specific waste management plan will be required as per the stipulations under this rule.</p> <p>As, this Project Road rehabilitation/widening of with demolition of old and damaged CD structures, the project road is unlikely to generate the demolition waste as per Rules.</p> <p>However, the project will have a project specific plan for disposal of debris from the construction activities. Also, project design considers</p>

S. No.	Act / Rules	Key provisions and purpose	Applicability to Project Road
			balancing the cut and filling volumes and reusing the debris/muck generated in the construction of sub-base and base layers of the road and to fill up low-lying areas within RoW. Excess debris will be safely disposed in accordance with an approved debris/muck disposal plan at pre-determined and approved sites by the project authorities and district administration.
29	Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (RFCTLARR)	The act provides for a transparent process and fair compensation in land acquisition for public purpose and provides for rehabilitation and resettlement of land owners and those affected by land acquisition. It comprises four schedules that provide the minimum applicable norms for compensation based on market value, multiplier and solatium; resettlement and rehabilitation (R&R) entitlements to land owners and livelihood losers; and facilities at resettlement sites for displaced persons, besides providing flexibility to states and implementing agencies to provide higher norms for compensation and R&R.	May not be warranted at this stage. However, the option would be used for acquiring land if warranted.
30	The Himachal Pradesh Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Social Impact Assessment and Consent) Rules 2015,	Provides the rules for operationalizing the provisions of the above-mentioned act	May not be warranted at this stage. However, the option would be used for acquiring land if warranted.

S. No.	Act / Rules	Key provisions and purpose	Applicability to Project Road
31	Acquisition of Land by Private Negotiation and Upkeep of Land Record/General Guidelines and Instruction (Standing Order No .28) (PBW(B)F (5)40/2017-PWD/ GoHP, January 2018	For speedier acquisition of land, the process of acquisition by private negotiations with the interested landowners have proved to be beneficial to both the parties i.e., landowners as well as acquiring department, Government of Himachal Pradesh in January 2018 publish the order to execute for infrastructure projects. If it is found that acquisition of land is imminent for a public purpose, following two options will be available with the concerned department i) Acquisition by private negotiation. ii) Compulsory acquisition under the provisions of the new Land Acquisition Act “Right to Fair Compensation and Transparency in Land Acquisition Rehabilitation and Resettlement Act, 2013.”	May not be warranted at this stage. However, the option would be used for acquiring land if warranted.
32	The Himachal Pradesh Road Infrastructure Protection Act, 2002 (and Rules 2004)	The Act defines road infrastructure that includes: roads, paths and streets for transport or communication and also shall include: - (i) acquired road land width; (ii) all types of road and their structure, such as road pavements, shoulders, retaining walls, breasts walls, (iii) any structure ancillary to road transport and communication system; (iv) bridges including approaches, return walls, wing walls, protection works and allied structures;(v) expressways including interchanges, (vi) road furniture, such as parapets, railings, etc. No person shall: encroach upon the Government land under road infrastructure; iii) raise any permanent, temporary, or movable structure on or from road infrastructure;	Applicable to all roads in Himachal Pradesh, specifically to address the issue of encroachments
33	The Himachal Pradesh roadside land control act 1968	Act has provisions for restriction on buildings etc., in a controlled area no person shall erect or re-erect any building or make or extend any excavation or lay out means of access to a road in a controlled area.	Applicable to all roads in Himachal Pradesh specifically to address the issue of encroachments
34	The Right to Information Act, 2005	The Act provides for setting out the practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, the constitution of a Central Information Commission and State Information Commissions and for matters connected therewith or incidental thereto.	Applicable to the project as a whole.

S. No.	Act / Rules	Key provisions and purpose	Applicability to Project Road
35	The Rights of Persons with Disabilities (RPD) Act, 2016	The Act ensures that persons with disabilities enjoy the right to equality and non-discrimination in all aspects of life. Every entity has to comply with the accessibility standards relating to physical environment, transport and information and communication technology as per the standards prescribed in the RPD Act. These include barrier free built environment having elevators/ramps for the benefit of wheelchairs. In respect to Access to Transport"- mentioned that-the appropriate Government shall take suitable measures to provide, —(a) facilities for persons with disabilities at bus stops, railway stations and airports conforming to the accessibility standards relating to parking spaces, toilets, ticketing counters and ticketing machines;(b) access to all modes of transport that conform the design standards, including retrofitting old modes of transport, wherever technically feasible	Applicable to the project road infrastructure in terms of making it more accessible to person with disabilities/physically challenged

3.2 World Bank ESF Policy, WBG's EHSGs and Standards – Extent of Relevance

73. Section below present the World Bank's ESF Policy,2016 with each of the ten standards (ESS1 to 10) and the World Bank Groups EHSG's IFC, 2007 along with its requirements and relevance to project road (ref **Table 3-2**).

Table 3-2: World Bank ESF Policy, 2016 and World Bank Groups' EHSGs, IFC, 2007

World Bank ESS Policy and Standards	Objectives	Requirements	Relevance & Extent of Relevance to the sub-project/project
World Bank Environment and Social Policy for Investment Project Financing	It sets out the mandatory requirements of the Bank in relation to the projects it supports through Investment Project Financing.	The types of E&S risk and impacts that should be considered in the environmental and social assessment. The use and strengthening of the Borrower's environmental and social framework for the assessment, development and implementation of World Bank financed projects where appropriate.	Applicable to this project
ESS-1 Assessment and Management of Environmental and Social Risks and Impacts	Identify, assess, evaluate, and manage environment and social risks and impacts in a manner consistent with the ESF. Adopt differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable, and they are not disadvantaged in sharing development benefits and opportunities	The types of E&S risk and impacts that should be considered in the environmental and social assessment. The use and strengthening of the Borrower's environmental and social framework for the assessment, development and implementation of World Bank financed projects where appropriate.	E&S risks and Impacts have been identified based on surveys and consultations with primary stakeholders including communities and implementing agency
ESS-2 Labour- and Working-Conditions	Promote safety and health at work. Promote the fair treatment, non-discrimination, and equal opportunity of project workers. Protect project workers, with particular emphasis on vulnerable workers. Prevent the use of all forms of forced labour and child labour. Support the principles of freedom of association and collective bargaining of project workers in a manner consistent with national law. Provide project workers with accessible means to raise workplace concerns.	Requirements for the Borrower to prepare and adopt labour management procedures. Provisions on the treatment of direct, contracted, community, and primary supply workers, and government civil servants. Requirements on terms and conditions of work, non-discrimination and equal opportunity and workers organizations. Provisions on child labour and forced labour. Requirements on occupational health and safety, in keeping with the World Bank Group's Environmental, Health, and Safety Guidelines (EHSG).	Project will be following types of workers: i) Direct workers will include the project managers and supervisors, who are employees or deputed to HPRIDCL by GoHP and deployed for HPSRTP; ii) All the work force deployed by the Contractors and the Project Management Consultant (for all packages) under the HPSRTP will be deemed to be contracted workers. The Contractor(s) might further engage multiple subcontractors; iii) Influx of migrant labour from other states for construction works has been a norm in the state and is likely to continue in this project; iv) Community workers may be employed HPRIDCL in relation to this Project from local sources particularly for supporting bio-engineering solutions towards slope stabilization workers, to instil sense of ownership and foster community driven development.

World Bank ESS Policy and Standards	Objectives	Requirements	Relevance & Extent of Relevance to the sub-project/project
<p>ESS-3 Resource- Efficiency- and- Pollution- Prevention- and- Management</p>	<p>Promote the sustainable use of resources, including energy, water, and raw materials. Avoid or minimize adverse impacts on human health and the environment caused by pollution from project activities. Avoid or minimize project-related emissions of short and long-lived climate pollutants. Avoid or minimize generation of hazardous and non-hazardous waste. Minimize and manage the risks and impacts associated with pesticide use. Requires technically and financially feasible measures to improve efficient consumption of energy, water, and raw materials, and introduces specific requirements for water efficiency where a project has high water demand.</p>	<p>Requires an estimate of gross greenhouse gas emissions resulting from project (unless minor), where technically and financially feasible. Requirements on management of wastes, chemical and hazardous materials, and contains provisions to address historical pollution. ESS-3 refers to national law and Good International Industry Practice, in the first instance the World Bank Groups' EHSs.</p>	<p>With respect to Resource Efficiency, the project preparation and the ESA process will identify feasible measures for efficient (a) energy use; (b) water usage and management to minimize water usage during construction, conservation measures to offset total construction water demand and maintain balance for demand of water resources; and (c) raw materials use by exploring use of local materials, recycled aggregates, use of innovative technology so as to minimize project's foot prints on finite natural resources.</p> <p>With respect to Pollution Management, based on past road project experiences, the project will develop, as part of the ESA process, prevention and management measures to offset risks and impacts of pollution from potential sources such as dust and emission from operation of hot-mix and batching plants, crushers, construction and haulage vehicles, material and spoil stockpile; effluents and wastewater from labour camps, construction camp; spillage or leakage during handling of chemical admixtures, hazardous materials like bitumen, high strength diesel, used oil, battery wastes etc.; and disposal of non-hazardous wastes (municipal wastes) generated during project implementation period.</p>
<p>ESS-4 Community- Health- and- Safety</p>	<p>Anticipate or avoid adverse impacts on the health and safety of project-affected communities during project life cycle from routine and non-routine circumstances. Promote quality, safety, and climate change considerations in infrastructure design and construction, including dams. Avoid or minimize community exposure to project-</p>	<p>Requirements on infrastructure, taking into account safety and climate change, and applying the concept of universal access, where technically and financially feasible. Requirements on traffic and road safety, including road safety assessments and monitoring. Addresses risks arising from impacts on provisioning and regulating ecosystem service. Measures to avoid or minimize the risk of water-related, communicable, and</p>	<p>In the project corridor there is likely to be i) hill cutting, landslides, road excavation, use of vibratory equipment, construction debris handling and disposal etc. during construction; ii) high likelihood of direct exposure to increased construction related traffic and equipment especially at road sections traversing settlement area with</p>

World Bank ESS Policy and Standards	Objectives	Requirements	Relevance & Extent of Relevance to the sub-project/project
	related traffic and road safety risks, diseases and hazardous materials. Have in place effective measures to address emergency events. Ensure that safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities.	non-communicable diseases. Requirements to assess risks associated with security personnel, and review and report unlawful and abusive acts to relevant authorities.	limited carriageway/roadway width, and sensitive receptors such as schools, religious place, health centre/hospitals; iii) high dust levels from earthworks/hill cutting, high noise and emission level from traffic congestion and idling of vehicles; and iv) influx of migrant workers could potentially cause local discomfort or potential conflicts with local people.
ESS-5 Land- Acquisition- Restrictions- on- Land- Use- and- Involuntary- Resettlement	Avoid or minimize involuntary resettlement by exploring project design alternatives. Avoid forced eviction. Mitigate unavoidable adverse impacts from land acquisition or restrictions on land use by providing compensation at replacement cost and assisting displaced persons in their efforts to improve, or at least restore, livelihoods and living standards to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher. Improve living conditions of poor or vulnerable persons who are physically displaced, through provision of adequate housing, access to services and facilities, and security of tenure. Conceive and execute resettlement activities as sustainable development programs.	Applies to permanent or temporary physical and economic displacement resulting from different types of land acquisition and restrictions on access. Does not apply to voluntary market transactions, except where these affects third parties. Provides criteria for “voluntary” land donations, sale of community land, and parties obtaining income from illegal rentals. Prohibits forced eviction (removal against the will of affected people, without legal and other protection including all applicable procedures and principles in ESS5). Requires that acquisition of land and assets happens only after payment of compensation and resettlement has occurred. Requires community engagement and consultation, disclosure of information and a grievance mechanism.	Project Road widening is limited to available Right of Way (RoW) and no additional land acquisition will be required for widening. However, right of way has encroachments by non-title holders at several stretches and these encroachments may get impacted during site clearance activities.
ESS-6 Biodiversity- Conservation	Protect and conserve biodiversity and habitats. Apply the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity. To promote the sustainable management of living natural resources.	Requirements for projects affecting areas that are legally protected designated for protection or regionally/internationally recognized to be of high biodiversity value. Requirements on sustainable management of living natural resources, including primary production and harvesting, distinguishing between small-scale and commercial activities. Requirements relating to primary suppliers, where a project is purchasing natural resource commodities, including food, timber and fibre.	Site clearance activities for road construction will involve removal of roadside vegetation and felling of trees. The biodiversity studies have indicated that entire corridor along the project road is rich in biodiversity, interspersed with invasive species. Other than the clearance of roadside vegetation, road construction will also require felling of trees.

World Bank ESS Policy and Standards	Objectives	Requirements	Relevance & Extent of Relevance to the sub-project/project
<p>ESS-7 Indigenous- Peoples</p>	<p>Ensure that the development process fosters full respect for affected parties' human rights, dignity, aspirations, identity, culture, and natural resource-based livelihoods. Promote sustainable development benefits and opportunities in a manner that is accessible, culturally appropriate and inclusive. Improve project design and promote local support by establishing and maintaining an ongoing relationship based on meaningful consultation with affected parties. Obtain the Free, Prior, and Informed Consent (FPIC) of affected parties in three circumstances. Recognize, respect and preserve the culture, knowledge, and practices of Indigenous Peoples, and to provide them with an opportunity to adapt to changing conditions in a manner and in a timeframe acceptable to them.</p>	<p>Applies when the Indigenous Peoples are present or have a collective attachment to the land, whether they are affected positively or negatively and regardless of economic, political or social vulnerability. The option to use different terminologies for groups that meet the criteria set out in the Standard. The use of national screening processes, providing these meet World Bank criteria and requirements. Coverage of forest dwellers, hunter gatherers, and pastoralists and other nomadic groups. Requirements for meaningful consultation tailored to affected parties and a grievance mechanism. Requirements for a process of free, prior and informed consent in three circumstances.</p>	<p>Not relevant to this sub-project road.</p>
<p>ESS-8 Cultural-Heritage</p>	<p>Protect cultural heritage from the adverse impacts of project activities and support its preservation. Address cultural heritage as an integral aspect of sustainable development. Promote meaningful consultation with stakeholders regarding cultural heritage. Promote the equitable sharing of benefits from the use of cultural heritage.</p>	<p>Requires a chance finds procedure to be established. Recognition of the need to ensure peoples' continued access to culturally important sites, as well as the need for confidentiality when revealing information about cultural heritage assets that would compromise or jeopardize their safety or integrity. Requirement for fair and equitable sharing of benefits from commercial use of cultural resources. Provisions of archaeological sites and material, built heritage, natural features with cultural significance, and moveable cultural heritage.</p>	<p>The alignment of the project road does not have any ancient monuments and/or archaeological site (s).</p>

World Bank ESS Policy and Standards	Objectives	Requirements	Relevance & Extent of Relevance to the sub-project/project
<p>ESS-9 Financial- Intermediaries</p>	<p>Sets out how Financial Intermediaries (FI) will assess and manage environmental and social risks and impacts associated with the subprojects it finances. Promote good environmental and social management practices in the subprojects the FI finance. Promote good environmental and sound human resources management within the FI.</p>	<p>Financial Intermediaries (FIs) to have an Environmental and Social Management System (ESMS) - a system for identifying, assessing, managing, and monitoring the environmental and social risks and impacts of FI subprojects on an ongoing basis. FI to develop a categorization system for all subprojects; with special provisions for subprojects categorized as high or substantial risk. FI borrowers to conduct stakeholder engagement in a manner proportionate to the risks and impacts of the FI subprojects.</p>	<p>Not relevant as there is no financial intermediary involved.</p>
<p>ESS-10 Stakeholder- Engagement- and- Information-Disclosure</p>	<p>Establish a systematic approach to stakeholder engagement that helps Borrowers identify stakeholders and maintain a constructive relationship with them. Assess stakeholder interest and support for the project and enable stakeholders' views to be taken into account in project design. Promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life cycle. Ensure that appropriate project information is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner.</p>	<p>Requires stakeholder engagement throughout the project life cycle, and preparation and implementation of a Stakeholder Engagement Plan (SEP). Requires early identification of stakeholders, both project-affected parties and other interested parties, and clarification on how effective engagement takes place. Stakeholder engagement to be conducted in a manner proportionate to the nature, scale, risks and impacts of the project, and appropriate to stakeholders' interests. Specifies what is required for information disclosure and to achieve meaningful consultation.</p>	<p>Relevant as the project will involve a wide variety of stakeholders during its project cycle including Police Department that are associated with activities under other components of the project such as Road Safety</p>
<p>World Bank's Guidance note on managing the risks of adverse impacts on communities from temporary project induced labour influx, 2016</p>	<p>The document provides guidelines to address issues and risks arising from influx of migrant labour leading to gender-based violence, forced labour etc.</p>	<p>Requires HPRIC to prepare a labour influx management and GBV risk mitigation plan</p>	<p>Applicable to all sub-projects, as influx of migrant labour in construction works is a norm in Himachal Pradesh</p>
<p>Good Practice Note on Road Safety</p>	<p>Road Safety - To identify, evaluate and monitor the potential traffic and road safety risks to workers, affected communities and road users throughout the project life cycle and, where appropriate, will develop measures and plans to address them.</p>	<p>Requirements on traffic and road safety, including road safety assessments and monitoring.</p>	<p>Yes</p>

World Bank ESS Policy and Standards	Objectives	Requirements	Relevance & Extent of Relevance to the sub-project/project
	The Borrower will incorporate technically and financially feasible road safety measures into the project design to prevent and mitigate potential road safety risks to road users and affected communities”.		
World Bank Groups’ EHSs, IFC, 2007			
General EHS Guidelines, April 2007, IFC	The General EHS Guidelines contain information on cross-cutting environmental, health, and safety issues potentially applicable to all industry sectors	Requirements on environmental, health, and safety issues during construction of project road.	Yes
EHS Guidelines for Construction Materials Extraction, April 2007, IFC	The EHS Guidelines contain the performance levels and measures that are considered to construction materials extraction activities such as aggregates, limestone, slates, sand, gravel, clay, gypsum, feldspar, silica sands, and quartzite	Requirements on the resource management of construction materials extraction activities such as aggregates, limestone, slates, sand, gravel, clay, gypsum, feldspar, silica sands, and quartzite.	Yes

74. The project will also adhere to all the applicable labor laws of GoI. The list of laws is presented in **Appendix-8**.

3.3 Comparison of GoI/ GoHP legislations and ESF, 2016

75. The GoI/ GoHP legislations and ESF, 2016 of World Bank have been compared and gaps if any are summarized in the **Table 3-3**.

Table 3-3: Comparison of GoI/ GoHP legislations and Regulations and ESF, 2016

S. No	ESS	Description	Equivalent National Environmental Policy (GoI/GoHP) and Regulations	Policy Gaps and its redressal
1	ESS-1	Assessment and Management of Environmental and Social Risks and Impacts	<ul style="list-style-type: none"> Environmental Impact Assessment Notification-2006⁸, 14th Sep-2006, as amended in 2009 and 2013 	<p>The ESS 1 requires EA for road irrespective of its type. While EIA notification is limited to Expressway, National highway and State Highway and not applicable to other category of roads such as Major District Roads (MDRs) and Other State Roads (OSRs). The present project roads are an MDR</p> <p>Thus, the EIA Notification-2006 is not applicable to the project road. Applicability status for project road does not change even after the notification of EIA Notification, 2020, since MDR and OSRs stands excluded in the new notification.</p>
2	ESS-2	Labour-and-Working-Conditions	<ul style="list-style-type: none"> The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 Himachal Pradesh Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Rules, 2008, Contract Labour (Regulation & Abolition) Act 1970, Minimum Wages Act 1948, Payment of Wages Act 1936, Child Labour (Prohibition & Regulation) Act 1986, Inter-State Migrant workmen's (Regulation of Employment & Conditions of Service) Act 1979 <p>Note: Draft Code on Occupational Safety, Health and Working Conditions, 2019, which seeks to amalgamate 13 existing laws including those mentioned above has already been introduced in Parliament, after a Standing Committee of Parliament submitted its recommendations in Feb 2020. The matter is on hold possibly due to COVID -19 and soon be notified.</p>	<p>The National legal provisions almost cover all requirements in ESS2 except relating to community workers and a functional GRM for all types of project workers. Hence, under this Project, HPSRTP specific Labour management procedure has been prepared to regulate working conditions and management of worker relations including workers specific GRM, terms and conditions of employment, non-discriminations and equal opportunity, protection of work force, prohibition of child/force labour and provision of OHS.</p>

⁸ Draft EIA Notification, 2020 has been notified by MoEF & CC, Government of India, which will supersede the present EIA Notification, 2006, although the applicability of EIA notification to the Project Road does not change, even if the Final EIA Notification, 2020 is notified (No has been re-scheduled due to COVID-19).

S. No	ESS	Description	Equivalent National Environmental Policy (GoI/GoHP) and Regulations	Policy Gaps and its redressal
3	ESS-3 and EHS Guidelines of IFC	Resource-Efficiency-and-Pollution-Prevention-and-Management	<ul style="list-style-type: none"> • Environmental protection Act, 1986 and subsequent amendments • Environmental Impact Assessment Notification-2006, 14th Sep-2006, as amended in 2009 and 2013 • Air (Prevention and Control of Pollution) Act, 1981. • Water (Prevention and Control of Pollution) Act, 1974, for Pollution-Prevention-and-Management. • The Noise Pollution (Regulation and Control) Rules, 2000 • National Resource Efficiency Policy, 2019 (Draft) • Notification for use of fly ash, 2003 and MoEF & CC notification dated 25th March 2015 • Municipal Solid Waste (Management & Handling) Rules, 2000 (MSW Rules) • Hazardous Wastes (Management, Handling and Trans-boundary Movement) Rules, 2008. • Batteries (Management and Handling) Rules, 2001 • Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules 1989 • The E-Waste (Management) Rules, 2016, • Plastic waste Management Rules, 2016 • Construction & Demolition, Waste Management Rules, 2016 	<p>The majority of ESS3 requirements are addressed by existing regulations and indirectly for resource efficiency and climate change aspects. Further, bridging of gap is most likely after notification of National Resource Efficiency Policy, 2019, currently at draft stage. However, in its absence currently, the resource optimization initiatives considered in project road design as part of DPR and provisions in ESMP provide for commensurate resource efficiency and pollution prevention and management measures.</p>
4	ESS-4	Community-Health-and-Safety	<ul style="list-style-type: none"> • Air (Prevention and Control of Pollution) Act, 1981. • Water (Prevention and Control of Pollution) Act, 1974, for Pollution-Prevention-and-Management. • The Noise Pollution (Regulation and Control) Rules, 2000 • Guidelines on Traffic Management in Work Zones IRC: SP:55 – 2014, • Municipal Solid Waste (Management & Handling) Rules, 2000 (MSW Rules) • Hazardous Wastes (Management, Handling and Trans-boundary Movement) Rules, 2008. • Construction & Demolition, Waste Management Rules, 2016 	<p>While other acts cover for all ESS 4 requirements, gaps exist for Community- community exposure to health issues</p> <p>The gaps are addressed through ESMP and C-ESMP, which considers all required measures/plans for Community health and safety like OHS plan, Water and Waste Management Plan, Influx management Plan, Worker’s camp management plan, CHS Plan, Transport (or road safety) management Plan, Quarry/borrow area management plan, establishment of GRM for labour and Site restoration Plan</p>

S. No	ESS	Description	Equivalent National Environmental Policy (GoI/GoHP) and Regulations	Policy Gaps and its redressal
5	ESS-5	Land-Acquisition-Restrictions-on-Land-Use-and-Involuntary-Resettlement	<ul style="list-style-type: none"> The Himachal Pradesh Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Social Impact Assessment and Consent) Rules 2015, Acquisition of Land by Private Negotiation and Upkeep of Land 2017-PWD/ GoHP, January 2018 Record/General Guidelines and Instruction (Standing Order No .28) (PBW(B)F (5)40) 	Gap exists specifically related to aspects such as identification of non-titleholders as PAPs; cut off dates for non-titleholders and valuation of structures with depreciation. The gaps are addressed with suitable provisions in Resettlement Policy Framework (RPF), specifically for HPSRTP.
6	ESS-6	Biodiversity-Conservation	<ul style="list-style-type: none"> Biological Diversity Act, 2002, Wildlife Protection Act 1972 (WLPA), The Forest (Conservation) Act, 1980 FCA 	Provisions from act meets the ESS requirements. Bio-Diversity Management Plan (BMP) will be prepared to address the wildlife presence and movement of Leopard in and around the project corridor. During bio-diversity investigations, local people have informed about sighting of leopard at some stretches along project road.
7	ESS-7	Indigenous-Peoples	Not applicable	
8	ESS-8	Cultural-Heritage	<ul style="list-style-type: none"> Ancient Monuments and Archaeological Sites and Remains Act, 1958 and The Himachal Pradesh Ancient and Historical Monuments and Archaeological Sites and Remains Act, 1976 	Provisions from the act meets the ESS requirements. Chance find procedures will be included in ESMP and C-ESMP. Impacts on religious structures (not protected, but social and cultural value) will be mitigated or managed through provisions for restoration or reconstruction of CPRs in ESMP.
9	ESS-9	Financial-Intermediaries	Not applicable	
10	ESS-10	Stakeholder-Engagement-and-Information-Disclosure	<ul style="list-style-type: none"> Environmental Impact Assessment Notification-2006, 14th Sep-2006, as amended in 2009 and 2013 The Himachal Pradesh Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Social Impact Assessment and Consent) Rules 2015, GoHP standing order on Private Negotiations Right to information Act 2005 	Environmental Impact Assessment Notification-2006 is not applicable to the project road though it has provisions for public hearing as part of impact assessment process. Similarly, HP RFCTLARR, 2015 has provisions for consultations during SIA. The Standing order on private negotiations requires consultations but with affected land owners only.

S. No	ESS	Description	Equivalent National Environmental Policy (GoI/GoHP) and Regulations	Policy Gaps and its redressal
				The Project has prepared a Stakeholder Engagement Plan (SEP) to engage with all stakeholders relevant to the different components sub-components of the project
11		EHS Guidelines for Construction Materials Extraction, April 2007, IFC	<ul style="list-style-type: none"> • National Resource Efficiency Policy, 2019 (Draft) • Environmental protection Act, 1986 and subsequent amendments • Environmental Impact Assessment Notification-2006, 14th Sep-2006, as amended in 2009 and 2013 • Air (Prevention and Control of Pollution) Act, 1981. • Water (Prevention and Control of Pollution) Act, 1974, for Pollution-Prevention-and-Management. • The Noise Pollution (Regulation and Control) Rules, 2000 • Notification for use of fly ash, 2003 and MoEF & CC notification dated 25th March 2015 • Municipal Solid Waste (Management & Handling) Rules, 2000 (MSW Rules) • Hazardous Wastes (Management, Handling and Trans-boundary Movement) Rules, 2008. • Batteries (Management and Handling) Rules, 2001 • Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules 1989 • The E-Waste (Management) Rules, 2016, • Plastic waste Management Rules, 2016 • Construction & Demolition, Waste Management Rules, 2016 • The Mines and Minerals (Development and Regulation) Act 1957 	<p>The majority of ESS3 requirements are addressed by existing regulations and indirectly for resource efficiency and climate change aspects. Further, bridging of gap is most likely after notification of National Resource Efficiency Policy, 2019, currently at draft stage.</p> <p>Project design considers measures for minimization of natural material extraction and reuse of extracted materials in project construction</p>

76. Based on comparative analysis of national/state's regulatory frameworks with ESS 1-8 and 10, the requirements in regulatory frameworks were found to be aligned with ESSs. The exception being (a) GHG emission calculation, (b) resource efficiency, (c) community health and safety and (d) workers grievance redressal mechanism. These aspects are considered in different themes of impact assessment in line with international best practices, but not mandatory under existing regulatory frameworks. Currently, National Resource Efficiency Policy, 2019 is being framed (draft stage) with an objective to mainstream resource efficiency across all sectors by fostering cross-sectoral collaborations, development of policy instruments, action plans and efficient implementation and monitoring frameworks.

77. Further as gaps exists between GoHP, GOI and ESS 5 requirements, gap-filling measures are reflected in the entitlement matrix of the Resettlement Policy Framework and in the Resettlement Action Plans. In case of stakeholder engagement, specifically, the EIA notification 2006 requires conducting of public hearings during process of impact assessment but is limited to project that are categorized as Category-A, while RFCTLARR Act and also GoHP Standing order on Private Negotiations requires consultation with project affected people during Social Impact Assessment.

78. In the event of any conflict or inconsistency between the provisions of this GOI, GoHP and RPF and the provisions of World Bank's ESF, the provisions of the ESF shall prevail.

3.4 Clearances and Permissions required for Project Road

79. The project road does not require any prior environmental or forest clearances from the State Government or Government of India level. The pre-construction and construction stage permissions required for the project road are given in **Table 3-4**.

Table 3-4: Clearances and Permissions Required for Project Road

S. No.	Clearances/Permissions required	Competent Authority to Accord Clearances	Responsibility to Obtain Clearance
A. Pre-construction Stage			
1	Permission for felling of an estimated 360 trees, which are within the Right of Way (RoW)/ Corridor of Impact (CoI)	Divisional Forest officer, Mandi, Department of Forests, GoHP and District Magistrate Mandi	HPRIDCL
B. Construction Stage			
1	Consent to establish and Consent to operate construction camp sites, crusher units, hot mix plants, concrete batch mix plants, WMM plants, work force camps etc.	Himachal Pradesh State Pollution Control Board	Contractor
2	Permissions for sourcing of water for construction activities (Surface and Ground Water)	HP Ground Water Authority and Irrigation and Public Health Department, GoHP	Contractor
3	License to store HSD and Explosives at Construction camp, if required.	Regional office of Chief Controller of Explosives, GoI, Himachal Pradesh	Contractor
4	Permission to Establish Construction camps	District Magistrate & Local Panchayat (s), landowners in case of private land	Contractor
5	Opening of new quarry sites for Stone aggregates	Geological Wing, Department of Industries, GoHP	Contractor
6	Labour licence/ permits for engaging construction workers (skilled & un-skilled)	Respective district level Labour Officer	Contractor

4 BASELINE DATA

4.1 Approach and Methodology

80. **Study Area:** The study area for environmental and social baseline data assessment is defined on the consideration of physical space to be occupied, whether permanently or temporarily, during construction of the entire road infrastructure, associated infrastructure, as well as adjacent spaces, performance of planned activities in the various stages according to project needs, requirements on use and exploitation of natural resources, abiotic, biotic and socioeconomic components, and the area where significant environmental impacts are evident, with a view to define limit on which components involved are analyzed.

- a. **Corridor of Impact for Sub-Project Road:** The land width that would be needed during road construction taking into account full construction width, movement of construction vehicle/equipment and safety zone on either side of centerline during construction stage is considered as Corridor of Impact (CoI). The CoI is considered as 50-metre-wide land strip i.e., 25 metres on each side of the centre line of the road (ref. **Figure 4-1**).
- b. **Corridor of Impact for Associated facilities:** Associated facilities comprise four bridges (1 major and 3 minor bridges) at different chainages, which are presently under construction by HPPWD (ref. 1.3 under Section 1). Based on the site assessment of alignment of approach roads and bridges at these 4 locations, an area covering over a 300-meter radius surrounding bridge locations is considered as CoI for the associated facilities (ref. **Figure 4-2**).
- c. **Project Influence Area:** 15 km strip on either side of project road and associated facilities is considered as the Project Influence area (PIA) for collecting baseline data from secondary data sources as required for conducting environmental impact assessment (Ref. **Figure 4-1**).

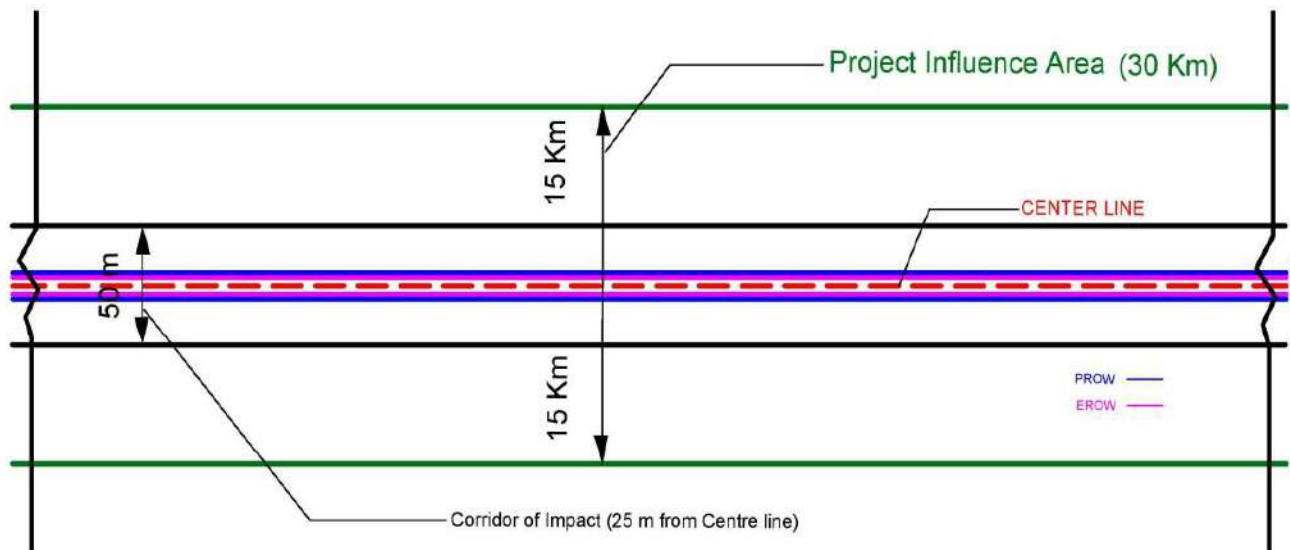


Figure 4-1: Corridor of Impact and Project Influence Area for Sub-Project Road



Minor Bridge under Construction at existing Ch. 5+820/ Design Ch 5+719
Coordinates: 31°40'24.74" N/ 76°54'29.48" E



Major Bridge under Construction at existing Ch 7+530/ Design Ch 7+365
Coordinates: 31°39'55.44" N/ 76°53'53.33" E



Minor Bridge under Construction at Existing- Ch 8+120/ Design Ch 7+842
Coordinates: 31°39'43.31" N/ 76°53'47.89" E



Minor Bridge under Construction at Existing- Ch 11+475/ Design Ch 11+054
Coordinates: 31°39'15.05" N/ 76°52'50.61" E

Figure 4-2: Location and CoI for Associated facilities along Mandi-Rewalsar-Kalkhar Road
 (Corridor of Impact – 300-meter radius surrounding each bridge location)

81. The baseline environmental assessment for the ESIA studies has considered both CoI and PIA as shown in Figure 4-1 as well as the respective tehsil/district as a whole in general.

82. Environmental and Social baseline data and assessment: The primary baseline information on different environmental and Socio-economic profile components for both CoI and PIA were collected through field surveys and secondary data sources. The input to field surveys i.e., identification of environmental factors to be considered for assessment was backed by thorough desk review of literature, existing rules/regulations/acts and reconnaissance survey. Field surveys were carried out to collect information on the major environmental features such as settlement facilities, drainage pattern of the area, forest stretches, trees within RoW of the alignment, water bodies, river flowing across road alignment, sensitive receptors, air, water, noise and soil quality etc. which helped in identifying areas of concern along the project road and associated critical issues. After the full documentation of the baseline environmental situation, each of the environmental aspects was examined against the project road upgrading component and activities. Environmental issues have been assessed to describe the potential impacts and risks that may result from construction works related to project road upgradation. Quantification has been done to the extent possible (See **Appendix-7: Inventory Checklist and Environmental Screening/ Transect Walk Survey Formats**).

83. The project influence area of 15 km was considered for socio-economic profile assessment based on the information collected from secondary and primary sources to provide an overview, levels of socio-economic development etc. of the project road. Secondary information from different government sources like Census of India, Economic and Statistics department, Agriculture department, Social Welfare & Women Development Department of Government of Himachal Pradesh. The secondary information helped to understand macro level socio-economic profile of the population by gender, ethnicity, vulnerability, poverty, working population and available infrastructure facilities for services in the project influence area.

84. Census-socio-economic survey⁹ included collection of information from primary sources are the likely affected households/ facilities and covered male, female and third gender stakeholders/ participants. Information comprised: general identification relating to household identification; social status; type of family; sexual orientation; income by sources; type of losses due to the project; vulnerable category of the household; type of inventory losses; impact category; use of structure/property; loss of structure; Other losses. Survey also collected details on ownership of the structure /land; options for R&R/Opinion on the proposed project; access to health, electricity, fuel, water supply, and sanitation; income, debt levels, expenditure pattern, loss of land, assets owned and productivity; health status; gender aspects; migration; and perception about the project. The impact on private land and structures (residential, commercial) government, encroachers and squatters in addition, detailed information on impact on community assets has also been collected (religious structure, educational institutions, community properties etc.). Subsequently collation and analysis of primary and secondary information collected from different sources has been carried out. On the basis of primary data, analysis has been done on potential social and economic impacts, categorization of impacts, risks, potentials impact, and alternatives etc. Local level consultations and focus group discussions and key informant interviews were deployed to elicit views and opinions of different stakeholders regarding the proposed road improvements.

85. As part of stakeholder engagement, stakeholders were identified through systematic consultation with project beneficiaries, project affected people, women, vulnerable and poor members of the community, and other stakeholders who may have an influence over the project. Consultations were undertaken with primary stakeholders: beneficiaries, disadvantaged, poor and vulnerable groups, people who may potentially be impacted by the project. Consultations were also carried out with secondary stakeholders: local community-based organizations (CBOs) and community representatives as well as government departments etc. (refer **Table 4-1**)

⁹ Conducted by trained Surveyors based on guidelines and questionnaire developed specifically for the project road.

Table 4-1: Stakeholder Consultations and Tools of Consultations

Tools of Consultation	Stakeholders	Purpose
Public meeting, Focus Group Discussion	Community, civil society organizations, NGOs, local leaders, Government officials	Discuss the objective of the project; Social impact (Land including ERoW, Structures, CPRs)
Public meeting, Focus Group Discussion	Women groups, Truckers, vulnerable road users etc.	Social Concerns (Road Safety, Critical Junctions, Rural Roads, Slow moving vehicles, Fair/Festival Traffic; Environmental improvement/ enhancement)
Key informant interviews	Government Officials (Managers, Engineers, Supervisors etc.);	Social impact (Land/ ERoW, Structures, CPRs)
	Neighbouring communities; Disadvantaged and vulnerable Groups (women, children, person with disability, old age); Employees and Managers (Project Managers, Site Engineers, technicians, supervisors, safety staff, multipurpose staff);	Social Concern (Road Safety, accident spots, critical Junctions)
	Village panchayat members/ local NGO's and Community Organization	Road Safety (Slow moving vehicles, importance of the road, Fair/Festival Traffic; Environmental improvement Social Concern road safety, accident spots, critical Junctions; role in the area)
	Community workers, Sarpanch, ANMs etc.	Social Concern (Road Safety, accident spots, critical Junctions)

86. Focus group discussions were conducted with a cross-section of men and women in the community. The objective of the discussions was to gain in-depth understanding of project issues and concerns from a broad group of stakeholders, including people who may be affected from loss of land/assets. The consultations focused on: inclusiveness in participation of community members, perceptions and concerns about the positive and negative social impacts of the project, including impacts on land and structures.

87. Separate individual interviews were conducted with disadvantaged and vulnerable members of the community to disseminate information about the project and to understand their views about the project. Women at select locations were also consulted on their interest in road related livelihood activities such as providing off-carriage maintenance works and supporting the much-needed nature-based solutions/measures (bioengineering) towards slope stabilization efforts along project road. A separate questionnaire was administered to females on issues relating to Gender Based Violence (GBV) particularly at hot spot locations along the project corridor like community market areas, socially sensitive locations like schools and hospitals along project road.

88. Individual one on one interviews were conducted during the social & environment surveys. Such interview helped to solicit views and opinions at the individual level. It enabled stakeholders to speak freely and confidentially about controversial and sensitive issues and enabled to build personal relations with stakeholders and record the interviews. The purpose was to understand the social concerns of the local community, who are likely to be directly/indirectly impacted by project road. A team comprising social development and communication professionals carried out these consultations. The outcomes of the public consultations were helpful towards providing key inputs to the DPR on adoption of the mitigation hierarchy and provide inputs for approach to management of E&S issues arising for the project road.

All formats used for collection of the above information, checklists used for consultations, photographs, attendance sheets are available in project files/records and included in **Appendices 7, 13, 15, 16, 17, 18, 19 and 21** respectively to this ESIA.

4.2 Data Sources

89. The baseline environmental profile of the CoI and PIA for both project road as well as associated facilities, in particular and Mandi district as a whole in general has been described in the following sections. The environmental profile includes key attributes like physiography, drainage, geology, soil, hydrogeology, land use, flora, fauna, forest/vegetation cover, climate, ambient air quality, water quality, ambient noise levels, hazards and vulnerability status of the PIA among others.

90. In order to assess the baseline environment, the data has been accessed from authentic and verifiable sources as given in **Table 4-2, Table 4-3**. Due attempt has been made to source and access only the latest available data from authentic and verifiable sources.

Table 4-2: Data Sources for Baseline Environmental and Social Assessment

Environmental Attribute	Source of data / Information	Date and Year of the Data
Climate/Weather Parameters like Temperature, rainfall, wind speed and other similar climatological parameters	IMD (Indian Metrological Department), Shimla and New Delhi	Last 5 years (2014-2020) data has been used
Soil & Geology	Geological Survey of India, Central Ground Water Board, State Mining Department, GoHP	District Ground Water Brochure of Mandi District published by the Central Ground Water Board/Authority (Northern Himalayan region-Dharamshala), in year 2013 and Ground Water Yearbook of Himachal Pradesh (Northern Himalayan region-Dharamshala), in Feb – 2016.
Landslide locations/Slope stability	Physical inspections of the project road	Primary investigations of the project road during August – September 2019 and Feb -March 2020.
Drainage/ Flooding	Satellite Imagery/ Toposheet /Hydrology study/State Water Resource Department. Ground truth verification by Physical inspections of the project road.	District Ground Water Brochure of Mandi District published by the Central Ground Water Board/Authority (Northern Himalayan region-Dharamshala), in year 2013 and Ground Water Yearbook of Himachal Pradesh (Northern Himalayan region-Dharamshala), in Feb – 2016. Primary investigations of the project road during August – September 2019 & March 2020.
Surface Water Bodies, Surface water quality and Ground water Quality	Topography sheets/field study. Hydrological data from the CGWB Reports followed by ground truth verification by Physical inspections of the project road. Also, Monitoring of the surface and ground water quality along the project road	District Ground Water Brochure of Mandi District published by the central ground water board (Northern Himalayan region-Dharamshala), in year 2013 and Ground Water Yearbook of Himachal Pradesh (Northern Himalayan region-Dharamshala), in Feb – 2016. Monitoring of the surface and ground water quality along the project road was carried out through NABL Accredited Laboratory during ESIA Studies (Sept-2019 and March 2020 & March 2021 at associated facility locations).
Ambient Air Quality and Ambient Noise levels, surface water quality, soil quality	Monitoring of the ambient air quality and ambient noise level measurements along the project road was carried out.	Monitoring of ambient air quality and ambient noise level along the project road was carried out through NABL Accredited Laboratory during ESIA Studies (Mar 2020 and March 2021 at associated facilities).
Forest/Protected Areas, Endangered Plant and Animal, Ecological Sensitive Area, Wildlife Corridors /Migratory routes	Department of Forest, Govt. of Himachal Pradesh, Consultations with DFOs, Forest Range Officers of forest department and with local community.	Forest area as of 2018-19, published by Himachal Pradesh Forest Department, GoHP and Primary investigations of the project road by ecological assessment of the project road corridor by an ecology/ biodiversity expert of ESIA team during August – September 2019 and March 2020.

Environmental Attribute	Source of data / Information	Date and Year of the Data
	This was followed by ecological assessment of the project road corridor.	
Trees and Vegetation Cover	Department of Forest, Govt. of Himachal Pradesh, Consultations with DFOs, Forest Range Officers of forest department and with local community. This was followed by ecological assessment of the project road corridor.	Physical inspections of the project road for ecological assessment by an ecology/ biodiversity expert of ESIA team during August – September 2019 & March 2020.
Population and Settlements within the RoW	Census of India, 2011 and Primary Surveys by of the project road corridor by a qualified and experienced social expert.	Census, 2011 data published by the Office of Registrar General & Census Commissioner, India, and primary social economic survey of all households along the project corridor by social surveyors under guidance / supervision of key social specialist of ESIA team.
Cultural / Heritage and Ancient Structures.	Consultations with Archaeological Survey of India, State Archaeological Department, GoHP and web-based data search.	Archaeological Survey of India, GoHP and web-based data search for information on Cultural / Heritage and Ancient Structures within the PIA and Primary investigations of the project road during August – September 2019 and March 2020.

Table 4-3: Data Sources for Baseline Environment Theme Maps

Sl. No.	Baseline Environment Theme Maps	Data Sources
1	Agriculture land cover map	Landsat-8 OLI Sensor
2	Agriculture map (Crop Pattern)	Maps of India and Landsat-8 classification
3	Drainage map	SRTM digital elevation model/CGWB
4	Earthquake map	Vulnerability Atlas of India, BMTPC (Building Materials and Technology Promotion Council)
5	Elevation map	SRTM digital elevation model
6	Flood Hazard map	Vulnerability Atlas of India, BMTPC (Building Materials and Technology Promotion Council)
7	Forest Map	Landsat-8 OLI sensor/HP Forest Department
8	Landslide map	Vulnerability Atlas of India, BMTPC (Building Materials and Technology Promotion Council)
9	Land Use and Land Cover (LULC) map	Landsat-8 OLI sensor
10	Physiography map	SRTM digital elevation model
11	Satellite map for Data interpretation	Landsat-8 OLI sensor
12	Soil Moisture Map	Amy McNally NASA/GSFC/HSL (2018).
13	Soil fertility map	Indian Institute of Soil Science (IISS)/HP Agriculture Dept
14	Taluka map	Census 2011 data, Government of India.
15	Vulnerability Map	HP state council for Environment science and technology and BMPTC
16	Wildlife Sanctuary map	Wildlife Institute of India, Dehradun
17	Wind Hazard map	Vulnerability Atlas of India, BMTPC (Building Materials and Technology Promotion Council)

4.3 Land Environment

4.3.1 Geology

91. The Mandi district being primarily a hilly district presents an intricate mosaic of mountain ranges, hills and valleys. The rock formations occupying the district range from pre-Cambrian to Quaternary period. The geological succession in the district is given in **Table 4-4**.

Table 4-4: Geological Formations of Mandi District

Age	Formation	Lithology
Quaternary	Alluvium: Terrace & Fluvial deposits	Alluvium, clay, sands, gravels, pebbles, boulders and cobbles
Lower Pleistocene to Middle Miocene	Siwalik Group	Clay, siltstones, sandstones, and boulder beds
Oligocene to Lower Miocene	Dharamshala/ Kasauli Formation (Sabathu Group)	Grey/ green sandstones, splintery shale, clay etc.
Permian	Basic volcanic intrusive	
Proterozoic	Shimla Group	Phyllites, Quartzites, limestone, shale and dolomite
	Shali/ Sundernagar/ Kullu Formation	Phyllites, Quartzites, dolomite conglomerate and limestone
	Jutogh Group	Quartzites, Schists and phyllites
		Dalhousie/ Kullu granites and gneisses

Source: CGWB, Ministry of Water Resources, Government of India

92. The hilly and mountainous terrain of the district is characterized by the hard formations and mainly comprises of igneous and metamorphic rocks, belonging to the Jutogh, Shali/ Lari and Shimla group and occupy major part of the northern, central and eastern parts of the district. The western and southern parts of the district is characterized by the sedimentary origin formations comprising of sandstone, shale, siltstone, conglomerate etc. belonging to the Dharamshala/Sabathu group and Siwalik group of Tertiary age. Alluvium, terrace deposits, fluvial deposits of Quaternary period occur in the intermontane valleys, viz., Balh valley, Sarkaghat valley etc. which constitute an important unit from ground water point of view.

4.3.2 Hydrogeology and Ground Water Resources

93. Major part of Himachal Pradesh is hilly and mountainous with few small intermontane valleys covering about 15% of the area. These intermontane valleys comprise of alluvial deposits, which form extensive aquifers and thus represent porous formations. Major valleys in the state are Indora-Nurpur and Kangra-Palampur valleys in district Kangra, Una valley in district Una, Balh valley in district Mandi, Nalagarh valley in district Solan and Paonta valley in district Sirmaur.

94. The Siwalik and Sirmaur group represent the Tertiary formation in the state. These two groups occur in the western part of the state and have northwest to southeast trend. The Siwalik comprises of boulder, conglomerate, sandstone and clay while, Sirmaur group comprises of shale, sandstone and clay. The primary porosity and permeability in the Tertiary formation is low to moderate and hence, these aquifers do not form high yielding aquifers.

95. The older rock formations of Proterozoic to Mesozoic eras constitute of igneous and metamorphic rocks like granite, gneiss, slate, schist, phyllite, quartzite etc. Due to their consolidated nature, these rock formations serve as poor aquifers. However, due to tectonic movements, they have

been traversed by faults, thrust and joints, which have enhanced their ground water potential. The quality of ground water in hard rocks and alluvial areas is by and large good and suitable for domestic and irrigational use. The distribution of the hydrogeological formations and their yield potential in Mandi district and Himachal Pradesh as a whole is given below in **Table 4-5**.

Table 4-5: Hydrogeological Formations and Yield Potential in Himachal Pradesh

Age	Rock Formation	Districts	Hydrogeological Characteristics
POROUS FORMATIONS			
Recent to sub-recent	Boulder, Cobble, Pebble, Sand, Silt, Clay	Kangra, Una, Solan, Sirmaur, Mandi and Kullu	High Yield 30-75 m ³ /hr
FISSURED FORMATIONS			
Tertiary	Boulder Conglomerate Sandstone, Clay	Kangra, Solan, Sirmaur, Bilaspur, Una, Mandi and Hamirpur	Moderate to Low Yield < 30 m ³ /hr
Proterozoic to Mesozoic	Shale, Slate, Phyllate, Limestone, Dolomite, Sandstone, Quartzite, Granite, Schist	Lahaul & Spiti, Kinnaur, Chamba, Mandi, Shimla, Kangra, Sirmaur, Solan and Kullu	Moderate to Low Yield < 05 to 30m ³ /hr

96. Hydro geologically, Mandi district is divided into two distinct and well-defined units viz. *porous formations* constituted by unconsolidated sediments and the *fissured formations* or hard rock formation constituted mainly by the semi-consolidated to consolidated rocks. The fissured formations include the semi-consolidated to consolidated (hard) rocks exposed in the district and are of sedimentary, metamorphic and igneous origin. These form low and high hill ranges throughout the district. Fractured and jointed sandstone, siltstone forms are low potential aquifers in the district. In general, the weathered and fractured hard rocks are favorable for groundwater aquifers. Fracture zones and contact zones form the important aquifers in the topographically lower areas with poor to moderate yields. These fracture or fault zones form potential ground water zones. Ground water in the hilly areas' oozes in the form of seepages, springs and utilized for domestic and other uses. At places, shallow boreholes fitted with and pumps have been constructed to develop ground water. The yield of the bore wells constructed along the fault/fracture/contact zones varies from less than 1 to 30 cum/hour. Weathered mantle in low topographic areas also form poor aquifers. Collecting wells/tanks, locally known as bowris are constructed at locations to tap the oozing out spring/seepage zones for collecting water, which generally meet the domestic water needs.

97. Rainfall is the major source for groundwater recharge, apart from the influent seepage from the rivers, irrigated fields and inflow from upland areas in the form of springs and base flow from streams.

98. The Ground water development in Mandi district is on moderate scale is restricted to Balh valley, Karsog valley and small valleys along the major streams and rivers. In these areas, all the major irrigation and drinking water supplies depend on tube wells and dug wells, in addition to various water supply schemes based on rivers / nallas. Irrigation & Public Health Department, being designated agency under the GoHP for water supply to meet domestic and irrigation demand, taps springs, which are perennial and generally yield discharge less than between 5 to 20 cum/hour and mostly water supply schemes are based on such springs. Generally, these springs are tapped at the source, so that the water can be supplied under gravity.

99. The Central Ground Water Board (CGWB) has carried out the ground water resources assessment and potential only for the Balh valley and no other part of the district has been assessed due to its mountainous terrain. The ground water resources of Balh valley computed as per the GEC-97 methodology are given in **Table 4-6**. The stage of ground water development in Balh valley in Mandi

district is mere 15.36% and falls under “Safe” category and no other area or block of the district has been notified groundwater development from point of view. There is thus, a scope for further ground water development, not only in Balh valley but all parts of the district.

Table 4-6: Ground Water Resources assessment of Balh Valley, Mandi District

Sl. No	Particulars	Area/ Quantity
1.	Area (Balh valley) considered for GW Assessment	9500 ha.
2.	Net Ground Water available	5942.33 ham
3.	Annual Ground Water draft	912.77 ham
4.	Stage of Ground Water Development	15.36%

Source: - CGWB, North Himalayan Region, Himachal Pradesh

4.3.3 Physiography

100. The project road entirely traverses within Mandi Tehsil of Mandi district, which is bounded by Kangra district in the North, Una – Hamirpur- Bilaspur districts in West, Shimla in East and Solan, Sirmaur districts in South respectively.

101. The Mandi district comprises 17 Tehsils. The alignment of project road, traversing entirely in Mandi Tehsil is shown in **Figure 4-3**.

4.3.4 Drainage

102. Himachal Pradesh is drained by 5 river basins, out of which Beas and Sutlej River forms major drainage basins of Mandi district. Beas basin drains 70%, while Sutlej basin drains 30% area of the district. The project road traverses through Dhauladhar range of Sutlej basin in Hilly/mountainous area as shown in **Figure 4-4**. The entire district has a dendritic pattern of drainage which is shown in **Figure 4-5**.

103. The project road traverse across several seasonal streams/ small rivulets at different chainages along the road. The project design has considered 143 cross-drainage structures across such streams, which includes 1 major bridge, 5 minor bridges, 5 slab culverts, 34 box culverts and 98 pipe culverts. However, none of these rivulets/ streams are perennial and most of these drain up during non-monsoon months, except two small rivulets streams at Ch. 5/820 and 7/530, which carries very minimal flow or insignificant flow during non-monsoon months, which can be attributed to the discharges from the form of springs in upland areas and base flow from streams. The project design considers construction of 14,500 meters of RCC cover drains and 11,010 meters length of ‘V’ shaped drawings along the road which will be connecting to the nearest culverts (ref. **Appendix-1** for drainage map)

104. Mandi District has three important lakes namely Prashar (Mandi Sadar Tehsil), Kamrunag (Chachiyot Tehsil) and Rewalsar lakes. The project road traverses in close proximity to Rewalsar lake and the nearest periphery of lake is about 40-50 meter away from the right of way (RoW) of the project road. The Prashar and Kamrunag lakes are beyond the 15 km PIA of the project road.



Figure 4-3: Tehsil Map of Mandi District

(Source: - <https://www.mapsofindia.com/maps/himachalpradesh/tehsil/Mandi.html>)

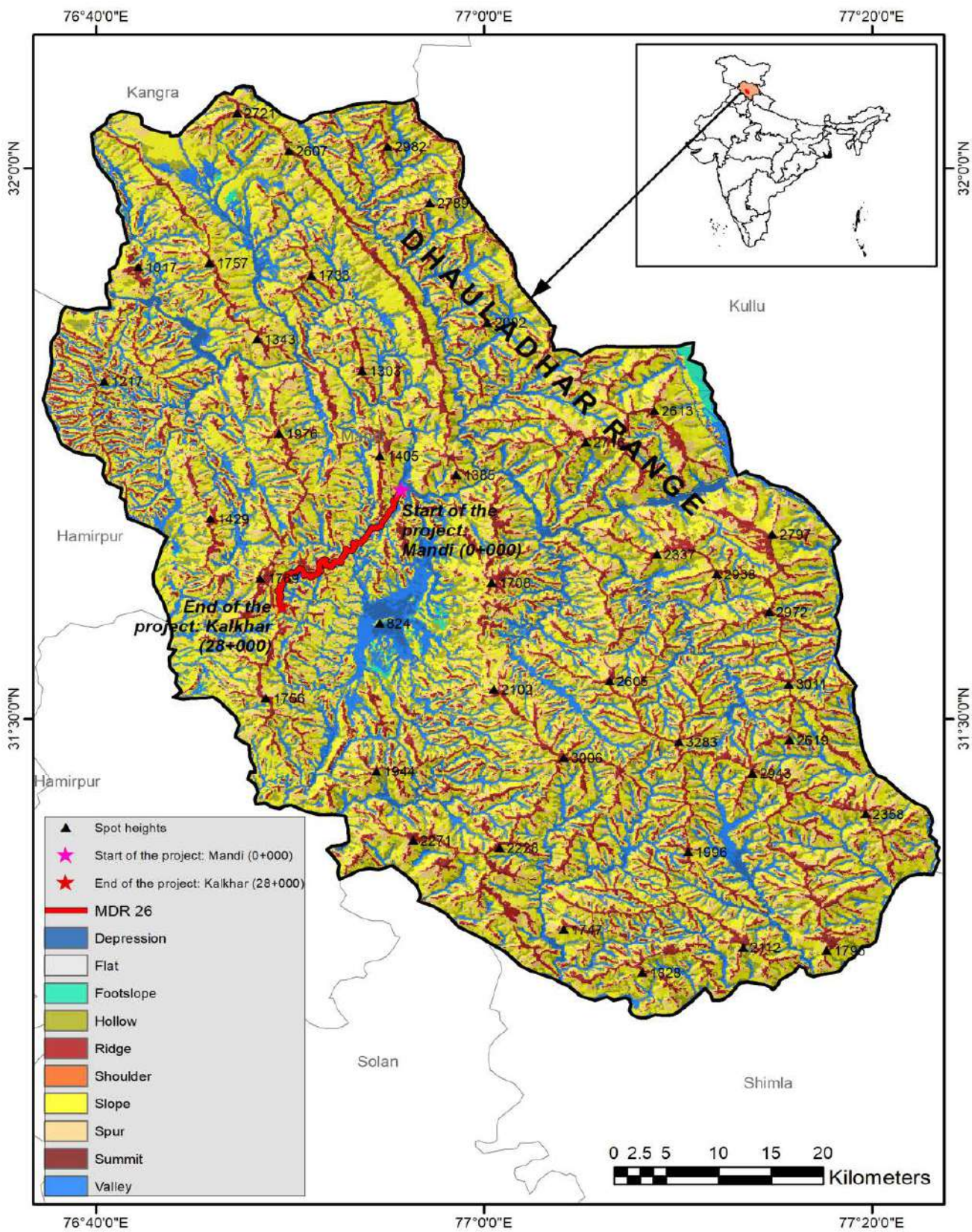


Figure 4-4: Physiography of Mandi District

Source: - Central Ground Water Board, Government of India and SRTM Digital elevation model

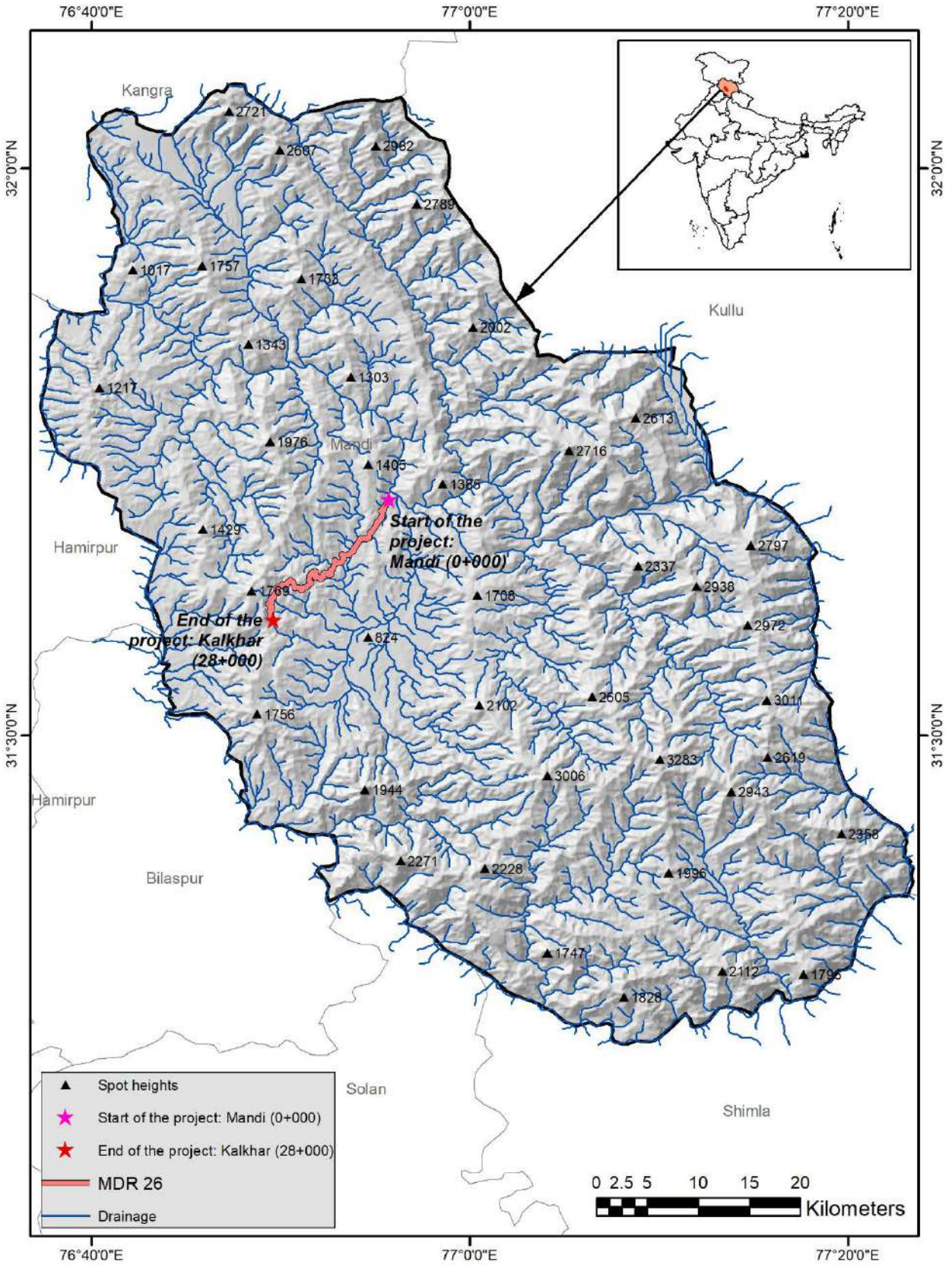


Figure 4-5: Drainage Pattern of Mandi District

(Source: - Central Ground Water Board, Government of India and SRTM Digital Elevation Model)

4.3.5 Elevation

105. The elevation of project road range between 700-1500 meters, with an average elevation of 1100 meters above mean sea level (MSL). The minimum and maximum elevation of the project road is 781 m at km 0+000 and 1411m above MSL at Km 21+700 respectively. The elevation profile of Mandi district showing the project road is given in **Figure 4-6**.

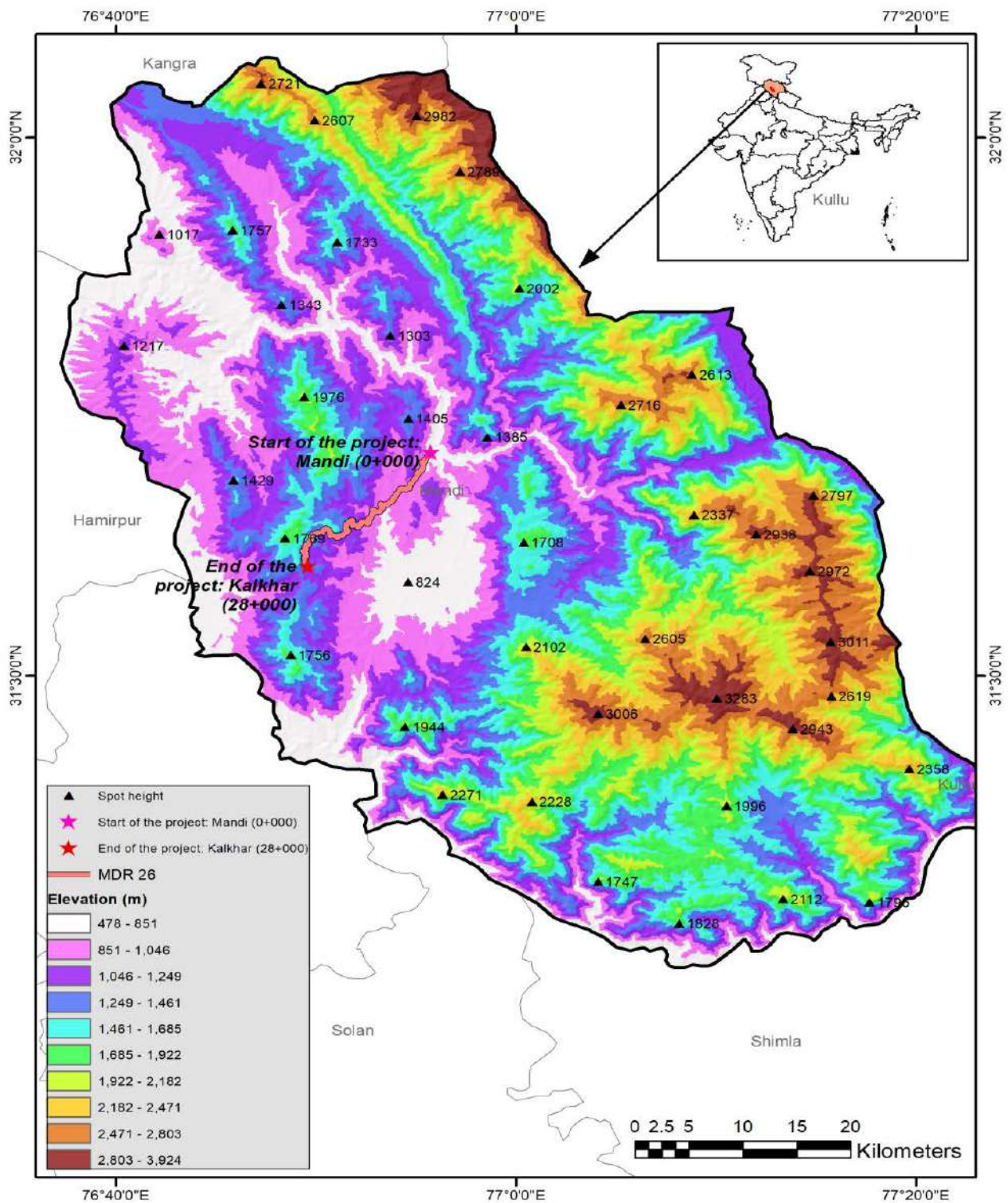


Figure 4-6: Elevation Profile of Mandi District
(Source: - SRTM Digital Elevation Model/ CGWB, GoI)

4.3.6 Geo-morphology and Soils

106. Mandi district presents an intricate mosaic of mountain ranges, hills and valleys. It is primarily a hilly district with altitude ranging from 550 m above MSL near Sandhol, where the Beas River exits the district, to about 3960 m above MSL near Kullu border. Also, there is a general increase in elevation from west to east and from south to north and the master slope is south westerly.

107. The south-western part consists of Siwalik ranges having scarped slopes. There are few small intermontane valleys; prominent among them is the Balh valley, located in the lesser Himalayan ranges, having an average altitude of about 790 m and have a general slope towards NNE. The valley floor is undulating and is marked by low hillocks and terraces fringing the hills and intervening low alluvial plain.

4.3.7 Soil, Moisture and Fertility Levels

108. Mandi district as a whole is largely dominated by two types of soils viz. sub-mountainous soil occurring in Seraj and Karsog blocks and Mountainous Soil occurring in remaining eight blocks of the district including Mandi tehsil, in which the project road traverses. The soil moisture of Mandi district showing the project road is given in **Figure 4-7**.

109. The sub-mountainous soil is high in organic carbon, low in available phosphorous and medium in potash, whereas the mountainous soil is brown in colour, medium in available nitrogen & potash and deficient in available phosphorous. The soil reaction is slightly acidic to neutral and texture in general varies from loam to sandy loam, except in low valley areas being heavy textured.

110. The soil fertility along the adjoining areas of project corridor is reported to have medium fertility level. The soil fertility (NPK value) of Mandi district indicate N is Low, P as High and K as Medium. The soil fertility and soil moisture map of Mandi district showing the project road is given in **Figure 4-7, 4-8 and 4-9**.

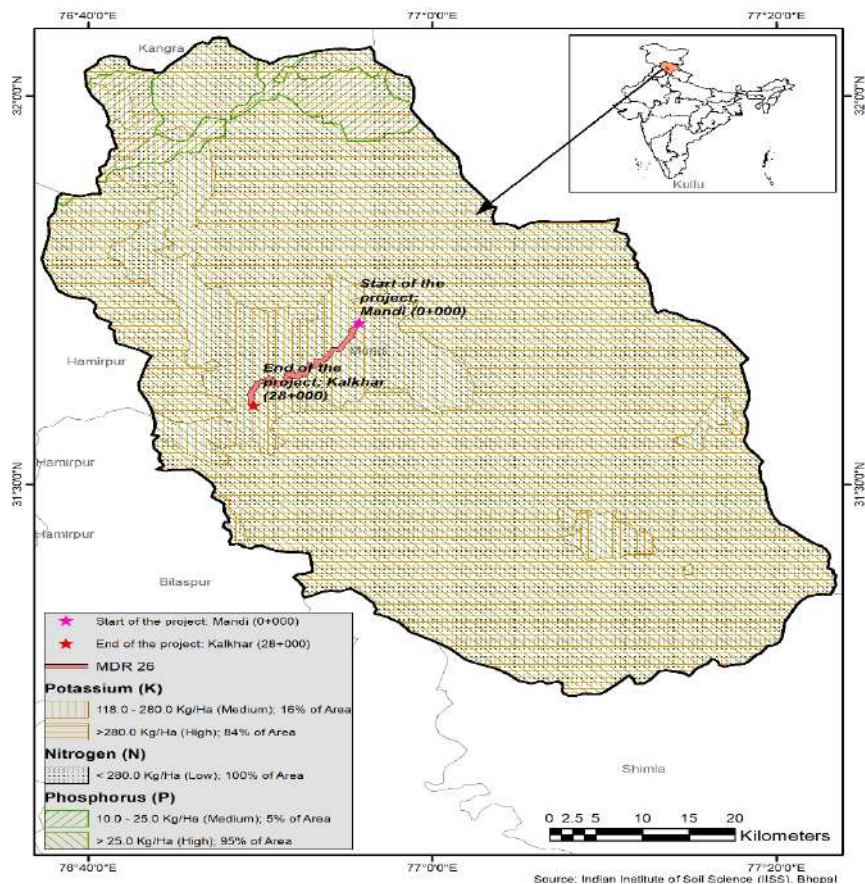


Figure 4-7: Soil Fertility Map of Mandi District

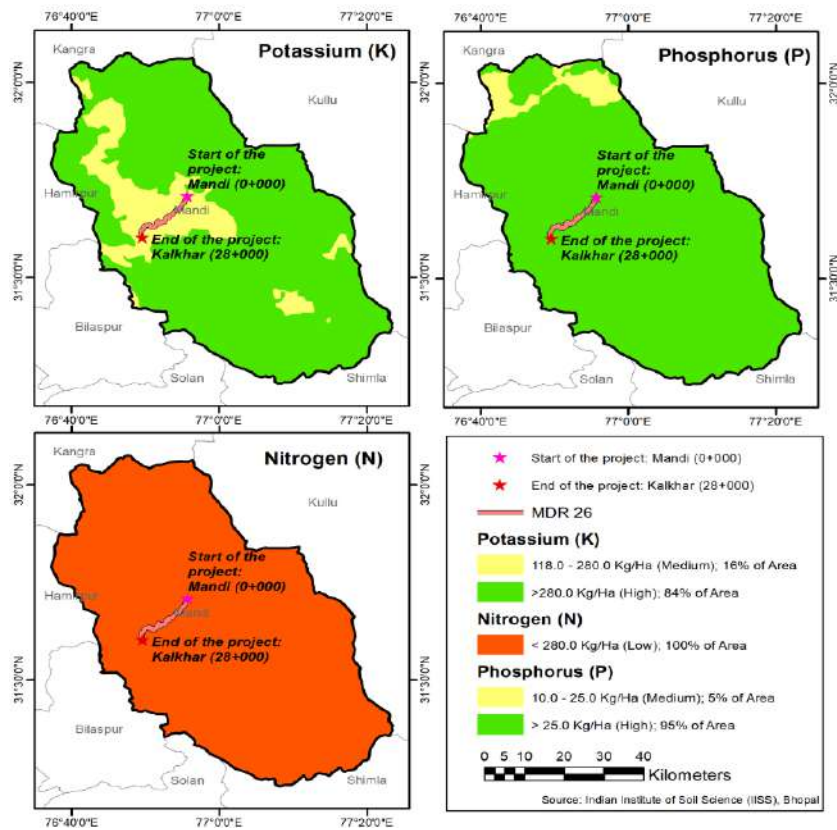


Figure 4-8: Soil Fertility Map of Mandi District
(Showing N, P and K levels)

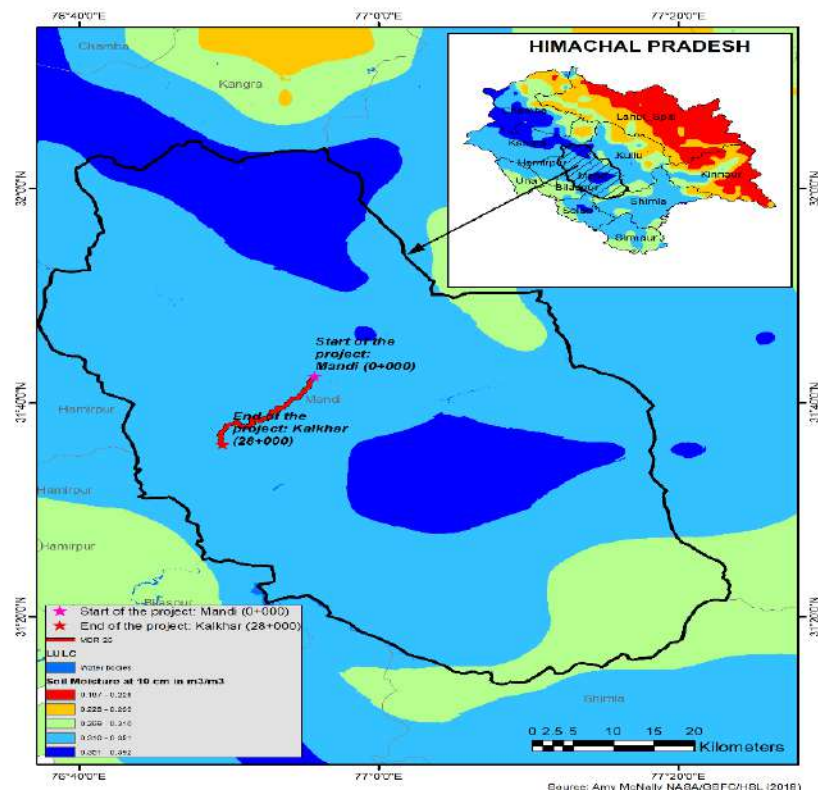


Figure 4-9: Soil Moisture Map of Mandi District

4.3.8 Land Use

111. The land use/ land cover of Mandi district showing the project road is given in **Figure 4-10**. The Land use and Land Cover Map of Mandi District comprises Built –up area of about 18.95 Sq km, Forest Plantation land occupies 317.05 Sq km, Water bodies around 6.63 Sq km, Agriculture Crop Land 72.45 Sq km, Forest Land around 110.32 Sq km, Barren land around 121.27 Sq km.

112. The land use map has been prepared using standard land use classification system followed by National Remote Sensing Centre (NRSC) and land use / land cover classes were mapped using satellite data for the entire Mandi District. Further, the land use/ land cover data has been subjected to broad ground truth verification along the project corridor/ PIA during September 2019 and March 2020 and updated as required.

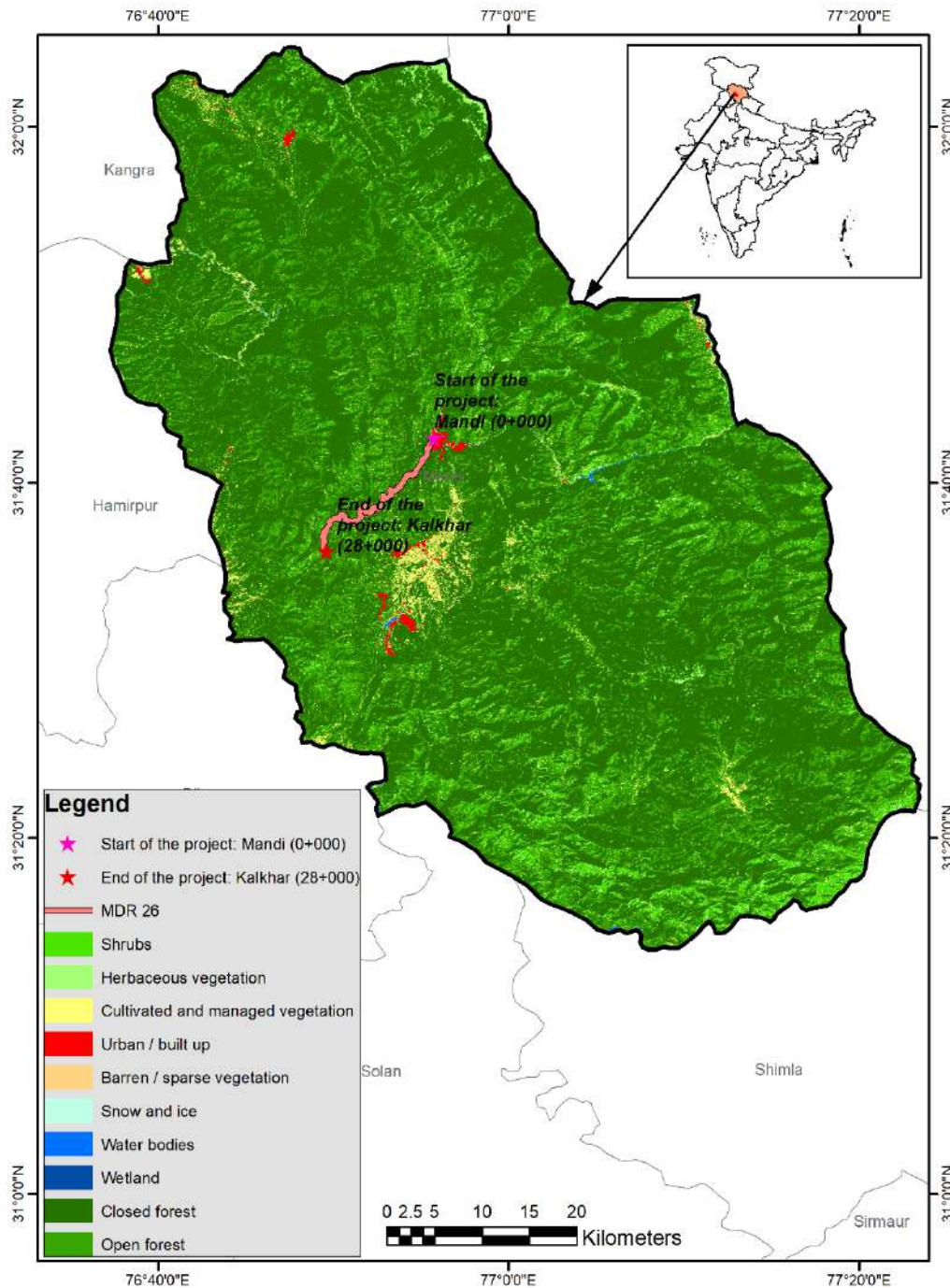


Figure 4-10: Land use and Land Cover of Mandi District
Source: Maps of India and Landsat-8 OLI Sensor classification

4.3.9 Agriculture

113. The project road traverses majorly along rainfed cropland interspersed with natural vegetation. Wheat is the most dominant agricultural crop within Mandi district, which can also be seen in cultivable lands along the project road. The cropping pattern Mandi district, showing the project road and the PIA is given in **Figure 4-11**.

114. Mandi district is known for producing quality wheat, paddy, and vegetable crop where the water drainage system and sprinkle system of irrigation have been adopted. The crops of corn maize, wheat, rice and vegetables are grown in other parts of the district, which cater to the demand of sizeable population. A milk processing plant run by H.P. State Co-Operation-Milk- Federation at Chakkar is 8 kilometers from Mandi.

115. The people of Mandi follow an agrarian economy and cultivate paddy, pulses, millets, tea, sesame seed, groundnut, sunflower oil and herbal products. Nearly 10,000 farmers are directly involved in cocoon cultivation for producing Silk in lower hills of Mandi District. Mandi is also known for Apple production. The area under fruit cultivation in Mandi is about 15 per cent of the total area. Mandi has salt mines at Drang and Guma, which also contribute to the district economy. With abundant deposit of salt and limestone, possibilities are being investigated for the existence of magnesite coal and china-clay. Mandi also has a fish market, where brown trout is one of the most traded and in demand fish species.

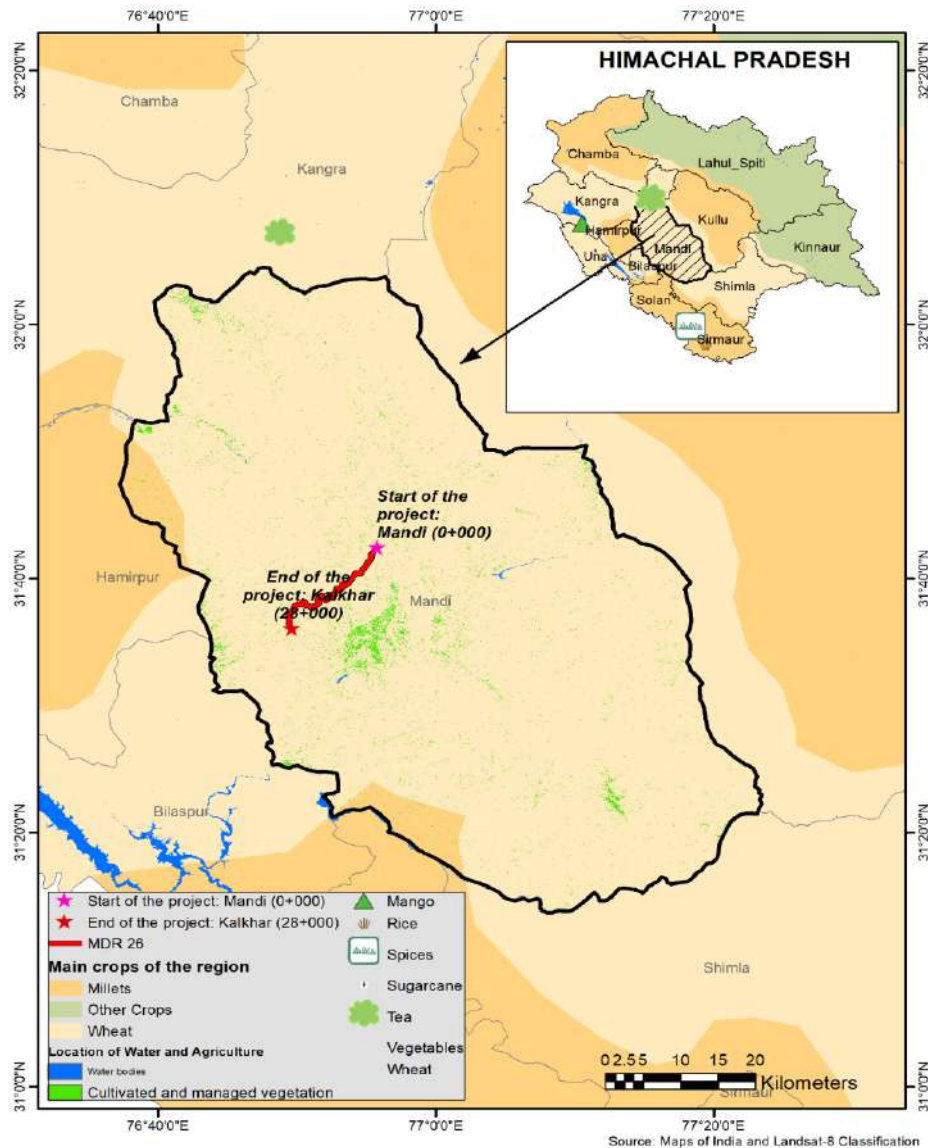


Figure 4-11: Cropping Pattern of Mandi District

4.4 Physical Environment

4.4.1 Climate and Rainfall

116. The climate of the Mandi district is sub-tropical in the valleys and tends to be temperate near the hilltops. In the higher region, the climate remains cold throughout the year. The winter starts from the middle of November and continues till the middle of March. Thereafter, the temperature continues to rise until the onset of the monsoon, which starts from the last week of June or early July and continues till the middle of September. During October and November, the nights are pleasant, whereas the days are a little bit hot. Average minimum and maximum temperature in the district vary from 3° C to 35° C.

117. The district receives precipitation in the form of rainfall, mainly during the monsoon period from July to September. The average annual rainfall in Mandi district over a period of 2014-20 is 1430 mm. The monthly rainfall and histograms of annual average rainfall for period 2014-2020 is given in **Table 4-7** and depicted in **Figure 4-12**.

Table 4-7: Annual Average Rainfall (mm) in Mandi District (2014-2020)

Year	Months												Total	Average Departure %
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec		
2014	64.1	113.2	105.9	62.1	102.9	124.7	396.9	374.6	152.1	27.5	2.3	94.4	1621	21.17
2015	87.5	130.2	154.4	100.1	38.8	113.4	407.5	340.9	73	29.6	9.7	39.4	1525	13.17
2016	13.5	42.8	93.1	24.7	165.1	208.2	314.6	415.1	108.6	10.9	0	0	1397	-22.75
2017	135.3	32.2	41.1	61.2	111.1	162.6	467.8	430.7	134.7	0	1.4	52	1630	-1.17
2018	11.5	44.5	39.3	80.1	30.5	190.4	414.9	434	311.3	8.7	36.8	4.5	1607	-2.75
2019	79.1	198.5	61.1	36.4	33.6	82.6	297	33.6	127	22.1	27.6	0	999	10.25
2020	67.2	11.9	141.7	87	56.6	108.8	258.7	387.8	58.4	0	33.3	21.2	1233	-7.50

Source: India Meteorological Department, GoI, Shimla

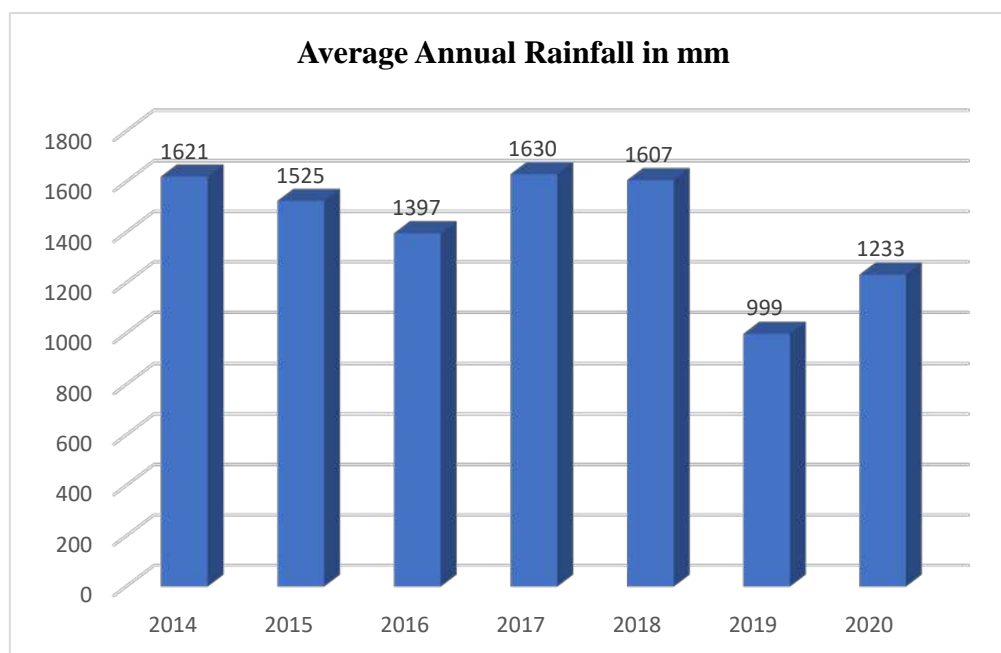


Figure 4-12: Annual Average Rainfall of Mandi District

4.4.2 Snow fall

118. The Project Road doesn't experience snow fall, although in the winter season, precipitation as snowfall also occurs in the higher reaches of the Mandi district beyond 2000m altitude.

4.4.3 Visibility

119. The project influence area (PIA) as well as project road has a visibility of 4 to 10 km for 208 days in morning hours and 128 days in evening and up to 1 km for less than a day in both morning and evening hours for about 30 days in a year.

4.4.4 Dust & Thunderstorms

120. The project influence area as well as project road does not experience any dust and thunderstorms in any part of year. However, thunders are experienced for about 30 days in a year.

4.4.5 Wind speed and direction

121. The project influence area experiences a wind speed of 1 to 19 kmph for 25 days during morning hours and 213 days in the evening days in a year. The predominant wind direction is South -East (SE) for 21 days in morning and 20 days in evening in a year. The calmness prevails in the project influence area for about 94 days in morning and 32 days in evening hours in a year.

122. The wind rose of the project road for the month of September to December 2020 is given in **Figure 4-13**. The most predominant wind direction is from south-west and the wind speed range between 2.10 to 3.60 meters/sec observed majorly along the project road.

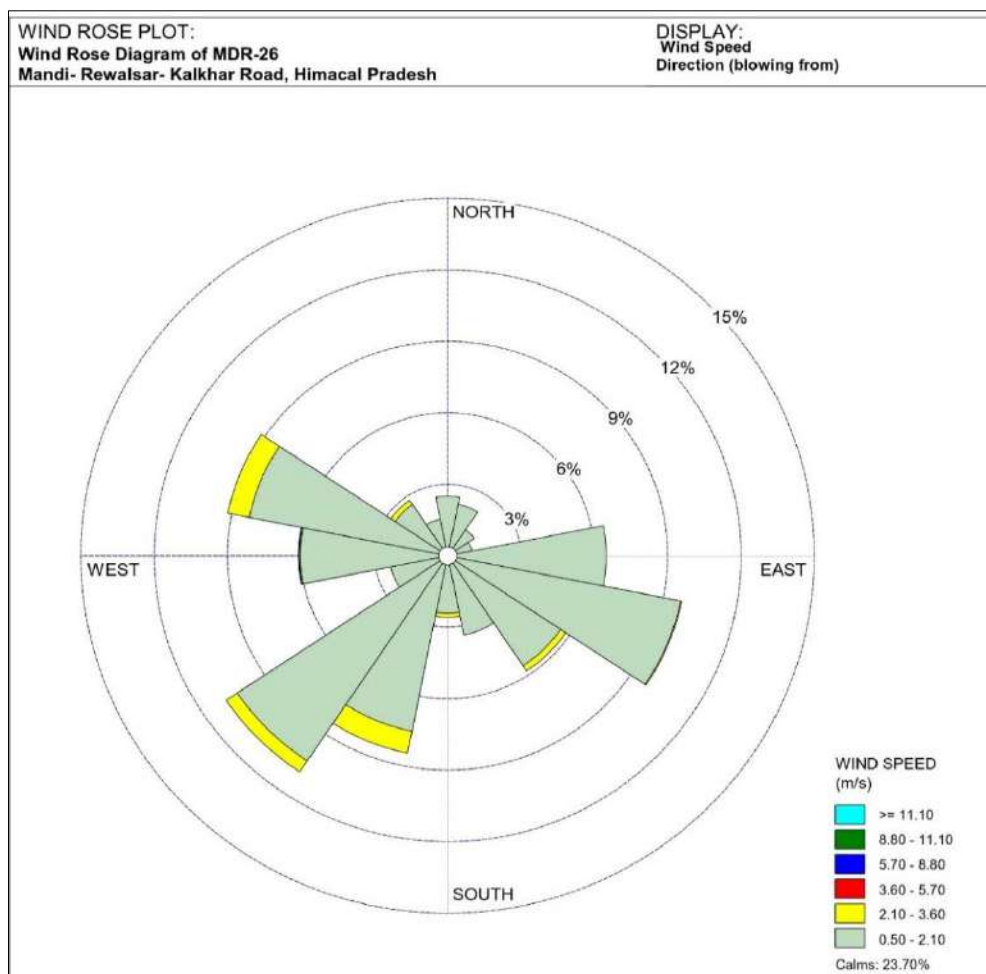


Figure 4-13: Wind Rose of Project Road

4.4.6 Baseline Environment Monitoring Schedule and Methods

123. The baseline environmental monitoring comprising ambient air quality, ambient noise, water quality and soil fertility along the project road and Associated Facilities was carried out during March 2020 and March 2021 to represent pre-monsoon season. The monitoring schedule, sampling locations along with its category and GPS coordinates is given in **Tables 4-8 and 4-9**. The sampling/ monitored locations along project road and associated facilities are shown in **Figure 4-14 and 4-15**.

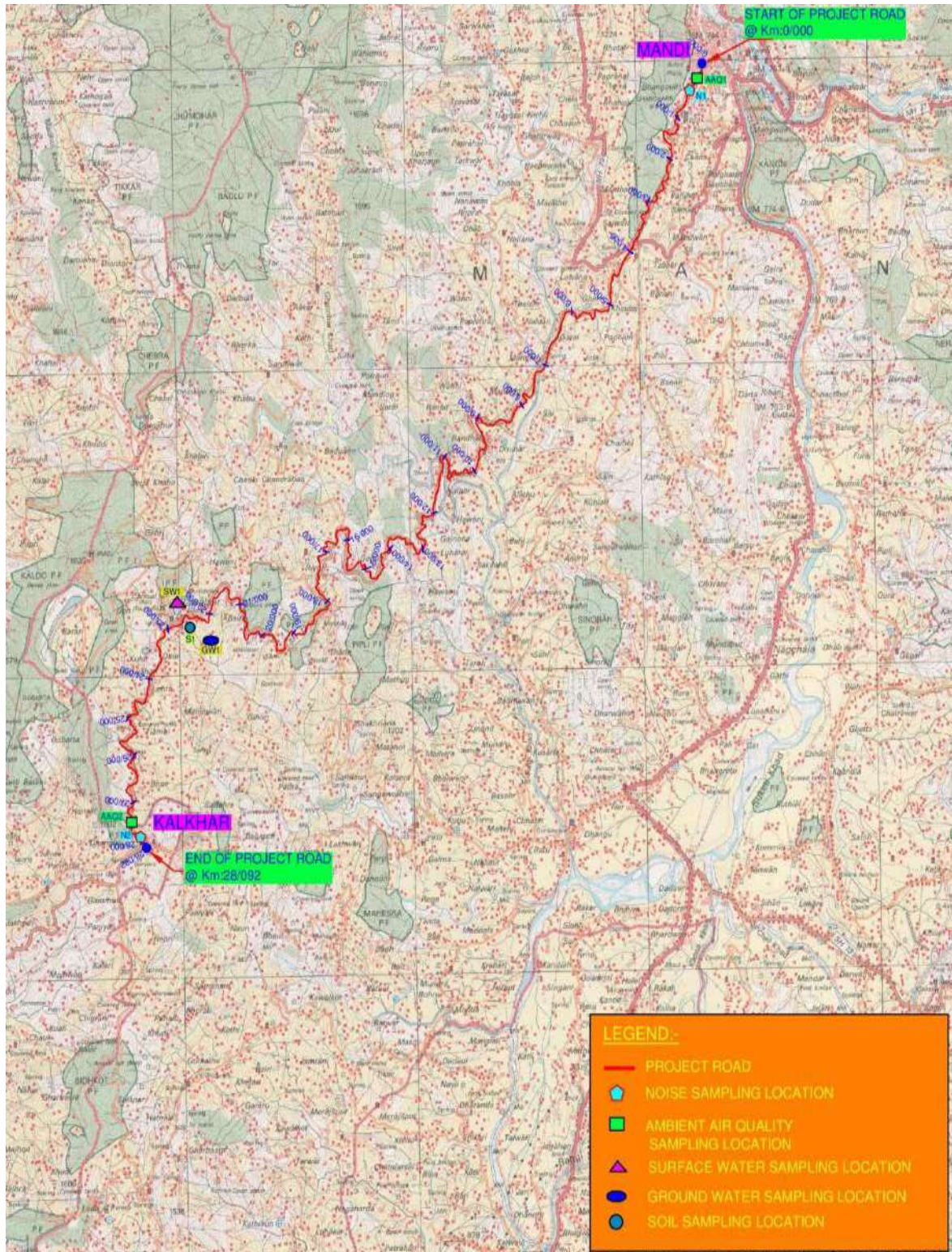


Figure 4-14: Environment Monitoring Locations along Project Road & Associated Facilities



Associated Facility-Major Bridge Location (31°39'55.44" N/ 76°53'53.33" E)



Associated Facility-Minor Bridge Location (31°39'43.31" N/ 76°53'47.89" E)

Note: AQ-Ambient Air Quality Monitoring location, NQ-Noise Level measuring station, WQ-Water Quality sampling station, SQ- Soil Quality sampling station

Figure 4-15: Location Plan of Environment Monitoring Stations at Associated Facilities

Table 4-8: Baseline Environmental Monitoring Schedule & Methods

S. No.	Item	Monitoring Schedule	Method
1	Air Quality Monitoring	24/8 hourly samples monitoring twice a week for one month at each location (2 locations along project road and 2 locations at <u>Associated Facilities</u> - Total 4 locations)	Respirable Sampler with arrangement for monitoring PM ₁₀ and PM _{2.5} carried out through NABL accredited Laboratory
2	Water Quality Monitoring	Grab samples from identified locations (2 locations along project road and 2 locations at <u>Associated Facilities</u> - Total 4 locations)	Grab sampling, representing both surface and ground water samples and analysed through NABL accredited Laboratory
3	Noise Level Monitoring	Continuous recording of noise levels for both daytime and night-time as per CPCB Norms (2 locations along project road and 2 locations at <u>Associated Facilities</u> - Total 4 locations)	Handheld Integrated Noise Level Monitoring Instrument and measured through NABL accredited Laboratory
4	Soil Testing & Analysis	Grab Sample from each identified location (2 locations along project road and 2 locations at <u>Associated Facilities</u> - Total 4 locations)	Grab samples drawn from 30 cm below existing ground level at edge of RoW along project road and stream bed at bridge locations of <u>Associated Facilities</u> and analysed through NABL accredited Laboratory

Table 4-9: Baseline Environmental Monitoring along Mandi Rewalsar Kalkhar Road

Sl. No.	Environmental Parameter	Monitoring Location	Category of Monitoring Location	Coordinates of Monitoring Location
A	Project Road			
1	Ambient Air Quality			
	AQ-01	Talyahar	Residential area and School zone	31°40'52.32" N, 76°54'52.27" E
	AQ-02	Rewalsar	Residential and Tourist place	31°37'32.43" N, 76°49'43.94" E
2	Noise Quality			
	NQ-01	Rewalsar	Residential and Tourist place	31°37'57.31" N, 76°50'15.49" E
	NQ-02	Talyahar	Residential area and School zone	31°40'57.48" N, 76°54'53.91" E
3	Water Quality			
	WQ-01 (GW)	Talyahar	Open dug well (ground water)	31°40'51.08" N, 76°54'49.73" E
	WQ-02 (SW)	Near Sauli Bridge, Village Gadel	Stream (surface water)	31°40'25.10" N, 76°54'30.36" E
4	Soil			
	SQ-01	Talyahar	Edge of ROW	31°40'51.6" N, 76°54'51.6" E
	SQ-02	Garlauni	Edge of ROW	31°37'46.96" N, 76°51'02.39" E
B	Associated Facilities			
1	Ambient Air Quality			
	AQ-01	Rathipul	Residential area near bridge	31°39'58.01" N, 76°53'55.06" E
	AQ-02	Raghwanu Bridge	Residential area near bridge	31°39'42" N, 76°53'46" E
2	Noise Quality			
	NQ-01	Rathipul	Residential area near bridge	31°39'55" N, 76°53'55" E
	NQ-02	Raghwanu Bridge	Residential area near bridge	31°39'45" N, 76°53'46" E
3	Water Quality			
	WQ-01 (SW)	Rathipul	Downstream of bridge site	31°39'55" N, 76°53'55" E

Sl. No.	Environmental Parameter	Monitoring Location	Category of Monitoring Location	Coordinates of Monitoring Location
	WQ-02 (SW)	Raghwanu Bridge	Downstream of bridge site	31°39'45' N, 76°53'46' E
4	Soil			
	SQ-01	Rathipul	Downstream of bridge site	31°39'55' N, 76°53'55' E
	SQ-02	Raghwanu Bridge	Downstream of bridge site	31°39'44' N, 76°53'48' E

4.4.7 Ambient Air Quality

124. The project influence area is devoid of any major polluting industries, which contribute to air pollution and the area also does not have any significant construction activities, except for construction of private individual houses by local inhabitants. The ambient air quality was monitored at four locations, representing two locations for project road and two locations for Associated Facilities during March 2020 & March 2021 respectively. The monitoring locations covered both rural as well as urbanized settlement areas along the project road and the construction sites of Associated Facilities. The monitoring test results carried out in March 2020 and again in March 2021 are given in **Table 4-10**. The test reports, sampling locations and its GPS coordinates, Photos taken during monitoring are given in **Appendix-9**.

125. It may be seen that the ambient air quality (for all tested parameters) at all monitored locations are below the National Ambient Air Quality Standards as well as 24-hour values of EHS guidelines or below the detection levels.

Table 4-10: Ambient Air Quality along Project Road and Associated Facilities

S. No.	Monitoring Locations	Ambient Air Quality in March 2020 & March 2021							
		PM ₁₀	PM _{2.5}	SO ₂	NO _x	CO	HC as CH ₄	C6H ₆	Benzo-a-Pyrene
A	Along Project Road								
1.	Talyahar Near School at Ch. 4+200	69	41	8	20	0.29	0.32	Bdl	Bdl
2.	Rewaslsar Settlement area /Religious and Tourist Place at Ch. 22+500	72	43	9	23	0.38	0.43	Bdl	Bdl
B	At Associated Facilities								
3.	Ratipul bridge construction site at Ch. 7+530	76	45	8.5	11.6	Bdl	Bdl	Bdl	Bdl
4.	Ragwanu bridge construction site at Ch. 8+120	78	47	8.6	12.4	Bdl	Bdl	Bdl	Bdl
5.	National Ambient Air Quality Standards, CPCB (NAAQS)	100	60	80	80	04	NS	05	01
6.	IFC- EHS Guideline Values (24 Hour values)	50	25	20	200	Not Specified (NS)			

Note: All units are in ug/m³ except Benzo -a-Pyrene, which is ng/m³; Bdl- Below Detection Level (<0.1) for Benzo Pyrene and <5 for Benzene

4.4.8 Ambient Noise Levels

126. Ambient noise levels were measured at four locations (2 locations along project road & 2 locations at Associated Facilities) covering both rural as well as urbanized settlement areas along the project road and construction sites of Associated Facilities were measured during both daytime (6am to 10pm) and nighttime (10pm to 6am). The ambient noise levels were monitored during March 2020 for project road & March 2021 for associated facilities. The measured ambient noise levels are given in

Table 4-11. The test reports, sampling locations and its GPS coordinates, Photos taken during monitoring are given in **Appendix-9**. It may be seen that the ambient noise levels (for both day and night times) at all monitored locations hover around the National Ambient Noise levels well as one-hour values of EHS guidelines with exception of Rewalsar where it marginally exceeds both during day & night-time.

Table 4-11: Ambient Noise Levels along Project Road and Associated Facilities

Sl. No.	Project Road Monitoring Location	Ambient Noise Levels Leq dB (A) in March 2020 & March 2021		
		Daytime		Night-time
A	Along Project Road			
1.	Talyahar Near School at Ch. 4+200	45.5		43.1
2.	Rewalsar Settlement area /Religious/ Tourist Place at Ch 22+500	57.9		53.8
B	At Associated Facilities			
3.	Ratipul bridge construction site at Ch. 7+530	52.9		37.6
4.	Ragwanu bridge construction site at Ch. 8+120	51.5		36.9
5.	National Ambient Noise Levels Leq dB(A)	Residential (R)	55	45
		Commercial (C)	65	55
6.	IFC EHS Guideline Values (One Hour Leq dB(A))	Residential (R)	55	45

4.4.9 Surface and Ground Water Quality

127. In order to test water quality of surface and ground water sources along project road, Open well near Talyahar (ground water) and open stream near village Gadel (fresh flowing Surface water) were chosen. At the Associated Facilities, the water samples from the rivulet/ stream bed were collected for assessing the baseline water quality. The samples were analyzed for physical, chemical and bacteriological parameters as per BIS 10500: 2012 through a NABL accredited laboratory and the test results are given in **Table 4-12**. The sampling locations, GPS coordinates, site photographs taken during the monitoring and the laboratory test reports are given in **Appendix-9**.

128. A comparison of tested water quality parameters with the respective acceptable and permissible limits indicates that the tested parameters for both surface as well as ground water sources does not critically exceed the respective limits for Drinking Water, Designated Best Use Water Quality criteria for surface waters and primary water quality criteria for outdoor bathing water, notified by CPCB, MoEF & CC (**Table 4-13 & 4-14**)

Table 4-12: Water Quality along Project Road and Associated Facilities

S. No	Parameters	Unit	Project Road		Associated Facilities		Drinking water Standards as per BIS 10500:2012	
			Open Dug Well (Ground Water), Talyahar (4+200)	Open Stream, Near Village Gadel (5+940)	Ratipul bridge construction site at Ch. 7+530	Rughwanu Bridge construction site at (8+120)	Acceptable Limit	Permissible Limit
1	pH	--	7.44	7.18	7.89	8.2	6.5-7.5	No Relaxation
2	Turbidity	NTU	4.6	5.3	<5	<5	1	5
3	Conductivity	µMho/Cm	405	405	203	228	-	-
4	Total Dissolved Solids	mg/L	263	761	132	148	500	2000
5	Colour	CU	< 5	< 5	<2	<2	5	15
6	Odour	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable

S. No	Parameters	Unit	Project Road		Associated Facilities		Drinking water Standards as per BIS 10500:2012	
			Open Dug Well (Ground Water), Talyahar (4+200)	Open Stream, Near Village Gadel (5+940)	Ratipul bridge construction site at Ch. 7+530	Rughwanu Bridge construction site at (8+120)	Acceptable Limit	Permissible Limit
7	P-Alkalinity as CaCO ₃	mg/L	Nil	Nil	-	-	-	-
8	Alkalinity as CaCO ₃	mg/L	198	515	65	100	200	600
9	Total Hardness as CaCO ₃	mg/L	194	530	90	130	200	600
10	Calcium as Ca	mg/L	147	182	32	34	75	200
11	Magnesium as Mg	mg/L	38	18	14	23	30	100
12	Sodium as Na	mg/L	26	43	12	16.2	-	-
13	Potassium as K	mg/L	13	28	8.4	10.0	-	-
14	Chlorides as Cl ⁻	mg/L	82	110	29.9	24.9	250	1000
15	Sulphates as SO ₄ ⁻²	mg/L	25	78	15.6	17.8	200	400
16	Nitrate Nitrogen as N	mg/L	2.9	5.2	7.1	5.9	-	-
17	Fluorides as F ⁻	mg/L	< 0.65	0.55	0.18	0.24	1.0	1.5
18	Iron as Fe	mg/L	< 0.35	0.39	0.05	0.08	0.3	No Relaxation
19	Manganese as Mn	mg/L	< 0.05	< 0.05	BDL	BDL	0.1	0.3
20	Phenolic Compounds as Phenols	mg/L	< 0.001	< 0.001	BDL	BDL	0.001	0.002
21	Copper as Cu	mg/L	< 0.02	< 0.02	BDL	BDL	0.05	1.5
22	Cadmium Cd	mg/L	< 0.01	< 0.01	BDL	BDL	0.003	No Relaxation
23	Zinc as Zn	mg/L	< 0.05	< 0.05	1.6	1.1	5	15
24	Lead as Pb	mg/L	< 0.001	< 0.01	BDL	BDL	0.01	No Relaxation
25	Mineral Oil	mg/L	< 0.01	< 0.1	BDL	BDL	0.5	No Relaxation
26	Mercury	mg/L	< 0.0005	< 0.0005	BDL	BDL	0.001	No Relaxation
27	Silver as Ag	mg/L	< 0.01	< 0.01	BDL	BDL	0.01	No Relaxation
28	Total Cyanide	mg/l	< 0.01	< 0.01	BDL	BDL	0.05	No Relaxation
29	Selenium as Se	mg/L	< 0.01	< 0.01	BDL	BDL	0.01	No Relaxation
30	Total Coli forms	MPN/100ml	Absent	23	<2	<2	Shall not be Detectable in any 100 ml sample	No Relaxation
31	Faecal Coli forms	MPN/100ml	Absent	9	<2	<2	Nil	Nil

Note: Additional parameters tested for water samples of Associated Facilities

S. No	Parameters	Ratipul bridge construction site at Ch. 7+530	Rughwanu Bridge construction site at (8+120)	CPCB, Surface Water Quality Standards (as per IS: 2296).				
				A	B	C	D	E
32	Dissolved Oxygen, mg/l	5.8	5.2	6	5	4	4	--
33	Biochemical Oxygen Demand, mg/l	2.0	3.0	2	3	3	--	--

Source: - Field Investigations for ESIA studies March 2020 & March 2021 for Associated Facilities

Table 4-13: Designated Best Use Water Quality Criteria

Designated Best Use	Class of Water	Criteria
Drinking water source without conventional treatment but after disinfection	A	Total Coliforms Organism MPN/100ml shall be 50 or less
		pH between 6.5 and 8.5
		Dissolved Oxygen 6mg/l or more
		Biochemical Oxygen Demand 5 days 20°C- 2mg/l or less
Outdoor bathing (organised)	B	Total Coliforms MPN/100ml shall be 500 or less
		pH between 6.5 and 8.5
		Dissolved Oxygen 5mg/l or more
		Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Drinking Water Source after conventional treatment and disinfection	C	Total Coliforms MPN/100 ml shall be 5000 or less
		pH between 6 to 9 Dissolved Oxygen 4mg/ 1 or more
		Dissolved Oxygen 4mg/ 1 or more
		Biochemical Oxygen Demand 5 days 20°C 3 mg/l or less
Propagation of Wildlife and Fisheries	D	pH between 6.5 to 8.5
		Dissolved Oxygen 4 mg/l or more
		Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste Disposal	E	pH between 6.0 to 8.5
		Electrical Conductivity at 25°C micro mhos/cm Max 2250
		Sodium absorption ratio Max. 26
		Boron, Max. 2 mg/l

Source: - CPCB, MoEF and CC

Table 4-14: Primary Water Quality Criteria for Bathing
(Water used for organized outdoor bathing)

Sl. No.	Criteria	Rationale
1.	Faecal Coliform MPN/100 ml 500 (desirable) 2500 (Maximum Permissible)	To ensure low sewage contamination Faecal coliform and faecal streptococci are considered as they reflect the bacterial pathogenicity
2.	Faecal Streptococci MPN/100 ml 100 (desirable) 500 (Maximum Permissible)	The desirable and permissible limits are suggested to allow for fluctuation in environmental conditions such as seasonal change, changes in flow conditions etc.
3.	pH Between 6.5 to 8.5	The range provides protection to the skin and delicate organs like eyes, nose, ears etc. which are directly exposed during outdoor bathing
4.	Dissolved Oxygen 5 mg/l or more	The minimum dissolved oxygen concentration of 5 mg/l ensures reasonable freedom from oxygen consuming organic pollution immediately upstream which is necessary for preventing production of anaerobic gases (obnoxious gases) from sediment.
5.	Biochemical Oxygen Demand (3 days at 27°C) 3 mg/l or less	The Biochemical Oxygen Demand of 3 mg/l or less of the water ensures reasonable freedom from oxygen demanding pollutants and prevent production of obnoxious gases

Source: - CPCB, MoEF and CC

4.4.10 Soil Quality along Project Road and Associated Facilities

129. The soil quality along the project corridor was tested at four locations, representing the project road (2 locations) and Associated Facilities (2 locations). The soil fertility test values at these four locations are given in **Table 4-15**. The laboratory test reports, GPS coordinates of sampling locations and test methods followed are given in **Appendix-9**. The tested soil fertility levels along the project road as well as at Associated Facilities, generally confirms to soil fertility levels of the Mandi District and shown in Figures 4-7, 4-8 and 4-9 (ref. 4.3.7 of Section 4).

Table 4-15: Soil Test Results along Project Road and Associated Facilities

S. No	Parameters	Units	Soil quality along Project Road		Soil quality at Associated Facilities	
			Near Village Talyahar	Near Village Garlauni	At bridge construction site Ratipul (Ch. 5+820)	At bridge construction site Rugwanu (Ch. 7+530)
1	pH (1:2 Soil Water Extract)	--	7.49	7.82	7.41	7.68
2	Electrical Conductivity (micro mhos) (1:2 soil Water Extract)	mmhos/cm	0.304	0.325	0.844	0.842
3	Bulk Density	gm/cc	1.64	1.59	1.42	1.38
4	Phosphates as P	Kg/Ha	8.0	9.4	4.97	3.87
5	Potassium as K	Kg/Ha	90	109	24.6	34.2
6	Nitrogen as N	Kg/Ha	212	121	12.5	11.80
7	Total Organic Carbon	%	0.59	0.48	0.41	0.40
8	Copper as Cu (mg/ Kg)	mg/kg	30	19	3.14	3.15
9	Zinc as Zn (mg/ Kg)	mg/kg	105	111	22.1	24.20
10	Nickel as Ni (mg/ Kg)	mg/kg	0.42	0.36	2.84	2.15
11	Chromium as Cr (mg/ Kg)	mg/kg	3.6	2.8	BDL	BDL
13	Lead as Pb	mg/kg	4.6	2.8	0.61	0.84
14	Cadmium as Cd	mg/kg	BDL	BDL	1.75	1.28
15	Cation Exchange Capacity (CEC)	meq/100gr	3.6	3.1	1.6	1.4
16	Sodium Absorption Ratio (SAR)	-	5.2	4.4	5.6	5.75
17	Texture of Soil	--	Sandy loam	Sandy loam	Loam	Loam
	a) Sand	%	71.3	61.8	32.2	36.20
	b) Silt	%	13.8	14.4	42.7	42.10
	c) Clay	%	14.9	23.8	25.10	23.70

Source: Field Investigations during ESIA, March-April 2020 & March 2021 for Associated Facilities

4.5 Biological Environment

4.5.1 Forest Area within State & Mandi District

130. Nearly 80 % of state's geographical area is hilly and mountainous with altitude ranging from 460 meters to 6,600 m above mean sea level (MSL). About 63.6 percent of state's area is classified as forest area, though only 26.4 percent (ISFR, 2015) is under actual forest cover. Within Himachal Pradesh, legally forest is classified into Reserve Forest, Demarcated Protected Forest, un-demarcated protected forest, other forest, not managed by forest department. (Refer **Table 4-16**).

Table 4-16: Legal Classification of Forest areas in Himachal Pradesh (as of 2018)

S. No	Category wise Forests	Area (Sq. Km)	Percentage Area
1	Reserved Forests	1883	4.96
2	Demarcated Protected Forests	12852	33.87
3	Un-demarcated Protected Forests	16035	42.25
4	Other Forests (Managed by Forest Department)	7160	18.87
5	Other Forests (Not managed by Forest Department)	18	0.05
	Total	37948	100

Source: - <https://hpforest.nic.in>

131. Himachal Pradesh has been bifurcated into 12 forest circles, with a total forest area of 37948 sq. km. As of year, 2018, Mandi Forest circle, in which project road traverses has a forest cover of 1879.74 sq. km (5% of total state's forest area) constituting reserve forests, demarcated protected forests; un-demarcated protected forests as given in **Table 4-17**. The forest map of Himachal Pradesh along with the project road is shown in **Figure 4-16**.

Table 4-17: Forest Cover of Mandi Circle and Himachal Pradesh

Forest Circle	Forest Division	Forest Area (Sq. Km)					
		Reserve Forests (RF)	Demarcated Protected Forests (DPF)	Un-demarcated Protected Forests (UDPF)	Municipal Forests	Other Forests	Total Forest
Mandi	Jogindernagar	0	221.49	36.27	0	0	257.76
	Mandi	0	317.47	19.16	0	0	336.63
	Karsog	0	368.29	8.17	0	107.61	484.07
	Nachan	0	366.96	5.23	0	0	372.19
	Suket	0	273.61	5.32	0	150.16	429.09
Mandi Total		0	1547.82	74.15	0	257.77	1879.74
Himachal Pradesh		1883	12852	16035	18	7160	37948

Source; <https://hpforest.nic.in>

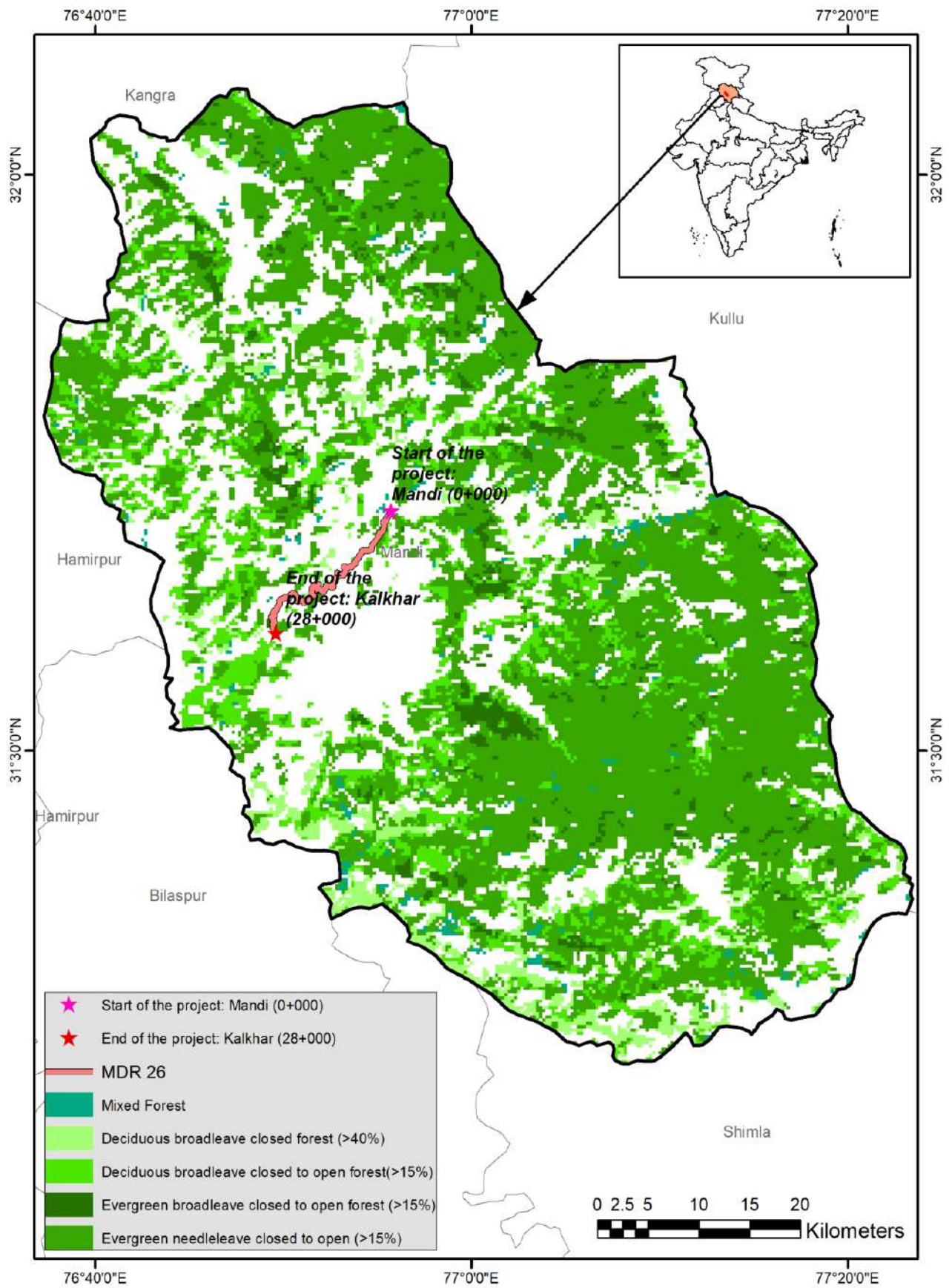


Figure 4-16: Forest Cover of Mandi District
 (Source: <https://hpforest.nic.in/>)

4.5.2 Forest Areas along Project Road Corridor

132. The project road predominantly traverses along rainfed cropland interspersed with natural vegetation. However, there exists forest areas adjacent to the right of way of project road at eight locations, over a cumulative length of 4.255 km as shown in **Table 4-18** and shown in **Figure 4-17**.

Table 4-18: Forest Stretches and Category of Forest along Project Road

S. No.	Chainage	Forest Name	Forest Category	Revenue Village	Length (m)
1	Ch 3/350 to 04/200	ND-575 Gandharb	Demarcated Protected Forest (DPF)	Jungle Gandharb	850
2	Ch 13/735 to 13/915	ND-620 Bahotu	Un-Demarcated Protected Forest (UDPF)	Village Natned	180
3	Ch 15/400 to 16/125	ND-619 Ghour Nala	Un-Demarcated Protected Forest (UDPF)	Ghour Village	725
4	Ch 18/500 to 19/000	ND-614 Safaru	Demarcated Protected Forest (DPF)	Reiur Village	500
5	Ch 20/500 to 21/200	ND-613 Jalpadhar	Un-Demarcated Protected Forest (UDPF)	Gariaunni Village	700
6	Ch 26/600 to 27/350	ND-608 Jher-II	Un-Demarcated Protected Forest (UDPF)	Chaddi Village	750
7	Ch 27/600 to 27/750	ND-608 Jher-II	Un-Demarcated Protected Forest (UDPF)	Grauddu Village	150
8	Ch 28/500 to 28/900	ND-605 Kukain-I	Un-Demarcated Protected Forest (UDPF)	Kalkhar Village	400
Total Length (m)					4255

133. The widening /upgradation of project road along all the above mentioned 8 forest stretches will be limited/confined to the existing /available right of way (RoW) and thus will not require additional land beyond RoW, which will otherwise warrant diversion of forestland and forest clearances thereof under forest conservation act,1980.

134. Based on the submitted chainage wise RoW details of Mandi Rewalsar Road, the concerned Divisional Forest Officer (DFO), Mandi Forest Division, has communicated to the HPPWD that existing road area between Mandi- Rewalsar and Kalkhar, which includes 8 forest stretches has the status of 'gairmumkin sadak' and the ownership of GoHP under the physical possession of HPPWD and therefore issuance of 'No Objection Certificate' for the widening/upgradation of the road will not be warranted. Copy of communication issued by DFO, Mandi Forest Division is given in **Appendix-2**.

135. During the internal verification of revenue documents by HPPWD, the mutation of land title in favor of HPPWD, has been inadvertently left out in one stretch i.e., 850 meters between Ch 3/350 to 4/200 (ref. **Table 4-18**) due to a clerical error, whereas the mutation of land title in all other 7 forest stretches has been completed in favors of HPPWD few decades back. The HPPWD, now has taken up this matter with the district administration with citing several justifications in its favors and currently efforts are underway to rectify to land title records in favor of HPPWD for chainage between Ch 3/350 to 4/200.

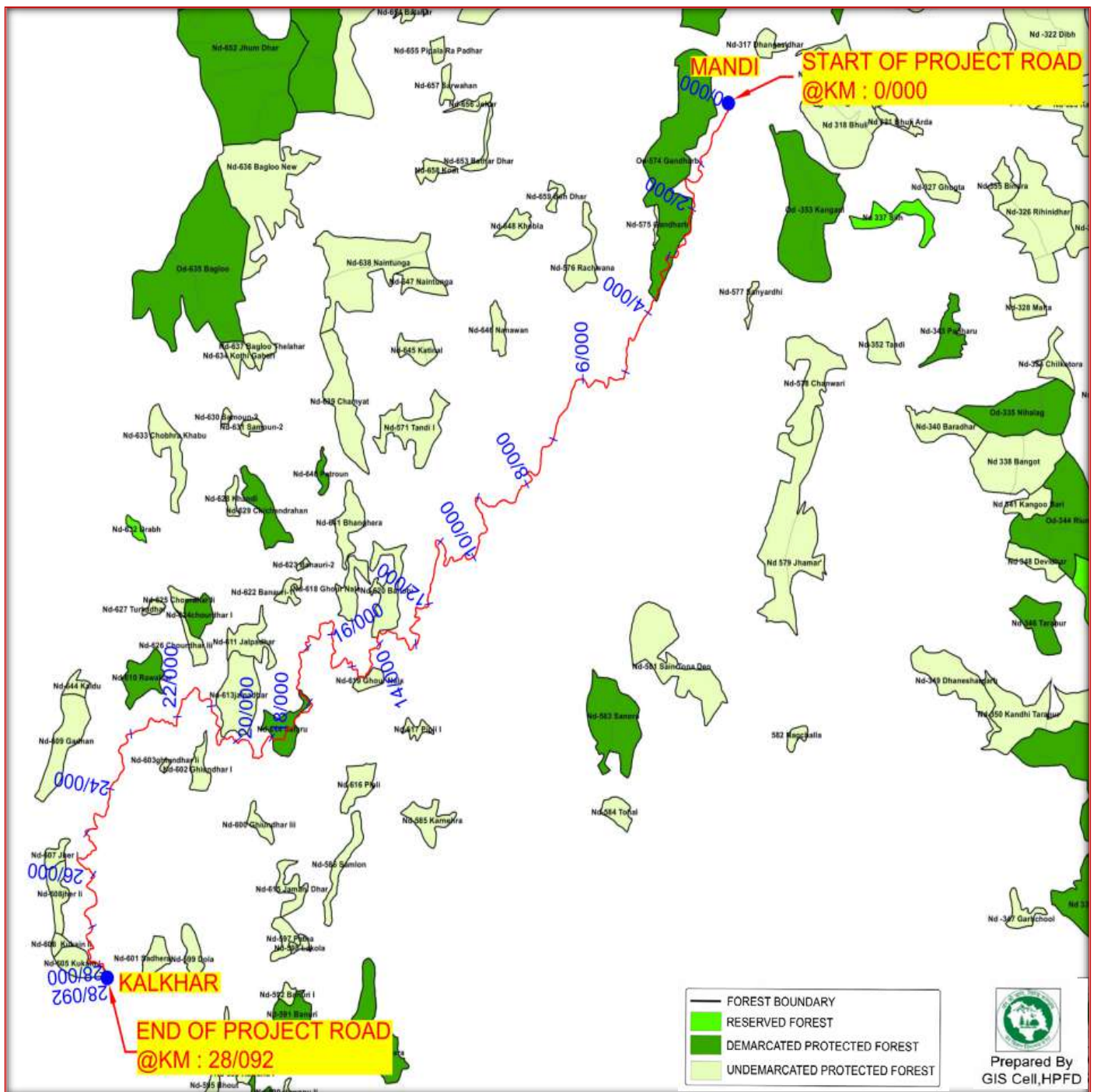


Figure 4-17: Forest Stretches along Project Road
 (Source: - GIS Cell, HP Forest Department, GoHP)

4.5.3 Protected Areas

136. Although, the project road falls within the jurisdiction of Mandi Forest division, which has three wildlife sanctuaries, but no such protected areas within 10 km radius of the project road. The Wildlife Protected areas in Himachal Pradesh are shown in **Figure 4-18**. There are no National Park, Wildlife Sanctuary, Biosphere Reserve and any other notified sensitive area within 15 km on either side of the project road.

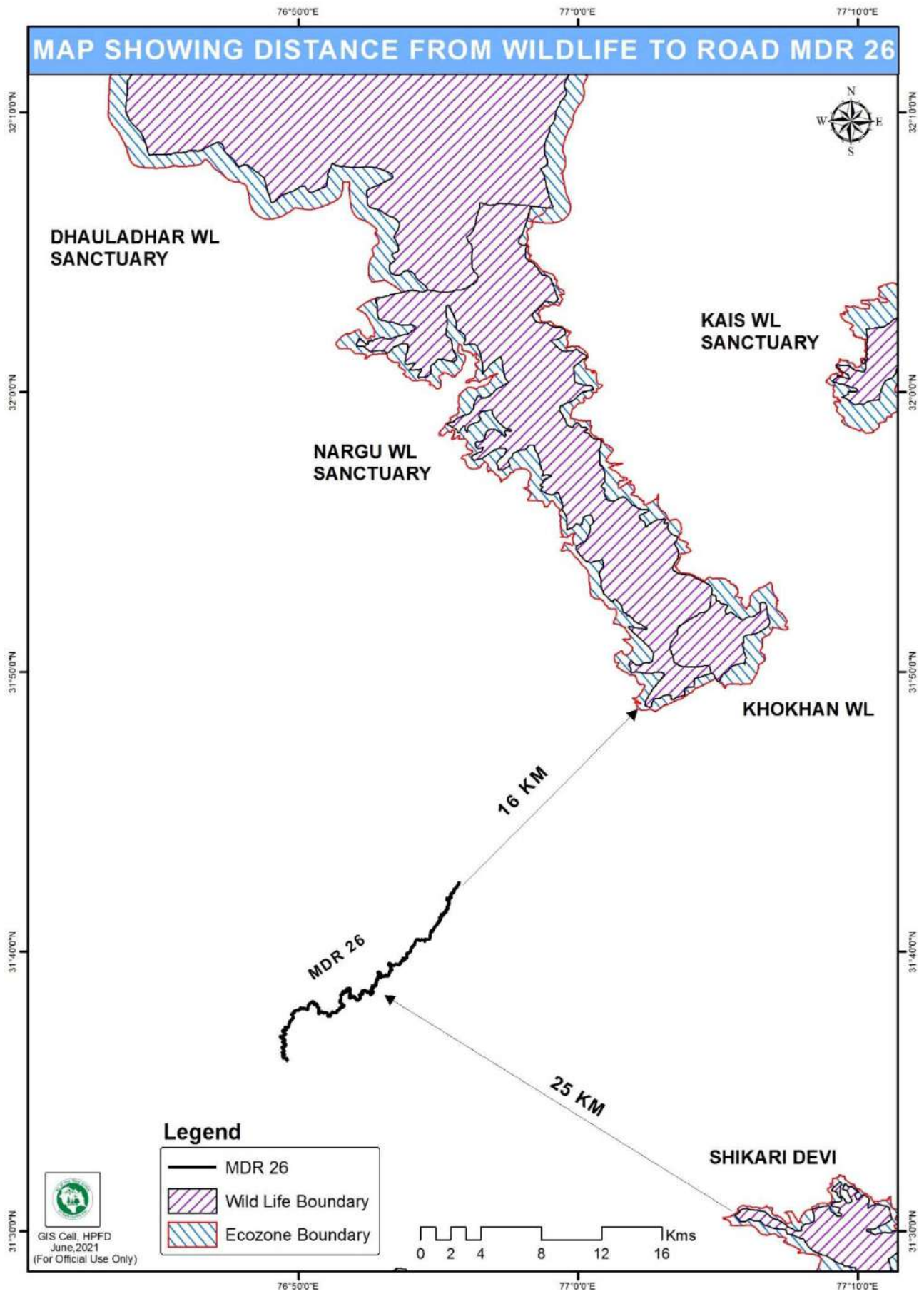


Figure 4-18: Protected Area Map of Mandi District

4.5.4 Biodiversity

137. The forests of the Himachal Pradesh are known for their grandeur and majesty and have been classified on an ecological basis as laid down by Champion and Seth can be broadly classified into Coniferous Forests and broad-leaved Forests. Distribution of various species follows fairly regular altitudinal stratification. The vegetation varies from Dry Scrub Forests at lower altitudes to Alpine Pastures at higher altitudes. In between these two extremes, distinct vegetational zones of Mixed Deciduous Forests, Bamboo, Chil, Oaks, Deodar, Kail, Fir and Spruce, are found. The forests of Himachal Pradesh are rich in vascular flora, which forms the conspicuous vegetation cover. The richness and diversity of Himalayan flora can be gauged from the fact that, out of total 45,000 species found in the across India, as many as 3,295 species (7.32%) are reported in Himachal Pradesh. More than 95 of the species are endemic to Himachal Pradesh and characteristic of Western Himalayan flora, while about 5 (150 species) are exotic, introduced over the last 150 years.

4.5.5 Floral Diversity

138. Ecological investigations along the project road corridor (corridor of impact) have indicated presence of luxuriant growth of 92 taxonomic groups and 81 comprise angiosperm taxonomic group, out of which invasive species comprise *Ageratum conyzoides*, *Eupatorium adenophorum*, *Lantana camara*, *Parthanium hysterophoros* (ref. **Table 4-19**).

Table 4-19: Taxonomic groups of Flora along CoI of Project Road

S. No	Taxonomic group	Nos
1	<i>Angiosperm</i>	81
2	<i>Gymnosperm</i>	1
3	<i>Pteridophyta</i>	3
4	<i>Bryophyta</i>	5
5	<i>Lycopodiophyta</i>	2

139. **Methodology used for Vegetation Analysis:** A stratified random sampling approach was followed for vegetation survey; project corridor was divided into relatively homogeneous sub-stretches and then sampling has been done in each sub-stretch. The corridor of sampling location is given in **Table 4-20**.

Table 4-20: Vegetation Sampling Locations along CoI of Project Road

Sl. No.	Sampling Location	Co-ordinates
1.	Near Manjethi (Gandhrb DPF)	N31.694 /E76.922
2.	Near Lohardi Village (Banotu DPF)	N31.64/E76.86
3.	Near Garlauni Village (Jalpa Forest)	N31.63/E76.83

4.5.6 Trees, Shrubs and Herbs along Project Road

140. The ecological investigations along the project corridor have indicated the presence of variety of trees, shrubs and herbs. The flora recorded along the project corridor were assessed for their conservation status by cross checking with IUCN Red Data Book of Indian plants (Nayar and Sastry, 1987-1990) and none of the plant taxa was found under the **Rare endangered and threatened (RET) category** (ref. **Table 4-21**). The recorded plant species were also assessed for their endemism in the study area and none of the species was recorded endemic to present road corridor. All the species recorded along the road corridor were distributed more frequently and vigorously outside the RoW of the project road.

141. The trees, shrubs and herbs recorded along the project corridor and most dominant species recorded at each of the sampled locations are given in **Table 4-21, 4-22 & 4-23**.

Table 4-21: List of Trees, Shrubs and Herbs along Project Road Corridor

S. No.	Type	Botanical Name
1.	Trees	<i>Pinus roxburghii</i> , <i>Dalbergia sissoo</i> , <i>Mallotus philippensis</i> , <i>Albizia chinensis</i> , <i>Pyrus pashia</i> , <i>Ficus religiosa</i> , <i>Syzygium cumini</i> , <i>Lannea grandis</i> , <i>Morus alba</i> , <i>Toona ciliate</i> , <i>Bauhinia variegata</i> , <i>Erythrina suberosa</i> , <i>Robinia pseudoacacia</i> , <i>Melia azedarach</i> , <i>Grewia optiva</i> , <i>Pistacia integerrima</i> <i>Ficus palmate</i> , <i>Populus ciliate</i> , <i>Bombax ceiba</i> , <i>Salix alba</i> , <i>Sapindus mukorossi</i> , <i>Sapium insigne</i> , <i>Litsea monopetala</i> , <i>Xylosma longifolium</i> , <i>Ulmus villosa</i> , <i>Celtis australis</i> , <i>Ficus roxburghii</i>
2.	Shrubs	<i>Murraya koenigii</i> , <i>Carissa opaca</i> , <i>Adhatoda vasica</i> , <i>Lantana camara</i> , <i>Berberis lyceum</i>
3.	Herbs	<i>Ageratum conyzoides</i> , <i>Bidens biternata</i> , <i>Eupatorium adenophorum</i> , <i>Parthenium hysterophorus</i> , <i>Eriophorum comosum</i>

Table 4-22: List of dominant Flora along Project Road

Location	Tree	Shrub	Herb
Near Manjethi (Gandharb DPF)	<i>Pinus roxburghii</i> , <i>Dalbergia sissoo</i> , <i>Mallotus philippensis</i>	<i>Murraya koenigii</i> , <i>Carissa opaca</i> , <i>Adhatoda vasica</i>	<i>Parthenium hysterophorus</i> , <i>Ageratum conyzoides</i> , <i>Eupatorium adenophorum</i>
Near Lohardi Village (Baneter DPF)	<i>Dalbergia sissoo</i> , <i>Mallotus philippensis</i> , <i>Albizia chinensis</i>	<i>Adhatoda vasica</i> , <i>Carissa opaca</i> , <i>Lantana camara</i>	<i>Eriophorum comosum</i> , <i>Ageratum conyzoides</i> , <i>Parthenium hysterophorus</i>
Near Garlauni Village (Jalapadar UDPF)	<i>Pinus roxburghii</i> , <i>Emblia officinalis</i> , <i>Pyrus pashia</i>	<i>Murraya koenigii</i> , <i>Carissa opaca</i> , <i>Berberis lycium</i>	<i>Ageratum conyzoides</i> , <i>Bidens biternata</i> , <i>Eupatorium adenophorum</i>

142. Some of the flora having medicinal value and recorded along the project corridor comprise *Acacia catechu*, *Adhatoda vasica*, *Aegle marmelos*, *Agave Americana*, *Asparagus adscendens*, *Barleria cristata*, *Bauhinia vahlii*, *Bauhinia variagata*, *Berberis asiatica*, *Bombax ceiba*, *Cannabis sativa*, *Cassia fistula*, *Emblia officinalis*, *Eriophorum comosum*, *Melia azadirach*, *Phoenix sp.*, *Terminalia balerica*, *Tinospora sinensis*, *Pinus roxburghii*, among others.

Table 4-23: List of Flora recorded along CoI of Project Road

Sl. No.	Botanical Name	Taxonomic Group	Status/ Importance			
			Invasive	Medicinal	Non-timber	IUCN Category
1	<i>Acacia catechu</i>	Angiosperm	-	Yes	Yes	Not evaluated
2	<i>Achyranthes bidentata</i>	Angiosperm	-	Yes	-	Not applicable
3	<i>Adhatoda vasica</i>	Angiosperm	-	Yes	-	Least concern
4	<i>Agave americana</i>	Angiosperm	-	Yes	-	Not evaluated
5	<i>Ageratum conyzoides</i>	Angiosperm	Yes	Yes	Yes	Least concern
6	<i>Albizia chinensis</i>	Angiosperm	-	Yes	-	Not included
7	<i>Amaranthus viridis</i>	Angiosperm	-	Yes	-	Least concern
8	<i>Arundinella bengalensis</i>	Angiosperm	-	-	Yes	Not evaluated
9	<i>Asparagus adscendens</i>	Angiosperm	-	Yes	-	Least concern
10	<i>Barleria cristata</i>	Angiosperm	-	Yes	-	Not involved
11	<i>Bauhinia vahlii</i>	Angiosperm	-	Yes	-	Not evaluated
12	<i>Bauhinia variegata</i>	Angiosperm	-	Yes	Yes	Least concern
13	<i>Berberis lyceum</i>	Angiosperm	-	Yes	Yes	Not evaluated
14	<i>Bidens biternata</i>	Angiosperm	-	Yes	-	Not included
15	<i>Bidnes pilosa</i>	Angiosperm	-	Yes	Yes	Not evaluated

Sl. No.	Botanical Name	Taxonomic Group	Status/ Importance			
			Invasive	Medicinal	Non-timber	IUCN Category
16	<i>Boehmeria platyphylla</i>	Angiosperm	-	Yes	Yes	Least concern
17	<i>Bombax ceiba</i>	Angiosperm	-	Yes	Yes	Least concern
18	<i>Carissa opaca</i>	Angiosperm	-	Yes	-	Not evaluated
19	<i>Cassia fistula</i>	Angiosperm	-	Yes	Yes	Not evaluated
20	<i>Cassia tora</i>	Angiosperm	-	Yes	-	Not evaluated
21	<i>Celtis australis</i>	Angiosperm	-	Yes	-	Least concern
22	<i>Cissampelos pareira</i>	Angiosperm	-	Yes	-	Not evaluated
23	<i>Clematis gouriana</i>	Angiosperm	-	Yes	-	Not evaluated
24	<i>Colebrookea oppositifolia</i>	Angiosperm	-	Yes	Yes	Not evaluated
25	<i>Commelina benghalensis</i>	Angiosperm	-	Yes	-	Least concern
26	<i>Cyanotis cristata</i>	Angiosperm	-	Yes	Yes	Not evaluated
27	<i>Cynodon dactylon</i>	Angiosperm	-	Yes	Yes	Least concern
28	<i>Dalbergia sissoo</i>	Angiosperm	-	Yes	Yes	Least concern
29	<i>Debregeasia longifolia</i>	Angiosperm	-	Yes	Yes	Least concern
30	<i>Desmodium elegans</i>	Angiosperm	-	Yes	Yes	Not evaluated
31	<i>Dioscorea bulbifera</i>	Angiosperm	-	Yes	-	Not evaluated
32	<i>Embllica officinalis</i>	Angiosperm	-	Yes	-	Least concern
33	<i>Engelhardtia spicata</i>	Angiosperm	-	-	-	Not evaluated
34	<i>Eriophorum comosum</i>	Angiosperm	-	Yes	Yes	Not evaluated
35	<i>Eucalyptus globulus</i>	Angiosperm	-	Yes	Yes	Least concern
36	<i>Eupatorium adenophorum</i>	Angiosperm	Yes	Yes	-	Not evaluated
37	<i>Euphorbia hirta</i>	Angiosperm	-	Yes	Yes	Not evaluated
38	<i>Ficus roxburghii</i>	Angiosperm	-	Yes	Yes	Least concern
39	<i>Fragaria nubicola</i>	Angiosperm	-	Yes	Yes	Not evaluated
40	<i>Grewia optiva</i>	Angiosperm	-	Yes	Yes	Not evaluated
41	<i>Hedychium spicatum</i>	Angiosperm	-	Yes	-	Not evaluated
42	<i>Heteropogon contortus</i>	Angiosperm	-	-	Yes	Not evaluated
43	<i>Inula cappa</i>	Angiosperm	-	Yes	-	Not included
44	<i>Ipomea carnea</i>	Angiosperm	-	Yes	-	Not evaluated
45	<i>Lantana Camara</i>	Angiosperm	Yes	Yes	-	Not evaluated
46	<i>Mallotus philippensis</i>	Angiosperm	-	Yes	-	Not included
47	<i>Mangifera indica</i>	Angiosperm	-	Yes	Yes	Least concern
48	<i>Morus alba</i>	Angiosperm	-	Yes	Yes	Not included
49	<i>Murraya koenigii</i>	Angiosperm	-	Yes	Yes	Not included
50	<i>Oxalis corniculata</i>	Angiosperm	-	Yes	Yes	Not included
51	<i>Parthanium hysterophoros</i>	Angiosperm	Yes	Yes	-	Not evaluated
52	<i>Phoenix humilis</i>	Angiosperm	-	Yes	-	Not included
53	<i>Phyllanthus niruri</i>	Angiosperm	-	Yes	Yes	Not included
54	<i>Pilea scripta</i>	Angiosperm	-	-	-	Least concern
55	<i>Pilea umbrosa</i>	Angiosperm	-	-	-	Least concern
56	<i>Xanthium indicum</i>	Angiosperm	-	Yes	-	Not evaluated
57	<i>Plectranthus japonicus</i>	Angiosperm	-	Yes	-	Least concern

Sl. No.	Botanical Name	Taxonomic Group	Status/ Importance			
			Invasive	Medicinal	Non-timber	IUCN Category
58	<i>Prinsepia utilis</i>	Angiosperm	-	Yes	Yes	Not included
59	<i>Pyrus pashia</i>	Angiosperm	-	Yes	-	Least concern
60	<i>Quercus leucotrichophora</i>	Angiosperm	-	Yes	Yes	Least concern
61	<i>Reinwardtia indica</i>	Angiosperm	-	Yes	Yes	Not included
62	<i>Ricinun Communis</i>	Angiosperm	-	Yes	-	Not included
63	<i>Rubus ellipticus</i>	Angiosperm	-	Yes	Yes	Least concern
64	<i>Saccharum spontaneum</i>	Angiosperm	-	Yes	Yes	Not evaluated
65	<i>Sapium insigne</i>	Angiosperm	-	-	-	Not evaluated
66	<i>Sida cordata</i>	Angiosperm	-	Yes	-	Least concern
67	<i>Smilax aspera</i>	Angiosperm	-	Yes	-	Not evaluated
68	<i>Solanum nigrum</i>	Angiosperm	-	Yes	-	Least concern
69	<i>Solanum viarum</i>	Angiosperm	-	Yes	-	Not evaluated
70	<i>Stellaria media</i>	Angiosperm	-	Yes	Yes	Not evaluated
71	<i>Thalictrum foliolosum</i>	Angiosperm	-	Yes	Yes	Not evaluated
72	<i>Thysanolaena maxima</i>	Angiosperm	-	-	-	Not evaluated
73	<i>Toona ciliata</i>	Angiosperm	-	Yes	Yes	Least concern
74	<i>Tridax procumbens</i>	Angiosperm	-	Yes	-	Not evaluated
75	<i>Tridax sp</i>	Angiosperm	-	-	-	Not evaluated
76	<i>Urtica dioica</i>	Angiosperm	-	Yes	Yes	Not evaluated
77	<i>Vernonia cinerea</i>	Angiosperm	-	Yes	-	Not evaluated
78	<i>Vitex negundo</i>	Angiosperm	-	Yes	Yes	Least concern
79	<i>Woodfordia fruticosa</i>	Angiosperm	-	Yes	Yes	Least concern
80	<i>Ficus palmata</i>	Angiosperm	-	Yes	Yes	Least concern
81	<i>Pinus roxburghii</i>	Gymnosperm	-	Yes	Yes	Least concern
82	<i>Funaria hygrometrica</i>	Bryophyta	-	-	-	Least concern
83	<i>Marchantia nepalensis</i>	Bryophyta	-	-	-	Not evaluated
84	<i>Marchantia polymorpha</i>	Bryophyta	-	-	-	Least concern
85	<i>Anthoceros sp</i>	Bryophyta	-	-	-	Not included
86	<i>Riccia discolor</i>	Bryophyta	-	-	-	Not evaluated
88	<i>Adiantum Caudatum</i>	Pteridophyta	-	-	-	Least concern
89	<i>Adiantum incisum</i>	Pteridophyta	-	-	-	Least concern
90	<i>Cheilanthes farinosa</i>	Pteridophyta	-	-	-	Not included
91	<i>Selaginella chrysocaulos</i>	Lycopodiophyta	-	-	-	Not included
92	<i>Selaginella sp</i>	Lycopodiophyta	-	-	-	Not evaluated

4.5.7 Trees Felling Requirement

143. Project road widening will require felling of trees, which are within RoW. During the baseline assessment, enumeration of trees within the RoW was carried out and the numbers of trees, which require felling were estimated to be 360 out of 545 trees. The list of trees which require felling along with their uses/importance is given in **Table 4-24 and 4-25**. The forest beat/ block wise/range wise trees within the RoW, which may be required to be felled are provided in **Appendix-10**.

Table 4-24: Tree Species to be Felled for widening of Project Road

S. No.	Botanical name	Local name	Nos. of trees	Uses or Importance	IUCN Category
1	<i>Pinus roxburghii</i>	Chill	161	Resin, medicinal	Least Concern
2	<i>Eucalyptus spp.</i>	Safeda	11	Pulpwood, oil	Least Concern
3	<i>Albizia chinensis</i>	Ole	19	Agro-forestry	Not Included
4	<i>Ficus religiosa</i>	Pipal	3	Spiritual value, medicinal	Not Included
5	<i>Syzygium cumini</i>	Jamun	8	Agro-forestry, edible, timber	Least Concern
6	<i>Lannea grandis</i>	Salmbra	2	Agro-forestry, medicinal	Not Included
7	<i>Morus alba</i>	Chimu	14	Agro-forestry, medicinal	Not Included
8	<i>Lannea coromandelica</i>	Samba	1	Agro-forestry	Not Included
9	<i>Toona ciliata</i>	Toon	63	Timber, fodder	Least Concern
10	<i>Bauhinia variegata</i>	Kachnar	6	Agro-forestry, medicinal	Least Concern
11	<i>Robinia pseudoacacia</i>	Rabina	2	Timber, medicinal	Least Concern
12	<i>Erythrina suberosa</i>	Paryara	1	Agro-forestry	Not Included
13	<i>Melia azedarach</i>	Drek	10	Medicinal, timber, fuelwood	Least Concern
14	<i>Mallotus philippinensis</i>	Kambal	13	Dye, fodder	Not Included
15	<i>Ficus spp.</i>	Debree	1	Agro-forestry, edible	Not Included
16	<i>Grewia optiva</i>	Bihul	8	Agro-forestry	Not Included
17	<i>Pistacia integerrima</i>	Kakre	3	Agro-forestry, medicinal	Not Included
18	<i>Pyrus pashia</i>	Segal	1	Agro-forestry, edible	Least Concern
19	<i>Litsea monopetala</i>	Gawanu	9	Timber, seed oil	Least Concern
20	<i>Xylosma longifolium</i>	Drendu	2	Fuelwood	Not Included
21	<i>Ficus palmata</i>	Fegura	2	Agro-forestry	Not Included
22	<i>Ulmus villosa</i>	Merinu	4	Timber	Not Included
23	<i>Celtis australis</i>	Khidak	3	Timber, edible, medicinal	Least Concern
24	<i>Bombax ceiba</i>	Simbal	1	Agroforestry, edible	Least Concern
25	<i>Sapium insigne</i>	Balodhar	1	No major use	Not Included
26	<i>Dalbergia sissoo</i>	Shisham	1	Timber, medicinal	Not Included
27	<i>Populus ciliata</i>	Poplar	4	Agro-forestry, timber	Least Concern
28	<i>Ficus roxburghii</i>	Trayambal	3	Agro-forestry	Not Included
29	<i>Salix alba</i>	Buins	1	Timber	Least Concern
30	<i>Sapindus mukorossi</i>	Ritha	1	Medicinal	Not Included
31	<i>Bamboo spp.</i>	Bamboo clump	1	Construction, handicrafts	Not Included
Total			360		

Table 4-25: Forest Beat /Block/Range wise Trees to be Felled for widening of Project Road

S. No	Forest Beat /Block/Range/Forest Division	Total Tree Nos
1	Rewalsar /Rewalsar/Mandi/Mandi	109
2	Manjhyali/Rewalsar/Mandi/Mandi	71
3	Randhara/Sadar/Mandi/Mandi	89
4	Talyahar/Sadar/Mandi/Mandi	91
Total		360

144. The Forest Department GoHP has created an ONLINE web portal for receiving applications for tree felling and accord permissions in line with the current regulations of GoHP and MoEF& CC. Prior to issuance of tree felling permission, a joint inspection of project corridor by the Forest Department officials for onsite inspection of the existing/proposed centerline of the road, available right of way and joint enumeration of trees will be undertaken to determine the number of trees, which are essentially to be felled for road widening purposes.

4.5.8 Fauna

145. There are no National Park, Wildlife Sanctuary, Biosphere Reserve and any other notified ecologically sensitive area within the 15 Km PIA considered for baseline assessment. Also, no wildlife crossing corridors are reported along the project corridor, except for sighting of a leopard reported by local villagers near Manjhiyali (Km 18/000) along the project corridor (refer **Appendix-11** for ecological investigations report). Few pockets of Mandi, Hamirpur, Una and Shimla districts have reported sporadic leopard attacks in the last decade triggered by their preying on livestock resulting in human conflict, although numbers of such reported cases are on the decline in recent years.

146. In a bid to reduce man-animal conflict, the wildlife division of forest department, GoHP is making efforts to create awareness among people and carryout sensitization programs all over the State on issues of man-animal conflict and to ensure peaceful co-existence of leopards with humans.

147. Among the recorded mammals, Common Leopard was the only species found under Schedule-I category of Indian Wildlife Protection Act (WPA)-1972. Seven species were found under Schedule II, three species were under Schedule-III, five were under Schedule-IV and three were under Schedule V (see **Table 4-26**). No species has been encountered during primary survey which comes under the Rare and endangered category of IUCN. All the species recorded were found under Least Concern Category except Sambar Deer and Common Leopard which come under Vulnerable category of IUCN.

Table 4-26: Mammalian fauna recorded/ reported in Project Region

Sl. No.	Name	Scientific Name	IUCN Status	WPA Status
1	Rhesus Macaque	<i>Macaca mulatta</i>	Least Concern	Schedule-II
2	Red Muntjac	<i>Muntiacus muntjak</i>	Least Concern	Schedule -III
3	Sambar	<i>Rusa unicolor</i>	Vulnerable	Schedule -III
4	Wild Pig	<i>Sus scrofa</i>	Least Concern	Schedule -III
5	Common Leopard	<i>Panthera pardus</i>	Vulnerable	Schedule -I
6	Jungle Cat	<i>Felis chaus</i>	Least Concern	Schedule -II
7	Palm Civet	<i>Paradoxurus hermaphrodites</i>	Least Concern	Schedule -II
8	Indian Civet	<i>Viverricula indica</i>	Least Concern	Schedule -II
9	Grey Mongoose	<i>Herpestes edwardsi</i>	Least Concern	Schedule -II
10	Indian Mongoose	<i>Herpestes auropunctatus</i>	Least Concern	Schedule -IV
11	Golden Jackal	<i>Canis aureus</i>	Least Concern	Schedule -II
12	Yellow throated Marten	<i>Martes flavigula</i>	Least Concern	Schedule -II
13	Indian Hare	<i>Lepus nigricollis</i>	Least Concern	Schedule -IV
14	Indian Pika	<i>Ochotona roylei</i>	Least Concern	Schedule -IV
15	Grey Shrew	<i>Crocidura attenuate</i>	Least Concern	UL
16	House Shrew	<i>Suncus murinus</i>	Least Concern	UL
17	Porcupine	<i>Hystrix indica</i>	Least Concern	Schedule -IV
18	Palm Squirrel	<i>Funambulus pennantii</i>	Least Concern	Schedule -IV
19	Long tailed tree mouse	<i>Vandeleuria oleracea</i>	Least Concern	Schedule -V
20	House Mouse	<i>Mus musculus</i>	Least Concern	Schedule -V
21	Indian Flying fox	<i>Pteropus giganteus</i>	Least Concern	Schedule -V

148. **Herpatofauna:** Monitor lizard (*Varanus bengalensis*) and Common House Lizard (*Hemidactylus brookii*) were sighted during primary study in the study area. Some species of snakes like Rat Snake (*Ptyas mucosa*), Indian Cobra (*Najanaja*), Himalayan Pit viper (*Gloydius himalayanus*) and Common Indian Karait (*Bungarus caeruleus*) were also reported from the PIA area but none of these species were sighted during primary faunal survey, conducted during September 2019. All the recorded/reported faunal species are assessed for their RET status as per Indian Wildlife Protection Act-1972 and IUCN. Only one species of reptile, Monitor Lizard was placed in Schedule-I of Wildlife Protection Act-1972.

4.5.9 Avifauna

149. A variety of bird species are reported/ recorded within PIA are given in **Table 4-27** and **Appendix-11**. Among recorded/reported avifauna, Common peafowl (*Pavo cristatus*) comes under Schedule-I (part III) category under Wildlife Protection Act-1972. These are no important bird areas (IBAs) within Project Influence Area (PIA).

Table 4-27: Avifauna recorded/reported in Project Region

Sl. No.	Name	Scientific Name
1	Chukar Partridge	<i>Alectoris chukar</i>
2	Koklass Pheasant	<i>Pucrasia macrolopha</i>
3	Kalij Pheasant	<i>Lophura leucomelanos</i>
4	Cheer Pheasant	<i>Catreus Wallichii</i>
5	Common Kestrel	<i>Falco tinnunculus</i>
6	Pallid Harrier	<i>Circus cyaneus</i>
7	Eurasian Sparrowhawk	<i>Accipiter nisus</i>
8	Steppe Eagle	<i>Aquila nipalensis</i>
9	Common Pigeon	<i>Columba livia</i>
10	Oriental Turtle Dove	<i>Streptopelia orientalis</i>
11	Eurasian Cuckoo	<i>Cuculus canorus</i>
12	Himalayan Cuckoo	<i>Cuculus saturates</i>
13	Himalayan Wood Owl	<i>Strix (aluco) nivicola</i>
14	Common Hoopoe	<i>Upupa epops</i>
15	Green-Bee-eater	<i>Merops orientalis</i>
16	Great Barbet	<i>Megalaima virens</i>
17	Blue-throated Barbet	<i>Megalaima asiatica</i>
18	Speckled Piculet	<i>Picumnus innominatus</i>
19	Himalayan Woodpecker	<i>Dendrocopos himalayensis</i>
20	Long-tailed Minivet	<i>Pericrocotus ethologus</i>
21	Ashy Drongo	<i>Dicrurus leucophaeus</i>
22	Yellow-bellied Fantail	<i>Chelidorhynch hypoxantha</i>
23	Eurasian Jay	<i>Garrulus glandarius</i>
24	Black-headed Jay	<i>Garrulus lanceolatus</i>
25	Yellow-bellied Blue Magpie	<i>Urocissa flavirostris</i>
26	Red-billed Blue Magpie	<i>Urocissa erythrorhyncha</i>
27	Grey Treepie	<i>Dendrocitta formosae</i>
28	Large-billed Crow	<i>Corvus macrorhynchos</i>
29	Eastern Jungle Crow	<i>Corvus (macrorhynchos) Levaillantii</i>
30	House Crow	<i>Corvus splendens</i>

Sl. No.	Name	Scientific Name
31	Great Tit	<i>Parus major</i>
32	Coal Tit	<i>Periparus ater</i>
33	Himalayan Bulbul	<i>Pycnonotus leucogenys</i>
34	Red-vented Bulbul	<i>Pycnonotus cafer</i>
35	Brown-flanked Bush Warbler	<i>Cettia fortipes</i>
36	Grey-sided Bush Warbler	<i>Cettia brunnifrons</i>
37	Lemon-rumped Warbler	<i>Phylloscopus chloronotus</i>
38	Grey-hooded Warbler	<i>Phylloscopus xanthoschistos</i>
39	Rusty Scimitar Babbler	<i>Pomatorhinus horsfieldii</i>
40	Jungle Babbler	<i>Turdoides striata</i>
41	Oriental White-eye	<i>Zosterops palpebrosus</i>
42	Brown Dipper	<i>Cinclus pallasii</i>
43	Common Myna	<i>Acridotheres tristis</i>
44	Blue Whistling Thrush	<i>Myophonus caeruleus</i>
45	Black-throated Thrush	<i>Turdus atrogularis</i>
46	White-capped Redstart	<i>Chaimarrornis leucocephalus</i>
47	Little-Forktail	<i>Enicurus scouleri</i>
48	Spotted Forktail	<i>Enicurus maculates</i>
49	Grey Bushchat	<i>Saxicola ferreus</i>
50	Mrs Gould's Sunbird	<i>Aethopyga gouldiae</i>
51	House Sparrow	<i>Passer domesticus</i>
52	Russet Sparrow	<i>Passer rutilans</i>
53	Grey Wagtail	<i>Motacilla cinerea</i>
54	White Wagtail	<i>Motacilla alba</i>
55	Red Jungle fowl	<i>Gallus Gallus</i>
56	Blue Whistling Thrush	<i>Myophonus caeruleus</i>
57	Asian Barred Owlet	<i>Glaucidium cuculoides</i>
58	White-throated Kingfisher	<i>Halcyon smyrnensis</i>

150. **RET Birds:** Among recorded/reported avifauna, two species of pheasant *Kalij Pheasant* and *Cheer Pheasant* come under Schedule-I (part III) category under Wildlife Protection Act-1972. Rest of the species are common and reported to be widely distributed though out project region.

4.5.10 Fish and Fisheries

151. Rewalsar lake at Km 22.5 is the only prominent aquatic eco-system along Project Corridor. The project road traverse in close proximity to Rewalsar lake and the nearest periphery of the lake lies within a distance 30 to 40 meters from the edge of the project road and connects to another internal road, which can be termed as the peripheral road surrounding the Rewalsar lake (ref. 4.6.3 hereunder for more details). The other similar aquatic bodies within Mandi district are in Prasher, Kamrunag which are beyond the 15 km of PIA.

152. Rewalsar Lake, also known as Tso Pema, is a mid-altitude square shaped lake located in the midst of surrounding hilly/mountainous terrain spur and dense wooded vegetation. The elevation of Rewalsar lake is about 1,360 m above MSL with a water spread area of 2.6 Ha, max depth of 6m, average annual silting/sedimentation rate of 3.35 cm/year, 735 meters long shoreline and a catchment area of 1.7Sq. km with 1200 mm of annual rainfall.

153. The Department of Fisheries has introduced several species of fishes in Rewalsar lake for the ecological sustenance and as well as for the tourist attraction. The fish species reported at Rewalsar lake is Channa Marulius (Great Snakehead), Cyprinus carpio (European carp), Catla catla (catla), Carassius auratus (goldfish), Channa punctatus (snakehead), Rasbora rasbora (Gangetic scissortail), and Puntius sarana (sarana) and Puntius ticto (ticto) are some of the fish species reported in the Rewalsar Lake. However, fishing of any kind and feeding of fish by tourists is prohibited at Rewalsar lake.

154. Rewalsar lake has reported fish kills, the last such incident reported was in year 2014 & 2017, particularly during summer months. The fish kills are reportedly due to the hypoxia conditions or oxygen deficiency in a biotic environment caused by surface water pollution, discharge of sewage, rainwater flooding, sedimentation/siltation, excess growth of weeds and dumping of waste by tourists.

4.6 Cultural/ Heritage and Places of Historical/ Religious Importance

4.6.1 Archaeological and Historical Monuments

155. There are no protected archaeological or historical monuments within 200m on either side of project road as well as Mandi tehsil as a whole. Government of India regulations prohibits any construction activity within 200 meters of any protected monument under the Ancient Monuments and Archeological Sites and Remains Act, 1957 and amendments thereof.

4.6.2 Culture/ Heritage and Places of Religious Importance

156. Rewalsar, which is along the project corridor at 22.5 Km, is a tranquil place with its lake surrounded by wooded area is stunningly beautiful and has 4 monasteries, 3 Hindu temples and 1 Gurudwara. Naina Devi temple, is also another revered place of religious importance, situated on hilltop and at a distance of 10 Km from Rewalsar (aerial distance is mere 500 meters). Rewalsar attracts Buddhist tourists from all part of India and abroad (ref **Table 4-28** and **Figure 4-19**).

Table 4-28: Religious/ Tourist Places of importance at Rewalsar along Project Road

Sl. No.	Name of Religious/ Tourist Places of importance	Aerial Distance from Project Road	Side	GPS Coordinates
1	Rewalsar Lake	50 meters	RHS	31°38'03.24" N/ 76°50'02.39" E
2	Nyingma Gompa Buddhist Monastery	110 meters	RHS	31°37'58.02" N/ 76°49'58.22" E
3	Drikung Kagyud Buddhist Monastery	70 meters	RHS	31°38'02.22" N/ 76°50'03.85" E
4	Zigir Drukpa Buddhist Monastery	90 meters	RHS	31°37'56.00" N/ 76°49'56.38" E
5	Guru Padma-sambhava Statue	195 meters	RHS	31°37'58.57" N/ 76°49'56.66" E
6	Maharishi Lomash Temple	210 meters	RHS	31°38'01.35" N/ 76°50'00.85" E
7	Zangdok Palri Palace Monastery	220 meters	RHS	31°38'06.29" N/ 76°50'08.81" E
8	Naina Devi Temple	500 meters	RHS	31°38'13.04" N/ 76°49'57.17" E
9	Gurudwara, Rewalsar	180 meters	RHS	31°38'05.77" N/ 76°50'07.04" E
10	Shiva Temple, Rewalsar	250 meters	RHS	31°38'01.41" N/ 76°50'01.17" E

Note: Distances from project road to religious or places of importance indicated above are much longer as compared to aerial distances and separated by settlement areas in between.



Figure 4-19: Location of Religious/ Tourist Places of importance at Rewalsar along Project Road

4.6.3 Rewalsar Lake

157. Rewalsar Lake, also known as Tso Pema, is a mid-altitude square shaped lake located in the midst of surrounding hilly/mountainous terrain spur and dense wooded vegetation. The lake is at about 1,360 m above MSL with a water spread area of 2.6 Ha, max depth of 6m and 735 meters long shoreline with a peripheral road surrounding the lake.

158. Rewalsar Lake is regarded as a sacred spot for Tibetan Buddhists for the Vajrayana practices of Padmasambhava and Mandarava and are credited for the lake's creation several centuries back and thus carries heritage value. The lake is also regarded as sacred for Hindus and Sikhs visiting the temples and Gurudwara at Rewalsar and is also a place of attraction place for enroute tourists, passing through Rewalsar.

4.6.4 Buddhist Monasteries at Rewalsar

159. The **Nyingma Gompa** is the first monastery established at Rewalsar, several centuries ago and is situated on the most vantage position along the lake front. It was constructed by Dudjom Rinpoche, an accomplished master from the Nyingma school of Tibetan Buddhism.

160. The **Drikung Kagyud** Monastery is the second monastery established at Rewalsar by Ontul Rinpoche, who came to Rewalsar from Tibet in the 1970s and established this monastery from scratch.

161. The **Zigar Drukpa Kagyud** Monastery is situated on the western side of the lake and houses the statue of Padmasambhava, which is about 20 meters tall, completed in year 2011 and is dominantly visible from most parts of Rewalsar.

162. The **Zangdok Palri Palace** Monastery is situated on the northern side of the lake is the newest monastery at Rewalsar.

163. The Drikung Kagyud Gompa and the Zigar Gompa are among the prominent monasteries of Nyingmapa order of Buddhism and the unique feature of these monasteries or gompas is the amalgamation of the Indo-Chinese style of architecture with beautiful interiors adorned with stucco images and paintings.

4.6.5 Hindu Temples and Gurudwara at Rewalsar

164. Rewalsar is equally revered by Hindu and Sikh religions, which has temples dedicated to lord Krishna, lord Shiva and Sage Lomas alongside the lake. Naina Devi temple, is another revered place of religious importance, situated on hilltop and at a distance of 10 Km from Rewalsar.

165. Rewalsar also has a 'Rewalsar Gurudwara Sahib', which was built in 1930 by Raja Joginder Sen of Mandi and attracts Sikhs from Punjab and other parts of India and abroad.

166. Although the Monasteries, Temples and Gurdwara at Rewalsar have historical importance, religious significance and attracts several thousands of followers and tourists on various auspicious days/months of the year from various parts of Indian and elsewhere, none of these are either along the project road corridor or fall under protected category under the Ancient Monuments and Archaeological and Remains Act.

167. In addition, the Project road has 24 religious' shrines/small temples/structures including Peepal trees with platforms along its corridor, which are revered as places of worship mainly by the local community at the respective settlement areas.

4.6.6 Common Property Resources

168. The common property resources like natural water sources, religious shrines/ Peepal tree platforms, schools and primary health center located along the project corridor are given in **Table 4-29, 4-30 & 4-31**.

Table 4-29: Natural Water Sources along CoI of Project Road

Sr. No.	Design Chainage	Side	Village	Type of Natural Water Source	Usage	Distance from existing Centreline of Road (m)	GPS Coordinates
1	3+700	RHS	Gandharv	Spring/ Seepage from Hill side	Drinking water	4	31°41'13" N/ 76°55'02" E
2	4+297	RHS	Talyahar	Dug well	Drinking water	5.8	31°40'57" N/ 76°54'56" E
3	8+280	LHS	Rughwanu	Dug well	Drinking water	3.2	31°39'41" N/ 76°53'45" E
4	10+416	RHS	Randhara	Spring/ Seepage from Hill side	Drinking water	4	31°39'08" N/ 76°53'09" E
5	12+482	RHS	Hawani	Spring/ Seepage from Hill side	Drinking water	6.5	31°38'46" N/ 76°52'42" E
6	18+060	RHS	Manjalhy	Spring/ Seepage from Hill side	Drinking water	7.2	31°38'12" N/ 76°51'28" E

Table 4-30: Religious Shrines/ Small Temples along CoI of Project Road

S. No	Design Chainage	Side	Village	Typology of Structure	Distance from existing Centreline of Road (m)	GPS Coordinates
1	2+022	RHS	Tawambra	Shrine	4.3	31°41'49" N/ 76°55'19" E
2	2+820	LHS	Panjethi	Shrine	5.4	31°41'29" N/ 76°55'16" E
3	3+999	LHS	Gandharv	Shrine	4.4	31°41'05" N/ 76°55'01" E
4	5+321	RHS	Ghora	Peepal tree platform	4.2	31°41'30" N/ 76°54'41" E
5	5+820	LHS	Jola	Shrine	6.5	31°40'22" N/ 76°54'30" E
6	5+989	RHS	Ghaur	Shrine	4.2	31°40'25" N/ 76°54'26" E
7	8+275	LHS	Rughwanu	Peepal tree platform	3.8	31°39'41" N/ 76°53'46" E
8	8+738	RHS	Randhara	Shrine	3.6	31°39'32" N/ 76°53'34" E
9	10+122	RHS	Randhara	Shrine	6.0	31°39'15" N/ 76°53'15" E
10	10+725	LHS	Randhara	Shrine	6.0	31°39'07" N/ 76°53'00" E
11	12+388	LHS	Natned	Peepal tree platform	2.7	31°38'47" N/ 76°52'45" E
12	18+410	LHS	Manjalhy	Temple	5.0	31°38'04" N/ 76°51'37" E

S. No	Design Chainage	Side	Village	Typology of Structure	Distance from existing Centreline of Road (m)	GPS Coordinates
13	19+203	RHS	Palnu (Saphru)	Peepal tree platform	3.3	31°37'49" N/ 76°51'18" E
14	20+081	LHS	Garlauni	Shrine	4	31°37'47" N/ 76°51'00" E
15	20+706	LHS	Garlauni	Temple	3.8	31°37'47" N/ 76°50'43" E
16	20+751	LHS	Garlauni	Peepal tree platform	6	31°37'47" N/ 76°50'42" E
17	21+084	LHS	Hawani	Shrine	6	31°37'57" N/ 76°50'41" E
18	21+704	LHS	Hawani	Peepal tree platform	3.7	31°38'09" N/ 76°50'31" E
19	22+997	LHS	Rewalsar	Peepal tree platform	3.0	31°37'59" N/ 76°50'03" E
20	24+218	RHS	Dehri Galu	Shrine	3.8	31°37'32" N/ 76°49'42" E
21	24+734	LHS	Tramb/Dhar1	Peepal tree platform	4.4	31°37'16" N/ 76°49'36" E
22	28+216	RHS	Kalkhar	Temple (Lakhdata Peer)	5.0	31°36'11" N/ 76°49'34" E
23	28+299	LHS	Kalkhar	Temple (Lakhdata Peer)	7.5	31°36'09" N/ 76°49'35" E
24	28+415	RHS	Kalkhar	Peepal tree platform	6.7	31°36'05" N/ 76°49'36" E

Table 4-31: Schools and Primary Health Centre along Project Road

S. No	Design Chainage	Side	Village	Typology of Structure	Distance from existing Centreline of Road (m)	GPS Coordinates
1	4+237	LHS	Talyahar	Govt. Sr. Sec. School	4.3	31°40'58" N/ 76°54'57" E
2.	4+515	LHS	Talyahar	Primary Health Centre	10	31°40'51" N/ 76°54'51" E
3	4+773	LHS	Talyahar	SVM Public School	6.4	31°40'43" N/ 76°54'46" E
4	22+570	LHS	Rewalsar	Unity Public School	4.0	31°37'56" N/ 76°50'16" E
5	23+280	RHS	Rewalsar	Govt Primary school	3.5	31°37'54" N/ 76°49'56" E

169. None of the Monasteries, Gurudwara and Temples at Rewalsar and 24 religious' shrines/small temples/structures including Peepal trees with platforms along the project corridor are protected under the Ancient Monuments and Archaeological and Remains Act.

4.7 Hazard and Vulnerability

170. The Hazard and Vulnerability of the PIA and Mandi district in terms of landslide hazards, wind hazards, earthquake hazards, flood hazards are summarized hereunder.

4.7.1 Landslide Prone Zones

171. As per landslide vulnerability map of the State, project road traverses in moderate to low and high landslide zones within the Mandi district as shown in **Figure 4-20**. The classification of landslides prone areas within Himachal Pradesh is given in **Table 4-32**.

Table 4-32: Landslide prone areas of Himachal Pradesh

Sl. No	District	Extent of Areas in Sq. Km.				
		Severe to Very High	High	Moderate to Low	Unlikely	Total Area
1	Bilaspur	2.16	8.42	0.83	0.01	11.42
2	Chamba	21.20	38.29	3.51	0.70	63.70
3	Hamirpur	0	8.51	2.04	0.45	11.00
4	Kangra	1.23	36.98	12.33	5.57	56.11
5	Kinnaur	8.68	49.56	4.98	0	63.22
6	Kullu	18.20	35.12	0.65	0.03	54.01
7	Lahaul & Spiti	1.27	116.37	18.25	0.02	135.91
8	Mandi	9.68	19.78	8.26	0.98	38.70
9	Shimla	8.93	33.45	7.67	0.14	50.19
10	Sirmaur	0.95	18.05	6.14	2.28	27.42
11	Solan	5.56	11.18	1.57	0.79	19.10
12	Una	0.02	6.78	5.17	3.11	15.08
13	Himachal Pradesh	77.88	382.49	71.40	14.08	545.86

Source: BMTPC, Landslide Hazard Zonation Atlas of India.

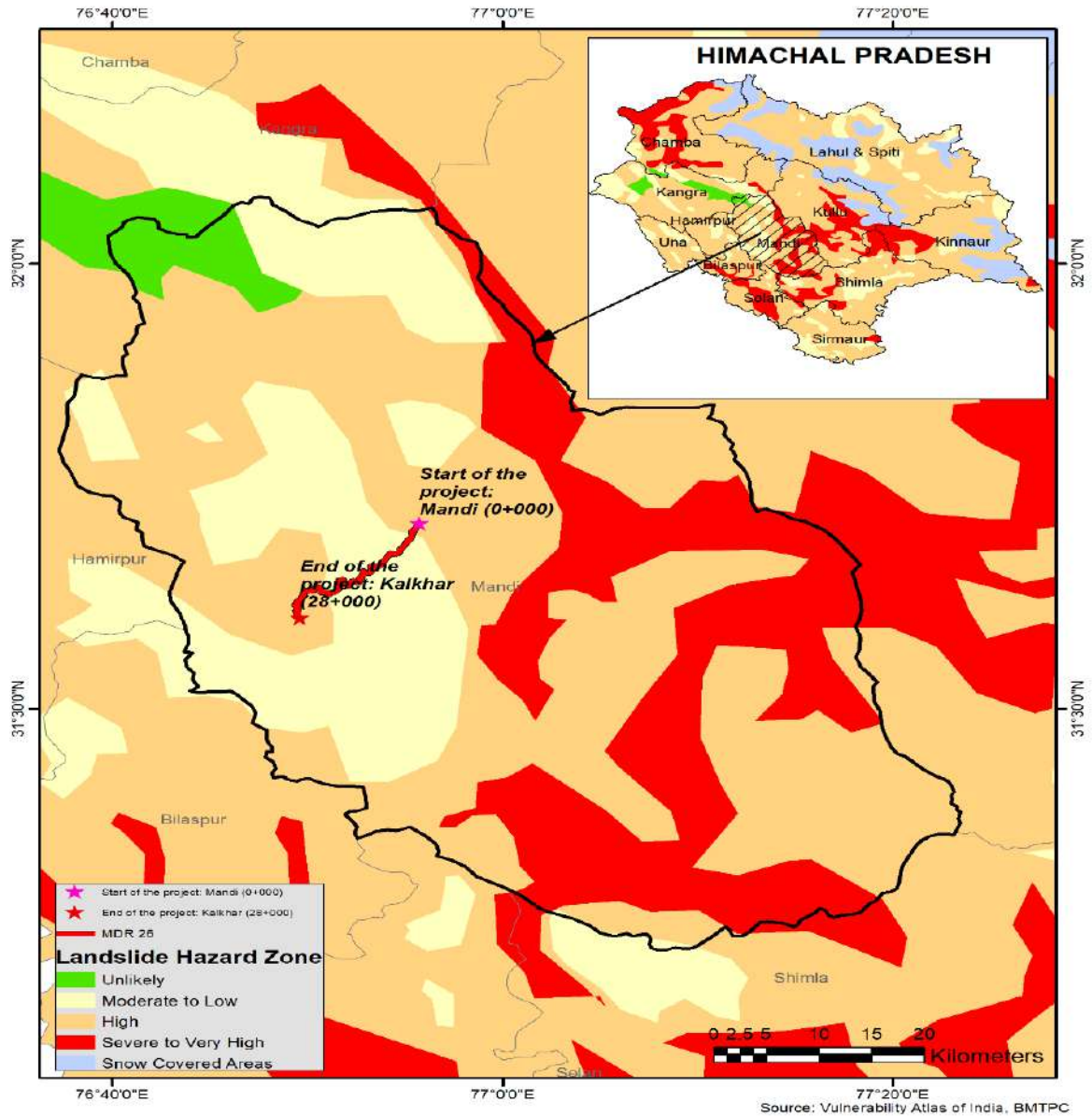


Figure 4-20: Landslide Vulnerability Status of Mandi District

172. The project road has landslide prone stretches at 19 locations with a cumulative length of 1495 meters, out of its 28 km length. The chainage wise landslide prone locations are given in **Table 4-33**.

Table 4-33: Landslide Prone locations along Project Road

Sl. No	Chainage From (m)	Chainage To (m)	Length (m)
1	5590	5670	80
2	6965	6995	30
3	10085	10430	345
4	11100	11180	80
5	11745	11775	30
6	13100	13130	30
7	13190	13220	30

Sl. No	Chainage From (m)	Chainage To (m)	Length (m)
8	15250	15280	30
9	16480	16540	60
10	18255	18275	20
11	19110	19210	100
12	20755	20805	50
13	23280	23350	70
14	23550	23900	350
15	24840	24880	40
16	25850	25900	50
17	27195	27225	30
18	27460	27500	40
19	27635	27665	30
Total length			1495

Source: Field Investigations during project preparation Sept 2019 and March 2020

4.7.2 Wind Hazard Prone Areas

173. As per wind hazard map of Himachal Pradesh, the project road completely traverses in moderate damage risk zone B. The wind hazard zonation map of Mandi district is shown in **Figure 4-21**. The wind hazard zonation based on wind speed as per BIS: 875 (Part 3) – 1987 titled “Indian Standard Code of Practice for Design Loads (other than earthquakes) for Buildings and Structures, Part 3, Wind Loads” is given in **Table 4-34**.

Table 4-34: Wind Speed Zones applicable for Project Road/ Region

S No	Wind Speed	Wind Hazard Zonation
1	55 m/s (198 km/h)	Very High Damage Risk Zone - A
2	50 m/s (180 km/h)	Very High Damage Risk Zone - B
3	47 m/s (169.2 km/h)	High Damage Risk Zone
4	44 m/s (158.4 km/h)	Moderate Damage Risk Zone - A
5	39 m/s (140.4 km/h)	Moderate Damage Risk Zone - B
6	33 m/s (118.8 km/h)	Low Damage Risk Zone



Figure 4-21: Wind Hazard Map of Mandi District
 (Source: - <https://ndmahimachalpradesh>)

4.7.3 Flood Zones

174. As per flood zone map, the PIA is not prone to flash floods as can be seen in **Figure 4-22**. The areas, which are probable for flash floods are more than 100 km away from project road. The project road has several seasonal streams, which drains mainly during rainy seasons. The project road design has considered 143 cross drainage structures (139 CD structures under project road and 4 bridges of Associated Facilities) to ease flow of water during monsoon season and avoid overtopping of water or inundating of project road at these locations during months/years of high rainfall (ref. 2.10 under Section 2).

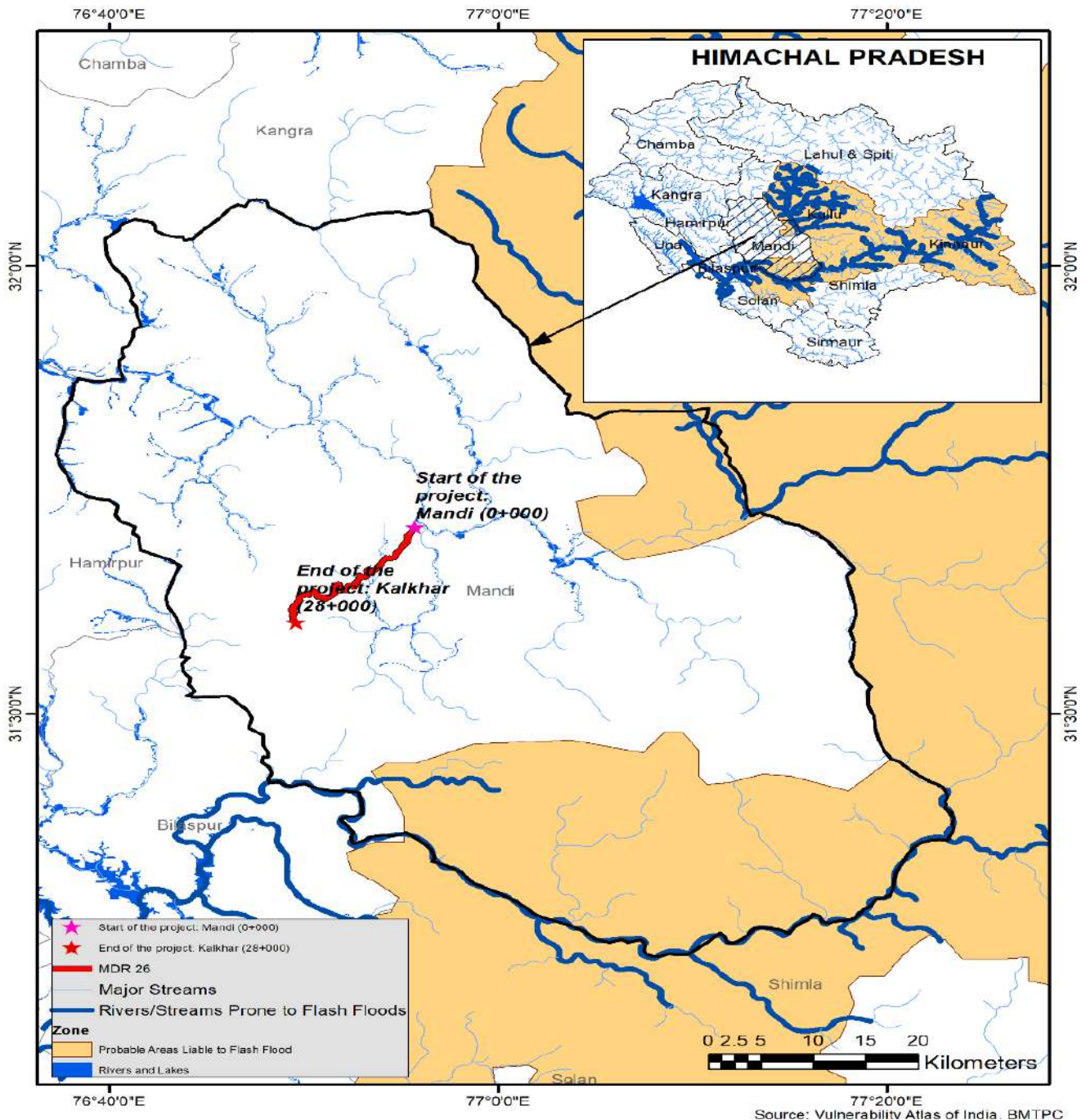


Figure 4-22: Flood Hazard Map of Mandi District
(Source: - <https://ndmahimachalpradesh>)

4.7.4 Cloud Burst Occurrence

175. Almost every year, Himachal Pradesh as a whole, experience incidents of cloud bursts followed by heavy rainfalls causing flash floods endangering the lives of people, cattle and destruction of property including road infrastructure and hydro power stations, among others. Historical data on occurrences of cloudbursts in Himachal Pradesh is given in **Table 4-35**.

Table 4-35: Historical Occurrences of Cloudbursts in Himachal Pradesh (1990-2001)

District	Months				Total	Average	Probability of occurrence of cloud bursts
	June	July	August	September			
Kullu	2	4	7	2	15	1.25	More than one per year
Shimla	1	1	4	0	6	0.5	One in two years
Kinnaur	0	2	2	0	4	0.33	One in three years
Mandi	0	2	1	0	3	0.25	One in four years
Kangra	0	2	0	0	2	0.17	One in six years
Chamba	0	0	2	0	2	0.17	One in six years
Sirmaur	0	0	1	0	1	0.084	One in twelve years
Solan	0	0	1	0	1	0.084	One in twelve years
Lahul & Spiti	0	1	0	0	1	0.084	One in twelve years
Hamirpur	0	0	0	1	1	0.084	One in twelve years
Bilaspur	0	0	0	0	0	0	Unlikely
Una	0	0	0	0	0	0	Unlikely
Total for HP State	3	12	18	3	36	-	Unlikely

Source: Independent Research Publication by S C Bhan and Others, IMD, Chandigarh

176. As per the information released by the State government and available in media, 33 cloud burst incidents have occurred across Himachal Pradesh during southwest monsoon (July to September) of Year 2019 alone, out of which two cloud burst incidents have been reported from Swarghat subdivision of Bilaspur district and most other cloud bursts have occurred in Kullu, Kinnaur, Kangra and Shimla districts.

177. No definite information is available about the exact locations, trend, and frequency of cloud bursts across Himachal as a State. However, probable number of incidences of cloudbursts per year across various districts as projected by independent researchers are given in **Table 4-36**.

Table 4-36: Cloudburst Occurrence Trend for Himachal Pradesh

Sl. No	Average period of occurrence of one event	Risk category	Districts
1	One year or less	Very high	Kullu
2	2-5 years	High	Shimla, Kinnaur and Mandi
3	6-10 years	Moderate	Kangra and Chamba
4	10 years or more	Low	Solan, Sirmaur, Hamirpur and Lahul & Spiti

Source: Independent Research Publication by S C Bhan and Others, IMD, Chandigarh

178. Overall, districts of Una, Kangra, Chamba, Sirmaur, Lahul & Spitti, Solan, Hamirpur and Bilaspur have been reported to be least affected by cloud bursts. Kullu district is most vulnerable to cloudbursts followed by Shimla, Kinnaur and Mandi districts.

179. No significant incidences of cloud bursts have been reported along the Project Corridor in the recent years.

4.7.5 Earthquake Zones

180. India is divided into 4 seismic zones (II, III, IV, V); Zone –II being the least active seismic zone, whereas Zone-V is the highest seismic zone as given in **Table 4-37**. As per the earthquake hazard map of Himachal Pradesh, the areas falling in districts Chamba, Kangra, Mandi, Kullu, Hamirpur Bilaspur are very sensitive and fall in Very High Damage Risk Zone (MSK IX or More) i.e., Zone V, whereas the rest of the areas falls in High Damage Risk Zone (MSK VIII).

181. The project road falls under Zone –V i.e., Very High risk - Intensity IX, which is at very high risk and warrant earthquake resistant designs for structures. The earthquake hazard map along the project road is shown in **Figure 4-23**.

Table 4-37: Earthquake Zones of India

S. No.	Zone	Intensity
1	Zone - V	Very High risk - Intensity IX
2	Zone -IV	High risk - Intensity VIII
3	Zone - III	Moderate risk - Intensity VII
4	Zone - II	Low Damage Risk - Intensity VI
5	Zone - I	Not in Use

182. The past occurrence of earthquakes in Himachal Pradesh during year 2016-17 is given in **Table 4-38**. The occurrence of most severe and devastating earthquakes occurred in within Himachal Pradesh is given in **Table 4-39**. Among the places mentioned in Tables 4-38 and 4-39, the nearest ones to project road are Sundernagar (25 km) and Kullu (90km) from Project Road.

Table 4-38: Occurrences of Earthquakes in Himachal Pradesh (2016-2017)

Date	Time of Occurrence	Latitude (deg. N)	Longitude (deg. E)	Depth (km)	Magnitude on Richter Scale	Region/Area within State
27-10-2017	08:54:20	32.5°N	76.4°E	10	3.7	Chamba, Himachal Pradesh
27-08-2016	03:38:15	31.4°N	77.4°E	10	4.2	Kullu Himachal Pradesh
27-08-2016	01:35:07	31.4°N	77.5°E	10	4.3	Kullu Himachal Pradesh
27-08-2016	01:14:32	31.4°N	77.5°E	10	4.6	Kullu Himachal Pradesh
01-08-2016	13:38:00	31.4°N	77.6°E	10	3.6	Rampur Himachal Pradesh
01-08-2016	12:34:00	30.9°N	77.1°E	10	3	Solan, Himachal Pradesh

Table 4-39: Most Severe Earthquakes in Himachal Pradesh

Date	Locations Affected	Magnitude	Extent of Reported Damage
4 th April, 1905	Kangra	7.8	20,000 people died, 53,000 domestic animals perished, 1,00,000 houses destroyed, Estimated economic cost of recovery 2.9 million rupees
1 st June, 1945	Chamba	6.5	NA
19 th January, 1975	Kinnaur	6.8	60 people died, 100 badly injured, 2000 dwellings devastated, and 2500 people rendered homeless
26 th April, 1986	Dharamshala	5.5	6 people died, Extensive damage to buildings. Loss estimated at Rs 65 crores
1 st April, 1994	Chamba	4.5	NA
24 th March, 1995	Chamba	4.9	Fearsome shaking, more than 70% houses developed cracks
29 th July, 1997	Sundernagar	5	Damage to about 1000 houses

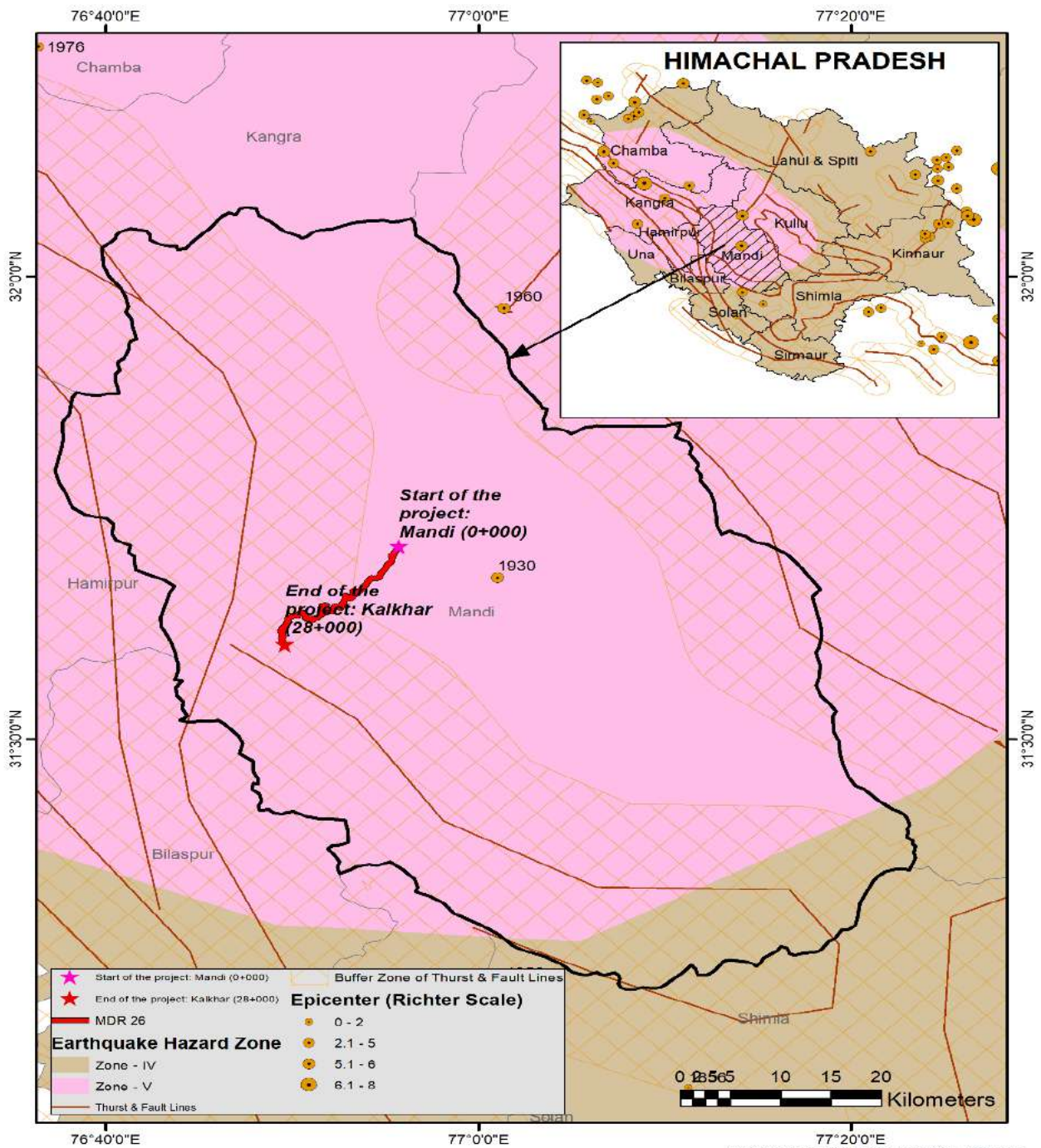


Figure 4-23: Earthquake Hazard Map of Mandi District

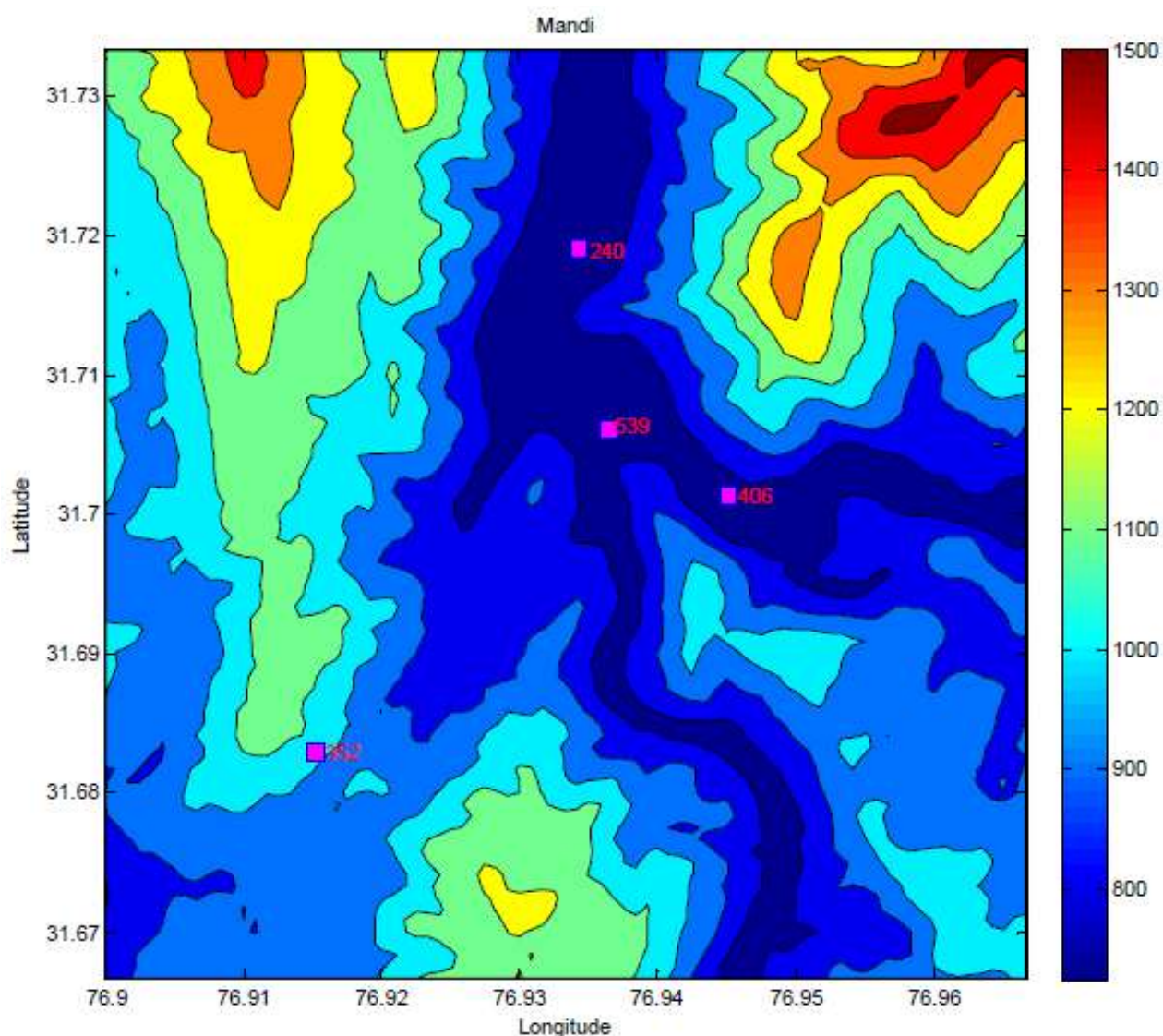
183. Seismic refraction survey and shear velocity profiles through Multi-Channel Analysis of Surface Wave (MASW) tests conducted¹⁰ on behalf of Himachal State Disaster Management Authority at 4 sites spread across Mandi city are being referred, since Mandi town is the starting point of project road. The measured V_{s30} values at these test sites range from 240 to 539 m/s is given in **Table 4-40** and shown in **Figure 4.24**.

¹⁰ complete investigation report can be accessed at <https://www.hpsdma.nic.in//adminis/admin>

Table 4-40: Shear wave Velocity profile of 4 test sites at Mandi

Sl. No.	Site id	Location	Average V_{s30} (m/s)	Soil Type
1	Mandi 1	31.72° N 76.93° E	240	D
2	Mandi 3	31.71° N 76.94° E	539	C
3	Mandi 4	31.68° N 76.92° E	352	D
4	Mandi 5	31.70° N 76.95° E	406	C

Source: Himachal Pradesh Disaster Management Authority



Source: HPDMSA, GoHP

Figure 4-24: V_{s30} Values of Test Sites at Mandi (nearest location to Project Road)

4.7.6 Overall Vulnerability Status

184. The project road and the PIA falls within the areas categorized as “High” by Himachal Pradesh Disaster Management Authority, GoHP and shown in **Figure 4-25**. The probability of seasonal hazards of Mandi district based on the District Disaster Management Plan is given in **Table 4-41**. The vulnerability status considers the probability of an area/region to severity of earthquakes, wind hazard, land slide and floods.

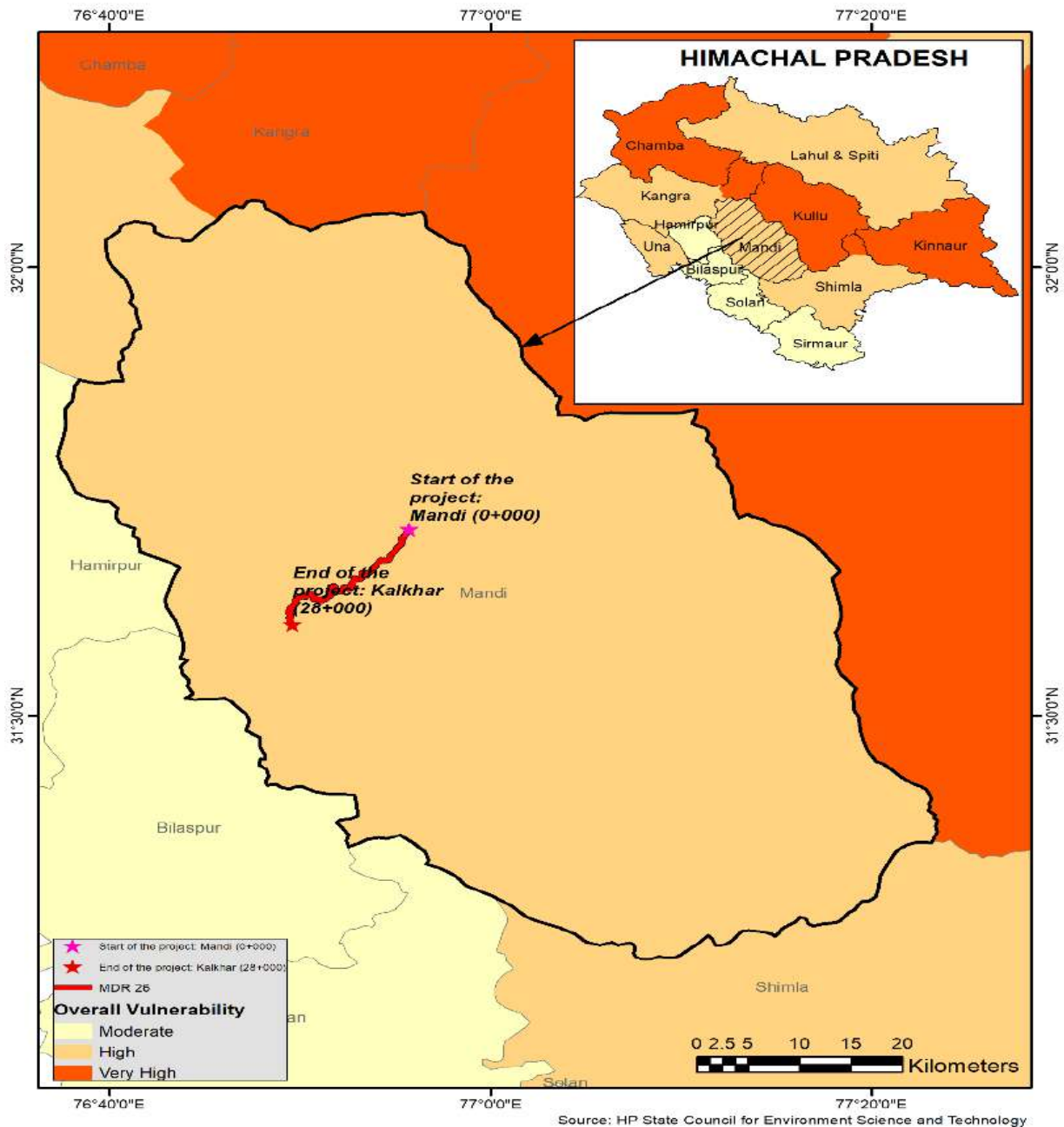


Figure 4-25: Overall Vulnerability Status of Mandi District

Table 4-41: Probability of Seasonal Hazards of Mandi District

Hazard	Probable Months											
	Jan	Feb	Mar	April	May	June	July	August	Sept	Oct	Nov	Dec
Flood						High	High	High	High			
Forest Fire				High	High	High	High	High				
Drought			High	High	High	High						
Earthquake	High	High	High	High	High	High	High	High	High	High	High	High
Cold Event	High	High										High

Hazard	Probable Months											
	Jan	Feb	Mar	April	May	June	July	August	Sept	Oct	Nov	Dec
Heat wave												
Hailstorm												
High Winds												
Road accident												

4.8 Social Economic Profile

185. The Mandi-Rewalsar-Kalkhar road designated as MDR-26 is 28+000 Km long traverse completely in Mandi tehsil of Mandi district. The latitude and longitude of project road are 31.707°N to 31.632°N and 76.930°E to 76.833°E respectively and its altitude ranges between 850-1350 m above mean sea level. The project road starts from jail road at Mandi intersecting NH-154 at 0 Km and NH-3 at 4.5 Km, SH-32 at 29 Km and connects NH-20 and NH-21 for visitors to Kullu, Manali, Lahul and Spiti, Dharamshala etc.

186. Mandi district was formed after the merger of Mandi state (Mandi) and Suket, two princely states on 15 April 1948. The name Mandi may have derived from the common name 'Mandi' which means 'market' as it serves as commercial hub and trade center. Mandi is situated almost at the geographical center of the Himachal and lies along the left bank of the river Beas at the foot hill of Shavilik ranges. It is also known as "Choti Kashi" for its beautiful carved stone edifice temples Ex: Trilokinath and Panchvaktra etc.

4.8.1 Economy

187. The economy of the region is predominantly agrarian and people cultivate rice, pulses, millets, vegetable crop, fruits, tea, and herbal products. It is also prominently known for cocoon cultivation (sericulture), silk, woolen and artificial thread-based industry and directly engage farmers. The region is also under apple cultivation and rural population of the district is actively engaged in livestock rearing like cattle, goatery and sheep for their daily needs. The district has a dairy unit run by the H.P. State Co-Operation-Milk- Federation at Chakkar which benefit small and marginal farmers.

4.8.2 Administrative Set-up

188. Administratively, Mandi district has nine tehsils, seven sub-tehsils, ten community development blocks, five urban local bodies (two Municipal Committees and three Nagar Parishads), 473 Panchayats constituting 2877 Wards, ten Panchyat Samities, and a Zila Parishad.

4.8.3 Culture and Heritage

189. Mandi population constitute 98.20% of Hindus followed by Muslims (0.92%) Sikhs (0.53%) and Buddhists (0.32%) respectively and their traditional dressing norms include dhoti, kurta, pajamas churidar and waistcoat, however dressing up of people have now become mixed up over the time with western influence. Hindi is the official language and 'Mandiali' is the local dialectic. Rewalsar, which is along the project corridor at 22.2 Km, is a tranquil place with lotus lake spread over an area of 2.6 Ha and surrounding woods is stunningly beautiful and has 4 monasteries, 3 Hindu temples and 1 Gurdwara (refer 4.6 under Section 4). Mandavya Kala Manch is an organization conducts cultural events and folk dance in schools and collages as well as during the International 'Mandi Shivratri fair' to preserve local culture, traditional and folk-dance forms. The famous folk dances performed in the theatrical shows are Luddi, Naagriya, Mandiyali, Bhduda and Bhantra.

4.8.4 Transport

190. Transport sector is essential not only for the growth of economic infrastructure but it also helps in development of trade commerce and industry. The project road connectivity will enhance and

facilitate travel to minimize travel time and facilitate sustainable and shared mobility for producers and consumers. Mandi is well connected and approachable by road to state capital Shimla, Bilaspur, Hamirpur and Kullu districts in Himachal Pradesh, Jalandhar, Pathankot in Punjab and Chandigarh & National Capital Delhi. Nearest Railway station is at Kiratpur Sahib (130 km) in Punjab, Kullu Airport in Bhuntar is at a distance of 60 km, Shimla Airport at 145 km, and International Airport 460 km away at Delhi.

4.8.5 Tourism

191. The project road widening and up-gradation will improve connectivity to the famous and renowned pilgrimage centers and attract several hundreds of pilgrims from neighboring states to Rewalsar and Mandi. The Buddhist monasteries at Rewalsar are 22 km from Mandi, Panchvaktra temple in Purani Mandi is 2 km and Trilokanath Temple 1.6 km. The other famous tourist places around the project corridor include Bhootnath Temple (600m) Hawa Mahal (1.6 km) and Tarna Devi Temple (2 km) at Mandi.

4.8.6 Demographic Profile of Mandi District

192. As per 2011 census, Mandi district had a population of about 9.99 lakhs. The population of the district has increased by 10.92% during 2001 to 2011. It constitutes 14.58% of the state population and rank second in position. Economy of the district is mainly agrarian and 80% of the population in the district is engaged in cultivation. The demographic profile and social amenities of Mandi district is summarized here under given in **Table 4-42 and 4-43 and Appendix-12.**

- The total population of Mandi district is 999777 comprising 498065 (49.81%) males and 501712 (50.19%) females. This shows that the female population is higher than male population. The male and female ratio of the Mandi district is 1007 females per every 1000 males.
- Decadal population growth (2001-2011) has increased by 10.92%. The tehsil/sub-tehsil Sarkaghat and Sandhol have shown decrease in population, whereas the other tehsil/sub-tehsils have shown increasing trend. Decadal growth rate in rural areas remained much higher (11.52%) than this rate in urban areas (2.71%).
- Out of the total population of the district, 93.74% live in rural areas, while 6.26% live in urban areas.
- Among the total population of district, 1.27% (12787) belongs to Scheduled Tribes, 29.38% (293739) belong to Scheduled Caste population and 69.34% (693251) population belongs to other castes.
- Among the total population, 61.18% are literate and 27.60% are illiterate, excluding the 0-6 age group.
- Among the literates, literacy levels of male population are marginally higher than female population.

Table 4-42: Demographic Profile of Mandi District

Demographic Parameters		Total	Rural	Urban
No. of Households		219145	203747	15398
Population	Persons	999777	937140	62637
	Males	498065	466050	32015
	Females	501712	471090	30622
Sex ratio (Females per 1000 Males)		1007	1011	956
Proportion of SC Population (%)		29.38		
Proportion of ST Population (%)		1.27		

Source: Primary Census Abstract, Census of India, 2011

193. **Average Household Size:** The Mandi district has an average family size of 4.5 persons per household as per 2011 census. This is a moderate family size and comparable to the average household size of state as a whole.

194. **Population Density:** The density of population works out to about 253 persons per Sq. Km, in the district.

195. **Working Population:** According to Census 2011, the total workers including main and marginal workers constitute 57.30 % of the total population of the district. Of the total workers, the share of the main workers is 28.40 % and the marginal workers are 28.90 %. The remaining 42.70 % population belongs to the category of non-workers. The work force participation rate in the rural area is 58.66 % and urban is 36.65 % and overall average workforce participation 47.65 %.

Table 4-43: Social Amenities within Mandi District

S. No	Particulars	No's
1	Primary School	270
2	Middle School	129
3	Secondary School	61
4	Government Colleges	2
5	Community Health Centers	4
6	Primary Health Centers	2
6	Primary Health Sub-Centers	21
7	Maternity and Child Welfare Centers	3
8	Veterinary Hospitals	17
9	Hand Pumps	35
10	Post Offices	25
11	Commercial Banks	5

196. **Corridor of Impact/ Direct Impact Zone:** The Project impact zone for social impact assessment is considered as 10m on either side of the road along corridor due to the widening & upgradation of project and in the adjoining buffer areas. The social surveys were carried based on the above consideration, which is more than required RoW to determine the social changes and to draw upon maximum impacts within Project Impact Zone.

197. **Project Influence Area (PIA):** The PIA for social assessment to study the potential social issues and impacts has been considered as 15km on either side of the 28 km long project corridor and includes 26 villages in Mandi and Baldwara Tehsils.

198. **Socio Economic Characteristics of PIA:** Development of infrastructure projects like National Highways/State Highways improvements and upgradation of the existing roads will have significant impacts on the standard of living of the people, their assets, livelihoods, and way of life, health, wellbeing, culture and community. Planned development project impacts could be negative, as well as positive. The socio-economic assessments seek to identify the impacts of the proposed project and focus on the ways and means to minimize the incidents of negative impacts and suggest the mitigation measures. Therefore, it is vital to understand the existing baseline socio-economic scenario in the study area to analysis the magnitude of the possible impacts. The socio-economic profile of the PIA is summarized hereunder.

4.8.7 Demography, Socio-Economic Profile and Social Amenities of PIA

199. The sociological aspects include human settlements, demography, and social strata such as Scheduled Castes and Scheduled Tribes and literacy levels besides infrastructure facilities available in the study area. The economic aspects include occupational structure and income levels of workers. The

following profile comprises of the study area. The Village Wise - Census & Socioeconomic Details are placed in **Appendix-12**.

- The total population of 26 villages and adjoining Baldwara Tehsil within the PIA is 41801, of which, male population is 21212 (50.75%) and the female population is 20589 (49.25%). This shows that the female population more or less equal in ratio. In Panolu & Randhara villages, female population is 10% higher than the male population as per census 2011.
- Of the total study area population, 0.94% (394) consists of Scheduled Tribes, 22.02% (9204) are of the Scheduled caste population and 77.04% (32203) belong to other castes.
- Majority of the population are Hindus (98.20%), followed by Muslims (0.92%) Sikhs (0.53%) and Buddhists (0.32%) respectively.
- The Schedule Tribe population within PIA is merely 0.94% and at district level it is 1.27%. The ST population are already integrated into mainstream society with lifestyles and living standards, high literacy rate and occupation of mainstream population.
- Among the total population, 80.82% (30668) are literate and 19.18% (7277) are illiterate. This excludes the 0-6 age group. This shows that more than half of the population is literate.
- Among the literates, 52.26% (16028) are males and 47.73% (14640) are females. This shows that the male literates are more than the female literates.
- The PIA has an average family size of 4.2 persons per household as per 2011 census. This is moderate family size and comparable with that of the district and state.

200. The project road passes through 26 villages in Mandi district. Of the total population, 96% reside in the rural areas and predominantly an agrarian society. Availability of basic education and access to health and hygiene are fairly present, women form almost half of the population and contribute equally to daily activities. The project road has both positive and negative impacts and can contribute directly or indirectly to enhance the rural livelihood and increases mobility, communication, agricultural production and open up alternative non- farm employment, more diversified sources of income. The socio-economic assessment seeks to identify the impacts of the project road widening and upgradation focus on the ways and means to minimize the incidents of negative impacts and suggest the mitigation measures. Therefore, it is vital to understand the existing baseline socio-economic scenario of the direct project impact zone as well as PIA to analysis the magnitude of the possible impacts. The socio-economic profile of the impact zone is presented as follows:

4.8.8 Profile of Project Affected Families/Households

201. At the household level, the social and census surveys were carried out along the entire corridor of impact/project impact zone and covered all the 18/16¹¹ households. Individual household surveys helped to collect the fairly reliable data with respect to the dominant livelihood source, family income and expenditure, education and health status, basic amenities availability, lifestyle and standards of living etc. All the surveyed households are staying along the corridor impact zone of RoW, since more than 10 years. The composition of surveyed households is summarized in **Table 4-44**. Analysis on literacy level of the surveyed households indicates nearly 95.46% of them are literates except a small percentage (4.54%) of illiterates. The average household size for the project affected population is 4.38, which is comparable to that of district and state. The census and socio-economic survey of the likely PAF's/PAH's outcomes are placed in **Appendix-13**.

Table 4-44: Composition of Surveyed Project Affected Families/ Households

Particulars	Description	No's	% of total
Population	Male	33	41.77

¹¹ Out of total 18 households only 16 participated in socio-economic survey. The remaining two head of HH's migrated on work to other states.

Particulars	Description	No's	% of total
	Female	46	58.23
	Total	79	100.0
Religious Group	Hindu	18	100.0
	Muslim	0	0.00
	Sikh	0	0.00
	Total	18	100.0
Caste/Social Group	General	16	88.89
	BC	0	0.00
	SC	2	11.11
	ST	0	0.00
	Total	18	100.0
Family Type	Joint	7	38.88
	Nuclear	9	50.00
	Not Available	2	11.11
	Total	18	100.0
Years of stay	Up to 10 years	8	44.44
	11 to 20 Years	1	5.56
	21-50 Years	5	27.78
	Above 50	2	11.11
	Not Available	2	11.11
	Total	18	100.0
Education level of surveyed PAF's/HHs	Illiterate	3	3.80
	Primary	3	3.80
	Secondary	36	45.57
	Higher graduate	22	27.85
	Professional	2	2.53
	Others	13	16.46
	Total	79	100.00

Source: Primary Social Surveys, ESIA Nov-Dec 2020

202. **Economic Profile:** Occupation wise, 17.72% of PAH/F's are engaged in service sector (private and government employees), 11.39% are engaged in commercial activities like trade/business, 6.33% are into agriculture. The occupational profile of likely Project Affected Families/ Households is given in **Table 4-45**.

Table 4-45: Occupational Profile of Project Affected Families/ Households

Particulars	Description	Nos	% Total
Occupation of PAFs	Agriculture	5	6.33
	Trade/Business	9	11.39
	Govt. Service	6	7.59
	Private Service	8	10.13

Particulars	Description	Nos	% Total
	Unemployed	24	30.38
	Students	13	16.46
	Household Family Duties	14	17.72
	Total	79	100.0
Monthly Income of PAFs/HHs	<10000	2	11.11
	10001 - 20000	9	50.00
	>20000	5	27.78
	Not Available	2	11.11
	Total	18	100.0

Source: Primary Social Surveys, ESIA Nov-Dec 2020

203. The income levels of majority of the 16 households (50%) fall under higher middle-income category earning 10,000 to 20,000 per month. The lower-income families are about 11.11% who earn less than 10,000 rupees per month and 27.78 % are in higher income group, earning more than Rs. 20,000 per month.

204. The expenditure pattern of the surveyed project affected households indicate that majority of them are having an average monthly expenditure less than 10,000 per month. The monthly expenditure detail of Project Affected Families/ Households is given in **Table 4-46**.

Table 4-46: Monthly expenditure Pattern of Project Affected Families/ Households

Monthly Expenditure (Rs)	Description	No of HHs	% of HHs
	<10000	16	88.89
	10001 - 20000	00	0.00
	>20000	00	0.00
	Not Available	2	11.11
	Total	18	100.0

Source: Primary Social Surveys, ESIA Nov-Dec 2020

205. The social survey includes information on household's assets for inferring the consumption pattern/standard of the households, their possession of various consumer durables. All the families have minimum standards of living, which can be seen from **Table 4-47**. Out of the total 18 surveyed households, 88.89% possess TV, 66.67% fridge and 55.56% possess washing machine and 100% of PAF's/HHs have mobile phones.

Table 4-47: Number of Project Affected Families/ Households with Assets

S. No	No of HH with Assets	Total	%
1	Television	16	88.89
2	Refrigerator/Fridge	12	66.67
3	Washing Machine	10	55.56
4	Geyser	5	27.78
5	Cycles	5	27.78
6	Two-Wheeler	6	33.33
7	Four-Wheeler	7	38.89

S. No	No of HH with Assets	Total	%
8	Mobile (cell Phone)	18	100.00

Source: Primary Social Surveys, ESIA Nov-Dec 2020

206. Out of the 16 households surveyed, 4 families (25%) have availed loan from banks for various purposes; interestingly they have not borrowed from the any private money lenders as given in **Table 4-48**.

Table 4-48: Debt levels of PAF's/ Households

Purpose of Borrowing	Source of Borrowing	No of HH's
Agriculture	Bank	1
Commercial	Bank	1
House Construction	Bank	1
Education	Bank	1
Total		4

Source: Primary Social Surveys, ESIA Nov-Dec 2020

207. **Health Status:** Data on health status of PAFs/PAHs indicate nearly 1 family has reported that 1 PAP is handicapped by birth and another family reported about the other chronic disease (**Table 4-49**), although no major illness has been reported in the social survey.

Table 4-49: Health Status of PAPs

S. No.	Health Status of PAFs	Number	%
1	Handicapped by Birth	1	50.00
2	Other Chronic Disease	1	50.00
	Total	2	100.0

Source: Primary Social Surveys, ESIA Nov-Dec 2020

4.8.9 Status of Women

208. Over the last five decades, the gender wise decadal¹² population of females is showing an increasing trend than the male population with an average of 19.92%. Status of the women had made a good progress in Himachal Pradesh. Women complete higher level of secondary school as compared to many other states in India. The average sex ratio in the PIA is 970 females per thousand males, which is lower the district sex ratio of 1007. Women within PIA also have a good literacy rate of 47.73%, although marginally lower as compared to male population.

209. A hill women's life is extremely busy from early morning to late evening and sometimes even till late at night. They work side by side with men in agriculture and their role is as important in the field as well as at home. From PAFs/PAHs, it has been observed the males constitute 50.75% and females are 49.25%, indicating female population is more or less equal. From the Surveyed families, in which 46 women members were involved in more than one activity (cultivation, dairy, poultry, sheep rearing, trade & business, household work etc.); all women (100%) members take care of household activities like any other women member across the country. Most women are engaged in multiple activities in the daily life and the percentage of their involvement in various activities are given in **Table 4-50**: During consultations, it came out that women are aware about the health problems and do take advice on gynecological problems and women related health issues in nearby health centers.

¹² Source: Gender Statistics, Himachal Pradesh, DoES, Shimla

Table 4-50: Engagement of women in economic and non-economic activity

S. No	Engaged Activities by Women	% of Women PAFs
1	Agriculture activities	1
2	Agricultural labour,	0
3	Non-Agricultural labour	0
4	Trade & business,	2
5	Govt. Services	3
6	Private Services	2
7	Household duties including cooking	36
8	Old/Young	14

Source: Primary Social Surveys, ESIA Nov-Dec 2020

210. The survey of PAH's/PAH's also included information related to involvement of women in various family financial matters to understand the level of involvement of women members in family financial matters and decision-making process. The survey indicates that majority of women in PAF's/PAH's have a say or are involved in decision making in all family matters, most dominant one's education of children, health care, purchase of assets, attending social functions etc. as per the details given in **Table 4-51**.

Table 4-51: Involvement of women in Decision Making of Family Matters

Decision making		Total PAFs
Education	Yes	15
	No	1
	Not Available	2
Health	Yes	15
	No	1
	Not Available	2
Financial	Yes	15
	No	1
	Not Available	2
Assets	Yes	15
	No	1
	Not Available	2
Day Activities	Yes	15
	No	1
	Not Available	2
Attending Social Functions/Engagement	Yes	15
	No	1
	Not Available	2

Source: Primary Social Surveys, ESIA Nov-Dec 2020

211. The project road widening will improve the accessibility to education, health, employment, tourism and trading opportunities and is expected to contribute towards alleviation of poverty. The project road widening will help to increase new economic and employment opportunities by providing improved linkages to markets, production centers and other areas of economic opportunities. As a result, people will have wider options in buying and selling their commodities. The villagers would be able to transport their produce faster and get more profit margins instead of depending solely on local markets and middlemen. Women will especially benefit, since their mobility will be augmented both in terms of access to social services, as well as access to higher levels of schooling. Women's access to higher levels of health care outside the village particularly during the time of childbearing will also improve considerably. Hence, the proposed Project will bring in economic and social changes in the area, which in turn would bring economic prosperity and would lead to poverty alleviation.

212. **Programs and Policies:** As part of socio-economic assessment, income generating schemes that are operational in Himachal Pradesh have been compiled and are summarized in **Appendix-14**. These would be considered in the preparation of RAP, as income generating measure for convergence possibilities as extra assistance measures, if warranted.

5 STAKEHOLDER CONSULTATIONS & INFORMATION DISCLOSURE

5.1 Stakeholders Consultations

213. The public/stakeholder consultations conducted as a part of environmental and social impact assessments for the road widening and upgradation along the Mandi-Rewalsar-Kalkhar corridor are summarized in this section. Consultations were held with communities at conspicuous locations like settlement areas, realignment sections, heritage sites, sensitive areas, hotspots, public administrative offices etc. to take into consideration the stakeholder inputs and aspirations, to identify impacts in finalization of the project designs.

214. During consultations due attention was given to discuss the concerns and the needs of the vulnerable population. In addition, while conducting census and socio-economic survey, the likely to be affected vulnerable populations (SC, ST etc.) were consulted on one-to-one basis and collected their views and responses, which helped to understand their status in the society, education, occupation income level etc.

215. During the consultation, the following project information was disseminated to participants: -

- i) Project Development Objective of HPSRTP including a background on HPSRP (Phase 1) which has since successfully completed by HPRIDCL.
- ii) Typical Cross Sections for the project road widening scheme along rural and settlement areas.
- iii) Land Acquisition Act of 2013(RFCTLARR), GoHP provisions for compensation and assistance as per approved RPF
- iv) Safety measures considered in the project road design.
- v) Likely beneficial and adverse impacts arising due to project road improvement

216. The Stakeholder Consultations elicited following from participants:

- i) Views on the project especially the probable adverse impacts.
- ii) Possible mitigation measures in case of adverse impacts.
- iii) Means of better delivery of compensation and assistance.
- iv) Assurance from the project authority not to marginalize people by depriving them of their livelihoods.
- v) Provision of infrastructure such as drinking water and toilets etc., whenever warranted.

217. Through public participation, stakeholder's viewpoints and suggestions were captured as an input to the technical design, which were duly considered, and all the suggestions were incorporated in the project design to the extent feasible and /or warranted.

218. Key issues raised from the consultations were relating to:

- a) Extent of compensation to be paid for PAPs
- b) Avoid/mitigate impacts on CPRs such as temples, schools etc. some are averse to shifting of temples and most people have expressed willingness for relocation of the temples to adjacent locations for road widening.
- c) Have indicated concern on losing their houses/properties/lands in case of the road widening taking place beyond existing RoW.
- d) Have expressed to preserve or improve the natural water resources and does not want to lose such water sources due to road widening.
- e) People are aware that several locations along the road have been encroached the RoW by adjacent landowners but have no serious concerns for removal/clearance of such encroachments but expect advance information for such removal of encroachment.

- f) To consider available open lands wherever it was possible instead of impacting private lands and structures.
- g) Safety measures near hospital and school zones; construction works should lead to jobs.
- h) Participants suggested that project should have provisions for parking areas in urbanized sections of road; project should take up the structural works (bridges and culverts) on priority during the early phase of the project cycle or otherwise these works mostly gets delayed
- i) Provide for noise barriers to minimize the noise pollution near schools and hospitals; additional assistance for employment/ income restoration for locals; and necessary measures to be taken during the construction stage to reduce and/avoid pollution and health risks during construction phase.

219. The aspirations and concerns captured during stakeholder’s consultations were duly shared with the DPR consultant team for incorporation in the project road design. While DPR consultant have been able to incorporate most of the aspirations and concerns of the stakeholders, certain issues which could not be integrated into the project design. The issues which have been incorporated into the design were as hereunder:

- i. Improvement or widening of road, which is also project objective.
- ii. Provision of footpaths in market and major settlement areas
- iii. Provision of drains along the road, as per requirement
- iv. Bus Stops (locally known as rain shelters), wherever existing ones are damaged or in dilapidated condition and at places no shelter exist, with provision for disabled friendly ramps and baffle bars to prevent stary animals entering the shelter area
- v. Minimize impacts on structures, natural water resources, religious places, to the extent possible
- vi. Provision of crash barriers at all deep valley stretches of road to prevent fatal accidents
- vii. Provision of Cross drainage structures across seasonal streams to facilitate drainage
- viii. Improvement of some stretches, which are prone to accidents or dangerous due to sharp curves
- ix. Improvement of Junctions at Kalkhar and other similar junctions along road

220. The issues which could not be addressed in the project road design were (a) Provision of land for bus stand (b) Parking facility at local market of Rewalsar, which are beyond the jurisdiction limit of HPRIDCL. The summary of stakeholder consultations at different locations along project road and outcomes are given in **Table 5-1 and Table 5-2**. The photographs taken during stake holder consultations and list of attendees of stakeholder consultations are given in **Appendix-15**.

Table 5-1: Summary of Stakeholder Consultations

S. No	Consultation Date, Place and No. of Participants	Issues Discussed and Outcome of Public Consultations
1	<p>Place: Kunthaya Gram Sewa - Rewalsar</p> <p>Date: 13.09.2019</p> <p>No. of Participants: Total 13 (Male 6, Female 7)</p>	<ul style="list-style-type: none"> • The Road is congested and requires improvement. People are very happy with the Govt initiative. • There should be no loss to the properties of the people, as adequate width is already available on roadside. • Road development will improve the socio-economic conditions of the people. During construction phase also people will be benefitted as they are likely to get jobs/small contracts. • There must be provisions for the parking in new road design. • Drainage must be provided on upgraded road. • Bus stops including bus lays must also be provided on improved road. • There is availability of nullahs (seasonal) or some permanent waterfall, accordingly water can be harvested for construction purpose. • Stray animals are found along the road. These are prone to an accident, especially in nights. Wild pig and monkeys destroy agricultural crops.
2	<p>Place: Vyapar Mandal Rewalsar</p> <p>Date: 13.09.2019</p> <p>No. of Participants: Total 10 (Male 10, Female 0)</p>	<ul style="list-style-type: none"> • The Road is congested and requires improvement. People are very happy with the Govt initiative. • Shops in the market area, if damaged or acquired for construction will directly affect the livelihood of the shopkeepers. There should be no loss to the properties, as adequate width is already available on roadside. • Rewalsar town has high potential for tourists and most of tourists are Buddhists. There is a huge gathering of Buddhists during Chheju fair in February every year. Mata Naina Devi temple is also a very famous tourist's attraction and visited by thousands of people, especially during Navratri every year. • Land for bus stand and parking area have already been identified by Govt. in Rewalsar town. Project road design must also have provisions of parking along the roadsides. • Crash barriers must be installed on improved road to avoid any accidents. • The road is prone to landslide and areas like Majheli and Trambi Nala needs some protection measures along in valley sides. Retaining/breast walls must be provided, wherever required in project design.

S. No	Consultation Date, Place and No. of Participants	Issues Discussed and Outcome of Public Consultations
3	<p>Place: Zangdok Parli Rewalsar</p> <p>Date: 14.09.2019</p> <p>No. of Participants: Total 9 (Male 9, Female 0)</p>	<ul style="list-style-type: none"> • People are very happy with the government's move to improve the road. • Road is very important as lots of Buddhist around the globe visit Rewalsar. Every month on 10th is celebrated as anniversary of Buddhist Guru Padmsambhava. There is a Kumbh celebration after every 12th year and this leads to huge gathering of the people. • The existing road lacks in parking provisions. • Solid waste management is an issue. • Either no drain on the existing road or these are choked. Improved road must have provisions of solid waste disposal, parking and drainage provisions. • The road around the Rewalsar Lake is used by tourists and local people a lot. If project have availability of funds, then this road must be provided with footpath (including railings), so that there is safe movement of the people, especially people of old age. • Stray animals/dogs are also found frequently around Rewalsar lake, threat to old people/woman.
4	<p>Place: Lomus Taxi Union, Rewalsar</p> <p>Date: 14.09.2019</p> <p>No. of Participants: Total 13 (Male 13, Female 0)</p>	<ul style="list-style-type: none"> • Existing road is prone to an accident. safeguard measures like crash barriers etc must be provided in improved road • Major and minor junction development are to be taken up and should have traffic signals. • Information boards needs to be provided along the road. • Existing culverts are narrow and needs to be widened. Sometimes, during the rainy seasons water flows over the road at such locations. Road should have enough room in culvert locations to avoid accidents • Provision of new bus stops with bus bays at appropriate locations • The new road should have parking provisions. A govt. land, just 1 Km prior to Rewalsar town can be used as debris disposal area and further can be developed as a parking. • A lot of stray animals/dogs are encountered on the road. Some safeguard measure must be adopted to avoid animal-traffic collisions. • Trees must be planted along roadside.

S. No	Consultation Date, Place and No. of Participants	Issues Discussed and Outcome of Public Consultations
5	Place: Local people at Kalkhar Date:13.09.2019 No. of Participants: Total 14 (Male 12, Female 2)	<ul style="list-style-type: none"> • The existing road is very congested and has no drainage provisions. The new road should be wide with drainage provisions. • The road is prone to an accident and frequent traffic collisions have been reported. • The junction at Kalkhar must be developed. • There must be provisions of parking at Kalkhar. There is a huge potential of tourism in this area. Rewalsar Lake has religious importance and is visited by the people of all religions. There is a very famous temple of Mata Naina Devi uphill and visited by thousands of people every day during Navratri festival. Hence parking provisions along the road must also be improved.

Table 5-2: Summary Outcome of Consultations and Issues Discussed

S No.	Issue Raised/ Discussed	Location/Date	Stakeholder/People's Perceptions/ Suggestions	Recommendations/ Mitigation Measures
1.	Relocation of Religious Structure at Kalkhar junction	At Gram Panchayat / 30.09.2019 Total Participant 16, Male 13, Female-3	The Religious Structure at the Kalkhar junction attracts pilgrims from various villages and requested not to disturb. Participants suggested that every affected religious property (partially or fully) must be modified/relocated and enhanced properly prior to the commencement of work.	Religious structure at the junction will not be disturbed and improvements will be proposed within the existing ROW and additional developments will be planned. Relocation/shifting of the temple to adjacent locations are considered prior willingness of people through consultations. The cost of construction/ relocation will be borne through project.
2.	Relocation of the Households/ PAF's At Rewalsar, 22+500	At Panchayat 22.09.2019 Total Participant 15, Male 10, Female-5 (Group Discussions)	Participants requested not to disturb the settlements & shops in the built-up area and proposed to take alternatives. The people requested to find the alternatives to minimise the impacts on their properties.	The built-up location in the rolling hilly terrain has environmental constraints and indulges in heavy costs during constructions. As suggested the alternatives were considered for widening within the available RoW to minimize the impacts. Compensation will be paid as per the RFP. .
3	Relocation of the commercial and residential structures @0+000 to 1+400	At Mandi 26.09.2019 Total Participant 30, Male 22, Female-8 (Group Discussions)	Participants requested not to widen along Mandi urban section. A relocation of about 150 structures is to be adversely affected due to the proposed project and it was informed not to take proper measures to minimize the impacts.	The build-up location in Mandi is densely populated, hence, to avoid the social constraints. It was proposed to do only Overlay at the section without any improvements.
4.	Compensation payment procedure	At all locations 25.09.2019	The compensation rates should be as par at market rates	Compensation for land, structure and other properties shall be paid as per RFCTLARR Act 2013 and Government of Himachal Pradesh Land Acquisition Rules.
5.	Road safety	At all locations 26.09.2019	The proposed intermediate lane road may be concern for safety specifically for women and children, accident risk will increase	Proper road safety measures are incorporated in the project design. Road safety measures like signage, speed breakers near schools, hospitals and marketplaces will be provided in project road design.

S No.	Issue Raised/ Discussed	Location/Date	Stakeholder/People's Perceptions/ Suggestions	Recommendations/ Mitigation Measures
6.	Provision for under pass / foot over bridges at junctions, school zones, pedestrian crossing, cattle crossing	At all locations 25.09.2019	Pedestrian crossing, cattle crossing should be provided at every habitation. Provision for foot over bridges /under pass at the sensitive areas.	These will be provided as per the design considerations of road safety measures and will be provided where it is very necessary. No under-passes/foot over bridge are proposed/considered.
7.	Provision of employment/ income restoration to the affected household	At all the locations 26.09.2019	Additional assistance for employment/ income restoration for locals	Employment in the road construction work as skilled, semi- skilled and unskilled workers made available to extent possible. Preference will be given to locals in road construction work. During the operation stage, as per the HPRIDCL direct and indirect employment will be generated in the rural areas.
8.	Provision of roadside drains, Retaining walls.	At all locations 26.09.2019	Roadside drains are not working properly as it has been choked or damaged at some locations. Cross drainage should also be provided.	At every urban location and slopes/hilly region proper drainage system has been considered in project road design.
9.	Relocation of Water Tank/ Well/ Hand Pumps	At habitation site 26.09.2019, 27.09.2019	Majority of the people living along the project corridor depend on water tank/ hand pump for drinking water and disposal of these will especially affect women folk.	All community property resources which will be affected by project road design will be replaced/restored.
10.	Public toilets at marketplaces	At marketplaces 22.09.2019	Lack of public toilets (ladies' toilets) at marketplaces as well as near bus stops	Included and this requirement will be evaluated and incorporated in project road design. However, there will be an Operation and Maintenance issue
11.	Pollution and health risks at the time of construction work	At all locations 25.09.2019	Necessary measures to be taken during the construction stage.	Mitigation measures in the management plan to be followed by the contractor and necessary measures to be taken to mitigate the impacts on natural resources.

5.2 Consultations on Gender Based Violence

5.2.1 GBV Consultation Approach and Methodology

221. Community consultations need to be carried out so that those affected by the project are properly informed, and to understand the types of Gender Based Violence (GBV) risks that are present in the community, particularly those, which may be exacerbated by the project. Consultations are important in managing risks and should be a continuous process throughout the project life cycle.

- Desk work through secondary source of information addressing GBV. Individual survey teams initially had done the reconnaissance survey prior to conduct of consultations in the project corridor and identified the hot spots, potential women groups, adolescent girls, female labours, community women, panchayat members, women pradhan and ward members, anganwadi and asha workers, teachers, schools in the settlement areas, tourist places, marketplaces, villages along the project corridor.
- GBV consultations were carried out between 01st to 08th November 2020, at different locations in Mandi – Rewalsar – Kalkhar road to assess risks associated with women, children and any other potential risk groups.
- Prior intimation was given to the members for informed participation and spirited discussions.
- Consultations with community members were carried out in identified Hot Spots to provide information on GBV, available redressal systems for incidents of sexual harassment and abuse and, to identify key concerns and aspirations across gender and socio-economic groups in the community.
- Preparation of the GBV consultations report which includes identifying potential risks; mitigation measures; prevention and responses strategy; key actions have been taken.

5.2.2 Consultations and FGDs on Gender Based Violence

222. Keeping in view of the previous experiences and apprehensions during construction activities in other projects, participants were informed about the workers/labours, employees from outside states to work at the construction site. They reside in camps, nearby settlements or at rented accommodation within the local villages and are highly mobile on their day-to-day activities. Hence, women and children from the local community are at the risk of exploitation and abuse.

223. During the consultations, the local community members have expressed concerns about road safety along the road for pedestrians particularly for women and school going particularly adolescent girls. Discussions also highlighted the issue of migrant labourers during the construction activities live and work in close proximity of hotspots where women and children are prone to high risks of exploitation and abuse. The summary of consultations and FGDs on GBV and outcomes are given in **Table 5-3**. The photos taken during stake holder consultations along project road and list of attendees of GBV consultations are given **Appendix-15** respectively. The attendance sheet of GBV consultations and photographs are given in **Appendix-16**. The checklists for community consultation and gender-based focus group discussions are also placed in **Appendix-17 and 18**.

Table 5-3: Summary of GBV Consultations

S. No	Consultation Date, Place and No. of Participants		Issues Discussed and Outcome of Public Consultations
1.	Date	03-11-2020	<ul style="list-style-type: none"> • Women actively participated in the discussions of GBV. • They are very happy with the Govt. initiative and assured to share this information with other women and girls in the community.
	Name of the Road	Mandi-Rewalsar-Kalkhar	
	Chainage in Kms	28+280	
	Name of the Place	Kalkhar	
	District	Mandi	
	Taluka/Tehsil	Rewalsar	

S. No	Consultation Date, Place and No. of Participants		Issues Discussed and Outcome of Public Consultations
	Time	1:30 PM	<ul style="list-style-type: none"> Few women members are not aware about the complaint mechanism or help line service on domestic violence or sexual harassment. During the consultation participants informed that there was no specific incident on GBV reported in their community earlier.
	No. of Female Participants	7	
2.	Date	03-11-2020	<ul style="list-style-type: none"> Participants informed that they had no information on GBV risks and no one discussed with them on this before. They were very happy with the project initiative and assured to oversee risks associated with women and girls as discussed at the meeting. Women and adolescent girls of other villages will also be made aware. Women became aware about the possible risks at the hotspots during the project construction stage due to discussions on GBV. It is reported that there is no Mahila Mandal or any self-help group in that village, where women can have a platform for their empowerment.
	Name of the Road	Mandi-Rewalsar-Kalkhar	
	Chainage in Kms	26+910	
	Name of the Place	Garodu (gararu) Chahri	
	District	Mandi	
	Taluka/Tehsil	Rewalsar	
	Time	11:00 AM	
	No. of Female Participants	9	
3.	Date	03-11-2020	<ul style="list-style-type: none"> The participants assured that they will follow the information as given to them and made aware to other women and girls in the community. Women shared an incident that took place in the past; about a local girl being eloped by an outsider and the community fought to bring her back. They complained to District officials and demanded legal action against the offender. However, girl was rescued and brought back safely. They were happy with the Govt. initiative and thankful for the information provided.
	Name of the Road	Mandi-Rewalsar-Kalkhar	
	Chainage in Kms	10+060	
	Name of the Place	Randhara	
	District	Mandi	
	Taluka/Tehsil	Sadar	
	Time	03:10 PM	
	No. of Female Participants	11	
4.	Date	03-11-2020	<ul style="list-style-type: none"> During the meeting, the women listened attentively on GBV and it was observed that they were unaware of basic information on GBV. During the discussion on GBV risk, the women informed no incidents of violence/abuse reported in the village before but if people migrate from other states for construction work, then they will be cautious according to the information provided.
	Name of the Road	Mandi-Rewalsar-Kalkhar	
	Chainage in Kms	27+480	
	Name of the Place	Gararu	
	District	Mandi	
	Taluka/Tehsil	Rewalsar	
	Time	11:50 AM	
	No. of Female Participants	10	
5.	Date	04-11-2020	<ul style="list-style-type: none"> It was observed that they were hesitating to share their personal experiences and concerns related to the domestic violence within the family and village. It has been observed that a section of women is aware about the daily incidents of sexual abuse.
	Name of the Road	Mandi-Rewalsar-Kalkhar	
	Chainage in Kms	19+940	
	Name of the Place	Saphru	
	District	Mandi	

S. No	Consultation Date, Place and No. of Participants		Issues Discussed and Outcome of Public Consultations
	Taluka/Tehsil	Sadar	
	Time	11:00 AM	
	No. of Female Participants	15	
6.	Date	04-11-2020	<ul style="list-style-type: none"> • They were happy with the Govt. initiative and assured to share information on awareness on VAWG with other women and girls in the community. • No incidents on GBV reported in their community earlier. • It has been observed that some women are aware about the daily incidents of sexual abuse.
	Name of the Road	Mandi-Rewalsar-Kalkhar	
	Chainage in Kms	09+270	
	Name of the Place	Randhara	
	District	Mandi	
	Taluka/Tehsil	Sadar	
	Time	01:00 PM	
	No. of Female Participants	14	
7.	Date	04-11-2020	<ul style="list-style-type: none"> • Participants informed that they had no knowledge or information on discussion about GBV. • It was reported that no Mahila Mandal or any self-help group in the village formed to have a common platform for problem solving and decision making.
	Name of the Road	Mandi-Rewalsar-Kalkhar	
	Chainage in Kms	08+700	
	Name of the Place	Hanuman Mod	
	District	Mandi	
	Taluka/Tehsil	Sadar	
	Time	04:00 PM	
	No. of Female Participants	11	
8.	Date	05-11-2020	<ul style="list-style-type: none"> • Teachers and adolescent girls participated in the discussions of violence against women and girl (VAWG), sexual harassment and eve teasing etc. • Information and knowledge were shared, awareness provided about the gender-based violence. They felt thankful and assured to share the same information with their family members and friends in the community. • Participants were advised to report incidents on sexual abuse to their family members, teachers, and project authorities or lodge a complaint to public officials with the help of community members. For immediate response to call women's Helpline no. 1100, 1098.
	Name of the Road	Mandi-Rewalsar-Kalkhar	
	Chainage in Kms	22+570	
	Name of the Place	Unity Public School, Rewalsar	
	District	Mandi	
	Taluka/Tehsil	Sadar	
	Time	10:00 AM	
	No. of Female Participants	3 Teachers and 35 Girl Students	
9.	Date	05-11-2020	<ul style="list-style-type: none"> • Participants informed that they had no knowledge or information on discussion about GBV. • It was reported that Mahila Mandal or any self-help group in the village was not formed to have a common platform for solving problems.
	Name of the Road	Mandi-Rewalsar-Kalkhar	
	Chainage in Kms	24+040	
	Name of the Place	Galu	
	District	Mandi	
	Taluka/Tehsil	Sadar	
	Time	11:30 AM	

S. No	Consultation Date, Place and No. of Participants		Issues Discussed and Outcome of Public Consultations
	No. of Female Participants	15	
10.	Date	05-11-2020	<ul style="list-style-type: none"> Discussion with the Station House Officer revealed that complaints received were mostly on domestic violence. They are referred to family counsellor or District family courts on disputes. However, issues related to serious crime such as rape, abduction and murder are very low. A lady officer referred to an old incident of an outsider eloped a local girl within the limits of the Hatli police station. Apparently, the girl was safely brought back and handed over to the family members.
	Name of the Road	Mandi-Rewalsar-Kalkhar	
	Chainage in Kms	23+030	
	Name of the Place	Rewalsar Police Chowki	
	District	Mandi	
	Taluka/Tehsil	Sadar	
	Time	11:30 AM	
	No. of Female Participants	9 (Male & Female)	
11.	Date	06-11-2020	<ul style="list-style-type: none"> Teachers and adolescent girls participated in the discussions of violence against women and girl (VAWG), sexual harassment and eve teasing etc. Information and knowledge were shared, awareness provided about the gender-based violence. They felt thankful and assured to share the same information with their family members and friends in the community. Participants were advised to report incidents on sexual abuse to their family members, teachers, and project authorities or lodge a complaint to public officials with the help of community members. For immediate response to call women's Helpline no. 1100, 1098.
	Name of the Road	Mandi-Rewalsar-Kalkhar	
	Chainage in Kms	04+180	
	Name of the Place	Govt. Sen. Sec. School, Talyahar	
	District	Mandi	
	Taluka/Tehsil	Sadar	
	Time	10:00 AM	
	No. of Female Participants	7 Teachers and 12 Girl Students	
12.	Date	06-11-2020	<ul style="list-style-type: none"> Participants informed that they had no knowledge or information on discussion about GBV. Women and adolescent girls of other villages did participate to know about the awareness programmes on violence on women and girls.
	Name of the Road	Mandi-Rewalsar-Kalkhar	
	Chainage in Kms	05+310	
	Name of the Place	Ghera	
	District	Mandi	
	Taluka/Tehsil	Sadar	
	Time	11:00 AM	
	No. of Female Participants	10	

5.2.3 Key Outcomes

224. In the context of this project, single women and adolescent girls living in adjoining communities along project road are at potential risks for eve teasing, stalking, harassment including sexual exploitation and abuse.

- It is anticipated that adolescent girls are quite vulnerable to the incidents of harassment, stalking and eve-teasing while going to schools, colleges, and vocational centres and women at workspaces and public places/ hot spots.
- Women are aware about the possible risk potential for them near marketplaces and liquor vends(hotspots) during the project construction phase.

- Many participants were not aware about the complaint mechanism or help line service on domestic violence or sexual harassment.
- Teachers and adolescent girls participated in the discussions on violence against women and girl (VAWG), sexual harassment and eve teasing etc. Participants were advised to report incidents on sexual abuse to their family members, teachers, and project authorities or lodge a complaint to public officials with the help of community members through women's helpline nos. 1100 and 1098.
- The Station House Officer at Rewalsar revealed that complaints received were mostly on domestic violence and they were referred to family counsellor or District family courts on disputes. However, issues related to serious crime such as rape, abduction and murder were low.

5.2.4 GBV Risk Mitigation Strategy/Action Plan

225. Although no incidents of GBV were reported during the consultations, GBV risk mitigation measures are to be implemented near all hot spots and closely monitored during entire project cycle. Migrant women labourers may also be vulnerable if adequate safety and security measures are not undertaken at work sites and within labour camps. Suitable work conditions for women's participation includes gender-equal wage rates, safety & security issues with GRM mechanism, childcare facilities, health and sanitary requirements and separate toilets for women, and temporary housing for families of labourers during the construction work at the labour camp site with strict compliance to availability of water and sanitation facilities. Strict adherence to child labour norms should be followed.

6 ANALYSIS OF ALTERNATIVES

6.1 Considerations for Alternatives

226. Environmental and social impact assessment during project design stage helps to minimize, reduce or mitigate potential negative impacts of project action and enable to enhance positive impacts, sustainability and development benefits. Although many benefits are expected from the project, social assessments have identified potential adverse impacts on the immediate roadside communities and directly affected by project construction and operation. These impacts include loss of land, assets and associated impacts.

227. In accordance with the principle of mitigation hierarchy for management of E&S risks and impacts, analysis of alternatives has been considered to reduce such potential direct negative E&S impacts of the project. Recommendations have also been made for incorporation at the project preparation (DPR) stage itself from technical, environmental and social impacts perspective. This section summarizes the various alternatives evaluated.

228. Public Consultations were held with the local people, likely project affected population, community leaders and government officials, wherever the negative impacts are likely to be high in order to find out the alternatives to minimize the impact. With the help of the survey and consultations and engineering inputs the mitigation measures have been worked out. Mitigation measures largely focused on settlement areas along the road or zones of potential impacts. The recommendations of the stakeholders have been incorporated in designs, wherever feasible.

229. Road design considerations to minimize or mitigate risks impacts included:

- Restrict the widening/ upgradation of project road to the available right of way and avoid fresh land diversion, subject to meeting the geometric design criteria adopted for project road.
- Avoid/minimize social impacts by considering alternate design considerations and alignment options, within the available right of way to the extent possible or feasible.
- Avoid direct impacts on natural resources/ springs/ community water resources, sensitive receptors and religious shrines or structures.
- Balance the cut and fill quantities through optimization of hill cut operation, limiting height of retaining walls (upto 4m max) and reclamation of low-lying areas within RoW and/ or reuse of excavated materials to the extent possible or feasible.
- Minimize land requirements for muck/ debris disposal.
- Providing suitable road calming and safety measures such as rumble strips for speed reductions and noise barriers near sensitive receptors like schools and hospitals.

6.2 Alternative Analysis Option – No project scenario

230. The project road at present has 1318 PCUs (as of year 2019), which is expected to reach 6151 PCUs by year 2038, warranting widening of the existing single lane to intermediate lane and two lanes configuration in accordance with LoS recommended by IRC (ref. 2.4 under Section 2).

231. Unless the project road is widened/ upgraded to IRC recommended LoS, the present average speed, which is ranging between 15 to 20km/hr. (less than IRC recommended design speed for single lane) is likely to further reduce and consequently increase the travel time for the road users. With the increased traffic level over next few years, the accident rates as well as the road safety issues can be concurrently expected to worsen off and increase the level of discomfort to the road users.

232. On the contrary the project road widening/ upgradation is expected to cater to the increased traffic levels, improved riding comfort and reduced travel time for movement of agriculture produce. Thus, contributing to the economy of the region as well as the state. The project road widening can also be expected contribute to reduced GHG emission due to the improved pavement condition and

decreased travel time (ref. Table 7-9 & 7-10 under Section 7). Thus, 'no project scenario' is not a viable/desirable alternative option, which can be exercised.

6.3 Alternative Analysis Option – Balancing cut and fill quantities

233. The project road design has considered to balance the cut and fill quantity by minimizing the hill cut requirements and opting for widening of the road on the valley/ low lying sections of right of way (RoW) through construction of retaining walls and toe walls. Such an option has enabled to redeploy/ reuse the excavated materials elsewhere along the road for construction of road, culverts/bridges, drainage and protection works and reclamation of low-lying stretches along the valley side within RoW for road widening through construction of retaining walls and toe walls.

234. In addition, this consideration also enables to reduce the requirement of fresh lands for muck disposal and also reduces the need to source new construction material for construction purposes. The details are presented in 7.3.2 under Section 7.

235. The project road design has considered construction of 6980m of retaining walls (PCC/RCC)/ toe walls (2m height with exceptions of height reaching up to 5m at few locations) and 12940m of breast walls (height ranging between 2 to 5m) (ref. Table 2-14 of Section 2), has enabled to reuse excavated materials to the extent of 273343 cum (44.54%) out of the total estimated generation of 6,13,650 cum of muck/ debris in the construction of embankment, sub-grade, backfill in culverts and bridges, backfill in protection works and back filling to reclaim low lying areas within RoW (ref. Table 7-3 of Section 7)

6.4 Alternative Analysis Option – Minimizing of Environmental and Social Impacts

236. Although the project road widening is limited to the existing/ available right of way, there are minor encroachments of RoW by both title and non-titleholders at several locations along the project road. The corridor has 28 settlement areas within the total length of 28km, with an average of one settlement area per km. At every settlement area/built up/market area along RoW, various alternatives were evaluated, which can ensure project design requirement, geometric improvement requirements/considerations and concurrently limit or minimize the social impacts in terms of number of impacted structures, although many of them are minor encroachments.

237. The analysis of alternatives included both desk review of alignment design drawings and evaluation of impacted structures, followed by verification through actual field level assessments. The field assessments included on- site revalidation/measurement of offset distances from the centerline of the road to the **proposed corridor of improvement** on both left and right-hand side of the road and concurrently evaluating, whether impacted structures as per design drawing can be saved as per site conditions and all such findings of field assessments were shared with DPR Consultant team for their review/modifications in design thereof.

238. This evaluation of alternative options and modification in design such as minor localized realignments, constricting drain and shoulder widths etc. enabled to reduce the number of impacted structures from 44 to 16 (64% reduction in number of impacted structures), without significantly affecting the design requirements. Similarly, impacts on natural water sources, religious shrines/structures (Peepal tree with platforms), schools and hospitals along the project road were also assessed for avoidance or reduction of impacts, without significantly affecting the design requirements.

239. The alternative analysis enabled to avoid impacts on 2 natural water resources and 8 religious shrines but impacts on 2 religious' shrines/ small temples could not be avoided, which have been considered for relocation. The summary of impacts, impacts avoided and the impacts, which could not be avoided but minimized for structures, natural water resources, schools/hospitals, religious shrines are given in **Tables 6-1 to 6-4**. The chainage wise details of structures which were evaluated for impact avoidance are given in **Tables 6-5 to 6-7**.

Table 6-1: Structures within Corridor of Improvement of Project Road

Type of Structures	Number of Impacted Structures		Impacted Structures (final)
	As per DPR Design	Impact Avoidance after site verification/ Design Review/modification	
Residential	18	15	3
Commercial	7	4	3
Residential cum Commercial	19	9	10
Total	44	28 (64%)	16

Table 6-2: Natural Water Sources within Corridor of Improvement of Project Road

Type of Structures	Number of Impacted Structures		Impacted Structures (final)
	As per DPR Design	Impact Avoidance after site verification/ Design Review/modification	
Natural Water Resources (NWR)	3	2	1 (partially impacted but main water source not affected)
Total	3	2 (66.6%)	1

Note: Out of 6 NWRs, 3 were not impacted, impact was mitigated for 2 NWRs and 1 was partially impacted but main water source not affected

Table 6-3: Sensitive Receptors within Corridor of Improvement of Project Road

Total Nos (Schools/ Hospital)	Impact mitigated by design review	Retained without any intervention "as it is"	Impacted Nos	Further Impact Mitigation through provision of Noise / Crash Barriers
5	1	1	0	3

Table 6-4: Religious Places within Corridor of Improvement of Project Road

Total Nos	Retained "as it is" with no renovation and enhancement	Not impacted but considered for renovation/ enhancement	Impacted and considered for relocation	Impacted but considered for marginal resizing and renovation	Fully impacted and loss of Peepal tree and platform
24	13	7	2	1	1

Table 6-5: Summary List of Impacted Structures and Impacts Saved by Design Review

S. No	Design Chainage	References to Design Drawing & Onsite Structure Identification Ref Number	Village	Side	Typology of Structure	Design Offset Distance from existing centerline (m)	Distance from existing Centerline (m)	Extent of Impact (m)	Length of the Structure (m)	Width of the Structure (m)	Impact Note /Remarks	Status and Extent of Impact
1	1/890	Adjacent to HP Gramin Bank & in front of R-25	Tawambra	LHS	Parking area	5.6	5.0	0.6	12.8	5.1	Impact on parking, boundary wall and shop	Impact Avoided/Saved through design Review/modifications
2	1/995	R-28	Tawambra	RHS	Boundary wall	4.6	4.1	0.5	17	2	Impact on boundary wall with gate only	Impact Avoided/Saved through design Review/modifications
3	2/160	Opposite to L - 37	Panjethi	RHS	Resi cum Comm	7.4	3.7	3.7	16	10	Impact residence with car washing station	Impacted and included for Census and Socioeconomic Survey
4	2/670	R-32	Panjethi	RHS	Resi cum Comm	7.8	6.0	1.8	20	10	Platform with staircase impacted	Impact Avoided/Saved through design Review/modifications
5	2/765	R-36-37	Panjethi	RHS	Resi cum Comm	7.5	6.3	1.2	11.9	10	Front of Main building Impacted	Impact Avoided/Saved through design Review/modifications
6	2/975	In front of L-53	Panjethi	RHS	Residence	5.0	4.7	0.3	15	10	Boundary wall, toilet and Staircase impacted	Impact Avoided/Saved through design Review/modification
7	4/456	L-63	Talihar	LHS	Residence	4.6	3.7	0.9	19	7	Partial impact	Impacted and included for Census and Socioeconomic Survey
8	4/470	In front of L-64	Talihar	RHS	Platform	3.4	3.1	0.3	25	8	Private residence access road	Impact Avoided/Saved through design Review/modifications
9	7/509	Adjacent to under construction Rattipul Bridge	Rattipul	LHS	Resi cum Comm	11.6	8.0	3.6	7.5	20	Resi cum comm, Tea stall and General store	Impacted and included for Census and Socioeconomic Survey
10	8/285	R-108	Rughwanu	RHS	Resi cum Comm	7.8	7.1	0.7	30	12	One main Pillar of house impacted which will affect entire building	Impact Avoided/Saved through design Review/modifications
11	8/330	R-112	Rughwanu	RHS	Residence	8.3	4.4	3.9	10.4	15	Impact on boundary wall	Impact Avoided/Saved through design Review/modifications
12	8/348	R-113	Rughwanu	RHS	Residence	7.1	3.3	3.8	9	15	Impact on boundary wall and structure	Impact Avoided/Saved through design Review/modifications
13	10/248	L-167	Randhara	LHS	Resi cum Comm	4.3	3.4	0.9	7.2	10.0	Store room under the ramp impacted	Impacted and included for Census and Socioeconomic Survey
14	12/408	R-145	Randhara	RHS	Residence	9.4	7.5	1.9	3.5	2.0	Semi Pucca Kitchen impacted	Impact Avoided/Saved through design Review/modifications
15	13/050	R - 152	Hawani	RHS	Residence	5.6	4.0	1.6	19.0	15.0	Impact wall, toilet and platform	Impacted and included for Census and Socioeconomic Survey
16	16/402	R-162	Ghour	RHS	Resi cum Comm	8.4	7.0	1.4	9.0	7.0	Main wall of structure is impacted	Impacted and included for Census and Socioeconomic Survey
17	16/561	R-159	Ghour	RHS	Resi cum Comm	7.1	6.9	0.2	18.0	8.0	Partial impact, according to locals Saraswati Vidhya Mandir School is closed/not in use since 8 months.	Impact Avoided/Saved through design Review/modifications
18	16/740	R- 167	Ghour	RHS	Resi cum Comm	9.7	7.7	2.0	3.7	3.0	Toilet and staircase Impacted	Impacted and included for Census and Socioeconomic Survey
19	19/756	R-178	Saphru	RHS	Resi cum Comm	10.4	7.5	2.9	20.0	10.0	Main front of the structure is impacted which will affect the entire building	Impact Avoided/Saved through design Review/modifications

S. No	Design Chainage	References to Design Drawing & Onsite Structure Identification Ref Number	Village	Side	Typology of Structure	Design Offset Distance from existing centerline (m)	Distance from existing Centerline (m)	Extent of Impact (m)	Length of the Structure (m)	Width of the Structure (m)	Impact Note /Remarks	Status and Extent of Impact
20	19/790	R - 177	Saphru	RHS	Residence	9.5	8.0	1.5	20.0	10	Only gate impacted	Only Gate Impacted and included for Census and Socioeconomic Survey
21	19/900	R - 179	Saphru	RHS	Boundary wall	8.9	4.6	4.3	1.5	5.0	Boundary wall impacted	Only Boundary Wall Impacted Census and Socioeconomic Survey Completed
22	19/920	R - 180	Saphru	RHS	Boundary wall	6.9	4.3	2.6	6.0	3.4	Boundary wall impacted	Only Boundary Wall Impacted Census and Socioeconomic Survey Completed
23	21/859	R-191	Hawani	RHS	Commercial Hotel	7.4	6.7	0.7	31.0	10.0	Front wall of the hotel is impacted which will affect the entire building	Impact Avoided/Saved through design Review/modifications
24	22/286	Before R-192	Rewalsar	RHS	Under construction building	7.7	6.7	1.0	9.0	5.0	Under construction building is partially impacted	Impact Avoided/Saved through design Review/modifications
25	22/306	R-192	Rewalsar	RHS	Residence A	8.5	5.0	3.5	28.0	3.0	Only toilet impacted	Impact Avoided/Saved through design Review/modifications
26	22/326	R-192A	Rewalsar	RHS	Residence B	7.6	5.2	2.4	28.0	3.0	Staircase impacted	Impact Avoided/Saved through design Review/modifications
27	22/480	R-193	Rewalsar	RHS	Residence	7.8	5.0	2.8	25.0	5.0	Main front of the structure is impacted which will affect the entire building	Impact Avoided/Saved through design Review/modifications
28	22/515	R-194	Rewalsar	RHS	Resi cum Comm	7.0	6.3	0.7	4.4	-	Main front of the structure is impacted which will affect the entire building	Impact Avoided/Saved through design Review/modifications
29	22/525	R-195	Rewalsar	RHS	Resi cum Comm	6.4	5.9	0.5	10.4	3.9	Main front of the structure is impacted which will affect the entire building	Impact Avoided/Saved through design Review/modifications
30	22/530	R-196-197	Rewalsar	RHS	Resi cum Comm	6.6	6.0	0.6	28.0	5.0	Main front of the structure is impacted which will affect the entire building	Impact Avoided/Saved through design Review/modifications
31	22/559	Indian Gas Store Next to Unity Pub School	Rewalsar	LHS	Residence	4.2	4.0	0.2	7.0	-	Main front of the structure is impacted which will affect the entire building	Impact Avoided/Saved through design Review/modifications
32	22/987	Sonu Dhaba	Rewalsar	RHS	Commercial	4.1	3.9	0.2	17.0	3.5	Dhaba shop, partial impacted	Impact Avoided/Saved through design Review/modifications
33	23/312	Next to L-220B	Rewalsar	LHS	Commercial	4.0	3.9	0.1	13.0	3.0	4 Shops partial impacted	Impact Avoided/Saved through design Review/modifications
34	23/322	Next to L-220B	Rewalsar	LHS	Commercial	4.0	3.5	0.5	9.5	3.0	2 shops partial impacted	Impact Avoided/Saved through design Review/modifications
35	24/208	R-200	Rewalsar	RHS	Resi cum commercial	9.0	3.6	5.4	12.0	7.0	Main Structure is Impacted	Impact Avoided/Saved through design Review/modifications
36	24/230	R - 202	Dehri Galu	RHS	Residence	7.6	4.0	3.6	6.5	10.0		Impacted and included for Census and Socioeconomic Survey Completed
37	24/610	R - 203A	Mujwari	RHS	Shade	7.0	6.2	0.8	4.0	2.5	Main structure impacted (kutcha)	Impacted and included for Census and Socioeconomic Survey

S. No	Design Chainage	References to Design Drawing & Onsite Structure Identification Ref Number	Village	Side	Typology of Structure	Design Offset Distance from existing centerline (m)	Distance from existing Centerline (m)	Extent of Impact (m)	Length of the Structure (m)	Width of the Structure (m)	Impact Note /Remarks	Status and Extent of Impact
38	24/670	R - 204	Mujwari	RHS	Resi cum commercial	7.0	5.8	1.2	16.7	5.0	Main structure impacted	Impacted and included for Census and Socioeconomic Survey
39	24/694	Next to R-204	Tramb/Dhar1	RHS	Residence	5.7	4.0	1.7	2.2	3.2	Toilet and staircase impacted	Impact Avoided/Saved through design Review/modifications
40	24/704	Next to R-204	Tramb/Dhar1	RHS	Residence	5.8	3.4	2.4	14.0	3.3	Footpath area, Balcony, toilet, shade impacted	Impact Avoided/Saved through design Review/modifications
41	27/426	R-207	Gararu	RHS	Residence	7.7	7.2	0.5	15.4	6.0	Staircase and balcony impacted	Impact Avoided/Saved through design Review/modifications
42	24/420	R - 208	Kalkhar	RHS	Squatter	11.1	0.6	10.5			Temporary fixed tin shade (fruits and vegetable squatter) from last 4 years	Impacted and included for Census and Socioeconomic Survey
43	28/415	L-230	Kalkhar	LHS	Commercial	10.3	3.9	6.4	6.0	4.0	2 Shops impacted	Impacted and included for Census and Socioeconomic Survey
44	28/420	L-230	Kalkhar	LHS	Commercial	10.7	5.0	5.7	8.4	4.0	Wine Shop Impacted	Impacted and included for Census and Socioeconomic Survey

Table 6-6: Summary List of Impacted Natural Water Sources and Impact Saved by Design Review

Sr. No.	Design Chainage	References to Design Drawing & Onsite Structure Number	Village	Side	Usage/ Type of Property	Design Requirement from existing centreline	Distance from existing Centreline	Impact	Length of the Structure	Width of the Structure	Height of the Structure	Remarks	Final Status
1	3+700	Drinking water stream	Gandharv	RHS	All season natural stream	3.7	4	-	8.3	6	2	Renovation of natural stream, plumbing work	Not Impacted
2	4+297	Infront of R-44	Talyahar	RHS	Dug well	5.4	5.8	-	2	2	1.5	Drinking/washing water to be repaired and reconstruction of the circular top ring	Not Impacted
3	8+280	Marked as well on drawing	Rughwanu	LHS	Natural drinking water resource	2.5	3.2	-	3	3	2	Plastering and whitewash	Not Impacted
4	10+416	Drinking water structure	Randhara	RHS	Natural water resource	5.4	4	-	1.4	2.1	2.0	Beautification, plastering and whitewash.	Impact mitigated by the design review
5	12+482	Next to R-148	Hawani	RHS	Natural water resource	8.7	6.5	-	1	1	1	Beautification during construction	Impact mitigated by the design review
6	18+060	Drinking water structure	Manjalhy	RHS	Water Storage of Natural Water Resources	8.5	7.2	1.3	1.3	1	1	Impact of storage water tank only and not source	Partial Impact Source not affected

Table 6-7: Summary List of Impacted Religious Shrines and Impact Saved by Design Review

S. No	Design Chainage	References to Design Drawing & Onsite Structure Number	Village	Side	Typology of Structure	Design Offset from existing centreline (m)	Distance from existing Centreline (m)	Extent of Impact (m)	Length of the Structure (m)	Width of the Structure (m)	Status of Impact	Remarks
1	2+022	Next to R-29	Tawambra	RHS	Shrine	4.7	4.3	-	-	-	Not impacted	Retained “as it is” with no renovation and enhancement
2	2+820	Near to L-51	Panjethi	LHS	Shrine	4.5	5.4	-	-	-	Not impacted	Retained “as it is” with no renovation and enhancement
3	3+999	-	Gandharv	LHS	Shrine	4.2	4.4	-	-	-	Not Impacted	Considered for renovation/ enhancement
4	5+321	RCPR-9	Ghora	RHS	Peepal tree	4.2	4.2	-	7.2	7.35	Not Impacted	Considered for renovation/ enhancement
5	5+820	Near to temple	Jola	LHS	Shrine	-	6.5	-	-	-	Not impacted	Retained “as it is” with no renovation and enhancement
6	5+989	-	Ghaur	RHS	Shrine	4.4	4.2	0.2	-	-	Impacted	Considered for relocation
7	8+275	Near to under construction Rughwanu Bridge	Rughwanu	LHS	Peepal tree platform	4.1	3.8	0.3	4.3	4.3	Marginally Impacted	Considered for marginal resizing of Plateform and renovation/ enhancement
8	8+738	Opposite to L-142/A	Randhara	RHS	Shrine	1.8	3.6	-	-	-	Not impacted	Retained “as it is” with no renovation and enhancement
9	10+122	Hanuman temple	Randhara	RHS	Shrine	4.7	6.0	-	-	-	Not impacted	Retained “as it is” with no renovation and enhancement
10	10+725	Temple marking on drawing	Randhara	LHS	Shrine	2.5	6.0	-	3	2	Not impacted	Considered for renovation/ enhancement
11	12+388	Next to L-188	Natned	LHS	Peepal tree and shrine platform	2.3	2.7	-	-	-	Not impacted	Retained “as it is” with no renovation and enhancement
12	18+410	Near general store	Manjalhy	LHS	Temple	2.8	5.0	-	-	-	Not impacted	Retained “as it is” with no renovation and enhancement
13	19+203	Platform	Palnu (Saphru)	RHS	Peepal tree platform	9.4	3.3	6.1	5.0	4.0	Fully impacted	Loss of Peepal tree and Platform
14	20+081	-	Garlauni	LHS	Shrine	1.9	4	-	-	-	Not impacted	Retained “as it is” with no renovation and enhancement
15	20+706	Temple	Garlauni	LHS	Temple	2.8	3.8	-	-	-	Not impacted	Retained “as it is” with no renovation and enhancement
16	20+751	Near general store	Garlauni	LHS	Peepal tree platform	1.2	6	-	-	-	Not impacted	Retained “as it is” with no renovation and enhancement
17	21+084	-	Hawani	LHS	Shrine	0.6	6	-	-	-	Not impacted	Retained “as it is” with no renovation and enhancement

S. No	Design Chainage	References to Design Drawing & Onsite Structure Number	Village	Side	Typology of Structure	Design Offset from existing centreline (m)	Distance from existing Centreline (m)	Extent of Impact (m)	Length of the Structure (m)	Width of the Structure (m)	Status of Impact	Remarks
18	21+704	-	Hawani	LHS	Peepal tree platform	3.1	3.7	-	-	-	Not impacted	Retained "as it is" with no renovation and enhancement
19	22+997	Near bus shelter	Rewalsar	LHS	Peepal tree platform	3.8	3.0	-	3.2	3.2	Not impacted	Considered for renovation/ enhancement
20	24+218	R-201	Dehri Galu	RHS	Shrine	8.6	3.8	-	3.1	2	Not impacted	Considered for renovation/ enhancement
21	24+734	marked as temple on drawing	Tramb/Dhar1	LHS	Peepal tree and shrine platform	3.3	4.4	-	3	3	Not impacted	Considered for renovation/ enhancement
22	28+216	Temple	Kalkhar	RHS	Temple (Lakhdata Peer)	9.4	5.0	4.4	1.6	1.6	Fully impacted	Considered for relocation
23	28+299	-	Kalkhar	LHS	Temple (Lakhdata Peer)	3.2	7.5	-	-	-	Not impacted	Retained "as it is" with no renovation and enhancement
24	28+415	Platform	Kalkhar	RHS	Peepal tree and shrine platform	0	6.7	-	5.5	4	Not impacted	Considered for renovation/ enhancement

7 ENVIRONMENT & SOCIAL RISKS AND IMPACTS AND MITIGATION MEASURES

7.1 ...related to Assessment and Management of E&S risk and impact (ESS 1)

240. The widening and upgradation of the 28 Km project road between Mandi-Rewalsar will have both beneficial and adverse impacts, particularly along settlement areas and/or built-up areas. The assessment has been done through a participatory process, involving the local communities, the likely PAPs/ PAHs, community leaders, Gram Pradhans, district authorities, and various government organizations during environmental, social surveys and impact assessment. This process provided the means by which public concerns, needs and values were identified, so that views of the likely affected and concerned people were considered during the evaluation of alternatives for minimization of impacts. The basic approach for the assessment of likely loss and impact on assets were as follows:

- i. to understand type, nature and extent of loss due to upgradation and widening of the project road.
- ii. inventory of assets likely to be affected, which serve as an input from social impacts perspective to evaluate alternatives; and
- iii. serve as an input to prepare strategic issues, while conducting public consultations/Focus Group discussions at the DPR preparation stage
- iv. To adopt a mitigation hierarchy approach to the project's E&S risks i.e., a) anticipate and avoid risks and impacts; b) minimize or reduce risks and impacts to acceptable levels, if not avoidable; c) once risks and impacts have been minimized or reduced, mitigate; and (d) where significant residual impacts remain, compensate for or offset them, where technically² and financially³ feasible.
- v. To help identify differentiated impacts on the disadvantaged or vulnerable and to identify differentiated measures to mitigate such impacts, wherever applicable.

241. The E&S risks and impacts of both project road and Associated Facilities have been assessed in terms of each relevant standard of ESSs (ESS 2-8) and all required impact mitigation management measures are included in ESMP Volume, which is a standalone document to the ESIA and may be referred for details. The social impacts of the project road widening have been significantly reduced by considering the design modifications through alternative analysis (ref. Section 6 - Analysis of Alternatives) and RAP have been prepared for the PAPs as per provisions of RPF under HPSRTP.

7.2 ... relating to Labour and working conditions (ESS 2)

Impacts

242. The Mandi-Rewalsar-Kalkhar road widening works will require an estimated 825 skilled and unskilled construction workers (contract workers). It is anticipated that out of 300-400 construction workers, nearly 50-60% are likely to be to be migrant workers and the rest are likely to be sourced from nearby villages and settlements areas. The skilled and unskilled construction workers will be managed by the supervisory and managerial staffs. All these contract workers will be supervised and overseen by the Direct Workers of HPRIDCL (ref. 2.15 under Section 2– Project Description).

243. Potential labor risks associated with construction workers/labors engaged in road construction are:

- Lack of training/awareness/ orientation amongst workforce and sensitization for safety at work, Safe working at heights/ depths and working around moving equipment/machineries
- Lack/Inadequate or inappropriate personnel protective gear and or safety accessories for workforce
- Injuries/fatalities leading to disability and/or even death, while at work during normal course, either due to negligence at work and/or inadequate experience/training or accidents

- Inadequate first-aid facilities at work sites and lack of emergency response mechanism for shifting injured to hospitals and care thereof
- Inadequate accommodation, sanitation and health facilities at work force camps
- Non-payment, disparity of wages and/ or denial of benefits (compensation, bonus, maternity benefits etc.)
- Discrimination in employment (e.g., abrupt termination of the employment, working conditions, wages or benefits etc.)
- Engagement of child labour and trafficking of labour
- Safety, security of women workforce at work sites and within workforce camps
- Lack/Inadequate facilities for pregnant women and lactating mothers and children at camp sites
- Sexual harassment and Gender based violence issues within workforce camps or at work sites
- Health risks of labour relating to HIV/AIDS and other sexually transmitted diseases
- Conflicts with local community at Potential GBV hotspots¹³ along project road (Mandi, Talyahar, Randhara, Rewalsar & Kalkhar).
- Absence of a grievance mechanism for labor to seek redressal of their grievances/issues
- Absence or inadequate or non-responsive emergency response mechanism for rescue of workforce, during natural calamities like cloud bursts, caving in/landslides, disasters due to earthquake/floods/fire outbreak etc. at operational sites and/or workforce camps

Mitigation Measures

244. HPRIDCL has a Labor Management Procedure (LMP) that is applicable for all priority roads under HPSRTP including the project road. The LMP include Environmental, Occupational Health & Safety and Social (OHSS) guidelines, labour management system and governance controls in accordance with Indian national and state regulations as well as the requirements outlined under ESS 2 of the ESF World Bank.

245. The construction workers/ labor risk mitigation and OHSS management of workers and related issues arising during construction works will be under direct control of contractors and thus have to be managed by contractors. Therefore, ensuring effective management of OHSS plan for contract workers by contractor is core to the implementation of HPSRTP by HPRIDCL.

246. The responsibility to manage the contract workers will be clearly reflected in the contractual obligations of the Civil Works Contractor with appropriate mechanisms for addressing non-compliance. The bid documents for construction will incorporate requirements for Environment, Social, Health and Safety (ESHS) including list of applicable labor laws¹⁴ and provisions and the metrics for periodic reporting by contractors. The bidders will be required to submit the following as part of their technical bid: i) ESHS strategy and implementation plan; code of conduct; ii) declaration of past ESHS performance. The successful Bidder will submit an Environmental, Social, Health and Safety (ESHS) Performance Security @ 2% of accepted contract value.

247. In order to further mitigate the potential labour risks, contractor will:

- i. source all unskilled labor locally (to extent possible) to minimize labor influx into the project region. Skilled labor force, if unavailable locally, have to be brought from outside the project area/state.
- ii. develop and implement a workforce camp management plan that addresses all requirements as per state or national regulations.

¹³ Identified as GBV hotspots during survey and field assessment.

¹⁴ Workmen Compensation Act, 1923, Minimum Wages Act, 1948, Payment of Wages Act, 1936, Equal Remuneration Act, 1979, Child Labour (Prohibition & Regulation) Act, 1986, Inter-State Migrant Workmen's (Regulation of Employment & Conditions of Service) Act, 1979, etc.

- iii. conduct periodic training programs on HIV/AIDS and other communicable diseases
- iv. implement a grievance redressal mechanism (GRM) for workforce
- v. provide information to communities in project area about the contractor's code of conduct for workers, wherever applicable.
- vi. Plan and implement a GBV risk mitigation strategy, which include measures such as orientation to all categories of labor, communities' sensitization, signing of codes of conduct by all workers (all categories and levels) to be undertaken during throughout project implementation phase (ref. Sl. No. 4, Table 4-1 of ESMP Volume).

7.3 ...relating to Resource Efficiency, Pollution Prevention & Management (ESS 3)

7.3.1 Physiography

Impacts

248. The project road is existing for last several decades and the present construction works involves only upgradation/ widening from single to intermediate lane, within the available right of way. The widening/ upgradation follow the same existing ground profile, without significantly altering the vertical profile, except for improvement of geometrics at few locations, to enhance road safety and achieve a uniform design speed (ref. 2.9 under Section 2 - Project Description).

249. Therefore, no significant impact on physiography and soil of the region (ref. 2.4 & 4.3.3 under Section 2 & 4) is foreseen/ anticipated due to road construction works.

Mitigation Measures

250. The project road widening does not warrant specific mitigation measures for managing the impact on physiography and soil. However, the ESMP includes several GIIPs for mitigating incidental impacts of project road construction like establishment of camp sites/ work force camps, opening of borrow areas/ muck disposal sites, removal of topsoil, contamination of soil from leakage and spillage during storage/ handling of fuels/ lubes, construction chemicals and construction materials, which may induce impacts on soil. The measures to be implemented to contain the impacts are given in Table 4-1 of ESMP Volume.

7.3.2 Geology

Impacts

251. The project road will require different construction materials such as earth, stone aggregates, cement and sand that occurs naturally or manufactured from naturally occurring mineral resources, formation of which take millions of years. In addition, ever increasing development works across the globe has stressed these finite natural resources and is increasingly becoming resource constraint/ challenge in recent times. Considering these aspects, minimization of construction footprint as well as resource efficiency is considered for project road construction.

252. The various 'resource efficiency' options considered during design include minimization of excavation, reuse of excavated materials in road construction, bridges and culverts and other protection works (breast walls, retaining walls, toe walls, gabion walls, etc.). Some of these resource efficiency options also enable to reduce the construction footprint in terms of reduction in fresh land requirement for muck disposal sites and thereby reduce potential impacts and achieve minimum construction footprint (ref. Section 2 Project Description & Section 6 Analysis of Alternatives, which provide details on excavated materials and its reuse in road construction).

253. The estimated quantity of materials that are required for the project road construction is given in **Table 7-1**. All good earth for project road construction will be borrowed from suitable locations within the project region with a lead distance ranging between of 0 to 15 Km. The borrow areas identified along the project road is given in **Table 7-2**.

Table 7-1: Estimated Construction Materials Requirement

S. No	Description	Unit	From Km 0/000 to Km 12/000	From Km 12/000 to Km 29/000	Total Quantity
A	Road Work				
1	Good earth excavated from borrow areas	Cum	1480	1271	2751
2	Stone aggregates for road work	Cum	48144	88353	136497
3	Bituminous material	MT	284	398	682
B	Bridges				
1	Aggregates used for RCC Structures	Cum	22609	32147	54756
2	Cement	MT	10121	13388	23509
3	Steel	MT	788	513	1301
4	Sand	MT	17522	24914	42436

Table 7-2: Potential Borrow Areas along Project Road

Borrow Areas	Chainage (km)	Side (LHS/RHS)	Land Ownership	Available Quantity
BA-1	10+500	LHS	Government	Hillside (Adequate)
BA-2	15+230	LHS	Government	Hill side (Adequate)
BA-3	22+000	LHS	Government	Hill side (Adequate)
BA-4	27+000	RHS	Government	Hill side (Adequate)

Mitigation Measures

254. In addition to the resource efficiency considerations, the following mitigation measures will enable to minimize the impacts:

255. The project's demand for boulders/stone aggregates and sand is to be sourced from authorized/pre-existing quarries, having all statutory/ regulatory compliances of SPPCB and no new quarries is to be opened. Using the existing quarries will prevent triggering of fresh impacts like slope and stability issues at quarry areas and associated issues like disrupting or altering sub-surface drainage, contamination of groundwater, soil erosion and deforming landscape. The project region has geological formations, which can adequately meet the construction material demand (ref. 4.3.1 under Section 4).

256. The borrowing of earth in an unregulated manner may lead to unstable slopes, erosion, inundation of water, breeding areas for mosquitos and unhygienic environment. The impacts of borrowing of earth can be minimized by the following measures:

- The contractor shall prepare and get the borrow area management plan approved by the CSC and all operations shall strictly adhere to the approved plan. The identified borrow area shall be inspected by CSC prior to its approval.
- Uplands shall be given a first choice while finalizing the borrow areas to reduce the footprint of the borrow areas. The borrow area management plan shall indicate land area, boundary limits, limiting side slopes for excavated areas, estimated borrowed quantity and existing environmental settings, but not limited to topography, drainage, water bodies, settlements, trees, haul road etc. to identify likely environmental, social risks and associated safety hazards (ref. 4.3.7 under Section 4, for soil quality and fertility levels within project region).

- Prior to commencing borrowing operations, all such identified borrow areas are to be approved by CSC based on compliance with existing regulations, suitability of earth, written agreement with landowner(s), likely potential environmental risks and safety hazards, borrow plan schedule including restoration/redevelopment plan. If government/panchayat land(s) have been chosen, then requisite approval/permissions from local self-government bodies shall be obtained prior to commencement of borrowing operations and conditions laid by the local bodies shall be complied thereof.
- Borrow areas shall not be opened in an irregular shape and sizes. The bottom of borrow pits shall not be left uneven and finished with a levelled bottom, to extent possible and shall not have deep pits within.
- The proposed depth of cutting shall be limited to a maximum of 1.5 meters below surrounding ground levels. In case excavation warrants for greater depth, such borrow area location shall also include occupational health and safety measures to prevent accidental or safety hazards till completion of restoration.
- Collection of topsoil in a segregated manner and its preservation and re-use elsewhere.
- The agreement for borrowing soil shall clearly state the lease duration, depth and land area and levels up to which the borrowing of earth shall be carried out, compensation for the agreed lease period, site restoration plan as desired/required by the landowner and any other condition mutually agreed upon between contractor and landowner. The agreement shall include a site restoration plan as agreed upon with the landowner.
- The transportation of earth from borrow areas in open/uncovered trucks can increase the dust levels. The contractor will ensure trucks are loaded only up to permitted capacities to prevent high emission, vehicle wear and tear, and road surface damage due to overloading.
- All haul roads either paved or unpaved used for transportation of materials shall be subjected to surveillance at regular intervals and rectify any type of surface damage till operation of borrow area and regularly clear the spills, if any.
- All haul roads (paved or unpaved) used for transportation of materials shall be subjected to daily surveillance especially along settlement/residential areas and carry out regular sprinkling of water for dust suppression until the completion of borrowing operations.
- Trucks in good condition shall only be deployed for operations and shall adhere to pre-determined routes. The contractor will resolve any conflict arising due to construction or material handling activities with community or individual, if any.
- CSC will conduct regular safeguards compliance audit during operation of borrow area and ensure prompt restoration of closed borrow area is in accordance with approved borrow area management plan.

7.3.3 Land Use and Soil

Impacts - Muck Disposal

257. The project road construction will generate muck/ debris from clearing operation within the RoW/CoI for road widening as well as construction of road (widening portion), culverts/bridges and protection works. The project design has evaluated alternatives and considered the most optimum option to limit the excavation quantities and reuse the excavated materials in road construction. This approach has reduced the need for disposal of excavated materials, but also reduced the need to source new material for construction purposes.

258. The earth work excavation activities of project road widening will generate an estimated 6,13,650 cum of muck/ debris. The project design considers reuse of such excavated materials to an extent of 2,73,343 cum in various project components as well as reclaim of low-lying areas within RoW, which works out 44.54% of total hill cut and other excavated /rock volumes. Thus, excess material which needs to be disposed as muck/ debris is estimated at 3,40,307 cum (**Table 7-3**).

Table 7-3: Estimated Quantities of Rock and Earth Work Materials

Sl. No	Item	Unit	Quantity in cum
A	Quantity from excavation		
	Excavation in roads	Cum	502054
	Excavation in culverts	Cum	6051
	Excavation in bridges	Cum	11166
	Excavation in drainage and protection works	Cum	94379
	Total A		613650
B	Reuse of excavated materials		
	Embankment	Cum	60803
	Subgrade	Cum	108779
	Backfill in culverts	Cum	4791
	Backfill in Bridge	Cum	3125
	Backfill in drainage protection works	Cum	22865
	Recovery of rock for reuse	Cum	72980
	Total B		273343
C	Excess material for disposal as muck/ debris (A-B)	Cum	340307

259. Based on the estimated muck generation, 13 potential muck disposal sites have been identified with an estimated holding capacity of 1,72,600 cum. The potential locations identified for muck disposal/ dump sites is given in Table 2-17 and shown in Figure 2-5 under Section 2, which is adequate to dispose estimated 50.71% of excess earth/rock cut material. During the construction phase, the contractor will have to identify additional muck disposal site as per requirements. The disposal of debris is likely to have environmental and social impacts and risk due to erosion, slides, clogging of drainage, drying of seasonal streams/spring, damage farmland, loss of soil productivity etc. if adequate mitigation measure are not implemented. Based on the general soil fertility level of the district, the impacts on soil quality of the region are not expected to be significant due to the selection of land for debris disposal, which are primarily barren lands, which are not under any productive use (ref. Figure 4-7 to 4-9 showing soil fertility of Mandi district under Section 4).

260. During the construction phase, land will be required to establish camp sites cum store yards, wet mix macadam plants, hot mix plants and concrete batch mix plants for road and bridge construction purposes apart from other activities like handling and stacking/storage of construction materials viz. cement, sand, stone aggregates, storing excavated topsoil and other construction materials as may be required. In addition, land will also be required to establish workforce camps, if warranted.

261. Considering that the project road will be implemented under 2 contract packages (km 0 to 11 & km 11 to 28), the estimated land requirement for establishing camp site (s) for each of the contract package will be 1.25 hectares. It may be possible that the contractor may choose to establish more than 1 camp site per package depending upon land availability. The impacts on this land used for establishing camp sites will be limited to the construction phase and impacts arising due to such change in land use will for limited period (construction phase) will not be significant and transitory in nature, provided the sites are managed and restored to its previous state, after the project completion.

Mitigation Measures

262. The mitigation measures for the muck disposal are summarized hereunder:

263. Prior to undertaking any site clearance and/or excavation activities, particularly clearance/ excavation operations in any segment/operational stretch, the contractor shall prepare a work plan, detailing the type and numbers of equipment required, estimated volume of material to be cut or excavated, details of approved muck disposal sites, arrangements made for transport of excavated

material to the approved disposal sites, dust suppression measures at excavation site and along transportation routes, method of stacking and/or handling the excavated material at the disposal site including rehabilitation plan of the disposal site, health and safety measures and emergency response plan for the entire operation shall be prepared in advance.

264. The criteria for selection of muck disposal site(s) and the content of a Muck Disposal Plan for typical site is given under Sl. No. 21 of Table 4-1, Section 4 of ESMP Volume. The requirement to have an approved Muck Disposal Plan will be mandatory part of contractor's ESMP(C-ESMP).

265. The construction debris from all operational areas shall be regularly scavenged and disposed off at identified disposal sites or those approved by District administration.

266. The CSC prior to approving contractor's civil work plan, shall ascertain preparation and inclusion of Muck Disposal Plan as one of main activity preceding site clearance and excavation activities.

267. The contractor shall prepare and get the Muck Disposal Plan approved by the CSC and shall strictly adhere to same. The Muck Disposal Plan shall ensure following:

- i. The muck disposal plan shall indicate boundary limits and existing environmental settings, but not limited to topography, drainage, water bodies, settlements, trees, haul road etc. in and around the identified muck disposal sites.
- ii. No muck disposal site shall be located in forest area or areas which are within 500 meters of any forest areas.
- iii. The muck disposal plan shall consider and addressed factors relating slope stability of the muck heaps and shall not alter the surrounding natural drainage, obstruct or alter waterways in and around muck disposal sites and shall not cause safety hazard, environmental and social risks/ impacts.
- iv. The gabion walls of adequate length and height (as per specific site requirement) shall be used to retain the dump muck and shall not lead to stability or erosion issues.
- v. All the muck disposal sites shall be treated with nature based bioengineering solutions, so as to have a vegetative/ green cover over the entire muck disposal area as part of the muck disposal site closure plan. The ESMP include provision for bio-engineering solutions at all muck disposal sites (ref. Section 8 of ESMP Volume).

268. The criteria for selection of land to establish campsites and workforce camps is given under 7.5 of this Section and Sl. No. 18 to 22 of Table 4.1, Section 4 of ESMP volume.

7.3.4 Water Resources

Impacts

269. The project road design considers construction of 139 CD structures (34 box culverts; 98 pipe culverts; 5 slab culverts; and 2 minor bridges across the seasonal rivulets/streams flowing across project road. In addition, the project road will have 4 more bridges (1 major bridge and 3 minor bridges), being constructed by HPPWD, which qualify as Associated Facilities under Tranche-I, HPSRTP (ref Table 2-12 & 2-13, under Section 2 and 4.3.4 under Section 4). The project design considers construction of 14,500 meters of RCC cover drains and 11,010 meters length of 'V' shaped drawings along the road which will be connecting to the nearest culverts (ref. **Appendix-1** for drainage map).

270. All the rivulets/streams flowing across project road, including the 4 bridges location of Associated Facilities are seasonal and carry the discharge only during monsoon months (June-October) and remain dry during the other months of the year (ref. 2.10 under Section 2 and 4.3.4 under Section 4). The construction of CD structures and bridges is unlikely to alter the existing flow regime of these seasonal rivulets/streams across the project road. On the contrary, new or reconstructed CD structure is expected to ease the flow of water during rainy season and enable to avoid flash floods on downstream side even during heavy rainfall months or years. However, certain mitigation measures while working

near CD structures along project road will be required to minimize the likely construction impacts on water resources.

Mitigation Measures

271. The mitigation measures to be adopted while working near water bodies/ CD structures including bridge construction sites along project road are:

- Schedule all construction activities to dry or non-monsoon seasons, particularly excavation works and casting of concrete structures/works
- Identify, minimize, demarcate and barricades the areas for construction activities
- The water way shall not be unwarrantedly constricted or kept to minimum during construction phase, to facilitate flow of water due to unseasonal rains.
- All construction works specially foundation works of stream/ channel bed and bank protection works shall be scheduled for non-monsoon months and swiftly complete the work prior to on-set of monsoon.
- Cordon-off and regulate the entry and exit points for workforce /construction labour for work sites. No workforce shall enter the waterfront/waterway/ stream bed unless it is warranted for construction works
- No construction related establishments like concrete batching plants, labour/workforce camps/material stack yards parking and vehicle servicing areas shall be established within 500 meters of the waterfront/waterway/ streams.
- All construction related establishments shall have adequate drainage facilities and potential contaminant areas shall have covered roofs and/or provided with segregated drainage systems, which shall have pre-treatment units like oil/grease separator, settling tanks, prior to its discharge. No untreated waste shall be disposed-off into any natural water streams /channels under any circumstances
- All construction and operational areas including waterfront/waterway/ stream beds shall be scavenged for clearing of any material spills on a daily basis and also mandatorily, prior to monsoon and after the completion of work. All construction sites near waterfront/waterway/ streams shall be maintained in a clean and tidy at all times during construction phase and completely cleared off, prior to monsoon.
- All hazardous waste materials from operational and vehicle servicing areas shall be collected, stored under roof areas and safely disposed-off as per state pollution control broad norms
- All the workforce at construction related establishment sites shall be provided with adequate water, sanitation facilities to ensure no untreated sullage/ sanitation waste enters stream or water ways.
- The worksites, specifically near the waterfront/waterway/ streams shall have provision for mobile toilets of at least one mobile toilet of 2-seater capacity (1 men and 1 woman with separate entrances) is stationed at a suitable place, within 100 meters from each operational area. The mobile toilet shall have at least 1000 liters overhead water storage, well always maintained and in usable condition. Bottom tanks of mobile toilets shall be regularly cleaned, and overhead tank replenished as per requirement.
- Work force shall be oriented to use mobile toilets and avoid using nearby open places/waterfront.
- Every operational area shall be provided with one mobile drinking water kiosk having a storage of 300 liters and placed at a suitable place within 100 meters from work site
- All workforce deployed near waterfront/waterway/ streams shall be adequately oriented during induction and thereafter at daily briefing/toolbox talks about safety procedures and

environmental requirements particularly when working near waterfront/waterway/ streams and provided with appropriate safety gear including retro-reflective jackets at worksite

- Ensure no waste of any form is dumped or construction material or waste/debris spills into waterfront/waterway/ streams during the entire construction works. All such waste materials/spills during construction shall be immediately cleared off to ensure no impacts on water quality.
- After the completion of the construction works, the cross-drainage construction site including upstream and downstream up to 100 meters shall be checked for remnant of construction debris/spills and same shall be and cleared off.
- All upstream and downstream sides of culverts/bridge sites are to be cleared off from the construction debris and bed profile shall not be altered, under any circumstances and/ or to be restored to match the original profile.
- Project designs include provision for construction of RCC/ stone boulder aprons on the upstream side along with steps with guiding walls and RCC/ stone boulder aprons on downstream side to channelize the water and dissipate energy to control the erosion and subsequently reduce floods on downstream areas. The engineering design drawings for CD structures at all locations along project road has included such required protection measures (ref. Appendix-5 for Typical details).
- In addition, nature-based solutions/measures (bioengineering) are also considered at selected locations to minimize the erosion and improve the slope stability as well as aesthetics. Adequate budget provisions have been included in the ESMP for undertaking bio-engineering interventions (ref. Section 8 of ESMP Volume).
- Renovation of 6 natural water sources have been considered as natural resources conservation and/or enhancement measures (ref. 4.6.6 of Section 4-Baseline Data & Table 6-6 of Section 6 – Analysis of Alternative). The Conservation and Enhancement Plans/Drawings of such natural water sources are included under Section 3 & 8 of ESMP Volume.

Mitigation measures specific to Associated Facilities

272. Since, the 4 bridges, qualifying as Associated Facilities are integral to the project road (ref. 1.3 under Section 1), the following mitigation measures will be included in the contract packages for widening and upgradation of Mandi Rewalsar Road and works will be implemented under the supervision of CSC. Photographs of the bridge construction sites are given in **Figure 7-1 & 7-2**, which clearly warrant mitigation measures to minimize/ avoid impacts due to bridge construction at respective sites.

- Ensure no concrete batching plants, camp sites, material stack sites, vehicle servicing areas for the project road construction works will be established along river/ stream beds at these locations of Associated Facilities.
- Undertake cleaning the river/ stream bed on both upstream and downstream sides (up to 100 meters) and remove all construction debris and/or remnants of construction works undertaken/ completed by HPPWD contractors at all 4 bridge locations.
- Check and undertake bed profile correction of the river/ streams, if warranted or utmost necessary, to match it natural bed profile beyond 100 meters on both upstream and downstream sides to ensure a smooth flow regime, without localized and uneven depressions on waterfront/waterway/ stream beds.
- Check and repair and/or restore the eroded or damaged river/ stream banks (on both sides) up to 100 meters on both upstream and downstream sides at each of the 4 locations of Associated Facilities.

- Assess and identify appropriate bioengineering (nature-based solutions) solutions, which can be undertaken along the river/ stream banks as a bank protection measures at Associated Facility locations (ref. Section 8 of ESMP Volume).
- HPRIDCL will take up the matter with the concerned departments of GoHP to manage the untreated sullage/ sewage discharges into river/ streams, which can be seen at some of the bridges of Associated Facilities (ref. Figure 7-2 – Ratipul Bridge Ch. 5/820 to 5/785).



Earth Excavation from Riverbed



Riverbed used as Access Road



Riverbed used for Construction Campsite



Bridge Pier Construction on Riverbed

Figure 7-1: Photographs of bridge construction activities at Rivulet/ Stream bed (Associated Facilities to Tranche I HPSRTP)

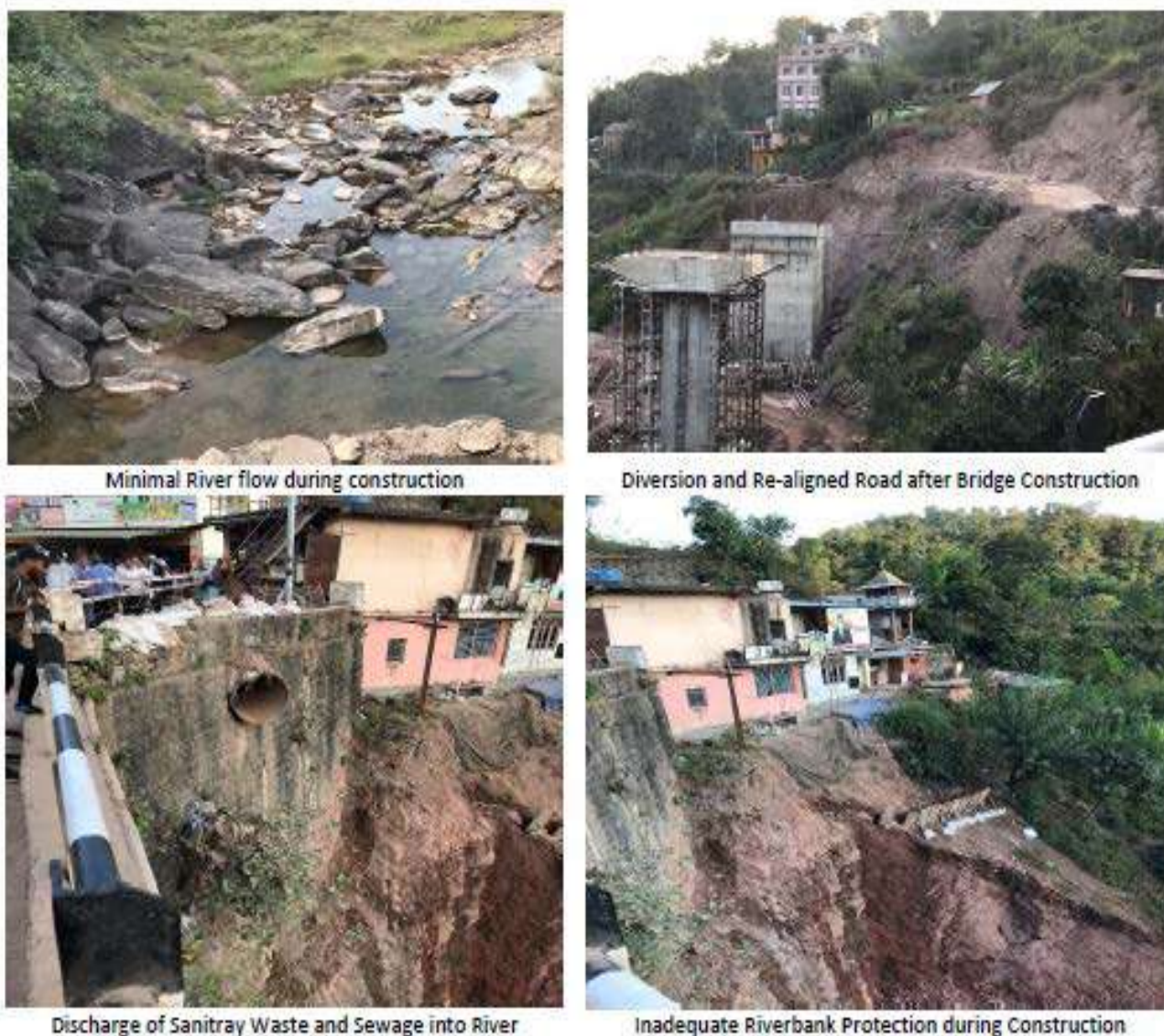


Figure 7-2: Photographs of sewage discharge and damaged riverbanks at Associated Facilities

7.3.5 Surface and Ground Water Resources Depletion

Impacts

273. The estimated water requirement for the project road construction is 324 KLD (Table 7-4) during project period for civil works like construction of embankment, sub-grade, bituminous work, concrete, dust suppression and daily consumptive use at work force camp, site offices, among others.

Table 7-4: Estimated Construction Water Requirement

S. No.	Activity	Unit	Quantity in litres/m	Quantity in KLD ¹⁵ litres
1	Road/Embankment	Litres/metre	500	140
2	Subgrade/WBM	Litres/metre	250	70

¹⁵ KLD refers to thousand litres per day consumption

S. No.	Activity	Unit	Quantity in litres/m	Quantity in KLD ¹⁵ litres
3	Construction of CD Structures	LS@10000 litres per location	-	13
4	Dust Suppression and camp site management	Litres/metre	250	70
5	On site sanitation & Drinking water	per day	5000	15
6	Camp Site Water Requirement	Litres	1000	3
7	Plantation of saplings/trees	Litres	5400000	120
Total Water Requirement				431
Add 5% for wastage and 20% for Contingency				539
Quantity of Water Requirement for entire Construction period				970
Quantity of Water Requirement KLD				324

274. The project road corridor and the PIA has no surface water bodies and thus ground water is the only dependable resource for meeting the construction water demand. The ground water utilization within Mandi District is less than 20% and none of the areas within Mandi district has been notified as over exploited /critical by CGWA/State Ground water authorities, construction water can be met through existing or new tube wells in and around project/area with prior permission from competent authorities (ref. 4.3.2 under Section 4). However, tapping of ground water sources (existing or new tube wells) for construction purposes will require prior permission from State Ground water Authority /Irrigation and Public Health department (IPH) for road construction purposes, as per present regulations.

Mitigation Measures

275. The impacts arising due to sourcing of construction water can be minimized through the following mitigation measures.

- Contractor can explore suitable locations for installing tube wells for meeting the construction water demand abstracting water (ref. 4.4.9 under Section 4 for water quality of sources along project road/ region). However, any such tube wells should be installed only after obtaining permission from competent/ designated State Govt. departments or Irrigation and Public Health Department, GoHP.
- Identify freshwater seepage springs along hill sides, where temporary storage tanks can be constructed to harvest the water for meeting construction demand. However, prior permission from Irrigation and Public Health Department, GoHP shall be taken prior to tapping such natural resources. In no case, seepage springs used by communities/ road users should be strictly avoided for meeting the construction water demand.
- During the pre-Construction stage, contractor can identify local depressions along the alignment in consultation with the local panchayat to be developed as water storage areas, if found suitable/feasible. Such developed water storage areas during construction phase can be handed over to the local Panchayat after the complete of the construction works.
- The water usage pattern within the construction camps can be minimized by adopting following best practices:
 - i. Use buckets for washing purposes instead of using running water.
 - ii. Use of auto shut off taps (without sensors) in labor accommodation.
 - iii. Install water meters with main supply pipes/water tanks/bore well to assess quantity of consumed water, supplement with periodic audit of water abstraction and use.
 - iv. Surveillance for plugging/rectification of leakages and /or overflows.

- Renovation of 6 natural water sources have been considered as natural resources conservation and/or enhancement measures (ref. ref. 4.6.6 of Section 4-Baseline Data and Table 6-6 of Section 6 – Analysis of Alternative). The Conservation and Enhancement Plans/Drawings of such natural water sources are included under Section 3 & 8 of ESMP Volume.

7.3.6 Surface & Ground Water Pollution

Impacts

276. The camp site offices and workforce camps establish for the project road construction will generate sewage and sullage/ sanitary wastes. The estimated sanitary waste generation at camps site offices and work force camps is given in **Table 7-5**. The sanitary waste needs to be treated through septic tank and soak pit disposal arrangements in order to prevent potential surface and/or ground water pollution and soil contamination.

Table 7-5: Estimated Sanitary waste during Construction Phase

Category	Nos	LPD ¹⁶	Quantity	Quantity of Sewage generation (80%) LPD
Supervision staff	76	45	3420	2736
Non-local /migrant labor at camp site	316	90	28440	22572
Total				25488

Mitigation Measures

277. Key avoidance and mitigation measures, which can prevent to avoid surface and/or ground water pollution include:

- All toilets and wash areas within the camp site and work force camps shall be provided with septic tanks and soak pit arrangements of adequate capacity. No wastewater from the camp/work force site shall be discharged directly into any surface water channels or drain, without any treatment, which eventually join surface water bodies.
- Typically, septic tanks each 5m length, 2m breadth and 1.5 m clear depth with 0.3 free board with soak pit arrangement, can serve up to 50 users at peak level as per CPWD specifications.
- The number of septic tanks required at the workforce camps and camp sites can be determined depending upon the number of locations of camp office sites and workforce camps and the number of users at each such locations.
- CPHEEO, Ministry of Housing and Urban Affairs, GoI recommended sizes of septic tank upto 300 users (as per BIS 2470 part I) are given in **Table 7-6**. Typical details of septic tanks and soak pit disposal arrangement for 50 users in given in **Figure 7-3 & 7-4**.
- The oil/lube storage shall be under roofed areas with impermeable cement concrete surfaces and provided with separate drainage system with provision for oil separators. No discharge from oil/lube storage areas shall be directly discharged into any open surface water channel/ streams.
- Oil interceptors shall be provided at vehicle service/ repairing area and oil/lube/fuel storage area with separate drainage system as shown in **Figure 7-5**.

¹⁶ LPD refers to litres per day consumption or discharge as the case may be

Table 7-6: CPHEEO Recommended Sizes of Septic Tank up to 300 users

No. of Users	Length (m)	Breadth (m)	Liquid depth (m) (cleaning interval of)	
			2 years	3 years
5	1.5	0.75	1.0	1.05
10	2.0	0.90	1.0	1.40
15	2.0	0.90	1.3	2.00
20	2.3	1.10	1.3	1.80
50	5.0	2.00	1.0	1.24
100	7.5	2.65	1.0	1.24
150	10.0	3.00	1.0	1.24
200	12.0	3.30	1.0	1.24
300	15.0	4.00	1.0	1.24

Source: CPHEEO, Ministry of Housing and Urban Affairs, GoI

Notes:

1. The capacities are recommended on the assumption that discharge from only WC will be treated in the septic tank.
2. A provision of 300mm should be made for free board.
3. The sizes of septic tank are based on certain assumption on peak discharges, as estimated in IS:2470 (part 1) and while choosing the size of septic tank exact calculations shall be made.
4. For users over 100, the tank may be divided into independent parallel chambers of maintenance and cleaning.

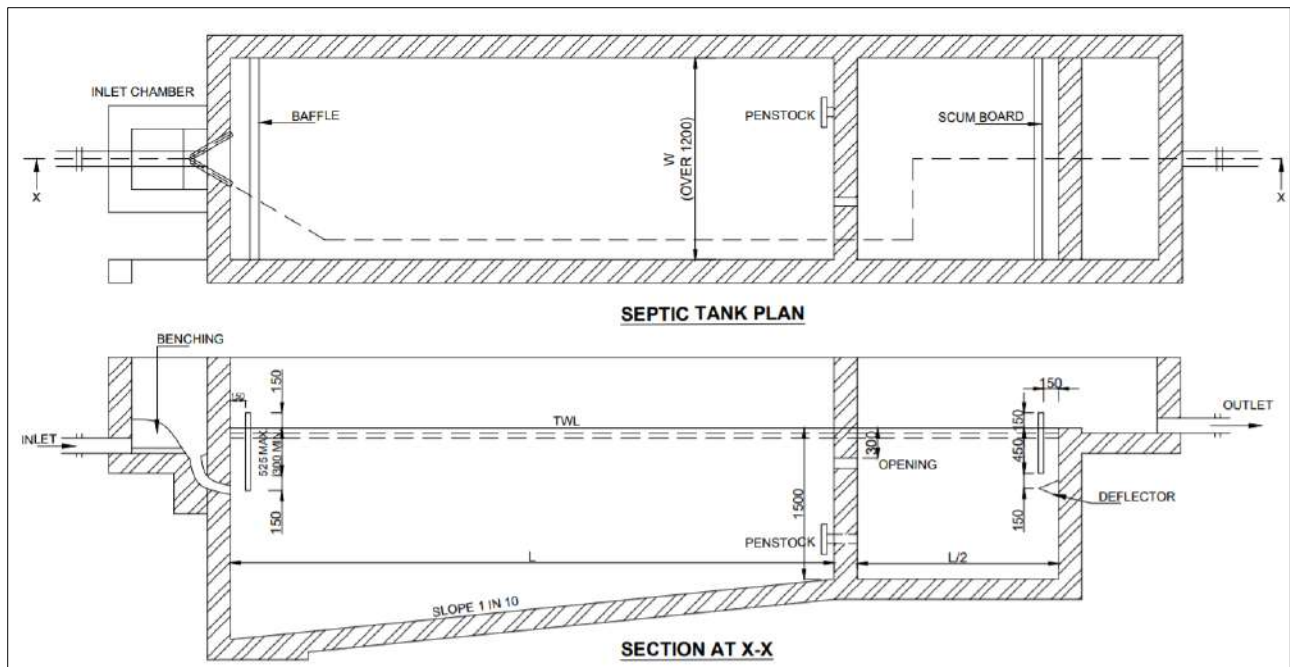


Figure 7-3: Typical details of Septic Tank

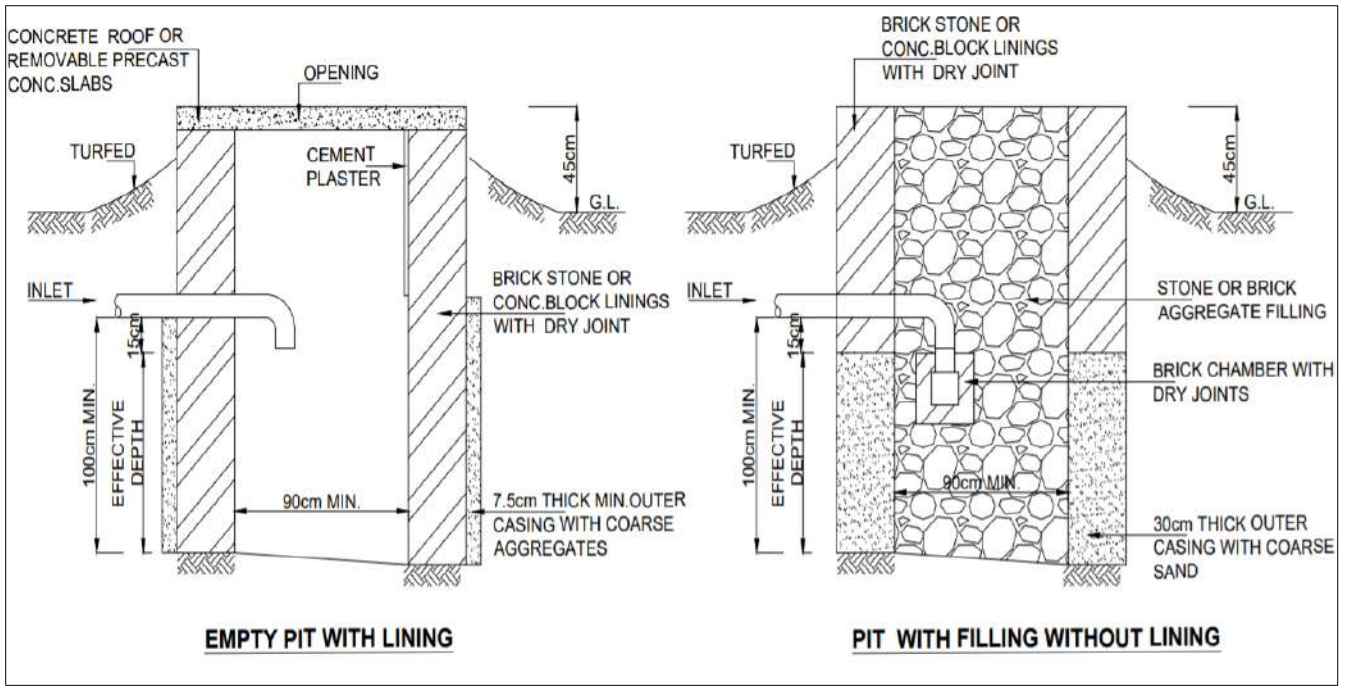


Figure 7-4: Typical Details of Soak Pit Disposal Arrangement

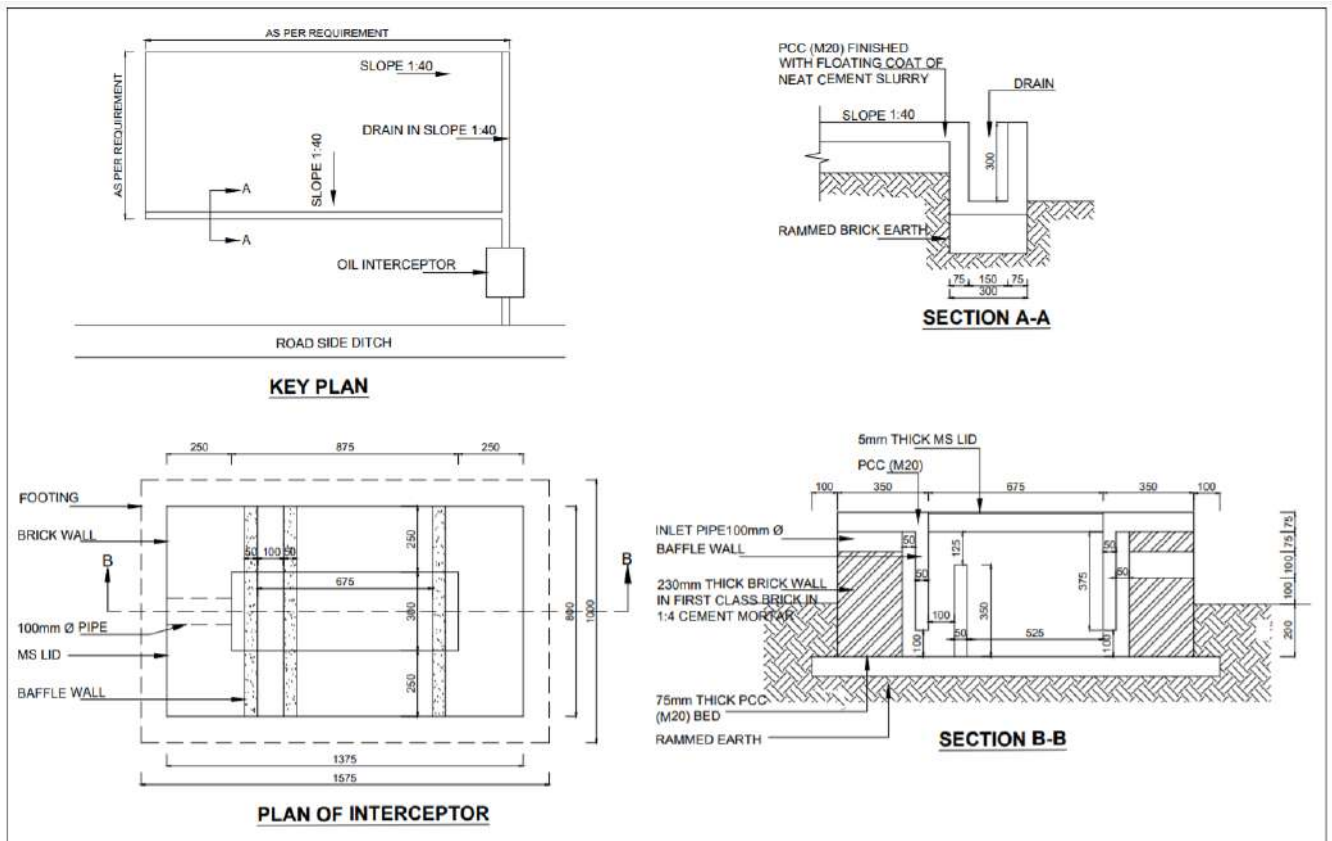


Figure 7-5: Typical Details of Oil Interceptor/ Separator at vehicle service/ Lube storage area

7.3.7 Air Quality

Impacts

278. The baseline ambient air quality for all monitored parameters (PM₁₀, PM_{2.5}, SO₂, NO₂, HC, CO) along project road and at Associated Facilities (ref. Table 4-9 under Section 4) were below the NAAQS, which can be attributed to present low vehicular traffic and absence of industrial emission sources along project road/area.

279. Road construction activities can contribute to increased dust levels due to activities like site clearance/preparation, excavation, hill cutting, material loading, unloading and transportation movement of construction vehicles/ equipment among others.

280. Gaseous emission during construction activities can be due to road construction machinery, equipment and plants like concrete batching plant, hot mix plant and wet mix macadam plant. The operation of vehicles, equipment and plant will result in emissions of carbon monoxide, sulphur dioxide, and oxides of nitrogen. Generally, additional vehicle movements generated during the construction phase will have the potential to influence local air quality particularly near sensitive receptors located at close proximity to road. Pollutant concentration is likely to reduce with increased distance from road.

281. Air quality modeling was carried out to determine the concentrations of PM₁₀, PM_{2.5}, NO_x, SO_x, CO on 500 meters¹⁷ either side, all along the project road at present/ base year (Year 2020-21), construction phase (2022-23), operation phase (2026 i.e., beyond 2023 onwards) and ultimate design year of the road i.e., 2038 using AERMOD ViewTM. Similarly, the air quality modeling was also carried out to determine the concentration of PM₁₀, PM_{2.5}, NO_x, SO_x, CO at sensitive receptor locations along the project road (ref. Table 4-31 under Section 4.6.6 – Baseline Data). The air quality modelling report is given in **Appendix-24** and the modelling results are summarized hereunder.

282. The emission rates used for air quality modelling using the IVE model (International Vehicle Emission) are given in **Table 7-7**. The maximum predicted GLCs along the project road including Associated Facilities for present/ base year (Year 2020-21), construction phase (2022-23) and operation phase (2026 i.e., beyond 2023 onwards) are given in **Table 7-8**. The predicted GLCs at baseline ambient air quality monitored locations along project road and Associated Facilities (within 500-meter area shown in circles) are given in **Table 7-9**. The predicted GLCs at the sensitive receptor locations along the project road are given in **Table 7-10**. The Isopleths of predicted ambient air quality parameters for selected scenarios are given in **Figures 7-6 to 7-12** and **Appendix-24** for complete modelling report.

283. It may be seen from Tables 7-9 & 7-10 that the predicted concentrations during the base year (2020-21), construction phase (2023), intermediate operation phase (2026) and design year (2038) is below the National Ambient Air Quality Standards (NAAQs) for all the ambient air quality parameters at baseline air quality monitored locations (Table 7-9) as well as sensitive receptor locations along the project road (7-10). Thus, the project road widening/ upgradation is not likely to have any significant impacts on the ambient air quality during the construction and operation phases, up to design year 2038.

Table 7-7: Emissions Rates Used for Air Quality Modelling

Ambient AQ Parameters	PM		NO _x		SO ₂		CO	
	g/km	g/s	g/km	g/s	g/km	g/s	g/km	g/s
Base Year - 2020	7.980	0.044	55.393	0.308	1.428	0.008	438.070	2.434
Construction Phase - 2023	12.415	0.052	122.977	0.512	3.321	0.014	610.013	2.542
Operational Phase – 2026	5.244	0.051	39.078	0.380	0.986	0.010	289.488	2.815
Design Year (2038)	12.554	0.122	95.256	0.926	2.351	0.023	682.121	6.632

¹⁷ To match with core impact zone covered for the bio-diversity management study report (ref. Appendix-11)

Table 7-8: Maximum Predicted GLCs of Air Quality Modelling (µg/m3)

Ambient AQ Parameters	Base Year - 2020	Construction Phase - 2023	Operational Phase - 2026	Design Year (2038)
PM (24 hr average)	1.16	1.35	1.33	3.19
NOx (24 hr average)	8.05	13.4	9.941	24.2
SOx (24 hr average)	0.208	0.362	0.251	0.602
CO (8 hr average)	92.6	96.72	107	252.37

Table 7-9: Predicted GLCs at Baseline Ambient Air Quality Monitored Locations (µg/m3)

Baseline Monitoring Location along Project Road at Talyahar Near School (AQ-01)										
Ambient AQ Parameters	Baseline Monitored Levels	Base Year - 2020		Construction Phase - 2023		Operational Phase - 2026		Design Year (2038)		NAAQs
		GLC	Total	GLC	Total	GLC	Total	GLC	Total	
PM (24 hr average)	69.00	0.04	69.04	0.05	69.05	0.04	69.04	0.85	69.85	100
NOx (24 hr average)	20.00	0.27	20.27	0.44	20.44	0.35	20.35	0.8	20.80	80
SOx (24 hr average)	8.00	0.01	8.01	0.01	8.01	0.08	8.08	0.02	8.02	80
CO (8 hr average)	0.29	3.50	3.79	3.00	3.29	4.57	4.86	8	8.29	2000
Baseline Monitoring Location along Project Road at Rewaslar Settlement (AQ-02)										
Ambient AQ Parameters	Baseline Monitored Levels	Base Year - 2020		Construction Phase - 2023		Operational Phase - 2026		Design Year (2038)		NAAQs
		GLC	Total	GLC	Total	GLC	Total	GLC	Total	
PM (24 hr average)	72.00	0.40	72.40	0.50	72.50	0.50	72.50	1.38	73.38	100
NOx (24 hr average)	23.00	3.00	26.00	5.00	28.00	3.70	26.70	8	31.00	80
SOx (24 hr average)	9.00	0.07	9.07	0.12	9.12	0.09	9.09	0.215	9.22	80
CO (8 hr average)	0.38	35.00	35.38	37.00	37.38	40.00	40.38	100	100.38	2000
Baseline Monitoring Location along Associated Facilities at Ratipul Bridge (AQ-01)										
Ambient AQ Parameters	Baseline Monitored Levels	Base Year - 2020		Construction Phase - 2023		Operational Phase - 2026		Design Year (2038)		NAAQs
		GLC	Total	GLC	Total	GLC	Total	GLC	Total	
PM (24 hr average)	76.00	0.70	76.70	0.90	76.90	0.80	76.80	2.36	78.36	100
NOx (24 hr average)	11.60	5.00	16.60	8.00	19.60	6.50	18.10	7.92	19.52	80
SOx (24 hr average)	8.50	0.14	8.64	0.27	8.77	0.17	8.67	0.045	8.55	80
CO (8 hr average)	BDL	65	BDL+65	60	BDL+60	70	BDL+70	191.4 1	BDL+191. 4	2000

Baseline Monitoring Location along Associated Facilities Raghwanu Bridge (AQ-02)										
Ambient AQ Parameters	Baseline Monitored Levels	Base Year - 2020		Construction Phase - 2023		Operational Phase - 2026		Design Year (2038)		NAAQs
		GLC	Total	GLC	Total	GLC	Total	GLC	Total	
PM (24 hr average)	78.00	0.11	78.11	0.20	78.20	0.16	78.16	0.39	78.39	100
NOx (24 hr average)	12.80	0.80	13.60	0.90	13.70	0.95	13.75	2.95	15.75	80
SOx (24 hr average)	8.60	0.02	8.62	0.04	8.64	0.03	8.63	0.065	8.67	80
CO (8 hr average)	BDL	10	BDL+10	10	BDL+10	2	BDL+2	33.3	BDL+33.3	2000

Note: All figures are in $\mu\text{g}/\text{m}^3$ *NAAQS – National Ambient Air Quality Standards, 2009

Table 7-10: Predicted GLCs at Sensitive Receptor Locations along Project Road ($\mu\text{g}/\text{m}^3$)

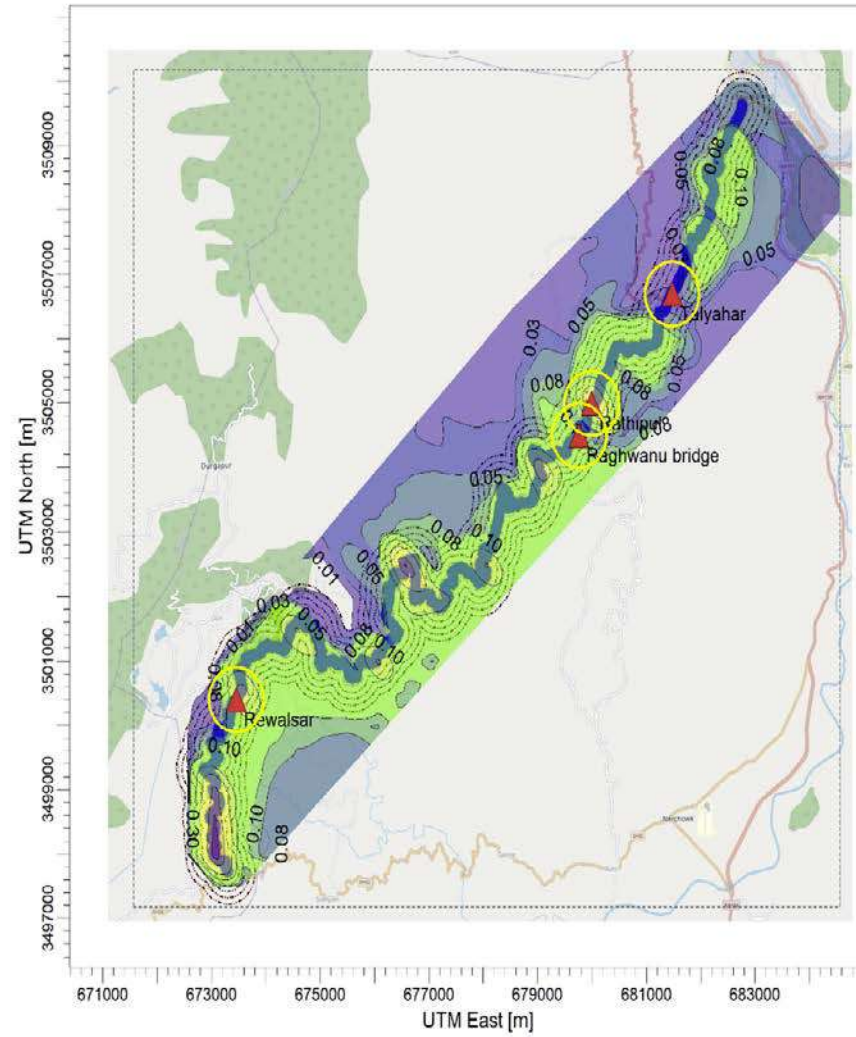
Govt Sr Sec School - Ch. 4+237 & at 4.3 m distance from existing centreline of road										
Ambient AQ Parameters	Baseline Monitored Levels	Base Year - 2020		Construction Phase - 2023		Operational Phase - 2026		Design Year (2038)		NAAQs
		GLC	Total	GLC	Total	GLC	Total	GLC	Total	
PM (24 hr average)	69.00	0.03	69.03	0.03	69.03	0.04	69.04	0.1	69.10	100
NOx (24 hr average)	20.00	0.16	20.16	0.40	20.40	0.33	20.33	0.7	20.70	80
SOx (24 hr average)	8.00	0.06	8.06	0.01	8.01	0.07	8.07	0.02	8.02	80
CO (8 hr average)	0.29	4.00	4.29	4.00	4.29	4.50	4.79	9.5	9.79	2000

Primary Health Centre - Ch. 4+515 & at 10 m distance from existing centreline of road										
Ambient AQ Parameters	Baseline Monitored Levels	Base Year - 2020		Construction Phase - 2023		Operational Phase - 2026		Design Year (2038)		NAAQs
		GLC	Total	GLC	Total	GLC	Total	GLC	Total	
PM (24 hr average)	69.00	0.04	69.04	0.04	69.04	0.04	69.04	0.09	69.09	100
NOx (24 hr average)	20.00	0.27	20.27	0.44	20.44	0.33	20.33	0.7	20.70	80
SOx (24 hr average)	8.00	0.01	8.01	0.07	8.07	0.02	8.02	4.0	12.0	80
CO (8 hr average)	0.29	4.00	4.29	3.50	3.79	4.50	4.79	9.0	9.29	2000

SVM Public School - Ch. 4+773 & at 6.4 m distance from existing centreline of road										
Ambient AQ Parameters	Baseline Monitored Levels	Base Year - 2020		Construction Phase - 2023		Operational Phase - 2026		Design Year (2038)		NAAQs
		GLC	Total	GLC	Total	GLC	Total	GLC	Total	
PM (24 hr average)	69.00	0.05	69.05	0.06	69.06	0.06	69.06	0.2	69.20	100
NOx (24 hr average)	20.00	0.40	20.40	0.06	20.06	0.45	20.45	1.1	21.10	80
SOx (24 hr average)	8.00	0.01	8.01	0.02	8.02	0.01	8.01	0.03	8.03	80
CO (8 hr average)	0.29	4.5	4.79	5.0	5.29	6.0	6.29	10.8	11.09	2000

Unity Public School - Ch. 22+570 & at 4 m distance from existing centreline of road										
Ambient AQ Parameters	Baseline Monitored Levels	Base Year - 2020		Construction Phase - 2023		Operational Phase - 2026		Design Year (2038)		NAAQs
		GLC	Total	GLC	Total	GLC	Total	GLC	Total	
PM (24 hr average)	72.00	0.21	72.21	0.24	72.24	0.25	72.25	0.55	72.55	100
NOx (24 hr average)	23.00	1.52	24.52	2.54	25.54	1.83	24.83	4.45	27.45	80
SOx (24 hr average)	9.00	0.04	9.04	0.07	9.07	0.05	9.05	0.11	9.11	80
CO (8 hr average)	0.38	19.0	19.38	19.5	19.88	24.5	24.88	50.0	50.38	2000
Rewalsar Lake - Ch. 22+970 & at 50 m distance from existing centreline of road										
Ambient AQ Parameters	Baseline Monitored Levels	Base Year - 2020		Construction Phase - 2023		Operational Phase - 2026		Design Year (2038)		NAAQs
		GLC	Total	GLC	Total	GLC	Total	GLC	Total	
PM (24 hr average)	72.00	0.19	72.19	0.22	72.22	0.22	72.22	0.45	72.45	100
NOx (24 hr average)	23.00	1.10	24.10	2.18	25.18	1.61	24.61	3.94	26.94	80
SOx (24 hr average)	9.00	0.03	9.03	0.05	9.05	0.04	9.04	0.04	9.04	80
CO (8 hr average)	0.38	15.0	15.38	16.0	16.38	17.0	17.38	41.8	42.18	2000
Govt Primary School - Ch. 23+280 & at 3.5 m distance from existing centreline of road										
Ambient AQ Parameters	Baseline Monitored Levels	Base Year - 2020		Construction Phase - 2023		Operational Phase - 2026		Design Year (2038)		NAAQs
		GLC	Total	GLC	Total	GLC	Total	GLC	Total	
PM (24 hr average)	72.00	0.22	72.22	0.26	72.26	0.27	72.27	0.6	72.60	100
NOx (24 hr average)	23.00	1.52	24.52	2.54	25.54	1.83	24.83	4.45	27.45	80
SOx (24 hr average)	9.00	0.04	9.04	0.07	9.07	0.05	9.05	0.11	54.00	80
CO (8 hr average)	0.38	18.8	19.18	19.0	19.38	21.8	22.18	45.0	0.38	2000

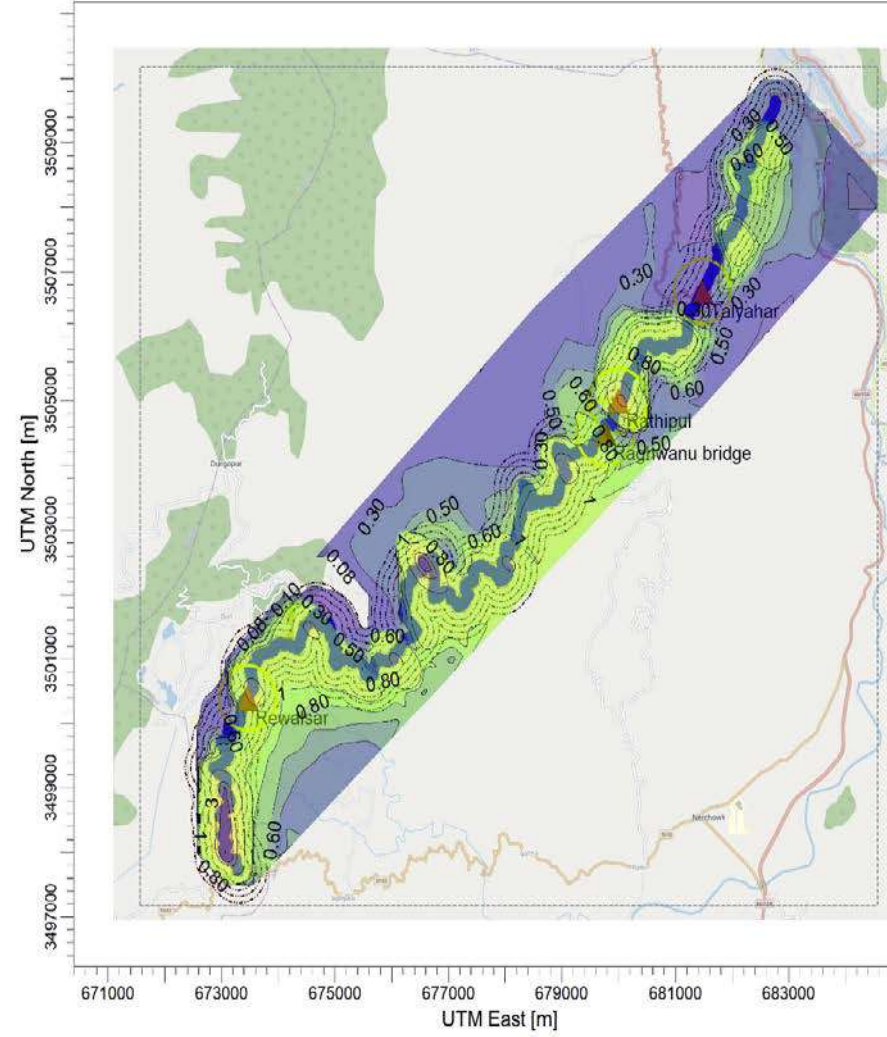
PROJECT TITLE:
MDR-26 PM (Present Scenario)
Mandi- Rewalsar- Kalkhar Road



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL
Max: 1.16 [$\mu\text{g}/\text{m}^3$] at (673065.51, 3497989.06)
Legend: 0.01, 0.03, 0.05, 0.08, 0.10, 0.30, 0.50, 0.80, 1.00, 1.16

Short Term 24 hourly GLCs of PM during Present Phase

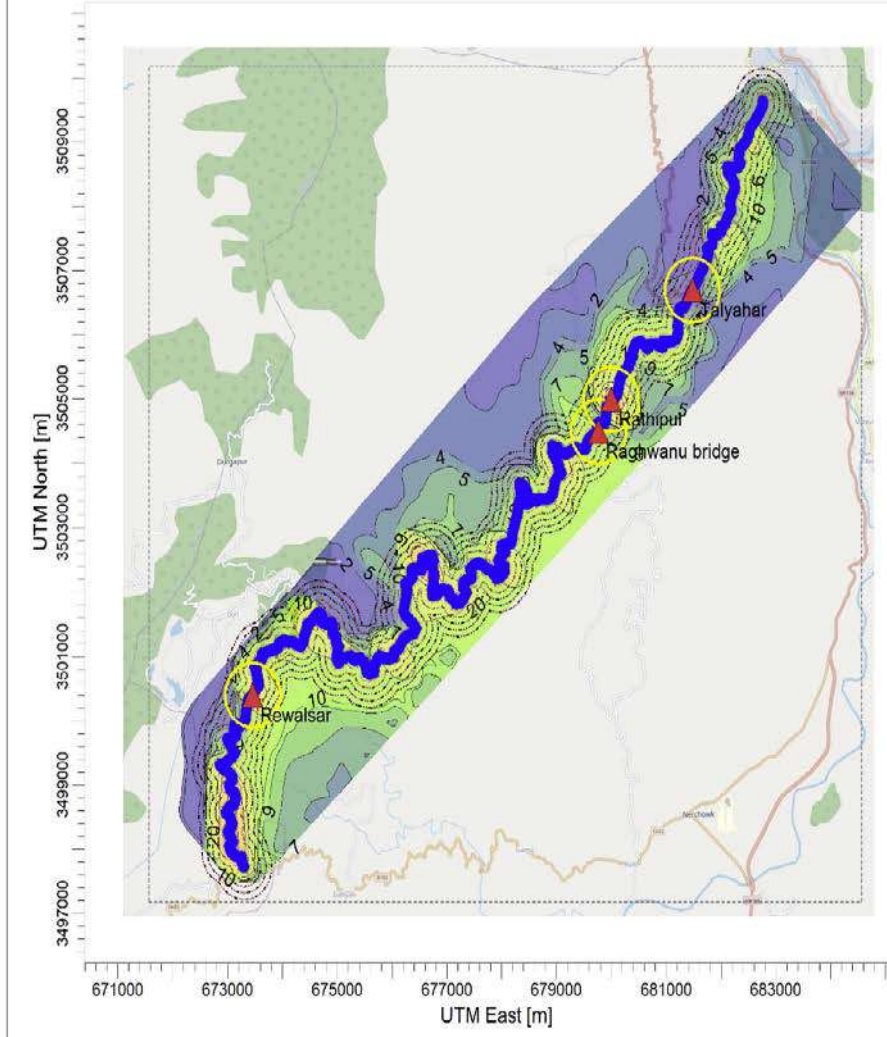
PROJECT TITLE:
MDR-26 NOx (Present Scenario)
Mandi- Rewalsar- Kalkhar Road



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL
Max: 8.05 [$\mu\text{g}/\text{m}^3$] at (673065.51, 3497989.06)
Legend: 0.08, 0.10, 0.30, 0.50, 0.60, 0.80, 1.00, 3.00, 5.00, 6.00, 8.00, 8.05

Short Term 24 hourly GLCs of NOx during Present Phase

PROJECT TITLE:
MDR-26 CO (Present Scenario)
Mandi- Rewalsar- Kalkhar Road



PLOT FILE OF HIGH 1ST HIGH 8-HR VALUES FOR SOURCE GROUP: ALL
Max: 92.6 [$\mu\text{g}/\text{m}^3$] at (673065.51, 3497989.06)
Legend: 0.9, 1.0, 2.0, 4.0, 5.0, 7.0, 9.0, 10.0, 20.0, 40.0, 50.0, 70.0, 90.0, 92.6

Short Term 8 hourly GLCs of CO during Present Phase

Figure 7-6: Isopleth of Incremental GLCs of Ambient Air Quality Parameters (PM, NOx & CO) for Project Road – Present Year 2020

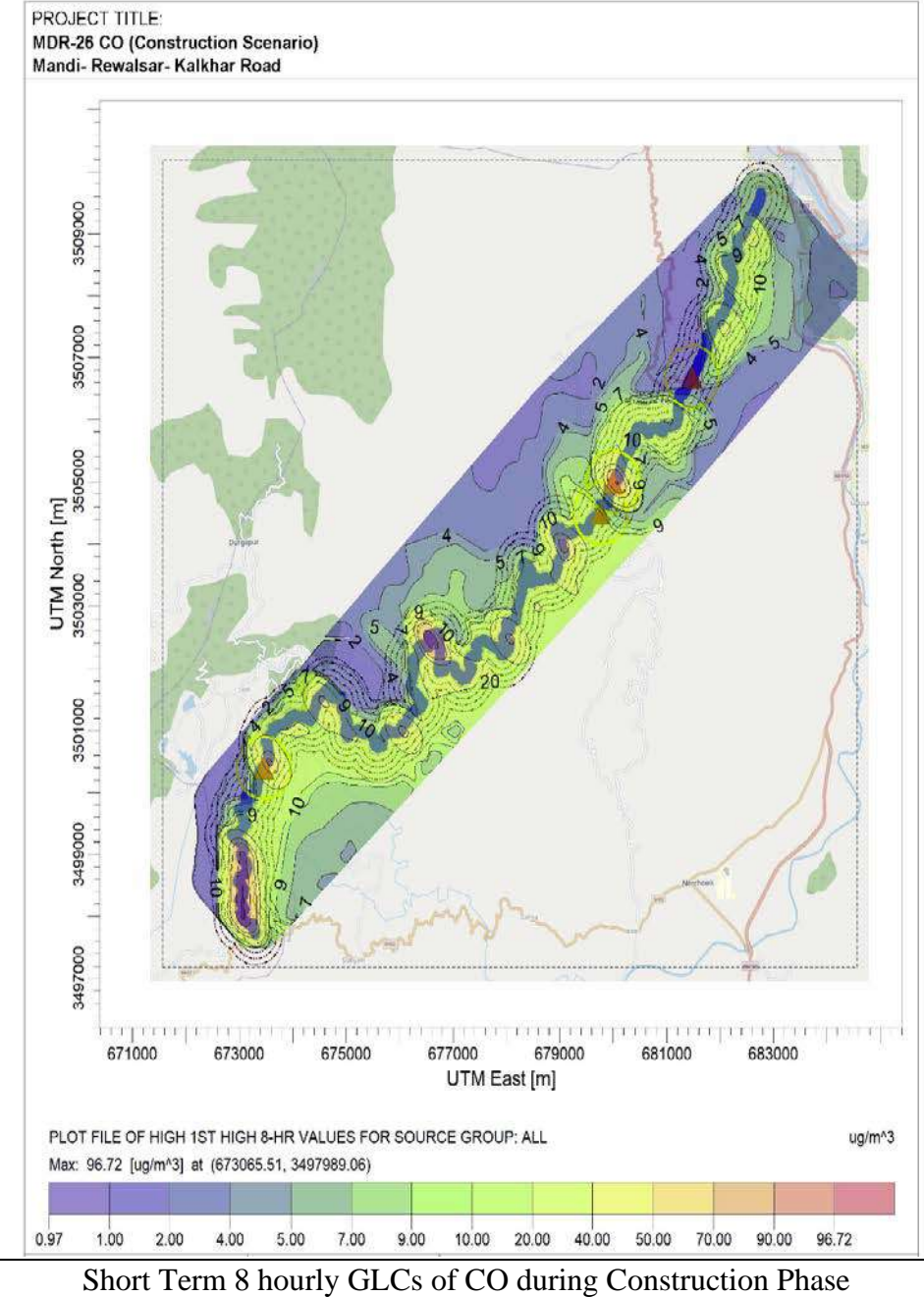
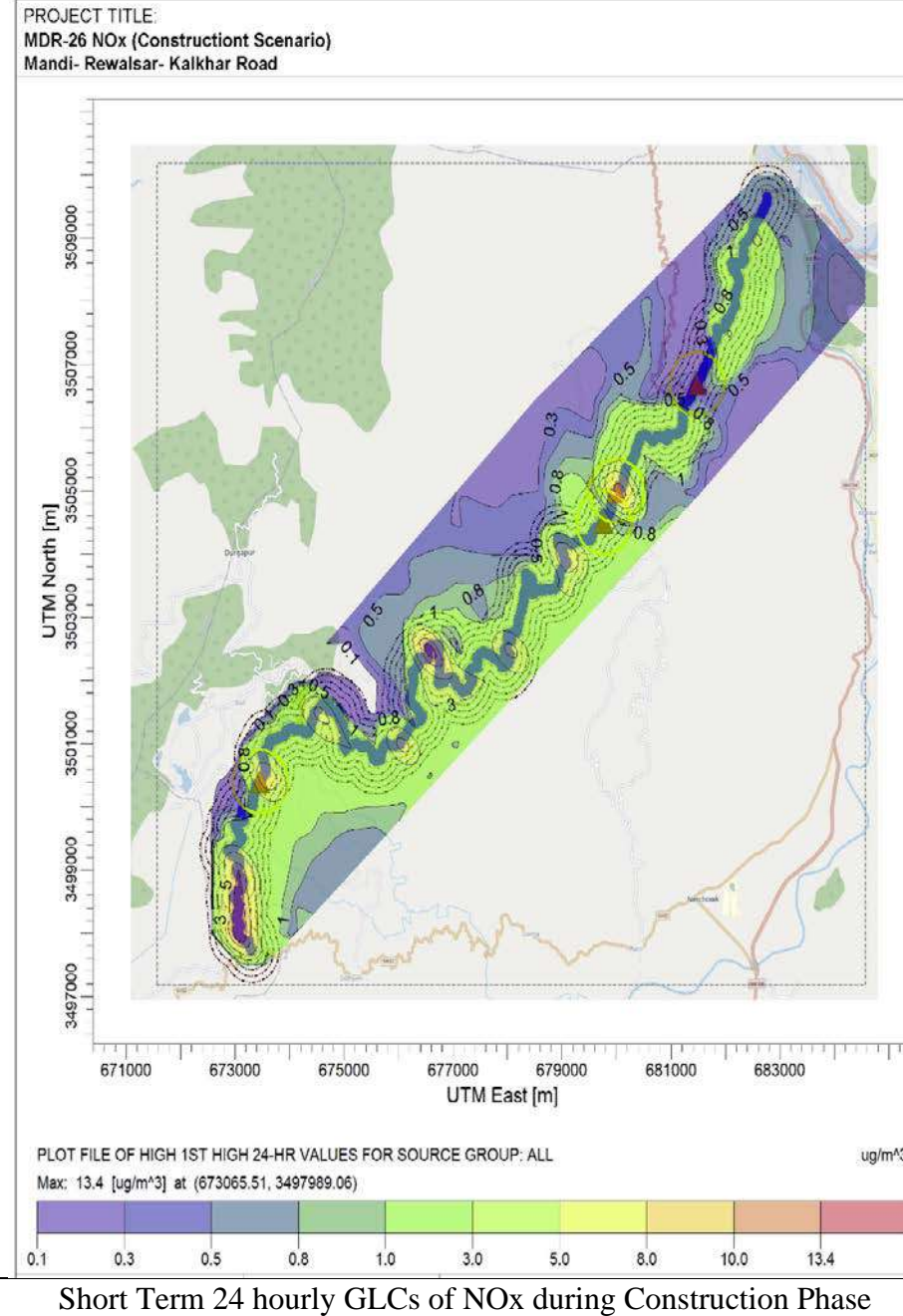
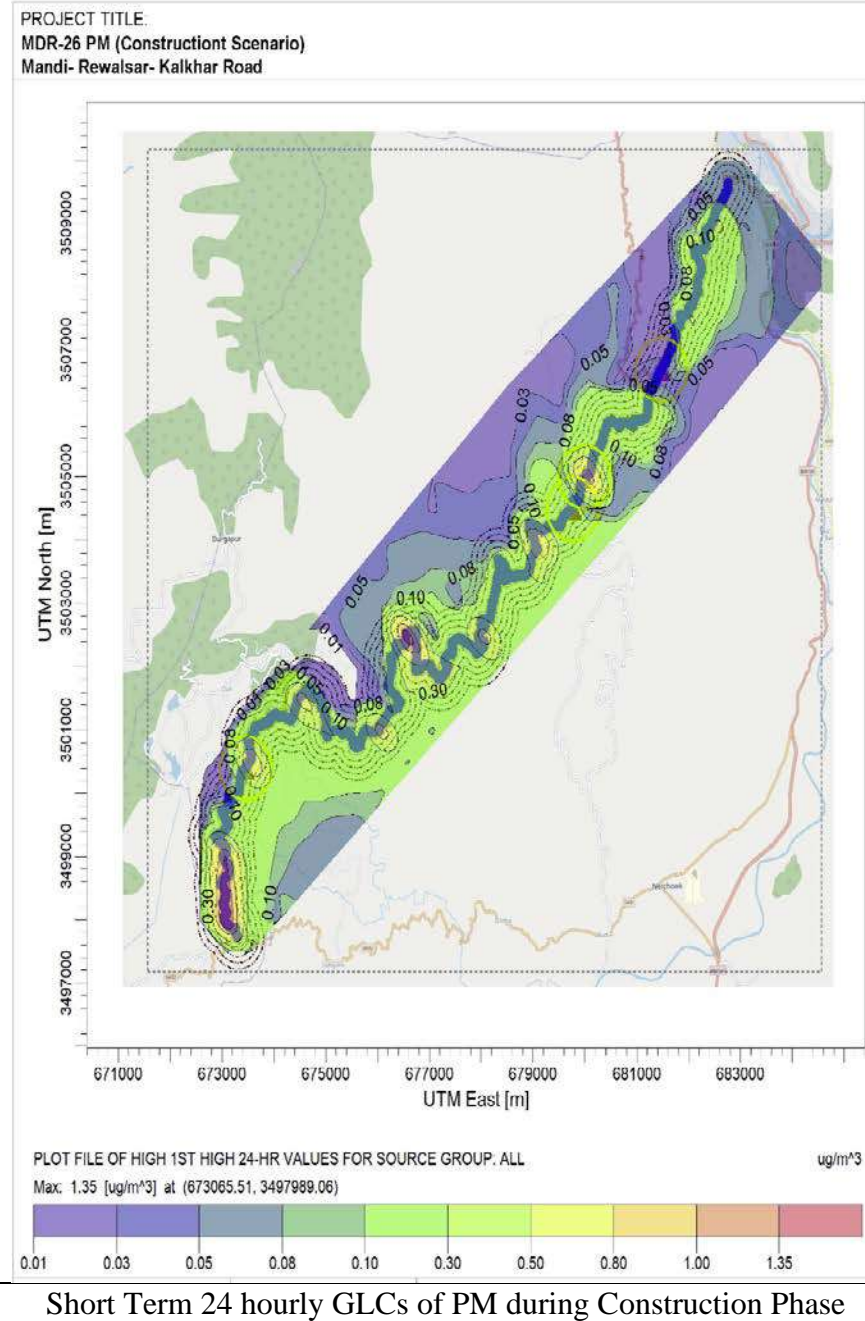
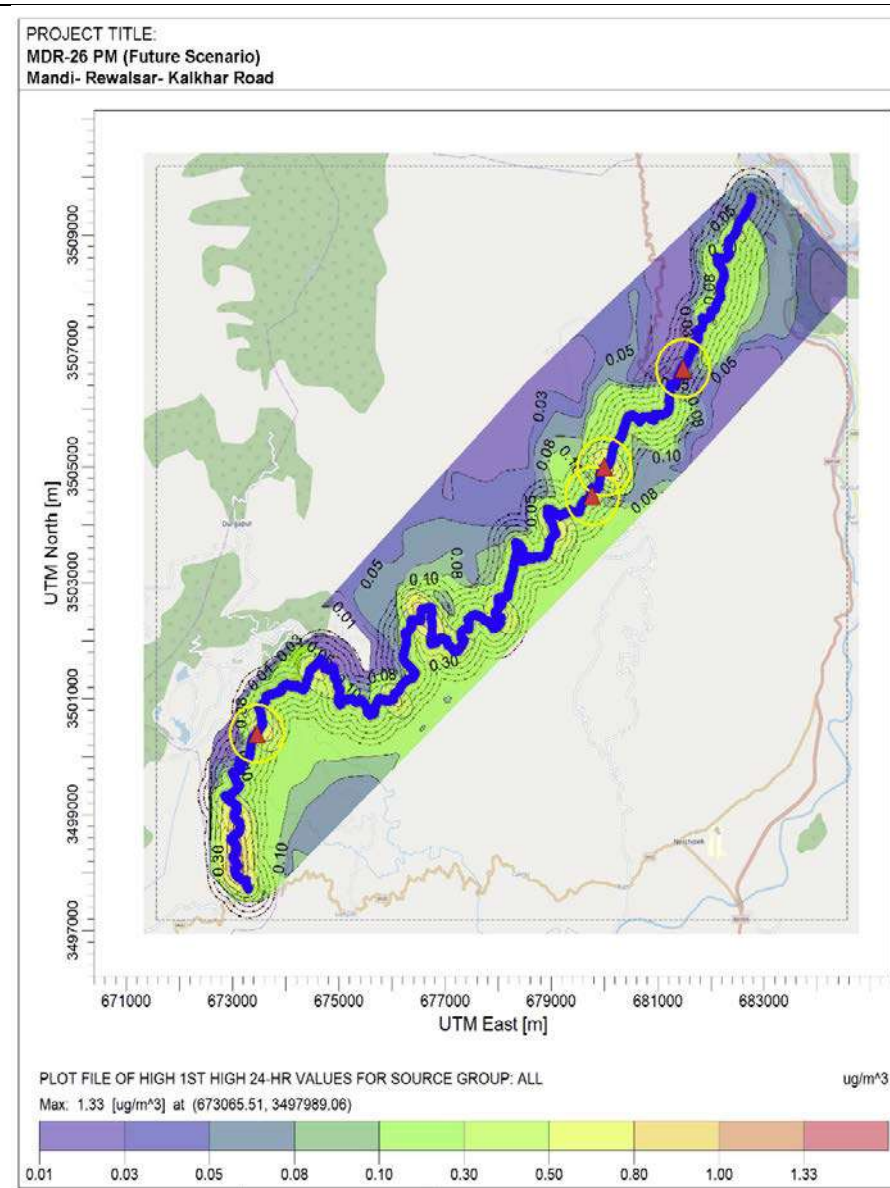
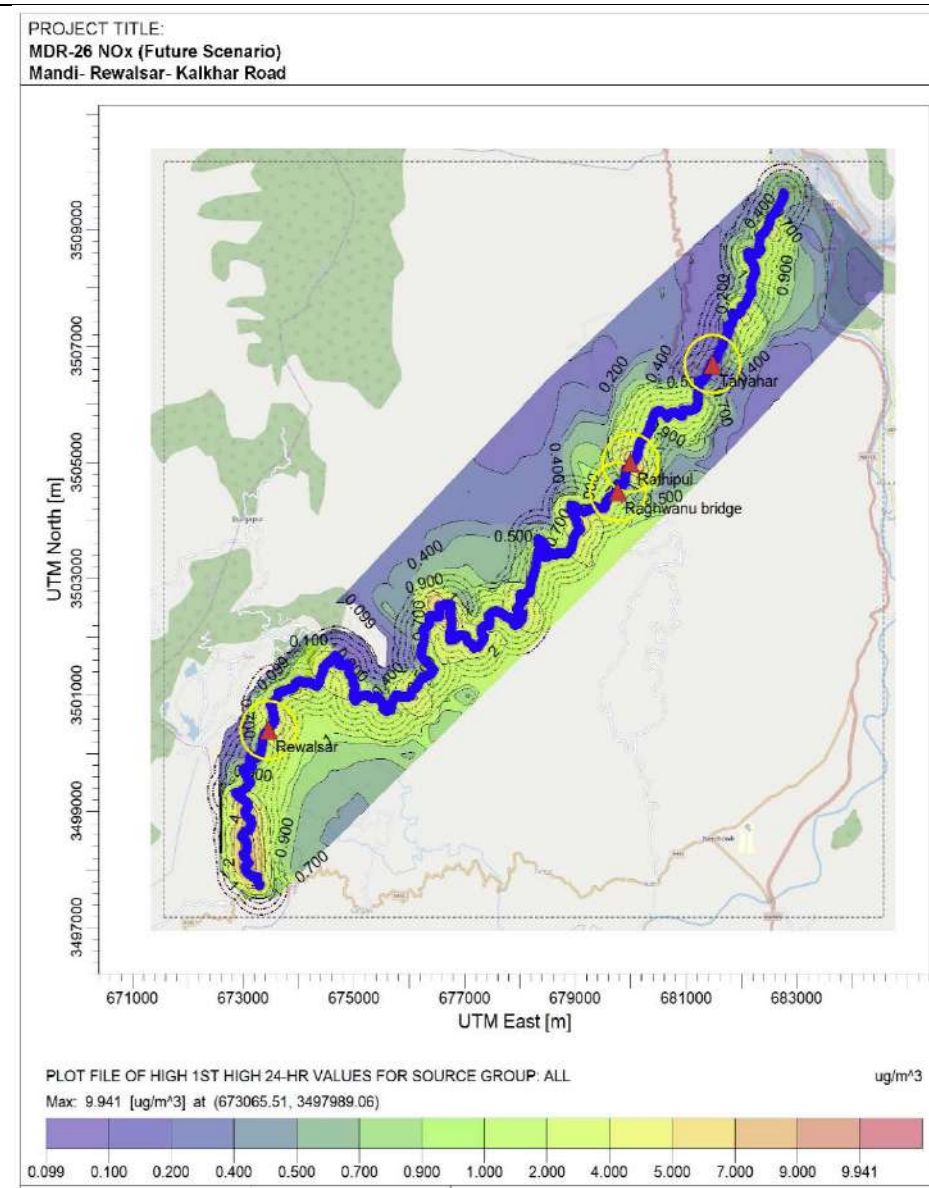


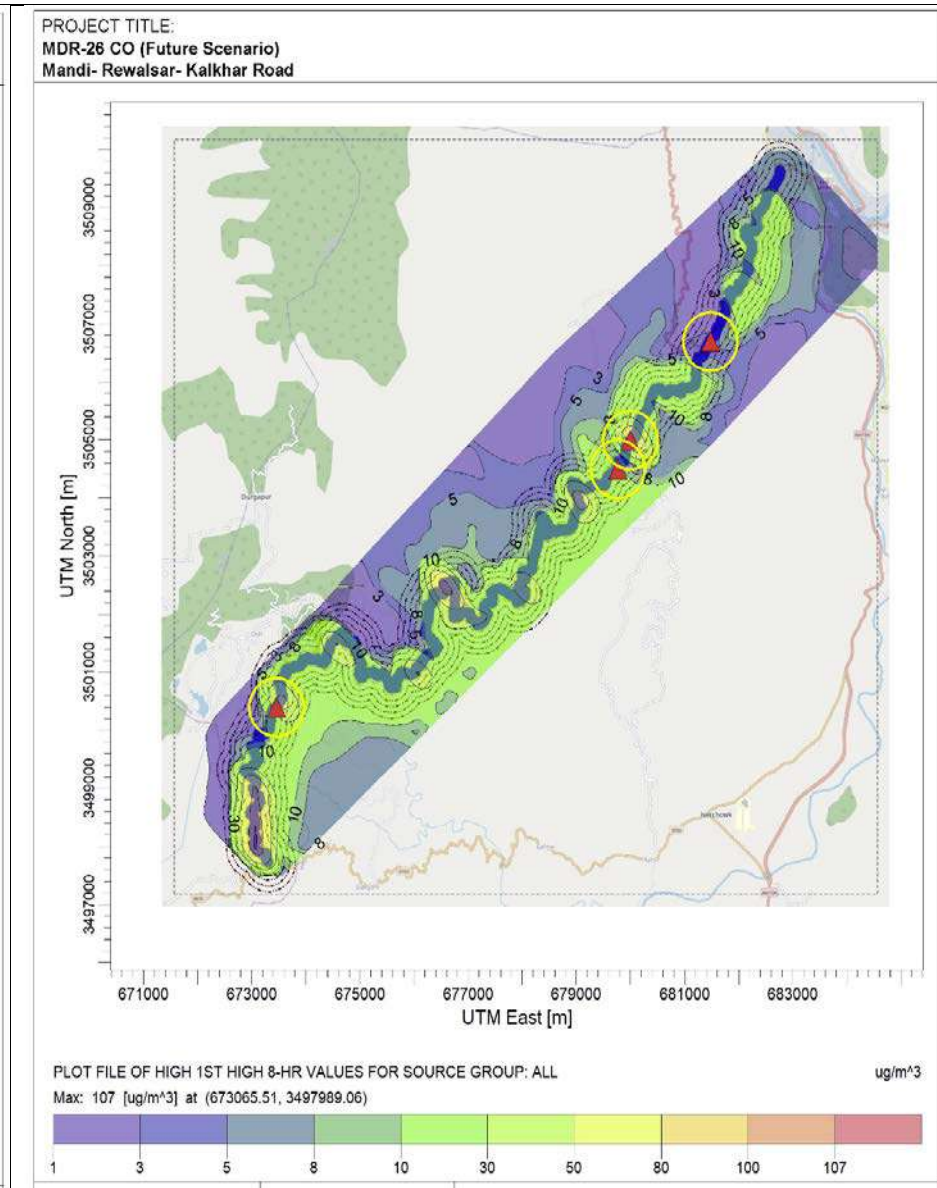
Figure 7-7: Isopleth of Incremental GLCs of Ambient Air Quality Parameters (PM, NOx, & CO) for Project Road – Construction Year 2023



Short Term 24 hourly GLCs of PM during Operational Phase



Short Term 24 hourly GLCs of NOx during Operational Phase



Short Term 8 hourly GLCs of CO during Operational Phase

Figure 7-8: Isopleth of Incremental GLCs of Ambient Air Quality Parameters (PM, NOx, & CO) for Project Road – Operational Year 2026

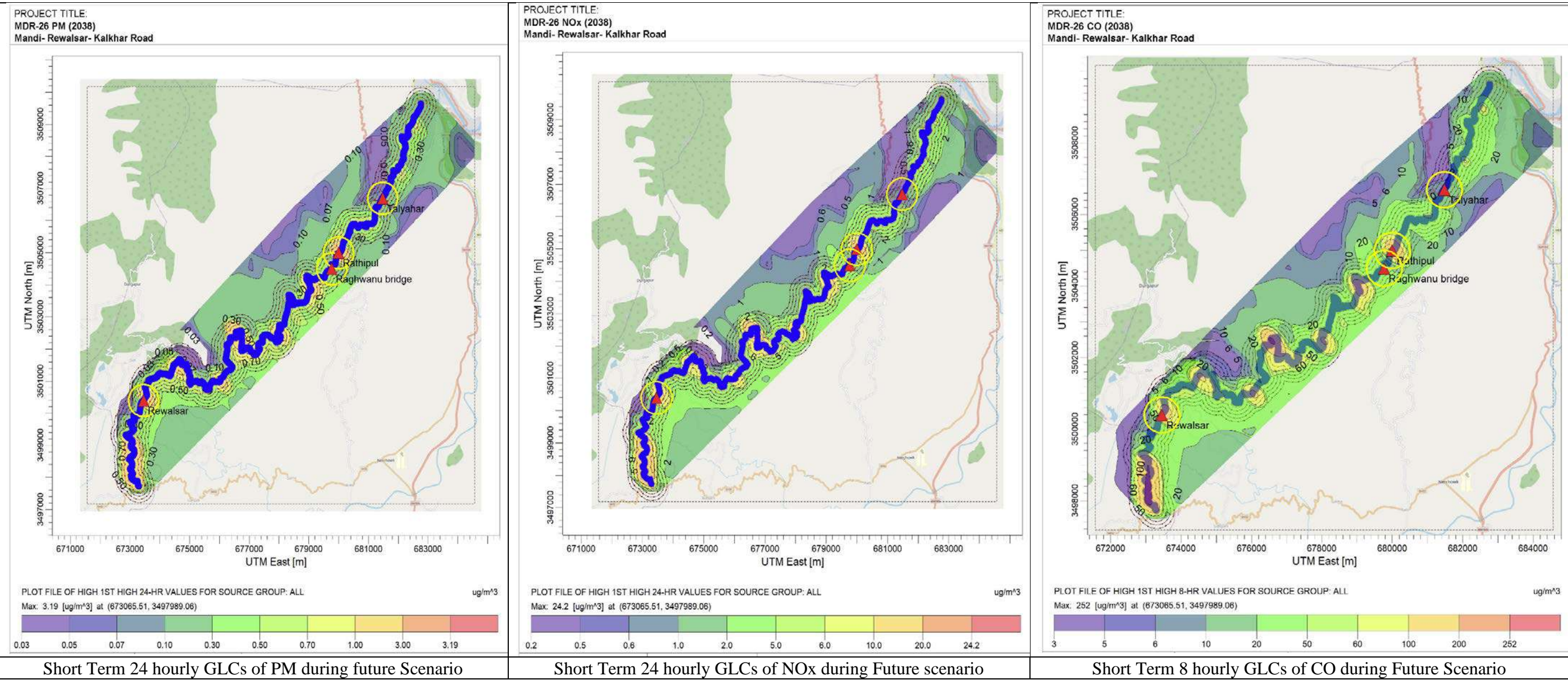
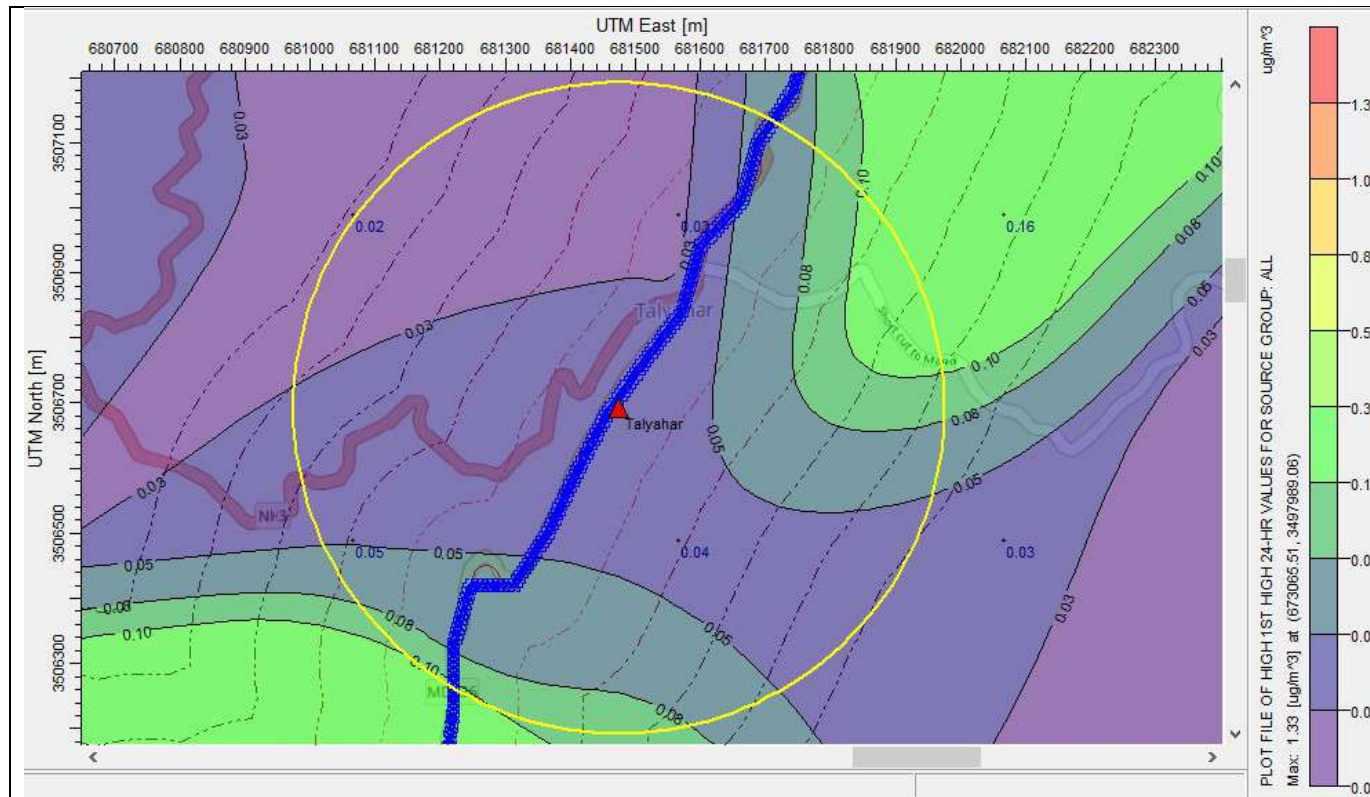
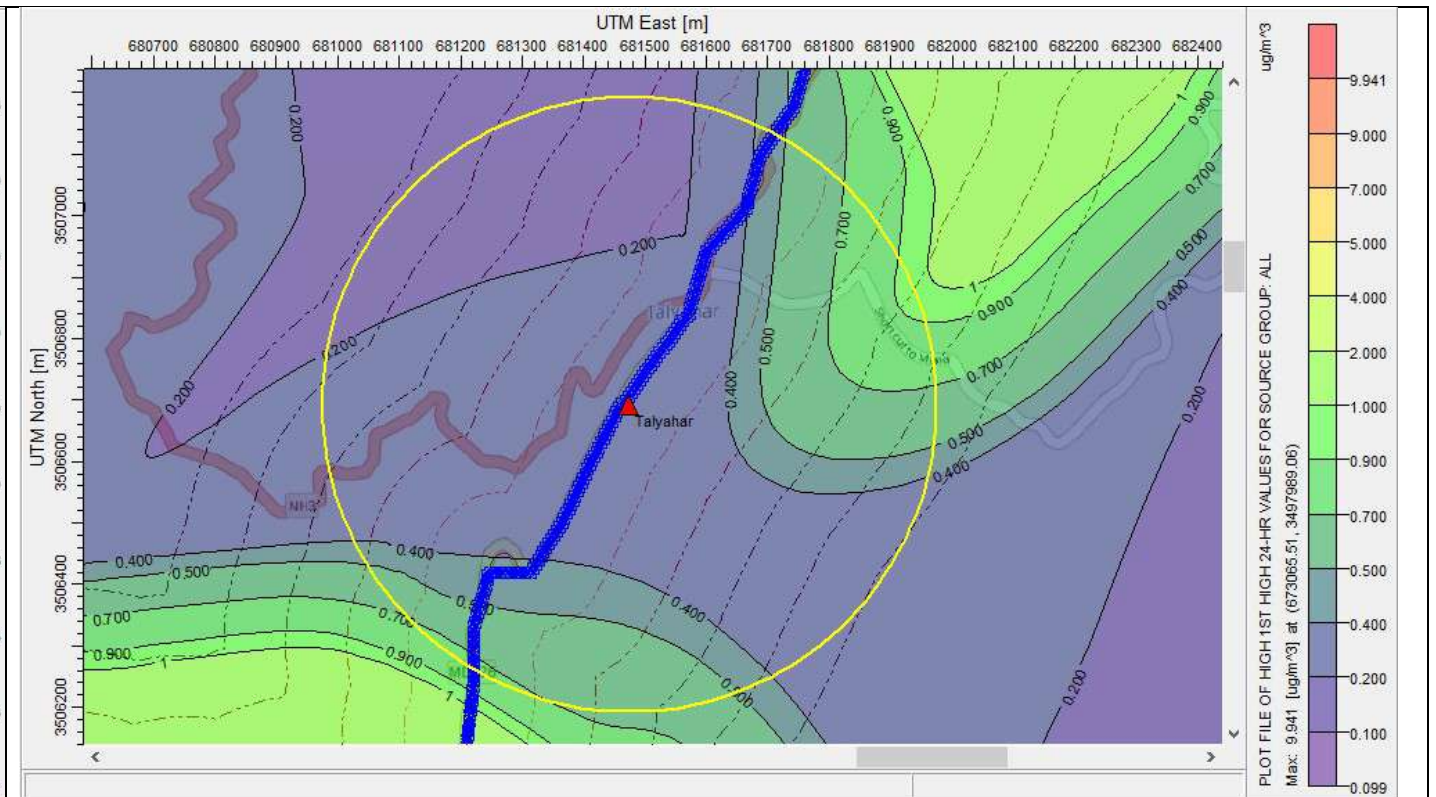


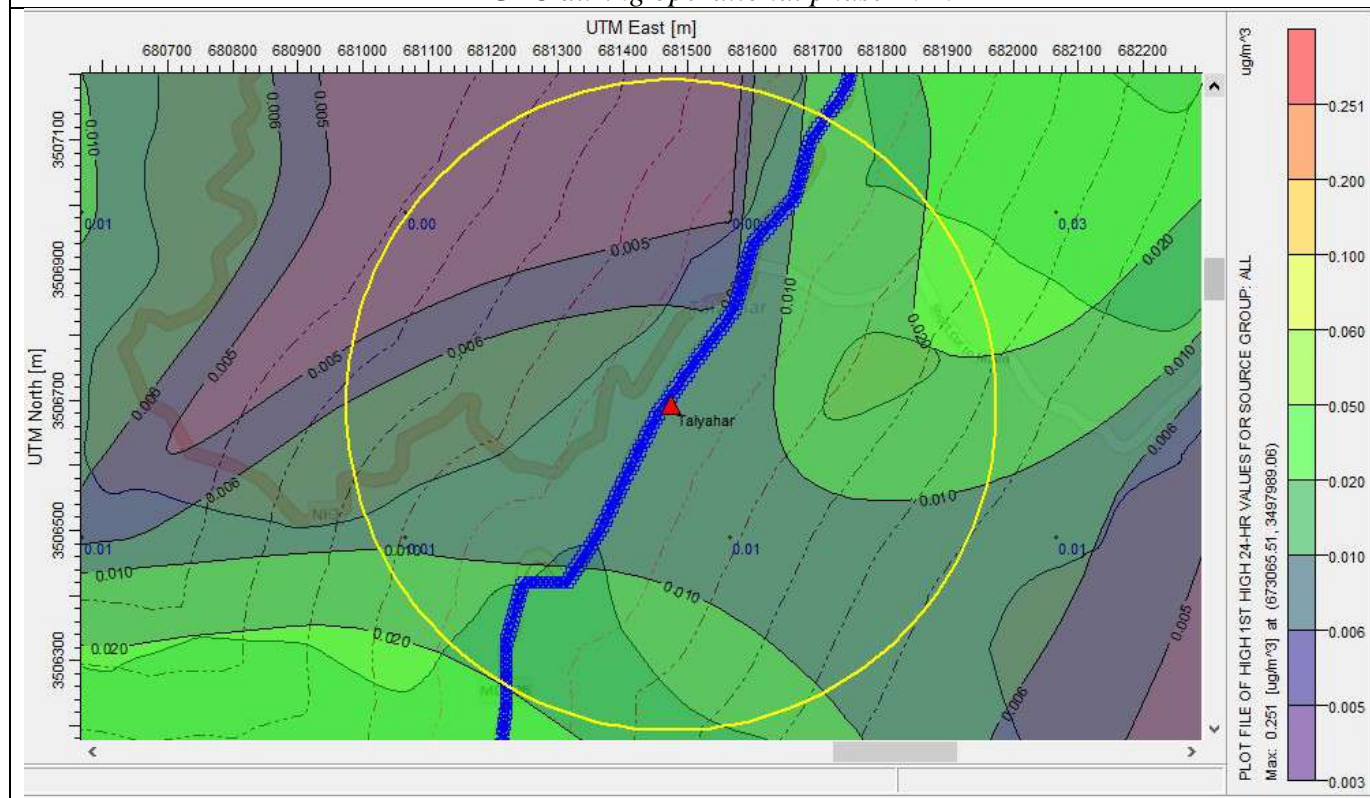
Figure 7-9: Isopleth of Incremental GLCs of Ambient Air Quality Parameters (PM, NOx, & CO) for Project Road – Future Scenario 2038



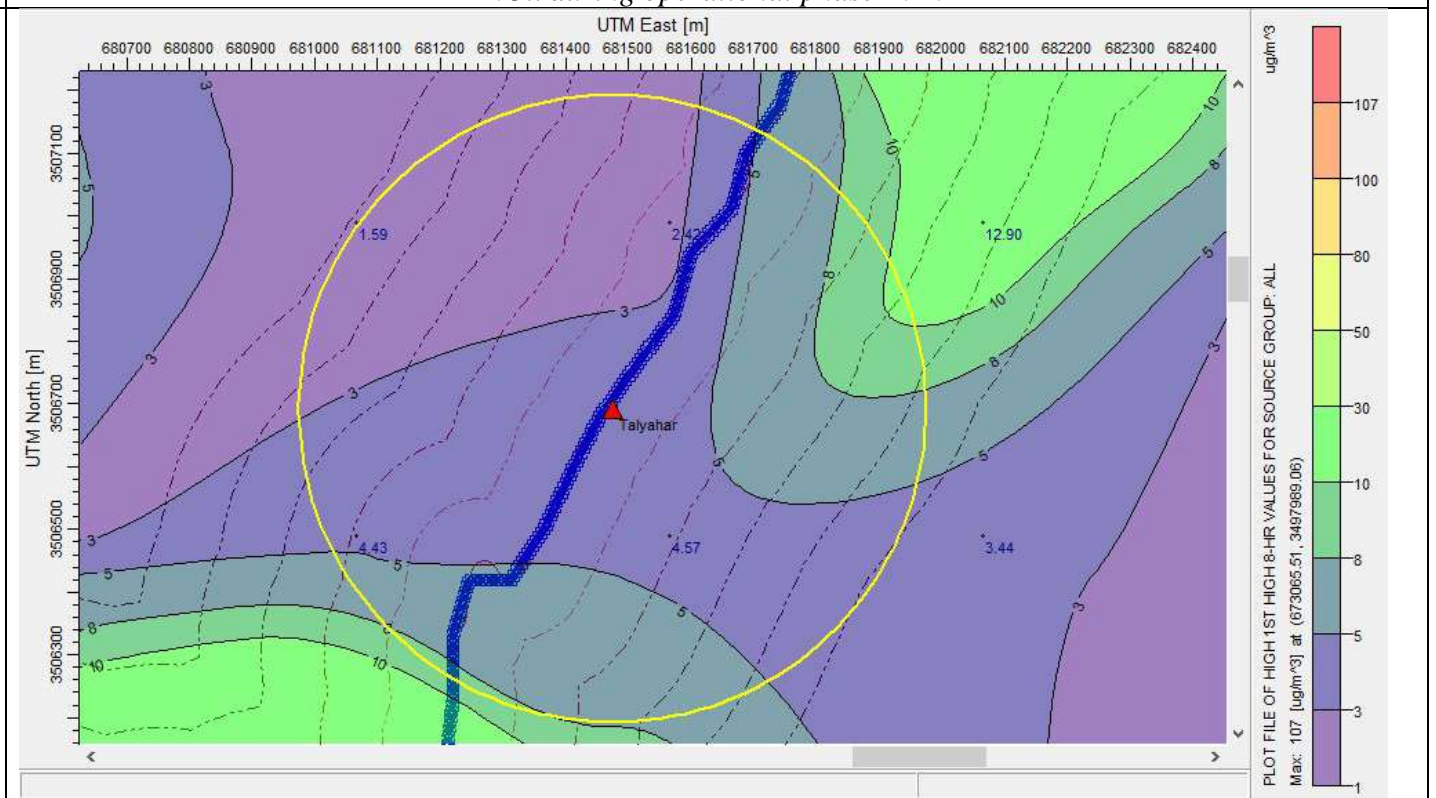
PM GLC during operational phase 2026



NOx during operational phase 2026

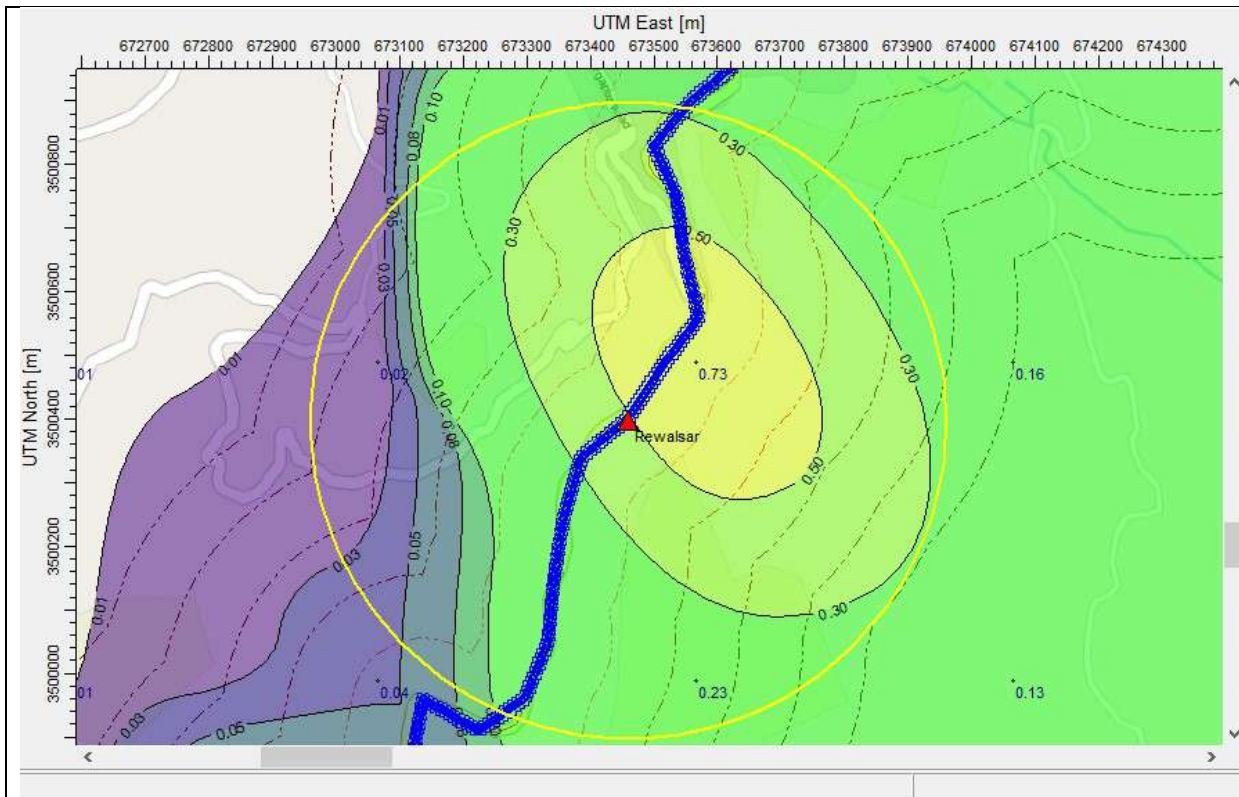


SOx during operational phase 2026

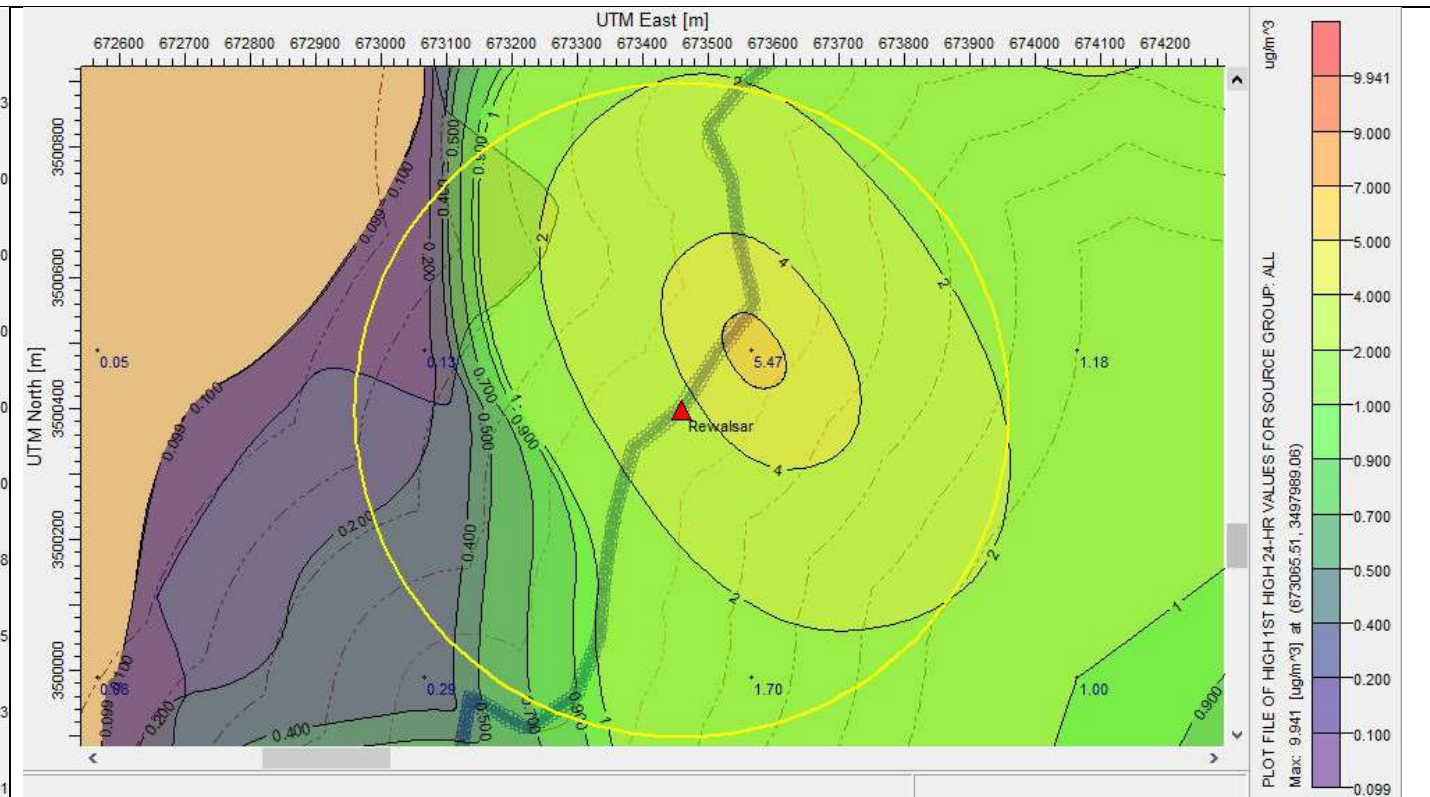


CO GLC during operational phase 2026

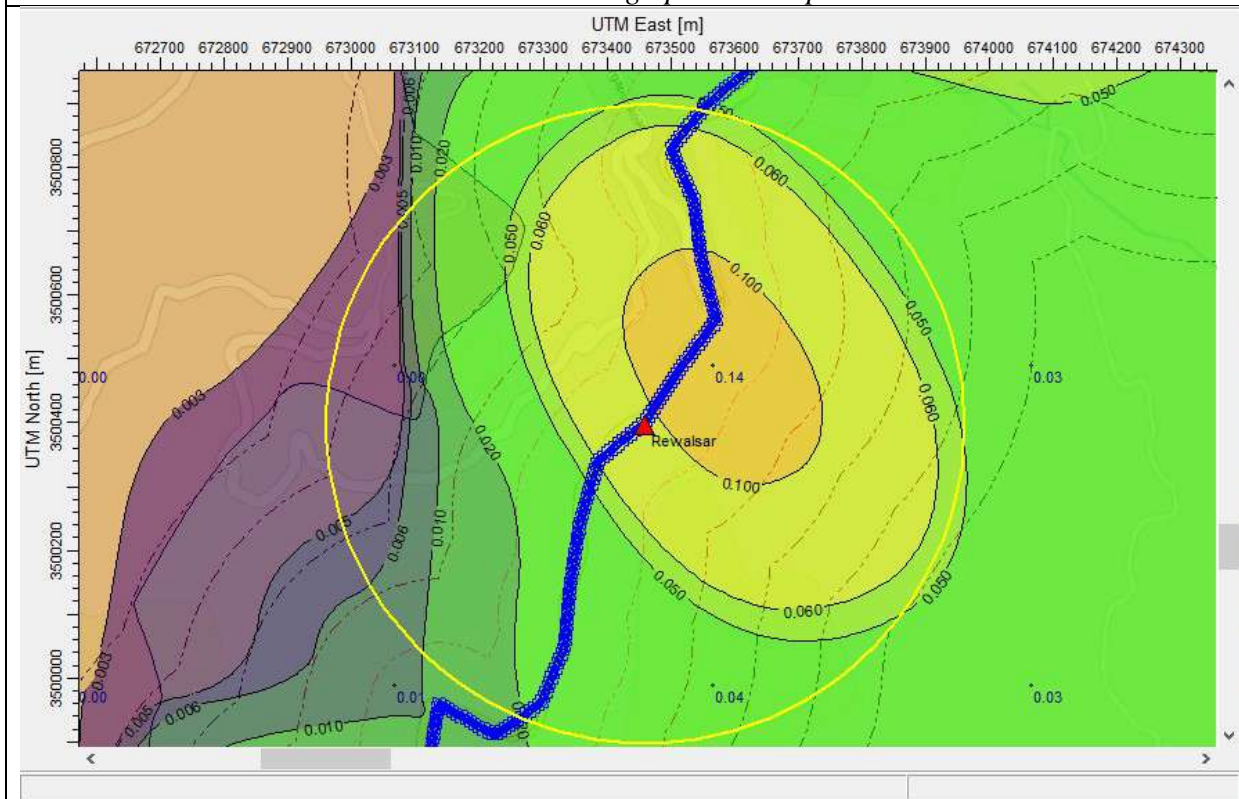
Figure 7-10: Isopleth of Incremental GLCs of Ambient Air Quality Parameters (PM, NOx, SOx & CO) at Baseline AQ Monitored Locations along Project Road – Operational Year 2026



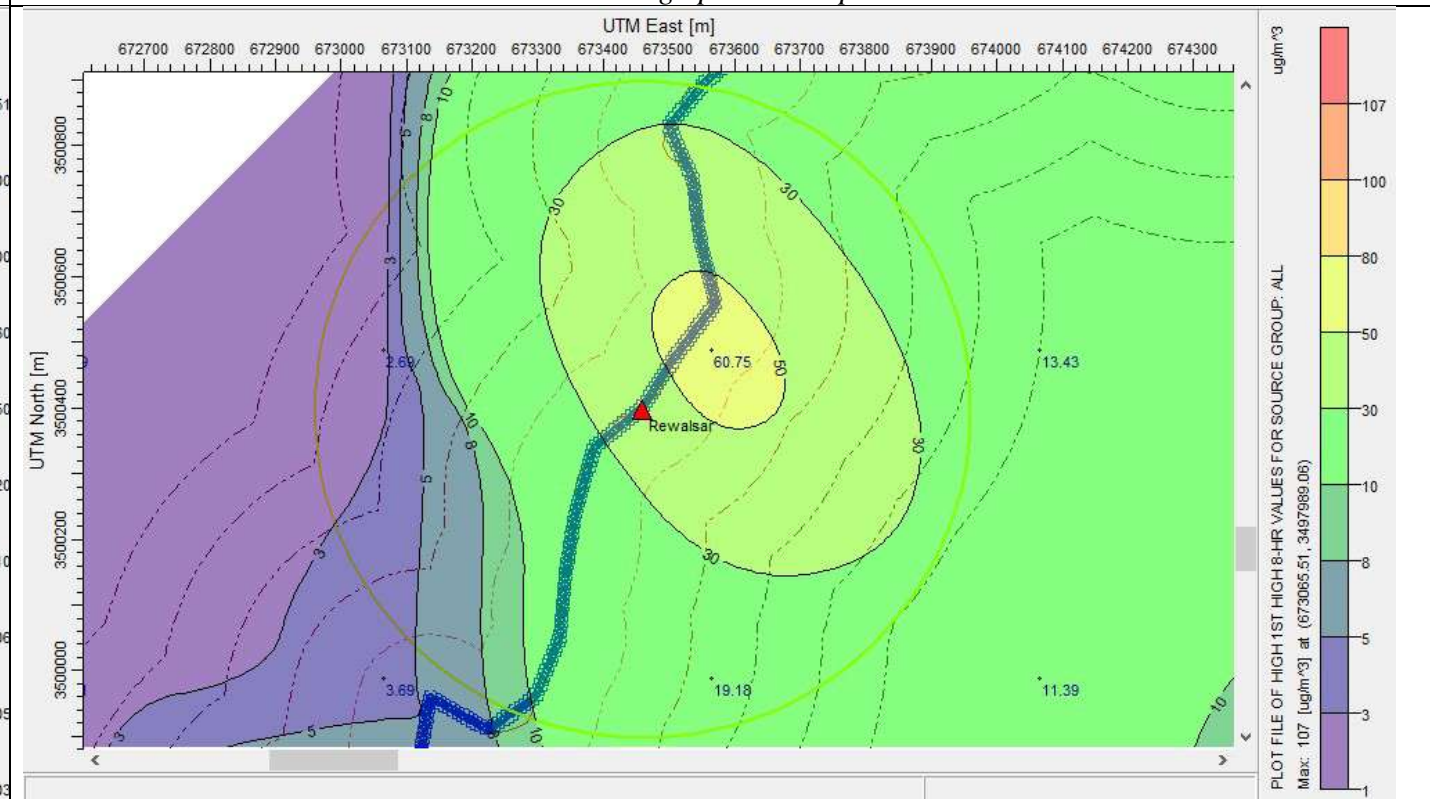
PM GLC during operational phase 2026



NOx GLC during operational phase 2026



SOx GLC during operational phase 2026



CO GLC during operational phase 2026

Figure 7-11: Isopleth of Incremental GLCs of Ambient Air Quality Parameters (PM, NOx, SOx & CO) at Baseline AQ Monitored Locations along Project Road – Operational Year 2026

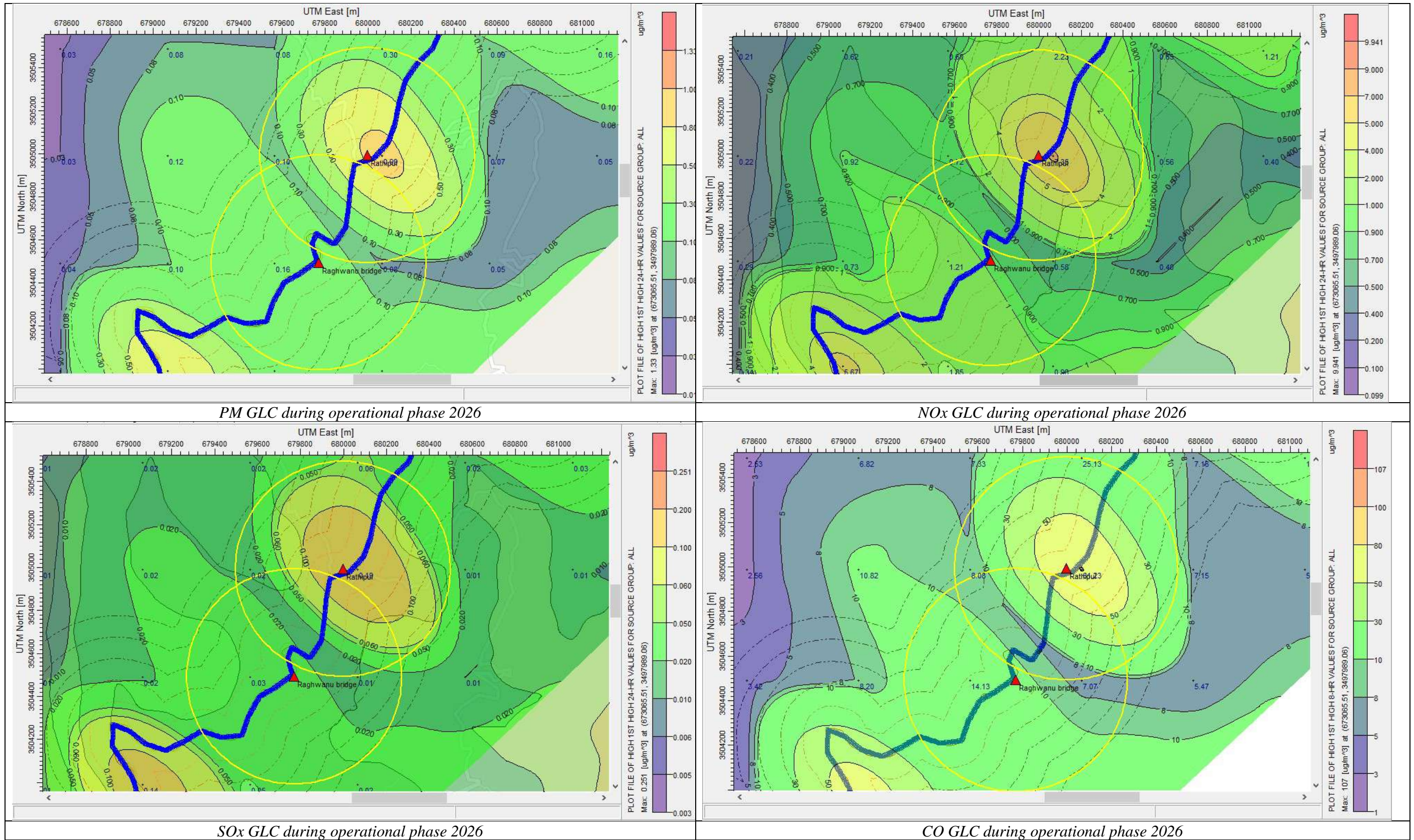


Figure 7-12: Isopleth of Incremental GLCs of Ambient Air Quality Parameters (PM, NO_x, SO_x & CO) at Baseline AQ Monitored Locations at Associated Facilities along Project Road – Operational Year 2026

Mitigation Measures

284. Although, the combined values of baseline monitored levels and predicted GLCs of the ambient air quality parameters for base year (2020-21), construction phase (2023), and operational phase (2026 & 2038 i.e., beyond construction phase and upto design year) at baseline monitored locations as well as sensitive receptor locations along the project road is well below NAAQs (ref. Table 7-7 to 7-10 and Figure 7-6 to 7-12).

285. Ensuring some of the following measures will further enable to sustain and further improve the ambient air quality along the project road. Among the air quality parameters, dust levels in terms of particulate matter PM_{2.5} and PM₁₀, and NO_x parameter is a matter of concern both in short and long term. In order to prevent and control the levels of these emissions, the following measures are to be strictly adhered to:

- All vehicles shall mandatorily have valid Pollution Control Certificates.
- The contractor shall do vehicle fitness test through competent authorities and vehicles with valid fitness certificate shall be deployed.
- All vehicles and equipment used during construction should be well maintained, efficient vehicles, having a lower unit emission ratio and higher payload shall be deployed.
- The pollution control equipment in hot-mix plant shall be kept in working condition at all times. The plant shall not be operated, if the pollution control equipment is not functional.
- The contractor shall provide wind barrier at perimeter of all plant sites to arrest or blowing of suspended particle depending on most prevailing wind direction and presence of sensitive receptors at downwind side of material stack yard.
- The contractor shall obtain and submit to CSC, all requisite permits (CTO and CTE) from the HPSPCB for operation of the hot mix Plant, stone crushing operations, batching plants and captive quarry operations and comply with all conditions stipulated in the CTO and CTE.
- Improved road conditions, after the completion of the project road widening is expected to improve average speed and congestion free traffic movement which in turn will reduce emissions and will not cause any significant increase in concentration of PM and CO during operation phase. Thus, the road shall be well maintained through periodic maintenance contract to ensure the pavement is in good condition and riding quality which can contribute to reduced GHG emissions during operation phase of project road.

7.3.8 GHG Emissions Estimate

286. In the existing scenario, due to lesser carriageway width and higher pavement roughness, the average vehicle speed is low, which results in more vehicular emissions, contributing to increased GHGs.

287. The project road widening with improved geometrics and improved/good pavement surfaces/riding quality will contribute to reduced GHG emissions during operation phase of project road (ref. 2.5 under Section 2 for traffic projection). The estimated reduction in GHG emissions in case of project road widening scenario is summarized as hereunder.

288. In the post-project scenario, improved road conditions improve average speed and congestion free traffic movement is likely to reduce emissions and will not cause any significant increase in concentration of PM and CO even after 20 years of operation, which is subjected to regular maintenance of the road condition and maintaining the average speed of traffic. The improved pavement surface and average speed is likely to contribute to reduced GHG emissions during operation phase of project road, summarized as hereunder.

289. The GHG emissions per year, at the present traffic, road geometry and pavement conditions are computed using the International Vehicle Emission (IVE) modelling and estimated at 3257.93 tons of carbon dioxide equivalents (CO₂) (which includes N₂O as well as CH₄). The GHG estimates of the widened project road scenario (as of 2019) at present traffic level is 1886.84 tons of CO₂, (which includes N₂O as well as CH₄.) Therefore, the if the project road, at present traffic levels in a widened and improved geometrics/pavement could reduce GHG emissions by 1372.23 tons of CO₂ as given in **Table 7-11**.

Table 7-11: GHG Emissions at Present Traffic Levels - Existing and Improved Road Conditions

Existing Project Road at Present Traffic levels (2019-20) but without widening/ improvement of pavement conditions				Widened/Improved Project Road at Present Traffic levels scenario (2019-20)			Change in Emissions		
Type of vehicle	CO ₂	N ₂ O	CH ₄	CO ₂	N ₂ O	CH ₄	Δ CO ₂	Δ N ₂ O	Δ CH ₄
Two wheelers	280.2	0.0000256	5.22	160.19	0	3.0055	-120.01	0	-2.215
Three wheelers	17.59	0.000376	0.01	10.05	0.0002	0.0077	-7.54	-0.00016	-0.006
LMV (4 Wheel)	2206.09	0.0322624	0.03	1260.96	0.0185	0.0154	-945.12	-0.01376	-0.01
Bus	546.14	0.0437854	0	312.2	0.0251	0	-233.94	-0.0187	0
Heavy truck	24.4	0.0026426	0	24.31	0.0026	0	-0.1	-0.00008	0
Light truck	18.69	0.0000037	0.39	18.68	0	0.3934	-0.01	0	0
Total emission	3093.11	0.0790955	5.65	1786.39	0.05	3.422	-1306.72	-0.03269	-2.231
Total emissions (in terms of Co₂ Equivalent)	3093.11	23.570459	141.25	1786.39	14.9	85.55	-1306.72	-9.74162	-55.775
	3257.93			1886.84			-1372.23		

Note: - N₂O and CH₄ is converted into Co₂ Equivalent using 298 kg and 25 kg as multiplication factor respectively.

290. The GHG emissions of the project road has been estimated using ROADEO and IVE (International Vehicle Emission) models for the projected traffic levels over the life cycle of project road (up to year 2038) with improved geometrics and pavement surface for two scenarios i.e. (i) Present Project Road without any improvement/upgradation and (ii) Widened Project Road with improved pavement conditions due to upgradation. The estimated GHG emissions for both the scenarios are given in Table 7.12.

291. The GHG estimations show an increasing trend for both scenarios up to year 2038 for all the GHG constituent gases. However, the GHG estimations for improved road conditions (Columns 5,6,7 of Table 7-12) are lesser than the project road without any improvement/ upgradation (Column 2,3, 4 of Table 7-12). The difference between these two scenarios is the net reduction in GHG emissions likely to accrue due to improved road conditions as reflected in Columns 8, 9 and 10 of Table 7-12. Thus, the estimated net reduction in GHG emissions over the project lifecycle (up to year 2038) is 73495 metric tonnes in CO₂ equivalent using the applicable conversion factors for N₂O and CH₄ (ref. **Table 7-12**).

Table 7-12: GHG Emission Projections with Present and Improved Project Road Scenarios

Year	Present Road with Projected Traffic Growth but without widening/ improvement of pavement conditions			Widened/Improved Pavement Conditions of Project Road with Projected Traffic Growth during Operation Phase			Change in GHG Emissions		
	CO ₂	N ₂ O	CH ₄	CO ₂	N ₂ O	CH ₄	Δ CO ₂	Δ N ₂ O	Δ CH ₄
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2020	3771.13	0.095	6.895	Construction Phase			Construction Phase		
2021	4377.43	0.117	7.074						
2022	4661.62	0.128	4.533						
2023	5368.69	0.142	8.683						
2024	6251.77	0.168	10.094	3741.2	0.106	5.812	-2510.57	-0.062	-4.282
2025	6796.21	0.183	10.994	4065.05	0.113	6.333	-2731.16	-0.069	-4.661
2026	7426.00	0.197	11.998	4443.79	0.124	6.909	-2982.21	-0.073	-5.088
2027	8097.46	0.215	13.107	4842.91	0.135	7.548	-3254.55	-0.08	-5.559
2028	8885.62	0.238	14.362	5315.01	0.15	8.272	-3570.61	-0.088	-6.09
2029	9554.00	0.256	15.447	5717.35	0.161	8.895	-3836.65	-0.095	-6.552
2030	10318.63	0.277	16.673	6175.38	0.172	9.603	-4143.25	-0.106	-7.07
2031	11117.68	0.296	17.984	6651.76	0.186	10.355	-4465.92	-0.11	-7.629
2032	12029.62	0.322	19.457	7197.05	0.201	11.203	-4832.57	-0.121	-8.253
2033	12856.14	0.336	20.944	7652.32	0.208	12.06	-5203.82	-0.128	-8.884
2034	13919.95	0.372	22.502	8329.50	0.234	12.958	-5590.44	-0.139	-9.545
2035	14950.99	0.402	24.174	8946.36	0.252	13.921	-6004.63	-0.15	-10.253
2036	16119.02	0.432	26.048	9644.88	0.271	14.999	-6474.14	-0.161	-11.05
2037	17270.45	0.464	27.919	10333.72	0.288	16.078	-6936.73	-0.175	-11.841
2038	18559.49	0.482	30.007	11104.60	0.31	17.279	-7454.9	-0.172	-12.728
Total	192331.91	5.12	308.89	104160.88	2.91	162.22	-69992.15	-1.729	-119.485
Total in Co₂ Equivalents	192331.91	1525.76	7722.25	104160.88	867.18	4055.5	-69992.15	-515.242	-2987.125
	201580			109084			-73495		

Note: - N₂O and CH₄ is converted into Co₂ Equivalent using 298 kg and 25 kg as multiplication factor respectively.

7.3.9 Noise & Vibration

Impacts - Noise

292. The principal source of noise during construction of project road would be from operation of equipment, machinery and vehicles deployed for construction activities, other than the regular traffic along the project road. This apart, there are 5 sensitive receptors i.e., 4 schools and 1 primary health center are located along the project road (ref. 4.4.8 under Section 4, for baseline noise level along project road).

293. The earth moving machineries e.g., excavators, graders and vibratory rollers has potential to generate high noise levels of more than 70 dB (A) and can cause disturbance to the settlements, adjacent to the carriageway or within 100 m from the worksite. The noise levels of construction machinery typically used in road construction works and permissible noise exposure levels as per OSHA (Occupational Safety and Health Administration), USA is given in **Tables 7-13 and 7-14**.

Table 7-13: Typical Machinery used in Project Road Construction

Sl. No.	Equipment Type and Capacity	Noise Level (dBA)	Sl. No.	Equipment Type and Capacity	Noise Level (dBA)
1	Dozer 200 Cum/hr Cap.	85	13	Backhoe and Front-end loader	80-85
2	Motor Grader - output above 150 KW Cap.	85-94	14	Bulldozer	85
3	Long arm Hydraulic Excavator	85	15	Compactor	82
4	Vibratory Roller (2 Tandem + 1 Vibro) - Minimum 8-10T static Weight	94	16	Compressor	81
5	Pneumatic Road Roller (200-300KN Cap.)	85	17	Concrete Mixer	85
6	Smooth Wheeled Roller - 8-10T Cap.	85	18	Concrete Pump	82
7	Tipper Truck - 5.5 Cum Cap.	85-88	19	Crane, Derrick/ Mobile	83
8	Rock Excavator - 60 Cum/hr Cap.	95	20	Pavement Breaker	88
9	Paver Finisher Hydrostatic with sensor control - 100 TPH Cap.	89	21	Paver	89
10	Paver Finisher Mechanical for WMM Work - 100 TPH Cap.	89	22	Pile Driver, Impact	101
11	Transit Mixer - 3-4.5 cum per hr Cap.	81	23	Pneumatic chip hammer/ Jackhammer	102-113
12	Cranes 60-80 T – capacities, with telescopic arm of Min 25 m length	85	24	Hammer	87-95

Table 7-14: Permissible Noise Exposures (OSHA Standards)

Sl. No.	Duration per day, hours	Sound Level dBA slow response
1	8	90
2	6	92
3	4	95
4	3	97
5	2	100
6	1 ½	102
7	1	105
8	½	110
9	¼ or less	115

Source: OSHA (Occupational Safety and Health Administration), USA

294. Dhwanipro noise model has been used for prediction of noise levels during construction and traffic noise propagation due to group noise sources (multiple sound sources of construction machinery) and traffic and to find out the resultant noise generated because of the estimated total traffic flow as well as construction activities for the base year (2020-21) and design year (2038) of the project road. In

addition, the noise levels at the sensitive receptor locations along the project road for the base year as well as the design year has been computed. The noise modeling has been done taking into account the design speed at various stretches and the stretches with restricted speeds. The predicted noise levels at the sensitive receptor locations are given in **Table 7-15**. The Contour map showing noise levels due to total traffic outcome along the project road (construction and operation phase) is shown in **Figures 7-13 and 7-14**.

295. It may be seen from Table 7-15, the predicted noise levels are exceeding the recommended National Standards for Ambient Noise Levels at all the sensitive receptor locations, warranting mitigation measures to limit the noise levels.

296. The noise generated during the construction would cause short term inconvenience to the population at settlement areas especially adjacent to the right of way, beyond which it would get drastically attenuated to acceptable levels. Since, the settlements along the road alignment are sparse, the severity of the impact is not expected to be significant and will be transitory in nature.

Table 7-15: Predicted Noise levels at Sensitive Receptor Locations along Project Road (dB)

S. No.	Sensitive Receptor Locations along Project Road	Nearby Settlement Area	Chainage (Km)	Distance from existing Centerline of Road (m)	Baseline Ambient Noise Level	Base Year 2020-21	Design Year 2038	Standard for Ambient Noise Level (daytime)
1	Govt Sr Sec School	Talyahar	4+237	4.3	45.5	67.5	83	50
2	Primary Health Centre	Talyahar	4+515	10	45.5	70	81	50
3	SVM Public School	Talyahar	4+773	6.4	45.5	67	84	50
4	Unity Public School	Rewalsar	22+570	4	57.9	77	83	50
5	Rewalsar Lake	Rewalsar	22+970	50	57.9	77.5	95	50
6	Govt Primary school	Rewalsar	23+280	3.5	57.9	79	87	50

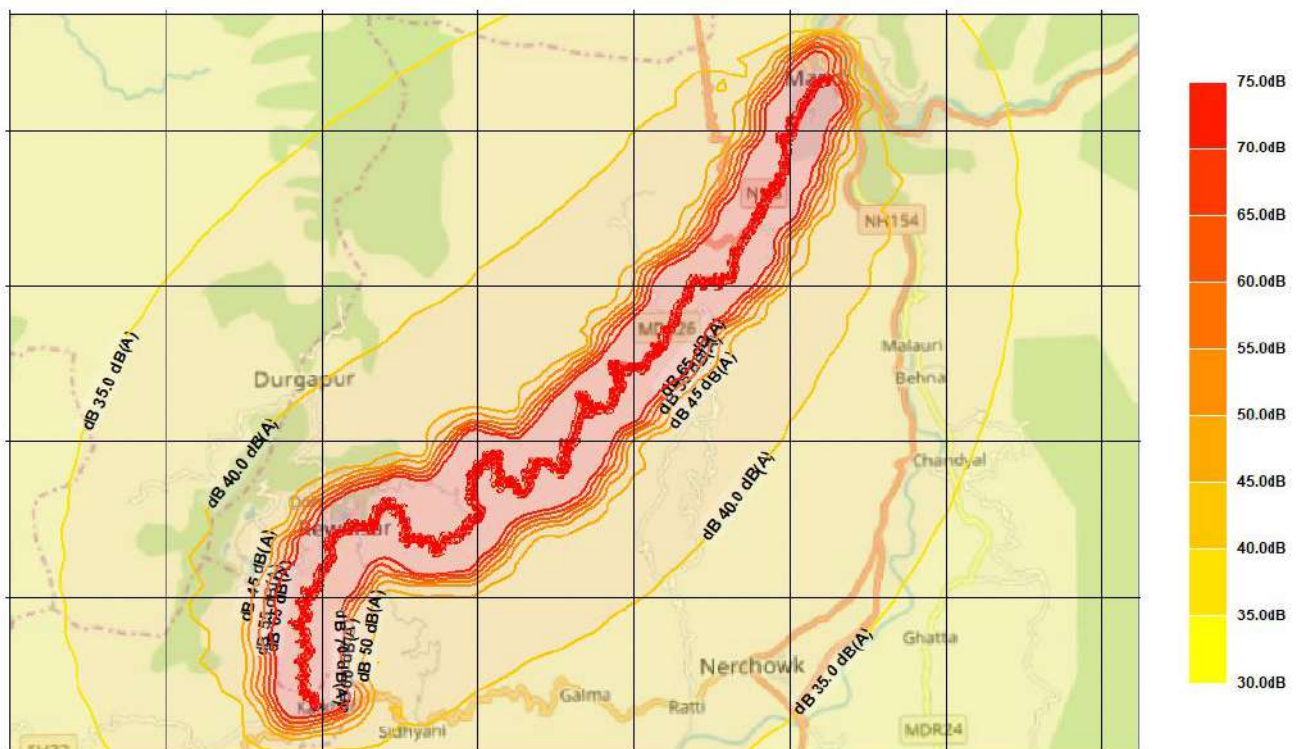


Figure 7-13: Contour map showing noise levels due to total traffic for Base Year 2020-21

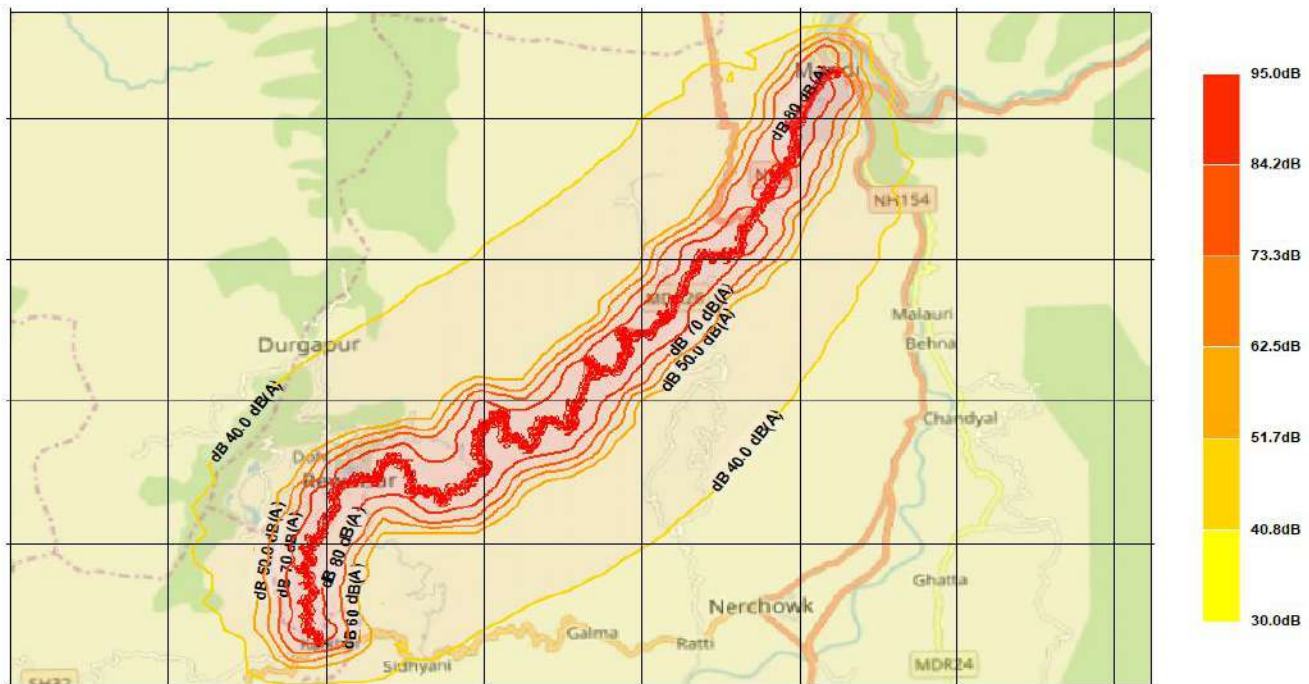


Figure 7-14: Contour map showing noise levels for Traffic Levels of Design Year 2038

Mitigation Measures - Noise

297. The mitigation measures to limit the ambient noise levels, which shall be adopted during construction phase include:

- The DG sets used in the project shall have acoustic enclosures and should conform to the CPCB stipulated standards.
- Regular maintenance of the machinery, equipment and vehicles shall be carried out to minimize the noise levels.
- Noise levels during construction phase, although is short term in nature, particularly at settlement areas and sensitive receptor locations can be controlled by measures like regulating construction activities to limited day hours, ensuring normal pace of construction activity with frequent breaks particularly in settlement areas.
- Nighttime construction activity shall be prohibited within 500 m of the settlement/habitations or sensitive receptor locations.
- Out of the 6 sensitive receptor locations (Table 7-15) only 2 locations warranted noise barrier provisions and other locations did not require any provisions due to their respective locations/site conditions¹⁸.

¹⁸ Out of the six locations mentioned in Table 7-15, provision of noise barriers has been restricted to only two locations and 4 locations did not warrant noise barriers due to their respective locations/site conditions as given here (i) Government Sr Sec School, Talyhar at Ch 4+237 has a huge boundary wall of more than 300 mm thick and height exceeding 4 m above road level. (ii) Primary Health Centre at Talyhar at Ch 4+515 is situated at 3m lower than road level (iii) Government Primary School at Rewalsar at Ch 23+280 is 3m higher than road level. (iv) Rewalsar lake is visited by tourists and does not have educational activity, which require attenuation of noise level.

- Noise barrier¹⁹ constituting polycarbonate sheets with 90% light transmittance fitted with polypropylene rubber gaskets and mounted on steel frames shall installed for 2 School buildings which are adjacent to RoW, without affecting the aesthetics. All such noise barriers shall be constructed in advance (prior to commencement of road construction works) at each sensitive receptor like Schools (refer **Table 7-16** for barrier locations and Section 3 of ESMP Volume for general arrangement of noise barriers).

Table 7-16: Proposed Noise Barrier(s) at Sensitive receptor Locations along Project Road

S. No	Chainage (Km)	Description	Type of Mitigation Measure
1	4+770	Saraswati Vidya Mandir Middle School	Barrier for noise attenuation
2	22+230	Unity Public School	Barrier for noise attenuation

- During the road construction near the sensitive receptors, appropriate traffic diversions are to be implemented including the deployment of uniformed traffic wardens with reflective hand-held batons.
- Road construction schedule near sensitive receptors like schools and hospitals shall be informed to the concerned authorities well in advance. All works near sensitive receptors shall be adequately well planned and works shall be completed in shortest possible time, with minimal inconvenience to users of sensitive receptors locations. If warranted, steel barricades shall be used to minimize the inconvenience to the road users as well as occupants of the sensitive receptors.
- In addition, a road safety awareness campaign including sensitization about traffic noise levels shall be conducted by CSC at all the schools located along project road. Such campaigns shall be conducted first prior to commencement of road construction works at such specific stretches and/or after the installation of proposed noise barriers, as the case may be.
- Along the settlement areas, the use of heavy construction machinery shall be regulated through slow pace of operations and ensure use of non – vibratory and small rollers to minimize noise levels as well as vibrations and to avoid cracks or damages to the kutchra or old structures, which are adjacent to RoW.

Impacts and Threshold Levels - Vibration

298. Vibration is an oscillatory motion²⁰, which can be described in terms of the displacement, velocity or acceleration and measured in terms of peak particle velocities (PPVs) i.e. maximum speed of movement of a point in the ground during the passage of a vibration. Traffic-induced vibration is a low frequency disturbance, which can be transmitted through air or ground.

299. Vibrations arising from construction activities like earth work excavation, compaction, paving and movement of construction vehicles/machinery is generally ground-borne.

300. The vibration velocity levels in rural settlement areas or low-density settings like the project road is usually 50 VdB (vibration decibels) or even lower, which is well below the threshold of perception for humans, deemed to be around 65 VdB.

¹⁹ Provision of polycarbonate noise barrier outside the school building has been discussed with the school authority during the Stakeholder consultation as part of ESIA. However, alternative materials or types for noise barrier like use of double-glazed windows for the school building can also be evaluated during the project implementation phase, in consultation with the school authorities, which may require to replace or retrofit all the windows with double glazed shutters and associated minor civil works (plastering) and white washing of walls.

²⁰ Source: Guidelines for Noise and Vibrations for Metro Rail Transit System by Research Designs and Standards Organization, Ministry of Railways, Government of India

301. Typical outdoor sources of perceptible ground-borne vibrations like earth work excavation, compaction, paving and movement of construction vehicles/machinery, buses and trucks rarely create vibration that exceed 70 VdB, unless the riding surface/condition of pavement is very poor. If the pavement/road conditions are reasonably satisfactory, ground borne vibration from traffic is rarely perceptible.

302. Most perceptible indoor vibration due to ground-borne vibration include perceivable movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception even by a small margin, although the vibration levels that cause annoyance will be well below the damage threshold for normal buildings.

Mitigation Measures - Vibration

303. The project road, even during the construction phase will be paved and maintained²¹ by the contractor to ensure smooth traffic movement and hence riding quality of pavement is expected to be satisfactory, thus not likely to contribute to ground borne vibration, beyond threshold levels.

304. The residual impacts of vibration during construction phase, although is short term in nature, is not likely to be significant and can be further controlled by measures like regulating construction activities to limited day hours, ensuring normal pace of construction activity with frequent breaks particularly in settlement areas. Such measures can reduce impacts of ground borne vibrations due to project road construction activities.

305. The project road during operation phase will have an improved pavement condition and smooth traffic movement, which considerably reduce ground borne vibration despite increased traffic movement during its design life over the years. Therefore, no specific mitigation measures are warranted during the operational phase, except for upkeep of pavement conditions and riding quality through routine maintenance.

7.3.10 Cumulative Impacts

306. As part of ESIA, an attempt was made to assess the cumulative impacts of other developmental programs within 15 km on either side of project road (PIA). Review of the available and latest information, within 15 km Project influence Area of the project road indicate

- No major tourism development projects
- No major industrial promotion program as per the Himachal industrial investment policy, 2019
- No scope for any major industries
- Construction of 231.49 Km of rural roads at 35 different locations in the vicinity of PIA for improving the connectivity of rural habitations to the state road network under PMGSY program of Government of India (**Table 7-17**), apart from routine maintenance works of existing roads by HPPWD.

307. Following are the list of ongoing Rural Road construction works under Bharat Nirman Program of Govt. of India in Mandi Sadar block (as on 31-03-2019), which are in the vicinity of PIA.

Table 7-17: Ongoing Rural Road Construction Works in Mandi Sadar Block of Mandi District

S. No	Name of Rural Road	Length (km)	S. No	Name of Rural Road	Length (km)
1	Ganpatti ki road	4.80	19	Bhatwari to Rensh road	15.91
2	Arnehar to Bunga	9.09	20	Talyahar to pariratti road	5.10

²¹ Contractors will be obligated to maintain the present road even during the construction phase through periodic pavement renewals and ensure riding quality and smooth traffic movement for present road users

S. No	Name of Rural Road	Length (km)	S. No	Name of Rural Road	Length (km)
3	Shiwa to Gharan road	10.10	21	Deodhar to Kheel galoo road	13.00
4	Purana Kataula to Kundhakh	6.75	22	Sain Gujra raropru	14.00
5	Mazhawar to Giula road	5.48	23	Batour to Bathar road	5.00
6	Jala to Khini road	2.47	24	Rewalsar pingla thona dharampur raod	10.00
7	Panarsa to Kota Dhar Road	5.83	25	Bathar to Batahan road	6.45
8	Dudar to bharaun Road	4.00	26	Sain to Sandoh road	12.00
9	Pandoh to Sayog road	4.00	27	Bhiuli to Tung Road	12.30
10	Lot ot Parrahal	2.00	28	Chmabi to Kuthar road	5.50
11	Hanogi to Bahandi road	15.00	29	Masar to Banaul road	4.50
12	Takoli to Pali Road	4.42	30	Kothi gehri to Patraun road	6.75
13	Nagwain to Silh Mashora road	6.70	31	Baryara to Kutli road	2.35
14	Bhiuli to chhipnu road	4.00	32	Kathyari to Ansar Road	3.00
15	Rahla to Shayari road	2.50	33	Hataun to Muthal road	6.50
16	Khad kalayana to bhaled road	6.00	34	Gharaun Taryasul Dawahan road	6.00
17	Sathol to upper sathol road	2.00	35	Kun to Kot road	2.00
18	Nasloh to Dhanog road	6.00	Total		231.49

308. Thus, the only contribution to the impacts is the construction of rural roads at sporadic locations in the vicinity of PIA for improvement of the connectivity, which could trigger increase in traffic levels along the newly constructed and other roads of the region. The constructional impacts of rural roads on the material extraction and/or other environmental resources are not expected to be significant.

309. The cumulative impacts due to the increased traffic has been already captured during the GHG estimations for the project road up to 2038, which considers increased traffic levels over the years. The GHG emission projections of the improved project road over its life cycle indicate that there will be a net reduction of 73495 metric tonnes (refer Table 7-12).

Mitigation Measures

310. Although, the project road widening and upgradation will have some short-term impacts, which can be mitigated or managed through implementation of an environmental and social mitigation plan (ESMP). The ESMP (in a separate standalone volume) include all such warranted mitigation management measures, which can negate the short-term impacts.

311. Further, the long-term benefits of project road widening can only be sustained through periodic pavement maintenance for sustained riding quality, which can concurrently contribute to reduction in GHG emissions (ref. Table 7-12) over the design life up to year 2038.

7.4 ... relating to Community Health and Safety (ESS 4)

7.4.1 Utility Shifting & Site Clearance Operations

Impacts

312. The project road has 220 electric poles and 12 handpumps along the corridor of improvement/ right of way, which will require shifting during the site clearance operation at the pre-construction stage (ref. 2.14.1 & 2.14.2 under Section 2 – Project Description). During utility shifting phase, there is likely

to be a temporary disruption to services to the community. As the communities are the end users of services provided by these utilities.

313. In addition, there will also be an additional demand for electricity, water and health facilities for the workers (all levels) engaged for project road construction. Though such demand is limited only to construction phase, specific details on these demands are not currently known. However, it is presumed that contractors will use both the electricity grid and captive generators on site, camp offices and work force camps.

Mitigation Measures

314. Adoption of a well-planned and coordinated approach for utility shifting with respective utility/line departments can minimize disruption to services and inconvenience to community. Although, the utilities will be shifted by the respective line departments, the CSC will closely coordinate to ensure a well scheduled shifting of utilities by the respective line departments with minimal disruption of services and inconvenience to community.

315. Use of both the grid electricity and captive generators at on site, camp offices and work force camps etc. will avoid stressing the local resources. Further, project's additional water demand through dependence on ground water resources will not stress existing water sources and it is unlikely to become cause of conflict with community, though such demand is limited to construction phase only. Nevertheless, CSC will ensure that no community water sources are considered for sourcing of the water by the contractor in the, while approving the C-ESMP.

7.4.2 Slope Stability and Landslide Hazards

Impacts

316. Landslide is one of the most significant, unpredictable occurrences in hilly roads, which often leads to road blockages, accidents and even could lead to loss of life at times. The project traverses in moderate to low and high land slide zones of Mandi district and has 19 locations, with a cumulative length of 1495m are given in Table 4-33 under Section 4, which are prone to erosion and landslides (ref. Section 4.7.1 & 4.7.6 – Baseline Data). The predominant cause of landslides is due to human interventions like steep hill cutting, de-vegetation, uncontrolled development works along up-hills. The project road construction activities like site clearance operations for road widening as well as excavation operations for construction of breast walls, toe walls and retaining walls could also trigger mud slips or localized landslides, particularly during or just after monsoon months.

Mitigation Measures

317. The adverse impacts of excavation operations of project road construction can be minimized by regulating slope cuts as given in **Table 7-18**.

Table 7-18: Recommended Slope cuts for Hillside along Project Road

S. No	Type of Material	Recommended Slope cuts
1	Loose Soil and Vulnerable Geology	2V: 1H
2	Compacted Soil with Slope towards Road	4V: 1H
3	Soft Rock	6V: 1H
4	Hard Rock	8V: 1H

318. Blasting and use of explosives in any form shall not be used by the contractor under any circumstances. All rock excavation/ hill cutting operations shall be carried out using the rock driller/hammer attachments with the excavators. Prior to commencement of any such rock excavation operations, contractor shall inspect the site to assess the potential for any disturbance to the adjoining houses/ properties and undertake the works in slow pace with prior intimation to such property owners, who are likely to get affected by the operations.

319. The landslide impact can be further minimized / mitigated through provision of engineering and non-engineering interventions. Some of the engineering measures considered for the project road are construction of breast walls along hill side (12940 meters long, height 2 to 5 meters) and retaining walls and toe walls along valley/ low lying areas along RoW (6980 meters long, height 1 to 4 meters) at various stretches along project road, in order to protect the vulnerable stretches due to excavation operations and potential land slide locations and, to prevent mud slips at such locations (ref. 2.11 under Section 2 and **Appendix-6**).

320. The impacts can be further minimized through provision of non-engineering and nature-based bio engineering interventions. Potential locations for nature-based bio-engineering intervention requirements assessed for the project road is given in **Table 7-19**. However, these locations will have to re-assessed/reviewed along with additional warranted locations for bio- engineering interventions once the excavation/hill cut operations along hill side and back filling works along valley side are completed during construction phase.

Table 7-19: Potential Locations for Bio Engineering interventions along Project Road

Sl. No.	Chainage	Bio-engineering Intervention	LHS/RHS	Length RM	Slope length (m)	Slope angle°
1	1+760	Hedge Brush Layer, Grass Slip Plantation	LHS/HS	25	8	50°
2	1+960	Hydroseeding	RHS/HS	300	6	>60°
3	2+580	Hedge Brush Layer, Grass Slip Plantation	RHS/HS	420	8	55°
4	3+350	Grass Slip Plantation	RHS/HS	8	8	45°
5	3+350	Grass Slip Plantation	LHS/VS	8	8	45°
6	3+490 to 3+800	Brush Layer, Grass Slip Plantation and Bamboo Crib Wall	RHS/HS	310	8	45°
7	5+480 to 5+530	Brush Layer, Grass Slip Plantation and Bamboo Crib Wall	LHS/HS	50	8	45°
8	5+480	Brush Layer, Grass Slip Plantation and Bamboo Crib Wall	RHS/VS	20	15	45°
9	9+430 to 9+460	Brush Layer, Grass Slip Plantation and Bamboo Crib Wall	RHS/HS	30	8	45°
10	10+200 to 11+200	Brush Layer, Grass Slip Plantation	RHS/HS	1,000	6	45°
11	12+200 to 12+800	Grass Slip Plantation, Shrub plantation	RHS	600	8	45°
12	12+200 to 12+800	Grass Slip Plantation, Shrub plantation	LHS	600	8	45°
13	23+960 to 24+940	Grass Slip Plantation	LHS	80	8	45°
14	0+000 to 28+000	25% of total length: Brush layer 2 layers, Grass seed sowing,	VS	7,000	5	45°
15	0+000 to 28+000	25% of total length: Brush layer 2 layers, Grass seed sowing,	HS	7,000	4	45°
16	0+000 to 28+000	Palisade 1% of total Brush layer	-	140	-	-
17	0+000 to 28+000	Fascine 4% of total Brush layer	-	1,120	-	-

Source: Field Investigations during ESIA, Sept 2019 & March 2020

321. Most suitable provisions made for the nature based (bioengineering) interventions considered for the project road are given in **Table 7-20** and cover potential landslide and erosion prone stretches along the RoW, upstream and downstream of seasonal streams/ CD structures, river/ upstream and downstream sides of river/stream banks, muck/debris disposal sites, low-lying areas reclaimed /open areas in RoW, areas of cleared of invasive vegetation among others.

322. Adequate cost provisions are included in the project cost estimates for both engineering and non-engineering interventions to avoid impacts due to landslides, erosion and enhance vegetative cover along project road (ref. Section 8 of ESMP Volume). The bio-engineering works will be executed in accordance with the detailed specifications of Bio-Engineering manual of HPPWD under the supervision of bio-engineering specialist of HPRIDCL at project level.

Table 7-20: Bio-Engineering Interventions for Slope Stability and Erosion Control

S. No	Description	Unit	Quantity
i)	Construction of hedge brush layer	RM	39500
ii)	Construction of brush layer	RM	38530
iii)	Construction of live palisade	RM	1430
iv)	Construction of live Fascine	RM	2760
v	Grass slip plantation on slope <45° @ 100 drills/sqm	sqm	8630
vi	Grass slip plantation on slope 45°-60° @ 100 drills/sqm	sqm	3200
vii	Grass slip plantation on >60° slope @ 100 drills/sqm	sqm	1260
viii	Plantation of large sized stature grass slips at slope of <45° @ 20 slips/sqm	sqm	7560
ix	Bamboo crib wall	cum	1460
x	Tree plantation in plains within RoW	nos	3200
xi	Shrub Plantation in plains Within Row	Nos.	1450
xii	Agave plantation in slopes	nos	200
xiii	Group plantation of shrubs	sqm	200
xiv	Hedge Plantation (2 plants/RM)	RM	500
xv	Hedge Plantation (4 plants/RM)	RM	500
xvi	Bamboo plantation within RoW	nos	500
xvii	Grass seed sowing at >40°slopes including vetiver	sqm	31200
xviii	Grass seed sowing<40° slopes	sqm	31550
xix	Grass seed sowing on slope 40-45 ⁰ with mulch and jute netting	sqm	28650
xx	Hydro seeding including dressing/trimming of slope including removing of fractured material and maintenance with watering 2 to 3 times after 12hrs of hydro seeding @ 1 litre/Sqm (each time) for six months/propagation of grasses and shrubs under supervision of hydro seeding provider	sqm	35650

7.4.3 Hazardous and Non-Hazardous Wastes

Impacts

323. Road construction related pollution risks include accidental spill of fuel, used oil or chemicals and contamination from poor waste management practices that can affect soil, surface and groundwater at operational sites and/ or establishment camp sites like concrete batching plants, hot mix plants, vehicle parking/ service area, oil/ lube storage areas among others.

324. The project road construction activities will generate both non-hazardous and hazardous wastes throughout the construction phase. The anticipated non-hazardous waste types include excavated

surplus material, construction debris, municipal solid waste, sanitary sullage and sewage generation from construction camp sites and workforce camps. While, hazardous waste may include used oil, lube/grease/cotton waste materials from service areas of construction machinery, empty drums or dis-used/replaced spares of vehicles/machinery, used batteries, dis-used chemicals for concreting like admixtures etc.

325. There are potentially several risks to human health and the environment that may be associated with the improper handling, storage and disposal of waste, both on and off-site. Improper handling and disposal could result in possible cross contamination of air, soil, surface and ground water resources, which can eventually impact on flora & fauna.

326. The estimated generation of hazardous waste during the construction phase of project road is given **Table 7-21**. The used/discarded batteries during the construction phase are to be disposed-off in accordance with the battery management rules. As per the rule, the used/ discarded batteries will have to be mandatorily taken-back by the sellers and/ sent to the hazardous waste disposal facilities through approved vendors by the State Pollution Control Board. Thus, no significant on-site impacts are foreseen due to discarded/used batteries.

Table 7-21: Estimated Hazardous Waste during Project Road Construction Phase

Equipment Type and Capacity	No.	Tank capacity in litres	Frequency @ Once in 6 months)	Quantity in litres	Grease and miscellaneous lube waste (@10 %) kg	Linen Cloth/Cotton waste @ 0.4 Kg per service
Dozer D-50-A15 - 200 Cum/hr Cap.	2	15	4	120	12	1.6
Motor Grader - Engine output above 150 KW Cap.	2	15	4	120	12	1.6
Long arm Hydraulic Excavator - 1.00 Cum	5	15	4	300	30	12
Vibratory Roller (2 Tandem + 1 Vibro) - Minimum 8-10T static Weight	2	12	4	96	9.6	2.4
Pneumatic Road Roller - 200-300KN Cap.	2	10	4	80	8	1.6
Smooth Wheeled Roller - 8-10T Cap.	2	15	4	120	12	1.6
Tipper - 5.5 Cum Cap.	20	15	4	1200	120	240
Water Tanker - 6 KL Cap.	5	15	4	300	30	10
Tractor-Trolley - 50HP Cap.	4	10	4	160	16	8
Rock Excavator/Ripper - 60 Cum/hr Cap.	2	12	4	96	9.6	1.6
Hot Mix Plant (Batch Type) with electronic controls and vibratory screens - Minimum 60 to 90 TPH	1	15	4	60	6	0.4
WMM Mixing Plant - Minimum 60 TPH	1	15	4	60	6	0.4
Stone Crushing Plant - 175-200 TPH Cap.	1	15	4	60	6	0.4
Paver Finisher Hydrostatic with sensor control - 100 TPH Cap.	1	15	4	60	6	0.4
Paver Finisher Mechanical for WMM Work - 100 TPH Cap.	1	15	4	60	6	0.4

Equipment Type and Capacity	No.	Tank capacity in litres	Frequency @ Once in 6 months)	Quantity in litres	Grease and miscellaneous lube waste (@10 %) kg	Linen Cloth/Cotton waste@ 0.4 Kg per service
Bitumen Pressure Distributor - 1750 Sqm/Hr Cap.	1	10	4	40	4	0.4
Power Broom - 1250 Sqm/hr Cap.	1	15	4	60	6	0.4
Loader - 1 Cum Bucket	2	15	4	120	12	1.6
Concrete batching and mixing plant - 15 to 20 cum/hr. Cap.	1	15	4	60	6	0.4
Mini smooth wheeled roller - 3-5T Cap.	2	12	4	96	9.6	3.2
Air Compressor - 170-250 cfm Cap.	5	10	4	200	20	16
Plate Compactor	3	15	4	180	18	4.8
Transit Mixer - 3-4.5 cum per hr Cap.	7	15	4	420	42	28
Cranes 60-80 T – capacities, with telescopic arm of Min 25 m length	2	15	4	120	12	1.6
Total Waste Generation				4188	418.8	2910

327. During the construction phase, the generation of municipal solid waste from construction camp site offices and workforce camps is estimated as 100 kg per day as shown in **Table 7-22**, which is to be safely handled and stored prior to its disposal at approved places by district administration.

Table 7-22: Estimated Solid waste Generation during Project Construction Phase

Category	Nos	Kg per day	Total Quantity of Solid Waste (kg/ day)
Supervision Staff	76	0.300	21
Construction workers at campsites	316	0.250	79
Total Municipal Solid Waste in Kg/day during Construction phase			100
Organic Waste (40%)			40
In organic Waste (60%)			60

Mitigation Measures

328. The hazardous waste generated at camp sites is to be collected in HDPE drums and placed under segregated roofed area for periodic disposal at approved waste disposal facilities by HPSPCB. The nearest such facility is located at Baddi-Barotiwala-Nalagarh Industrial Area (BBN) in the adjoining Solan District. The discarded batteries shall be disposed only through authorized recyclers from HPSPCB.

329. The organic waste generated can be composted at respective campsites/work force camps through construction of compost pits for treating organic waste and provision of color-coded separate bins for collecting the organic and inorganic waste. The inorganic waste shall be disposed-off at nearest approved municipal disposal sites of Mandi town.

330. The sanitary/ sullage/ sewage generated at campsites, work force camps and other operational sites are to be disposed off through septic tanks and soak pit disposal arrangements (ref. Figure 7-3 & 7-4).

331. Waste management and the minimization of potential impacts during construction will depend on the implementation of appropriate procedures, protocols and monitoring of materials being delivered, handled and stored prior to disposal. The ESMP provide the required measures for hazardous waste management during the construction phase (ref. Table 4-1, Sl. No. 35 of ESMP Volume).

332. The C-ESMP to be submitted by the contractor shall include a Waste Management Plan prepared in accordance with requirements stipulated in (a) The Batteries (Management & Handling) Rules, 2001 (b) Municipal Solid Wastes (Management and Handling) Rules, 2000, (c) Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2016 and (d) Construction and Demolition Waste Management Rules, 2016.

7.4.4 Work Zone Safety and Community Safety Risks

Impacts

333. The project road construction works will have potential work zone safety for workforce as well as community safety risks, which can be summarized as hereunder:

- i. Safety issues for both workforce as well as community due to mud slips or localized landslides during excavation operations for road widening and construction of protection works such as breast walls, toe walls and retaining walls
- ii. Cracks or minor damages to the structures adjacent to the right of way due to the use of heavy construction machineries, which may have potential to induce vibrations, particularly during site clearance operations, excavation, and paving operations
- iii. Safety issues for both workforce as well as community due to movement of rotating construction equipment, vehicles deployed for hauling of materials and debris disposals etc.
- iv. Community health concerns due to increased/ direct exposure to high noise levels of construction machineries, particularly along settlement areas with limited carriageway/roadway width, particularly at sensitive receptor locations such as schools, religious places, health centers/hospitals etc.
- v. Increased levels of dust and vehicle emissions due to construction activities, movement of construction vehicles, induced traffic congestion and idling of vehicles due to ongoing construction works
- vi. influx of migrant workers could potentially cause discomfort or potential conflicts with local community particularly at marketplaces.

Mitigation measures

334. Prior to commencement of construction, the contractor will prepare and submit Contractor's ESMP (C-ESMP), which will include contractor's management plan to comply with the project's safeguard requirements and Management Strategies and Implementation Plans (MSIPs) for (i) Work Management; (ii) traffic and work zone safety management plan for the prioritized encumbrance free stretches, in accordance with approved implementation schedule. In addition, the contractor will be contractually obligated to implement work zone safety arrangements conforming to the requirements of IRC: 67 and IRC: SP: 55: 2014, which include provision of PPEs, fixed/ mobile barricades between work area and pedestrian/ traffic and required measures for ensuring community safety during construction activities. The requirements also include site specific traffic management plan for all types of works along with work zone safety check list. A typical diagram showing traffic management during construction phase as shown in **Figure 7-15** and an illustrative checklist for work zone safety is given in **Appendix-25**.

335. The responsibility of contractor to manage these risks will be clearly reflected in the contractual obligations of the Civil Works Contractor with appropriate mechanisms for addressing non-compliance. The bid documents for construction will incorporate requirements for Environment, Social, Health and Safety (ESHS) including list of applicable labor laws and community safety provisions for periodic reporting by contractors. Commencement of any activity by contractor without prior approval of these requirements will be treated as "fundamental breach of contract".

336. The C-ESMP will be approved by the CSC, prior to the commencement of construction activities, will be periodically reviewed by CSC (but not later than every 3 months) and updated in a timely manner by the Contractor, to ensure that it contains appropriate measures for the work zone and community safety throughout construction phase.

337. The preparation and implementation of work zone safety requirements is included as part of the mandatory contractual obligation of the contractor's ESMP (C-ESMP) (ref. Sl. No. 6 under Table 4-1, Section 4 of ESMP volume).



Figure 7-15: Typical Traffic Management & Work Zone Safety Arrangements

7.4.5 Road Safety

Impacts

338. The built-up and settlement areas have direct access on to project road in addition to intersections like major and minor junctions. The road will also act as haul road for transporting construction materials and debris, along with concurrently ongoing construction activities at prioritized stretches. Adding to these, existing site settings i.e., present narrow roadway width, sharp curves, hilly/mountainous terrain will provide limited option for maneuvering.

339. All of these is likely to cause restrictions/inconveniences and safety issues to existing road users, requiring temporary traffic diversions, among others.

Mitigation Measures

340. To ensure ease of traffic movement as well as community safety (local people as well throughfare road users) along the road will largely depend on contractor's work management plan and procedures, which will be regulated through contractual obligations. In addition, traffic management through warden/monitor(s) with reflective jackets and handheld batons and appropriate traffic signages in addition to dust suppression and noise level management measures will also be required. Further, road safety measures like provision of information/caution boards, road signages, object markers will be provided at all required locations in accordance with IRC:99-2019 as per the road safety plan for the project road and are summarized in **Appendix-22** and under Section 3.3 of ESMP volume.

341. In addition to road safety signages, traffic calming measures have been considered where there is no adequate scope for providing either two-lane or vision berm(s). At hairpin and blind curve bends, safety precautions are proposed as per of IRC: 99-2018 as given below and shown in Appendix-22.

- i. Convex mirrors

- ii. Road studs along the curve portion
- iii. W-Beam Crash Barrier at curve location
- iv. Triple Chevron sign boards
- v. Speed restrictions – Speed limit, No overtaking and Blow horn signage
- vi. Rumble Strip markings

7.4.6 Sensitive Receptor (School/Hospital) Zones

342. At sensitive receptor (school/hospital) zones, traffic calming measures are considered as given below and shown in Appendix-22.

- a. Informatory signage (as applicable for School/Hospital zones) ahead on either side of traffic directions.
- b. Road Markings of Pedestrian crossing at the school/hospital entry gates. Informatory signage for indicating the same.
- c. Rumble strip marking – 2 sets ahead of Pedestrian crossing markings along with informatory signage for the same.

7.4.7 Traffic Calming Measures along Built-Up Stretches, Major/Minor Junctions

343. At built-up stretches, traffic calming measures are considered with due importance to both pedestrian and vehicular movements as list below and shown in **Appendix-22**.

- a. Informatory signage for built-up stretches
- b. Speed limit signage for vehicular movements in built-up areas.
- c. Place identification signage
- d. Restriction signage for cautioning the road user to abide traffic rules.

344. Due to restrictions on land availability at minor and major junction locations, utmost consideration has been given to make the junctions/intersections safe for the road users

345. Traffic calming measures in compliance to relevant to IRC standards at all such major or minor locations are considered. Typical arrangement for Y- Type and T –Type Minor junctions are shown in Appendix-22.

7.4.8 Natural Disasters/ Calamity and Hazard Vulnerability

Impacts

346. The vulnerability status of the Mandi district, within which the project road is located is “High” in terms of landslides, earthquake, wind, cloudburst and floods (ref. 4.7 under Section 4 - Baseline Data). However, the upgradation of 28 km long project road itself does not significantly alter the vulnerability status of the district as a whole.

347. Given the fact that the project road is in Zone V, which carries highest risk and presence of potential land slide locations along project road, construction work poses risk and safety hazard to workforce and community, in the event of natural disasters like earthquake and/or landslides triggered during tremors of high intensity earthquake. Such events may strand the workforce or even worse, they may get trapped at project construction and establishment camp sites.

Mitigation Measures

348. The mitigation measures in an event of climate change induced natural disasters and/or any other natural calamities shall be as follows:

- Mandi district has a Disaster Management Plan at district level, which provide the institutional arrangements, designated officers, emergency response systems, infrastructure facilities like hospitals, fire stations, police station at tehsil, sub-division and village levels.

- In order to ensure the safety of work force at operational sites and safe evacuation of workforce in the event of natural disaster and/or any other natural calamities, the project road construction contractor shall have an emergency response plan (ERP).
- As part of the ERP, the project contractor shall establish and maintain regular coordination with the designated officers for Disaster Management at district/sub-division levels. Maintaining regular coordination will enable to seek quick response in the event of natural disaster and/or any other natural calamity.
- All project operations shall be planned and coordinated in tandem with the weather predictions/alerts issued as relevant for the district/ project road.
- At project level, contractor shall designate Incident Controller (IC), Emergency Controller (EC), Assembly Coordinator (AC) and other required personnel for the emergency response mechanism in an event of natural disaster/ calamity in line with the ERP.
- The emergency response plan (ERP) of the contractor shall form a part of C-ESMP for approval of the CSC. A template for the Climate Change Disaster Management and Emergency Response Plan at the level of project road construction for the contractor is given in **Appendix-23**, which can be further updated after the mobilization of the Contractor.
- All work force irrespective of levels are to be provided with training and periodic mock drill to ensure the preparedness to respond any emergency situations, always in short notice.
- The local community along project road shall also be engaged in mock drills for proactive participation in case of any natural hazards or disaster/ calamity.

349. The mitigation measures are also included in ESMP volume (ref. Section 3 and Sl. No.5 of Table 4-1), as a contractual obligation of the contractor.

7.5 ...on land & assets (ESS 5)

Impacts

350. The project road widening and upgradation will be limited to the available right of way and no fresh land acquisition (of any type) will be required and hence there will not be any impacts on land use. However, the right of way has 16 encroachments (illegal extensions) will be impacted, which belong to 18 families (PAFs) with 79 PAPs. The impacted structures comprise 3 residential structures, 2 commercial, 4 residential cum commercial and 1 squatter. In addition, 6 nos of minor structures like compound walls, toilet, and cattle shed will also be impacted.

351. Among the 18 PAFs, 7 are vulnerable families (2 SC HHs, 2 HHs with above 65 years old, 1 is WHH with above 65 years old, 1 WHH with above 65 years and one handicapped family member and 1 HH with one chronic diseased family member) (**Table 7-23**). (ref. 4.8.8 under Section 4 - Baseline Data). The list of affected structures along with the respective PAFs and PAPs are placed in **Annexure 1 & 2** placed at the end of this ESIA report as well as **Appendix-19** of ESIA Appendices in a separate Volume.

Table 7-23: Summary of Social Impacts due to Project Road Upgradation

Sl. No.	Impact Type/ Category	Total Numbers
1	Impact of Land Acquisition (area in ha.)	00
2	Total Project Affected Families (PAFs)	18
3	Total PAPs	79 ¹
4	Impact on Properties of Non-titleholders/Encroachers	16 ²
	- Residential	3

Sl. No.	Impact Type/ Category	Total Numbers
	- Commercial	2 ³
	- Residential + Commercial	4
	- Others (Toilet/Cattle Shed/ Compound Walls)	6
	- Squatter (Commercial)	1 ⁴
5	Tenant (Commercial)	1
6	Vulnerable PAFs	7 ⁵
<p><i>Note:</i></p> <ol style="list-style-type: none"> 1. Out of 18 PAFs surveyed, 2 PAFs didn't respond, 79 PAPs belong to 16 PAFs. These 2 PAFs will be covered during the verification of PAFs under RAP implementation stage, 2. 16 structures belong to all 18 PAFs 3. Out of 2 commercial structures, 1 is run by owner himself (snacks/ tea shop) another 1 is liquor shop which is run by a tenant 4. Squatter is a vegetable/ fruits seller on a fixed stall 5. Vulnerable persons comprise 2 SC HHs, 2 HHs with 65 years & above, 1 WHH with 65 years & above, 1 WHH and a handicapped family member and 1 HH with chronic family member. 		

352. Out of total 16 structures, 14 are pucca/permanent, 1 kutcha and 1 temporary fixed structure (Squatter) as per the survey. Out of the total 16 households (HHs), 7 are in the loss category of less than 10%, 5 HH are in the loss category of between 10-30% and 1 HHs is in loss category of 30-50% and 3 HHs are in the loss category of more than 50% respectively. The 3 structures belonging to loss category of >50% are commercial shops/ structures and thus categorized as economically displaced (**Table 7-24**).

Table 7-24: Type of Structure and Extent of Impact

S. No	Type of Structure and Impact	Total
1	Pucca	9
2	Semi-Pucca	0
3	Kutcha	1
4	Commercial Squatter	1
5	Compound Wall/Toilet/Shed	5
Extent of impact on Structure		
1.	Less than 10%	7
2.	10% to 30%	5
3.	30% to 50%	1
4.	50% & above	3*
<p>Note: Out of 3 structures having 50% and above impact, 2 are commercial structures comprising 1 liquor shop run by tenant, 1 snack cum tea shop run by owner and 1 is a vegetable/ fruit seller on a fixed stall (squatter). All these 3 PAFs having 50% and above impact and 1 tenant of a commercial structure will have temporary loss of income and therefore treated as physically and economically displaced PAFs. All the displaced PAFs have consented to shift to adjacent location of their choice, which have been identified and confirmed by themselves but expect/ need assistance.</p>		

Mitigation Measures

353. The mitigation measures to minimize the social impacts are hereunder:

- A Resettlement Action Plan (RAP) along with requisite budgetary provisions has been prepared for all the PAPs including the vulnerable/disadvantaged among the PAPs in accordance with the entitlement provisions of RPF under HPSRTP (ref. Resettlement Action Plan for budgetary provisions).
- No encroached structures shall be removed, until the compensation and R & R assistance as per approved RPF provisions is disbursed and all salvageable materials have been retrieved by the encroachers.
- The impacts arising on land use due to establishing camp sites, workforce camps, hot mix plants, muck disposal sites can be minimized by adopting the following, which are also detailed under Sl. No. 20, 21 & 24 of Table 4-1 of ESMP volume:
 - Waste lands belonging to Government or non-agricultural lands belong to private or community are to be chosen for establishing construction camps material stack yards, hot mix plants & machinery, debris or muck disposal sites. If previously used sites are available along the road, the same sites shall be preferred, and no new site shall be opened up (ref. 4.3.7 under Section 4, for soil quality and fertility levels for project region/ PIA)
 - No agricultural land or grazing land or fertile community lands are to be used for any of project's establishments, including borrowing of good earth.
 - Reclamation of low-lying areas within the right of way for disposal of muck/construction debris will reduce the footprint/extent of land required, elsewhere.
 - Also, all muck /construction debris disposal locations will be treated with bio-engineering interventions, so as to stabilize the slopes as well as to develop a green vegetative cover on it.
 - The project design considers disabled friendly ramps (universal access) at all 16 bus stops along the project road (11 new and re-modelling of 5 existing bus stops) in accordance with The Rights of Persons with Disabilities Act, 2016, in addition to road safety components as per requirements along the project road.

7.6 ... relating to Biodiversity & Living Natural Resources (ESS 6)

7.6.1 Flora

Impacts

354. The widening/upgradation of the project road will be confined to the available right of way and hence diversion of the forest land for road widening is not required. Thus, the forest areas (undemarcated and demarcated forest types) adjacent to the right of way at eight stretches of project road, over a cumulative length of 4.255 km will not be directly impacted by construction activities (ref. 4.5.2 and Tables 4-18 to 4-23 under Section 4 - Baseline Data).

355. The site clearance activities for road construction will involve removal of roadside vegetation and felling of trees. The ecological investigations carried out along project corridor have indicated that although the entire area is rich in biodiversity, the project corridor is relatively less diverse due to human intervention and is also interspersed with invasive species like *Ageratum conyzoides*, *Eupatorium adenophorum*, *Lantana camara*, *Parthanium hysterophoros*. The investigations also have indicated that there are no rare, endangered and threatened floral species along the corridor (ref 4.5.4 and 4.5.5 under Section 4 - Baseline Data).

356. Field investigations as part of ESIA has enumerated 360 trees which are within RoW and may have to be felled for project road widening (ref 4.5.6 under Section 4 - Baseline Data). The enumerated trees are commonly found/ prevalent in the area and does not have any special ecological importance. As per the current procedure of department of forests, GoHP, tree enumeration has to be jointly conducted with the Department of Forests, after the on-site marking of the center line of the proposed road widening plan, as part of the laid down procedures for according the tree felling permissions for the project road.

Mitigation Measures

357. In order to avoid/ negate/ limit the impacts on flora, the following mitigation measures shall be adhered during the project construction phase.

- All road construction activities shall be restricted to existing right of way and forest area shall NOT be disturbed/trespassed for whatsoever reasons
- NO trees within forest areas shall be disturbed, felled and/or lopped for movement of construction machinery or for establishing working area within the right of way
- NO borrowing of earth or dumping of construction debris shall be done within forest areas or stretches of road along forest areas
- All road construction work along the forest stretches shall be under complete supervision and ensure that workforce shall NOT do any kind of damage and/or trespass into forests areas.
- NO workforce shall enter the forests areas, for whatsoever reason. Workforce shall be strictly barred from lighting of fire for whatsoever reason and use or carry inflammable materials along forest stretches
- Workforce shall be strictly instructed to not to harm, in case of sighting of any type of wild animals, workforce shall be strictly instructed NOT to panic and walk away from the scene without disturbing the wild animals
- All types of road construction work along forest stretches shall be limited to day light hours only and NO workforce shall remain in forests stretches after daylight hours.
- Compensatory Plantation shall be taken up either along the project corridor or at places identified by the department of forests, GoHP in order to compensate for the number of trees felled for road widening. Forest Department may stipulate planting of three saplings for every tree cut and maintenance of the same for three years with 70% survival rate (provision included in ESMP Volume ref. Section 4 & 8).
- Normally, all such compensatory plantation activities will be undertaken by the department of forest and maintained for three years as a deposit work as a deposit work, borne by HPRIDCL. With this compensatory plantation measures, the tree cover lost could be regained in 3 to 5 years and thus the impacts could get mitigated.
- Only local species, which are regenerative type, less water consuming and approved by the forest department shall be used for plantation. Normally, all such afforestation work will be undertaken by the Department of Forest including maintenance for three years as a deposit work.
- In order to limit the propagation of invasive species, firstly all such invasive species within the corridor of impact and/or right of way shall be removed/cleared and replanted with local species (provision included in ESMP Volume ref. Section 8 and is also one of the recommendations of the independent bio-diversity management study (refer **Appendix-11**)). The department of forests, GoHP has framed a procedure for removal of invasive species and replanting of local species, which shall be followed (refer **Appendix-20**).
- In view of the environmental/ecological concerns, vegetation clearance activities including removal of invasive species and replantation of suitable local vegetation types shall NOT employ any chemicals.

7.6.2 Fauna

Impacts

358. There is no National Park or wildlife sanctuary within 15 km PIA from project road (ref. 4.5.3 under Section 4 - Baseline Data). The ecological investigation along the project corridor has not indicted the presence of any wildlife crossing corridor, however sighting of Leopard has been reported by villagers at Km 18 Manjhiyali village. Incidentally, there is a natural water source at this Chainage, and leopard and other wild animals may be frequenting the natural water source for want of water and thus might have been sighted by local people. Consultations with local villages indicate that Leopard are

sighted at times, which comes in search of its prey as well as for water but with no known definite frequency.

Mitigation Measures

359. Mitigation Measures would include the following:

- HPRIDCL had commissioned an independent Bio-Diversity Management Study (refer. **Appendix-11**) to evolve measures to manage the human-animal conflicts, (particularly Leopard) for all project corridors under Tranche I, HPSRTP, which include the project road. The recommendations of the bio-diversity management plan will be duly implemented by HPRIDCL.
- All culverts along the project road (including 8 forest stretches) are adequately sized (minimum 1100 mm diameter for pipe culverts, much bigger size of box and slab culverts) to serve as animal crossing points, which is one of the recommendations of the independent bio-diversity management study (ref. Appendix-11).
- Renovation/conservation of natural water source at Km 18, where sighting of Leopard has been reported has been included for conservation and rehabilitation with adequate storage tanks and water troughs to facilitate drinking of water by wild animals/ grazing/ stray cattle. In addition, 5 natural water sources along the road are also being conserved/renovated as part of enhancement measure, out of which 3 are in rural settings, which can probably serve as water sources for wild animals, grazing and stray cattle (one of the recommendations of the bio-diversity management study for improving water holes for wild animals). Design/drawings for conservation and enhancement of water sources along with budgetary provisions have been included (refer Section 3, 4 & 8 of ESMP Volume).
- All work force shall be oriented to keep calm and walk away from the scene, in case, wild animals are sighted either during work hours at operational/work sites or at night hours at campsites.
- The construction work shall be restricted to day hours only, while working established in the vicinity/nearby forest areas and work shall not be carried out in the late evening hours/night hours /early mornings
- The Work force shall be strictly prohibited from entering forest areas under any circumstances. Work force shall be strictly instructed not to harm/kill and prohibited hunting of wild animals under any circumstances
- The Construction camp and work force camp sites shall not be established in the vicinity/nearby forest areas. Atleast 500m distance shall be kept from such areas under unavoidable circumstances.
- The camp sites and work force camps shall be access controlled and well-lit to avoid/prevent entry of wild animals. The work force shall be oriented not to feed monkeys and /or stray animals and to properly collect waste food in dustbins to prevent menace in camp area.
- HPRIDCL will implement all other recommendations of an independent Bio-Diversity Management Study to manage the human-animal conflicts and will earmark requisite budgetary provisions.

7.7 ... on Tribal/ Indigenous Population (ESS 7)

Impacts

360. The 28 km long project road is completely within Mandi district, which does not fall under the fifth schedule areas²² of Himachal Pradesh.

²² Fifth schedule areas in Himachal Pradesh are located in Lahaul & Spiti districts, Kinnaur, Pangi tehsil and Bharmour sub-tehsil in Chamba district.

361. The widening proposal of the project road does not impact on any land or structures involving tribal (ST) households (ref 4.8.8 under Section 4 and Table 4-44 for profile of PAPs). The project road impacts do not meet the characteristics outlined in ESS 7²³. Hence, the project road has no impact on ST households and neither warrant application of any specific RPF provisions for tribal households under HPSRTP.

Mitigation Measures

362. No specific mitigation measures or RAP provisions for tribal households are warranted for the project road.

7.8 ... on Cultural Heritage (ESS 8)

Impacts

363. The project road corridor and its vicinity (within 300 meters in all directions) does not have any protected archeological/historical monuments. The Government of India prohibit any type of construction activity within 100 meters and regulate construction activities within 200 meters beyond the prohibited distance of first 100 meters in all directions of the protected monuments under the Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010.

364. In addition, Rewalsar has four monasteries, one Gurudwara and three Temple (ref. 4.6 under Section 4) all of which attract tourists from various parts of the state as well as country and several religious gatherings occurs in many months of the year. These religious places are not located along the project corridor but are away from the corridor with an aerial distance ranging between 60 meters to 1km and segregated by settlement areas in between and thus are not directly exposed to the project corridor. None of these monasteries, Gurudwara and Temples are protected under Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010.

365. Thus, no impacts are foreseen on protected ancient monuments and archaeological sites due to the construction of project road (refer 4.6.1 under Section 4 - Baseline Data).

Mitigation Measures

366. Due to its location, the road construction activities will not directly impact any of the religious places of importance at Rewalsar except for the inconvenience & constricted movement for the visitors to these places, which will be limited to construction phase and transitory in nature.

367. The inconvenience to visitors to monasteries, particularly during their religious festivals/holy/auspicious days and other places of religious importance can be minimized or avoided by scheduling the road construction works along Rewalsar. In order to minimize the inconvenience to the existing road users and religious visitors at Rewalsar, the contractor shall exercise the following with utmost care

- Road construction schedule near Rewalsar shall be informed to the concerned authorities of monasteries, gurudwara and temples well in advance and avoid major construction works on religious/ auspicious dates at Rewalsar, to minimize inconvenience to religious visitors.
- Appropriate traffic diversions shall be planned near Rewalsar and adequate number of uniformed traffic wardens with reflective batons shall be deployed to manage the traffic, to ensure safety and minimal inconvenience to users of sensitive receptors location.
- All works between Ch. 21+000 to 23+000 near Rewalsar shall be well planned and works shall be completed in shortest possible time, with minimal inconvenience to community and tourist/ visitors. If warranted, steel barricades shall be used to minimize the inconvenience at these locations.

²³ characteristics as outlined in ESS 7 – Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities

- Dust suppression measures like regular sprinkling of water shall be carried out with more precaution near Rewalsar to ensure dust levels kept to minimum. The construction debris and spills cleared of all construction debris on a daily basis near Rewalsar and dumped at approved places.
- All work force shall be specifically oriented to strictly not to enter the lake area or feed the fishes and not to catch fish or do fishing of any type at Rewalsar lake.
- The Construction camp and work force camp sites shall not be established in the vicinity/nearby of the Rewalsar.
- Ensure no conflicting situation develop/arise with the local community/stakeholders and concerned authorities of monasteries, gurudwara and temples during the entire road construction phase through a responsive communication channels and resolve any grievances through a responsive GRM and conflict management initiatives.

368. The ESMP Volume (Sl. No. 44 & 45 of Table 4-1) include the management measures to minimize the inconvenience to the existing road users and religious visitors at Rewalsar.

369. Further, the project road corridor has 24 religious' shrines/structure (Peepal tree with platform), out of which 14 are retained and 10 are considered for renovation as a conservation measure, which include relocation of 2 religious shrines and one resizing of Peepal tree platform without significantly affecting the structure/shrine. The relocation of 2 religious shrines and one resizing of Peepal tree platform, although is an unavoidable impact. The design/drawings for conservation and enhancement of religious shrines/structures along with adequate budgetary provisions have been included under ESMP Volume (ref. 4.6.6 under Section 4-Baseline Data and Table 6-6 & 6-7 of Section 6 Analysis of Alternative of ESIA and Section 3 & 7 of ESMP for Enhancement/ Conservative Measures).

7.8.1 Chance Finds

Impacts

370. The project road corridor and its vicinity are not known to have any historical or archeologically important monuments and therefore the probability of “chance finds” during the earthwork excavation along the road or at potential borrow areas is extremely low. Thus, no potential impacts are foreseen on this account (refer 4.6.1 under Section 4 - Baseline Data).

Mitigation Measures

371. Despite having low probability of chance finds during earthwork excavation, in an unforeseen and unlikely scenario of sighting of remnants or chance find, the following management measures are to be followed as Cultural Heritage Management Plan as part of C-ESMP.

- Such sites shall be immediately cordoned off/ entry restricted to project workers as well as common people.
- The matter shall be immediately brought to the attention of HPRIDC as well as the State/Central Department of Archaeology or any other designated competent authority of the State/ Central Govt.
- All further work at such specific location(s) shall be carried out only after the site is cleared by the Archaeology Department or competent authorities.
- Any other instructions issued by the Archaeology Department or competent authorities shall be duly followed in all subsequent excavation works.

372. The ESMP Volume (Sl. No. 44 & 45 of Table 4-1) include the mitigation/management measures for “chance finds” along with the institutional responsibility for supervision and monitoring.

8 ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

373. An environmental and social management plan (ESMP) has been prepared for impact mitigation and management during pre-construction, construction & operation phases of the project road.

374. The ESMP is a standalone separate volume which cover the following and may be referred for further details.

- Pre-Construction Stage Activities by CSC
- Pre-Construction Activities by Contractor
- Construction Stage Activities by Contractor
- Operation Stage Activities by Contractor
- Institutional Arrangements for ESMP Implementation, Supervision
- ESMP Implementation Monitoring and Reporting requirements
- Grievance Redress Mechanism for PAPs/PAHs and Project Stakeholders/Community
- Grievance Redress Mechanism for Workforce
- Training and Capacity Building

8.1 Budgetary Costs for ESMP Implementation, Supervision and Monitoring

375. The ESMP include mitigation management measures, which are akin to Good International Industry Practice (GIIP), considered incidental to works and deemed to be included in the quoted bid price by the contractor. However, certain project road specific mitigation measures and/or environmental enhancement measures, considered as additional requirements that are to be implemented by the contractor have also been included against budget provision and integrated in the contract/bidding documents as Mandatory Contractual Obligations. The estimated budgetary provisions for implementation of such specific mitigation measures, ESMP and RAP is INR **909.26 Lakhs**) and included in ESMP. The abstract of the ESMP budget provision is given in **Table 8-1**.

376. The contractual ESHS (Environment, Social, Health and Safety) performance requirements by the contractor have been specified and incorporated as special conditions and performance requirements in bid documents of contract package for the project road. Adequate cost provisions for implementation of ESHS requirements have included in the item rates, so that contractor can perform requirements in a fair and objective manner. In addition, a provision of 2% of contract amount has been earmarked as ESHS performance security in the bidding documents. Thus, the contractor is expected to be fully aware of ESHS performance requirements at the bidding stage itself and accordingly deemed to have priced the performance requirements at the bidding stage itself.

377. The ESHS performance requirements incorporated in the bid documents, obligate the contractor, upon mobilization, to prepare a Contractor's ESMP (C-ESMP), which will include impacts mitigation and management plan, environmental enhancement plan, OHS plan, labor management plan, labor Influx management Plan, workers' campsite management plan, GRM for workers', traffic management and road safety management plan, COVID-19 considerations and among others in accordance with the GoI, GoHP, IFC & WB requirements.

378. The C-ESMP will be reviewed in consultation with HPRIDCL and approved by the CSC, prior to commencement of construction works. The approved C-ESMP will be reviewed periodically (but not more than every three (3) months) by CSC and updated in a timely manner, to address changed requirements, if any during project implementation.



Table 8-1: Budgetary Provisions for Specific Environmental Enhancement Measures
(Additional Requirements to be implemented by Contractor against budget)



S. No	Description	Amount in lakhs
1	Provision for Conservation/renovation/enhancement measures for religious shrines/structures (Peepal tree with platform) and natural water sources at 19 locations along the project road	32.5
2	Provision for Bio Engineering Interventions at selected locations along the project road as per requirements as per specification of HPPWD Manual on Bio-engineering	618.38
3	Clearance/Removal of Invasive Species like Lantana and Sea Ruthenium etc. form the road corridor and Plantation of Indigenous local vegetation and Maintenance and upkeep for 70% survival rate for 6 months (36 km (both sides) up to width of 1.5 m)	75.6
4	Provision of plantation and maintenance (tree guard) of 3000 Avenue trees along roadside and in RoW @ 1800 per tree.	54
5	Provision for Environmental Monitoring (ambient air quality, noise, water and soil) as per CPCB Standard Procedures through NABL accredited laboratory	56.3
6	Mitigation measures at Associated Facilities	Cost provision included in the bid documents
7	Provision for Compensatory Afforestation in lieu of Tree felling for road construction	HPRIDCL will make payment directly to Department of Forests, GoHP
8	Provision for deployment of Environmental Specialist, Social Specialist, Horticulture/ Bio-engineering Expert (full time) and Bio-engineering Specialist and Bio-diversity Specialist (intermittent basis) for implementation of ESMP	HPRIDCL will recruit positions directly or provided through PMC
9	Implementation of Resettlement & Rehabilitation Action Plan as per RPF, HPSRTP for Project Road	72.48
10	Relocation and construction of hand pumps, water storage tanks, OHTs, open wells & water taps as per directions of the Engineer.	HPRIDCL will make payment directly to respective Departments
11	Cost for institutional strengthening, capacity building and training by HPRIDCL	Cost borne by HPRIDCL
Total ESMP Budgetary Provision in Lakhs		909.26



Annexure 1




Inventory of the Affected Structures




Annexure 1: Inventory of the Affected Structures: Mandi – Rewalsar - Kalkhar Road



Sr. No.	Site marked Chainage	Village	Side	Usage/ Type of Property	Design Requirement from existing centreline	Distance from existing Centreline	Impact	Length of the Structure	Width of the Structure	Remarks	Photos
1	2+110	Panjethi	RHS	Resi. cum Commercial	7.4	3.7	3.7	16	10	Impact residence with car washing station	
2	4+400	Taliyar	LHS	Residence	4.6	3.7	0.9	19	7	Partial Impact	



Sr. No.	Site marked Chainage	Village	Side	Usage/ Type of Property	Design Requirement from existing centreline	Distance from existing Centreline	Impact	Length of the Structure	Width of the Structure	Remarks	Photos
3	7+465	Rattipul	LHS	Residential cum Commercial	11.6	8.0	3.6	7.5	20	Tea stall & General store	
4	10+215	Randhara	LHS	Residential cum Commercial	4.3	3.4	0.9	7.2	10.0	Store Room under the Ramp	

Sr. No.	Site marked Chainage	Village	Side	Usage/ Type of Property	Design Requirement from existing centreline	Distance from existing Centreline	Impact	Length of the Structure	Width of the Structure	Remarks	Photos
5	13+020	Hawani	RHS	Residence	5.6	4.0	1.6	19.0	15.0	Impact wall, toilet and platform	
6	16+410	Ghour	RHS	Residence	8.4	7.0	1.4	9.0	7.0	Wall of the Structure impacted	

Sr. No.	Site marked Chainage	Village	Side	Usage/ Type of Property	Design Requirement from existing centreline	Distance from existing Centreline	Impact	Length of the Structure	Width of the Structure	Remarks	Photos
7	16+730	Ghour	RHS	Residential cum Commercial	9.7	7.7	2.0	3.7	3.0	Toilet and staircase Impacted	
8	19+810	Saphru	RHS	Residence	9.5	8.0	1.5	20.0	10	Only gate impacted	
9	19+920	Saphru	RHS	Boundary wall	8.9	4.6	4.3	1.5	5.0	Boundary wall impacted	

Sr. No.	Site marked Chainage	Village	Side	Usage/ Type of Property	Design Requirement from existing centreline	Distance from existing Centreline	Impact	Length of the Structure	Width of the Structure	Remarks	Photos
10	19+940	Saphru	RHS	Boundary wall	6.9	4.3	2.6	6.0	3.4	Boundary wall impacted	
11	24+275	Dehri Galu	RHS	Residence	7.6	4.0	3.6	6.5	10.0		
12	24+660	Dehri Galu	RHS	Shade	7.0	6.2	0.8	4.0	2.5	Temporary tin shade/ cattle shade	

Sr. No.	Site marked Chainage	Village	Side	Usage/ Type of Property	Design Requirement from existing centreline	Distance from existing Centreline	Impact	Length of the Structure	Width of the Structure	Remarks	Photos
13	24+715	Dehri Galu	RHS	Resi. cum Commercial	7.0	5.8	1.2	16.7	5.0		
14	28+480	Kalkhar	RHS	Squatter	11.1	0.6	10.5			Temporary tin shade movable fruits and vegetable squatter from last 4 years	

Sr. No.	Site marked Chainage	Village	Side	Usage/ Type of Property	Design Requirement from existing centreline	Distance from existing Centreline	Impact	Length of the Structure	Width of the Structure	Remarks	Photos
15	28+490	Kalkhar	LHS	Commercial	10.3	3.9	6.4	6.0	4.0	Commercial shop	
16	28+495	Kalkhar	LHS	Commercial	10.7	5.0	5.7	8.4	4.0	Liquor Shop Impacted	

Annexure-2

List of PAPs/ PAFs of Impacted Structures

Annexure 2: List of PAPs/ PAFs of Impacted Structures

Sl. No.	Village/ Town ID	Side	No	Start	End	Name of the Village/Hamlet/ Scheduled Area	Name of Owner of Land/Property/ Structure	Length (m)		Width (m)		Area (sq.m)	
								Total	Affected	Total	Affected	Total	Affected
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	PJT	R	01A	2+110	2+126	Twambra/Panjeti	Bhupendar Thakur	16	16	10	3.7	160	59.2
2	PJT	R	01B	2+110	2+126	Twambra/Panjeti	Krishan Kumar	2 PAP is residing in the same premises (2 families of brothers)					
3	THR	L	13	4+390	4+409	Talihar	Karam Singh Guleriya	19	19	7	0.9	133	17.1
4	RTP	L	2	7+460	7+468	Gaddal	Inder Chandra Sharma	7.5	7.5	20	3.6	150	27
5	RND	L	3	10+215	10+222	Randhara	Mr. Rajesh Kumar	7.2	7.2	10	0.9	172	6.48
6	RLD	R	4	13+010	13+029	Hawani	Mr. Kashmir Singh	19	19	15	1.6	285	30.4
7	GHAUR	R	5	16+410	16+419	Ghaur	Jeevan Lal	9	9	7	1.4	63	12.6
8	GHAUR	R	6	16+730	16+734	Ghaur	Deewan Chand	3.7	3.7	3	2	11.1	7.4
9	SPR	R	7	19+810	19+830	Saphru	Gulab Chand	20	20	10	1.5	200	30
10	SPR	R	8	19+920	19+922	Saphru	Kishan Chand	1.5	1.5	5	4.3	7.5	6.45
11	SPR	R	9	19+940	19+946	Saphru	Subhash Chandra	6	6	3.4	2.6	20.4	15.6
12	DHG	R	10	24+275	24+282	Dhar Galu	Devki Devi	6.5	6.5	10	3.6	65	23.4
13	MJW	R	11	24+660	24+664	Mujwari	Teerath Raj	4	4	2.5	2.5	10	10
14	MJW	R	12	24+715	24+732	Mujwari	Gyan Chand	16.7	16.7	10	1.2	167	20.04
15	KLK	R	14	28+480	28+482	Kalkhar	Krishan Chand	2	2	1.5	1.5	3	3
16	KLK	L	15	28+490	28+496	Kalkhar	Chhaju Ram	6	6	4	4	24	24
17	KLK	L	16	28+496	28+504	Kalkhar	Savitri Devi (owner)	8.4	8.4	4	4	33.6	33.6
18	KLK	L	16	28+496	28+504	Kalkhar	Mrs. Kanta Kaushal (tenant)	2 PAPs for the same structure - (1 owner & 1 Tenant of commercial shop)					
Total								153	152.5	122	39.3	1505	326.27

Other details of PAPs/ PAFs of Impacted Structures

Sl. No.	Name of Owner of Land/Property/ Structure	Father Name of the Present Land/Property/ Structure Holder/ Occupier	Address, Phone Number and LANDMARK	Phone Number	ID Proof	No of Years in the Settlement
(15)	(16)	(17)	(18)	(19)	(20)	(21)
1	Bhupendar Thakur	Lt. Shri Ram Singh Thakur	Vill. Twambra, PO Talihar, Dist. Sadar, HP	9418166797	724842993061	70
2	Krishan Kumar	Lt. Shri Ram Singh Thakur	Vill. Twambra, PO Talihar, Dist. Sadar, HP	9816122182	385245427203	70
3	Karam Singh Guleriya	Lt. Govind Singh	Vill. Talihar, PO Talihar, Mandi	9218778005	552825270255	36
4	Inder Chandra Sharma	Lt. Laxman Sharma	Near Rattipul, Gaddal, PO Alathu, Sadar, Mandi	8219279117	645064968453	22
5	Mr. Rajesh Kumar	Lt. Shree Heera Singh	BPO Randhara, Teh. Sadar, Distt Mandi, HP	8580880453	726798902048	20
6	Mr. Kashmir Singh	6361826649	Met person refuse to provide any kind of other information			
7	Jeevan Lal	Deewan Chand	Teh. Sadar, Ghaur, Dist. Mandi, Reur		221161917367	3
8	Deewan Chand	Shree Dutt Ram	Met person refuse to provide any kind of other information			
9	Gulab Chand	Murli Ram	Vill. Saphru, PO Reur, Distt. Mandi, The. Bhal	9817665106	406056970335	24
10	Kishan Chand	Narottam Ram	Vill. Gerloni, PO Rewalsar, Dist. Mandi	9816765341	672678749177	5
11	Subhash Chandra	Het Ram	Vill. Saphru, PO Rewalsar, Distt. Mandi	9816348065	968068014895	25
12	Devki Devi	W/O Rama Krishnan	Dhar Galu, PO Rewalsar, Teh. Rewalsar	7018810127	881834161261	7
13	Teerath Raj	Shiv Ram	Teh. Ner Chowk, Dhar, Rewalsar, Mandi	7876524147	366364113677	10
14	Gyan Chand	Tek Chand	Vill. Dhar 1, PO Rewalsar, Teh. Bal	9805873665	797971599158	45
15	Krishan Chand	Lt. Dile Singh	BPO Kalkhar, Teh. Bal., Vill. Naundhar	9805224463	810236601539	5
16	Chhaju Ram	Makandu Ram	PO Kalkhar, Vill Kalkhar,	9805083030	336965298949	5
17	Savitri Devi	W/O Lt. Rameshwar Ram	PO Kalkhar, Vill Kalkhar,	8580772169	213868584968	10
18	Mrs. Kanta Kaushal	W/O BB Kaushal	Nr. SBI, Chitrokhadi, Salah, Sunder Nagar, Distt. Mandi		347659203403	3