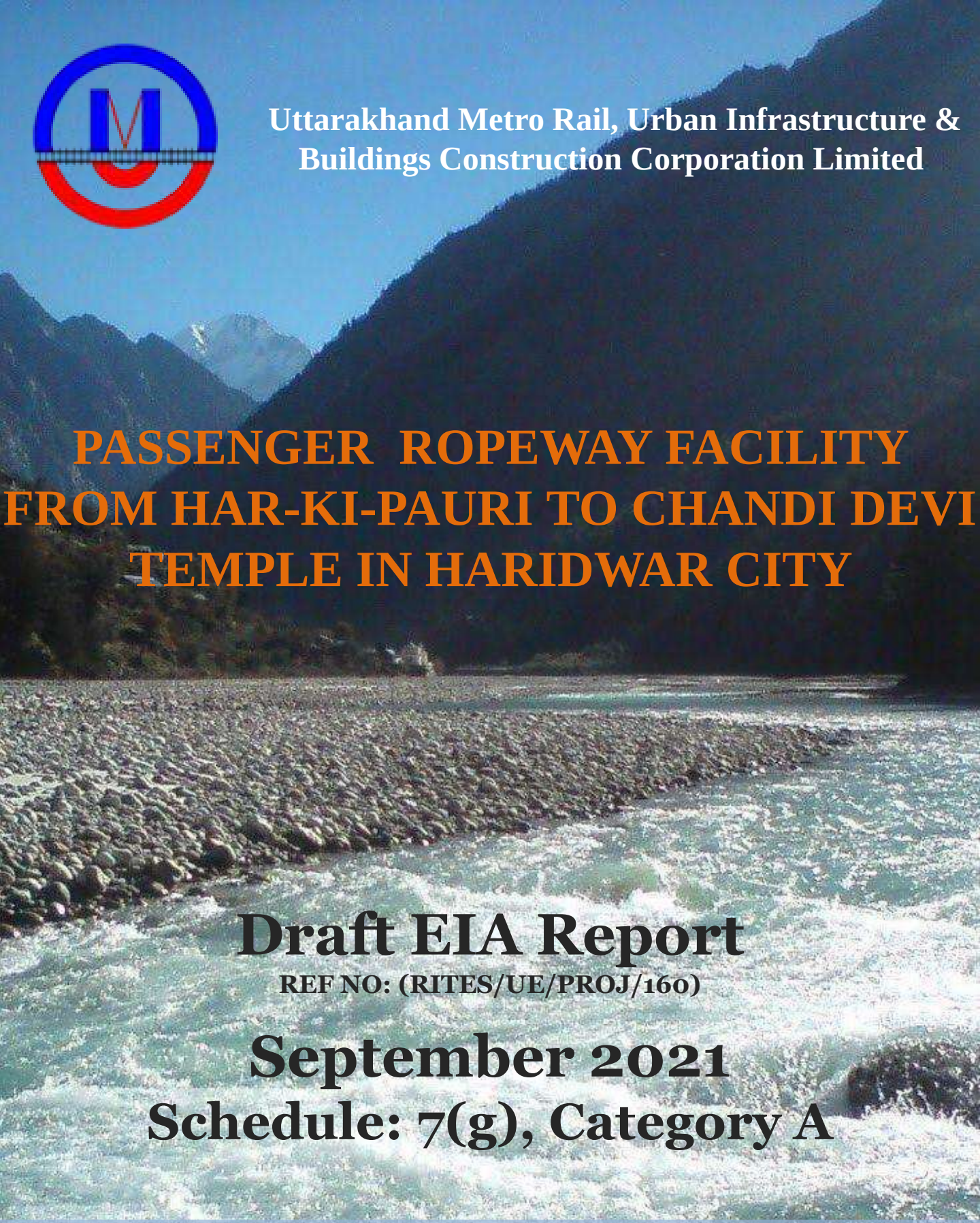

Uttarakhand Metro Rail, Urban Infrastructure & Buildings Construction Corporation Limited

PASSENGER ROPEWAY FACILITY FROM HAR-KI-PAURI TO CHANDI DEVI TEMPLE IN HARIDWAR CITY

Draft EIA Report

REF NO: (RITES/UE/PROJ/160)

September 2021

Schedule: 7(g), Category A

NABET QCI

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In this regard, we certify that the EIA/EMP report is prepared by QCI NABET accredited Environment Coordinator with the involvement of 12 Functional Areas Experts and the ToR have been complied with and the data submitted is factually correct. The laboratory used for analysis of the samples is NABL approved lab Arihant Analytical Laboratory Pvt Ltd. Certificate No. (TC-5826).

Authorized Signatory

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ABBREVIATION

AAQ	Ambient air quality
ASI	Archaeological Survey of India
BGL	Below Ground Level
BIS	Bureau of Indian Standards
C&D	Construction and Demolition
CGWB	Central Ground Water Board
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health and Environmental Engineering Organization
CSC	Construction Supervision Consultant
CTE	Consent to Establish
CTO	Consent to Operate
DG	Diesel Generator
DGMS	Director General Of Mine Safety
DPR	Detailed Project Report
E&M	Electrical and Mechanical
EA	Environmental Assessment
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EMoP	Environmental Monitoring Plan
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	Environment Protection Act
ESMP	Environmental and Social Management Plan
ESS	Environment and Social Standard
GIS	Geographical Information System
GoI	Government of India
GW	Ground Water
HT	High Tension
HW	Hazardous Waste
ICDS	Integrated Child development Scheme
IS	Indian Standard
IMD	Indian Meterological Department
IRR	Incremental Return Rate
IUCN	International Union for Conservation of Nature
KLD	Kilo Litres per Day
LCC	Lambert Conformal Conic
LISS	Linear Imaging Self Scanning Sensor
LTP	Lower Terminal Points
MH	Mixing Height

MLD	Million Liters per Day
MoEFCC	Ministry of Environment, Forests and Climate Change
NABL	National Accreditation Board for Testing and Calibration Laboratories
NQ	Noise Quality
NOC	No Objection Certificate
NH	National Highway
NRSC	National Remote Sensing Center
OHE	Over Head Equipment
OHSAS	Occupational Health and Safety Assessment Series
PCC	Physical Carrying Capacity
PM	Particulate Matter
PPE	Personal Protective Equipment
PPH	Passenger per Hour
PPV	Peak Particle Velocity
PWD	Public Works Department
RCC	Real Carrying Capacity
REET	Rare, Endangered, Endemic and Threatened
ROU	Right of Use
ROW	Right of Way
RMC	Ready Mix Concrete
SC	Scheduled Castes
SIA	Social Impact Assessment
SHE	Safety, Health and Environment
SPCB	State Pollution Control Board
STP	Sewage Treatment Plant
ST	Schedule Tribes
STW	Shallow tube wells
SW	Surface Water
ToR	Terms of Reference
UKMRCL	Uttarakhand Metro Rail, Urban Infrastructure & Buildings Construction Corporation Limited
UTP	Upper Terminal Points
VIR	Visual Flight Rules
VOC	Vehicle Operating Cost
WC	Water closet
WQ	Water Quality
WGS	World Geodetic System
WPA	Wildlife Protection Act

ToR COMPLIANCE

S. No.	ToR Points	Chapter	Section/ Page nos.	Remarks
Standard TOR				
i)	Examine and submit a brief description of the project-name, project site, geology, topography, nature, size, location of the project, project coverage, master plan, length of the proposed aerial rope way, details of ROW, height from MSL and its importance to the region/ State.	Chapter 2 Chapter-3	Section-2.3 to 2.8	The proposed project is a passenger ropeway system to reach the Chandi devi temple from Har ki Pauri. The brief of the project is as follows: ❖ Length- 2,305 m ❖ Area- 0.62 Hectares ❖ Carrying Capacity- 1800 PPH ❖ ROW- 10 m Details are given in chapter 2 of the draft EIA.
ii)	Any adverse impact of the works already carried out.	----	----	Not applicable
iii)	Submit the details of facilities viz. administration building, restaurant, toilets, waste collection and disposal etc. at Lower terminal and upper terminal including parking area.	Chapter-2	Annexure 2.1 to 2.5	• Six male and 11 female Indian style toilets 9 urinals at LTP. • 4 female 2 male 3 urinals at UTP. • 64 separate bins of 20 litre capacity have been proposed. • The L-section, Lower Terminal Plan (Road Level), Lower Terminal Plan (First Floor Level), Lower Terminal Plan (Boarding Level) and Upper Terminal Plan (Boarding Level) , Contour plan are given in Annexure 2.1, 2.2, 2.3, 2.4, 2.5 and 2.6. Respectively.
iv)	Submit the details of trees required to be cut for the project, including the type, girth size etc. Necessary	Chapter-3 Chapter-10	Annexure-3.1 Section 10.3	38 number of trees need to be felled for the development of the ropeway. **Girth**- 50-70 cm Approval for Diversion of Forest land is under process.

	permission from competent authority shall be obtained for tree cutting. Compensatory tree plantation shall be carried out and cost provision should be made for regular maintenance. Details to be submitted.			Details of the compensation given in Chapter 10.
v)	Examine and submit the likely impact due to influx of people and associated developments.	Chapter-4	Section 4.5.8	The development of Ropeway will not distrurb the existing environment but will facilitate and provide an easy and fast access to the Temple.
vi)	Submit maps of the project area and 10 km surrounding area from boundary of the proposed/existing project area, thereby delineating project areas wild life sanctuaries notified under the Wild Life (Protection) Act, 1972/critically polluted areas as identified by the CPCB from time to time/notified eco-sensitive areas/interstate boundaries and international boundaries.	Chapter-2 Chapter-3	Figure 2.2 Figure 3.9,	Toposheet map of 10 km and landuse land cover map of 15 km showing the sensitive receptors, protected forest, National park, interstate boundaries, district boundaries, settlement, water body is given in subsequent section of the EIA. Project site lies in the Buffer zone of Tiger Reserve.
vii)	Submit baseline data and description of existing situation of the land at the	Chapter-3	Section 3.2 to 3.7	Environmental baseline data include the physical, biological and socio-economic data. The environmental baseline data is compiled and reported for: • Land Environment (Physiography,

	proposed project site including description of terrain, hill slopes, inland topography, slope and elevation, rock types, regional tectonic setting (reported fractures/faulting/folding, warping), and history of any volcanic activity, seismicity and associated hazards..			Geology, Seismicity and Soils) • Water Environment (Water Resources, Water Use, Water Quality) • Air Environment (Meteorology and Air Quality) • Noise Environment (Noise Levels) • Ecological Environment (Flora and Fauna) • Socioeconomic environment
viii)	Submit details of power requirement and source. Energy efficiency measures in the activity should be drawn up. PP should also submit details of D.G. Sets along with noise control measures.	Chapter-2	Section 2.8, F	Total power requirement for the project will be 15KW for Upper Terminal and 425KW for Lower Terminal. The power shall be supplied from main substations. During power failure 02 Number of DG sets of Capacity 625 KVA for Lower Terminal and 25 KVA for Upper Terminal will be provided. Standby DG set will require diesel fuel which will be procured locally.
ix)	Details of anticipated impact during construction stage and operation stage w.r.t. landslides, surface drainage etc., should be predicted. The existing surrounding features up to 1 km and impact on them should be addressed separately.	Chapter-4	Section 4.3.1 and 4.3.7	Detail environment impact during construction and operation stage of the project has been predicted and reported in the Chapter-4 of the EIA.
x)	PP should examine and submit activities associated with aerial ropeway construction and	Chapter-4	Section 4.3 and 4.4.	Impact & mitigation measures for hazard prevailing at the project site is predicted and reported. Major impacts covered in the report are as follows:

	operations and likely associated hazards and accidents. therefore desirable that based on the categories of hazards prevailing at the project site, risk assessment may be carried out by specialists in the field and recommendations may be implemented. Risk assessment should be carried out for seismicity, slope stability, soil erosion, and flood hazard.			• Landslide • Earthquake • Wind & cyclone • Cloud Burst • Fire Explosion • Electrical • Flood • Due to project Design
xi)	Any litigation pending against the proposed project and/or any direction/ order passed by any court of law against the project, if so, details thereof should be provided.	-----	-----	Not applicable. There is no litigation pending against the project.
xii)	Submit Certificate from the competent authorities for safety of ropeway and its monitoring	-----	-----	After construction of Ropeway, the safety certification will will be taken as per the provisions of Uttarakhand Ropeway Act, 2014 and in accordance with the requirement stipulated in IS: 5229 (latest revision).
xiii)	Public hearing to be conducted for the project in accordance with provisions of Environmental Impact Assessment Notification, 2006	-----	-----	Public consultation has been carried out during the EIA study. Public hearing will be conducted and proceeding of public hearing will be reported in Final EIA report.

	and the issues raised by the public should be addressed in the Environmental Management Plan. The Public Hearing should be conducted based on the ToR letter issued by the Ministry and not on the basis of Minutes of the Meeting available on the web-site.			
xiv)	A detailed draft EIA/EMP report should be prepared in accordance with the above additional TOR and should be submitted to the Ministry in accordance with the Notification.	---	-----	Draft EIA report prepared in accordance with the above additional TOR.

EXECUTIVE SUMMARY

0.1 INTRODUCTION

Haridwar city is a main pilgrimage place of Uttarakhand. Every year lakhs of pilgrims visit here and important events like Maha Kumbh and Ardh Kumbh are organized in this city and every year lakhs of devotees also visit Haridwar city in Kanwar fair. Most of the pilgrims coming to Haridwar also visit Chandi Devi and Mansa Devi after taking Har ki Pauri bath. At present, ropeway facility is available on Najibabad Road where the devotees reach after traveling a long distance by road to visit Chandi Devi Temple. There is also not enough space available for parking of vehicles at that place, due to which pilgrims have to face a lot of difficulties in going to visit Chandi Devi temple and it also takes a lot of time. Due to these difficulties many pilgrims are unable to visit Chandi Devi Temple. In order to ensure proper movement of such a large number of people, along with the development of other means of transport in the city of Haridwar, it is also necessary to provide the ropeway facility from Har ki Pauri to Chandi Devi.

Uttarakhand Metro Rail, Urban Infrastructure & Buildings Construction Corporation Limited (UKMRC) is formulated to plan, design, develop, construct, maintain or operate metro rail or other similar mass rapid transport system of all types and descriptions including mass movers either individually or in association with other undertakings and companies or persons in India and/or abroad. In this context, and to further attract tourism, UKMRCL is now planning to develop a ropeway from Har ki Pauri to Chandi Devi Temple in Haridwar to facilitate the devotees and tourists visiting Haridwar.

RITES Ltd. (A Government of India Enterprise) was appointed by Uttarakhand Metro Rail, Urban Infrastructure & Buildings Construction Corporation (UKMRC), as consultant, for undertaking the Environmental Impact Assessment (EIA) study and preparation of the report for proposed Ropeway systems. RITES, Government of India enterprise was established in 1974. RITES is accredited for aerial Ropeway in "Category A" since 31st January 2011. RITES is accredited by NABET its accreditation number is **NABET/EIA/ 1922/RA/0193.**

An EIA study has been conducted and subsequently this report has been prepared as per the approved Terms of Reference (TOR) issued by Expert Appraisal Committee (EAC) of Ministry of Environment, Forest and Climate Change (MoEF&CC) for obtaining the Environmental Clearance of the project.

Approach and Methodology: The basic concept is to ascertain the existing baseline conditions and assess the impacts as a result of design, construction and operation of the project. The changes likely to occur in different components of the environment viz. physical, biological/ecological, and socio-economic etc. have been studied, analyzed and quantified, wherever possible. The accurate analysis of assessment depends upon the reliable data generated/available on environmental attributes. The impacts are assessed for various phases of project cycle namely, Impacts due to project location, project construction, and project operation. The cost of management and monitoring programs are

estimated on the basis of mitigation measures suggested for negative impacts and environmental monitoring programme during project construction and operation.

0.2 PROJECT DESCRIPTION

Proposed project is the development of the passenger ropeway system from Har Ki Pauri to Chandi Devi Temple in Haridwar city, Haridwar District of Uttarakhand. As per the 7(g) of EIA notification 2006 and its amendments, the ropeway projects are classified under category 'A' in case the project attracts general conditions i.e. site is located in an ecological sensitive area and/or the elevation of the site is 1,000 m above the mean sea level. Such projects require prior environmental clearance from Ministry of Environment Forest and Climate change (MoEFCC), Government of India. As per the letter no. 1044/21-5. dated 24.08.2021 issued by Haridwar Forest Department the alignment is passing through the Buffer zone of Rajaji Tiger Reserve. Therefore, the proposed project attracts the general conditions of the said EIA notification and classified as Category "A", which requires environmental clearance from MoEFCC.

Location and Connectivity: The proposed Passenger Ropeway from Har Ki Pauri to Chandi Devi Temple in Haridwar is started adjacent to Deen Dayal Upadhyay Parking at NH-34 to near Chandi Devi Temple at the junction point of pedestrian path, way to Chandi Devi Temple and way to Anjani Mata mandir.

Haridwar is about 230 Km from National Capital New Delhi and about 55 Km from State Capital, Dehradun. Haridwar is well connected with road and Indian Rail network. The Lower Terminal Point of the ropeway is adjacent to the NH-34. Nearest Railway station is Haridwar which is approx. 2 km (NW direction). Nearest Airport is Jolly Grant Airport Dehradun, at about 35 km.

Need and Justification:

- Since the ropeway is at Har Ki Pauri to Chandi Devi Mandir itself, so it will connect more people to reach at Maa Chandi Devi temple directly for the pilgrims reaching Haridwar and coming at Har ki Pauri.
- This will reduce the time and effort of the people in reaching Maa Chandi Devi Temple.
- It will generate local employment opportunities during construction and operation of the said project.
- Due to Har Ki Pauri to Chandi Devi ropeway project, there will be increase in tourism in state of Uttarakhand due to better connectivity.

Ropeway System: The design capacity of ropeway is estimated as 1800 PPHPD. The technical details of the proposed ropeway are given as under:

S.No.	Details	Value	Unit
1.	**Layout**		
	Location of drive station	Bottom	--

S.No.	Details	Value	Unit
	Location of return station	Top	--
	Location of the tensioning system	Bottom	--
	Type of tensioning	Hydraulic	--
	Direction of rotation	clockwise	--
2.	**Dimension**		
	Horizontal length	2281	m
	Vertical rise	209.35	m
	Inclined length	2305	m
	Track width	5	m
3.	**Transport Capacity**		
	Hourly capacity per direction	1800	PPH
	Uphill transportation	100	%
	Downhill transportation	100	%
	Drive speed, infinitely adjustable	1.0~5.0	m/s
	Trip time at max speed	~ 8	min
	Station speed	0.25 – 0.3	m/s
4.	**Main Drive**		
	Drive Machinery, Type	Overhead	
	Electric main drive:		
	Continuous Power Rating	300	kW
	Starting Power rating	360	kW
	Voltage	380 / 440	V
	Frequency	50	Hz
5.	**Evacuation Drive**		Unit
	Evacuation drive 1 (diesel hydraulic)	100	kW
	Evacuation drive 2 (electric)	~ 25	KW
	Evacuation speed, max.	~ 1.0	m/s
6.	**Carriers**		
	Carrier spacing	60	m
	Carrier interval	12	Sec
	Passengers per carrier	6	P
	Number of carriers	90	Nos.
	The number of other carriers:		
	Service Carrier	1	Nos.
	Freight Carrier	0	Nos.
7.	**Towers**		
	Number of towers	13	Nos.
8.	**Haulage rope**		
	Diameter	41	mm
	Actual Breaking Strength	1086	kN
	Tensile Strength	1860	N/mm2

S.No.	Details	Value	Unit
	Tension Force	400	KN

Manpower requirement: 100 numbers during construction and 15 numbers during operation.

Construction Schedule and project Cost: The proposed passenger ropeway system is expected to be completed in a period of 24 months with an estimated cost of Rs. 149.70 Crores only.

0.3 ENVIRONMENTAL BASELINE DATA DESCRIPTION OF ENVIRONMENT

Description of existing environment conditions for the proposed project facilities in and around the project sites. RITES have carried out field studies to generate primary data on soil, water, air, meteorology and noise quality at the project site. Field study is also carried out for assessing the ecological status in the study area. Additional data, wherever necessary, is collected from various reports, literatures, books and maps, and through discussions with various stakeholders. The project study area is within 500 m radius from the project boundary as per EIA Guidance Manual, however 10 km radius of the study area is considered for the proposed ropeway to collect primary and secondary data and 15 km area is considered for the Eco sensitive features around the project area. The primary data collection was carried out in the months of April-2021 to July-2021.

Physiography: The proposed Ropeway project is located in the Haridwar District of Uttarakhand. Haridwar District lies in the south-western part of the state in between latitude 29°35’ N & 30°40’N longitudes 77°43’ E & 78°22’ E. Haridwar District is bounded on North by the Dehradun district; on North- East by Pauri Garhwal district; on South and western side by the Uttar Pradesh State. The total geographical area of the District is 2360 sq. kms. District is well connected through by the network of metalled road and railway lines. The physiography of the Haridwar distirct comprises is plain except the presence of Shiwalik Mountain range. There is no void features except that the presences of nalla and River. Physiography of the district can be categorized into three- Structural Hills, Upper Piedmont and Lower Piedmont Plains

Geology: The Haridwar district is a part of west Indogangetic plain which is composed of Pleistocenec and subrecent alluvium material brought down by river from Himalayan region. The geology of the region belongs to the Cenozoic era. The upper Siwaliks are mostly redaceous consisting of sand stone, boulders, pebbles, conglomerates, shale, slit and clay. The middle Siwaliks in this area is largely consists of lower alterations of clay and sand stone sequence and an upper sequence of massive sand stones. Just below the Siwaliks are the Bhabar area which is characterized by the alluvial, consists of boulder, cobbles, pebbles, gravel with clay and silts.

Soil: The soil of the Haridwar has been classified into three broad categories Ultisols, Entisols and Molisols soil. A mixture of sand and soil are present on the exact location of LTP however, soil in the vicinity of LTP and UTP is unfertile.

Land use pattern: Open Forest land covers the majority of the land which is about 28.67% of the study area. The second highest pattern of the landuse is moderately dense forest covering the 26.21% of the study area. Settlement covers the 8.88% of the area. Dry River bed covers the 7.38% of the study area while 1.81% is the river perennial in the study area

Seismicity: Project site lies in the Seismic Zone IV indicating High damage risk zone as per the IS: 1893-2002 (BIS, 2002) and corresponds to MSK intensity VIII.

Water Environment: Haridwar district shows different hydrogeological conditions due to its variegated geological settings and topography. Shiwalik in extreme north where the ground water occurs in the form of spring and seepage. Haridwar district is rich in the water resources like ground water, surface water. The Groundwater is the main source of water for fulfilling the demands of irrigation, domestic and industrial purposes. The major part of the Haridwar district shows shallow water levels in the range of 10- 15mbgl.

In order to assess the baseline water quality status of the study area, 8 water samples are collected from the project site and its surroundings- 4 ground water sample, 1 tap water sample and 3 surface water sample. The results of water analysis are compared with IS: 10500-2012 Drinking Water Standards and CPCB standards for water quality. All parameter physical parameter, Parameters concerning substances undesirable in excessive amounts, biological parameters are within the acceptable limits. Ground water quality of the Region is good enough for the purpose of drinking without any treatment. Surface water quality is compared with the CPCB water quality standards to check the use based classification of surface waters. The analysed surface water of the Ganga River and its tributary lies in the class “B” it can be use for the purpose of Outdoor Bathing.

Meteorology and Air Environment: The climate of the district is hot sub-humid (dry) climate. The temperature begins to rise from March (27.6^0C) and reaches to its maximum at during May (37.2^0C) with the commencement of monsoon season by the mid of June and the temperature begins to lower by the end of June. During the winter season in the month of December to February the temperature ranges between 24.7^0C to 17.7^0C. The total annual rainfall for the state as a whole is about 133 cm and total annual number of rainy days are about 63.

The ambient air quality of the project site and surroundings the monitoring stations are selected on the basis of topography and meteorology of the area. Four monitoring stations are selected and Five parameters ($PM_{2.5}$, PM_{10}, CO, SO_2 and NO_2) are selected and monitoring was carried out for 2 days in a week for 3 months. The results obtained are analysed and compared with ambient air quality standards of Central Pollution Control Board (CPCB) and is found the results within the standards.

The Average AQI of the study region lies in the satisfactory category. Whereas 98 percentile value of the region lies in the moderate category. It is clear that PM_{10} is the prominent pollutant and contributes majorly to the high values of Air Quality Index. This can be due to the festival season the high vehicular movement near the Highway. The sub indices of NO2 ,SO2 and CO has been found in a 'good' category at all the locations and have no significant impact on human health.

Noise Environment: The impact of noise can lead to effects such as noise induced hearing loss and annoyance depending upon the loudness of noise level. Noise level survey is conducted at the project area with an objective to establish the baseline noise levels and assess the impacts of the noise expected due to the proposed development. Noise level survey is conducted at 4 locations. The noise levels were compared with the Ambient Air Quality Standard in respect of noise. Noise level during the day and night time is higher at all locations due to the vehicular activities in the areas.

Ecological Environment:

Ecology: Primary data was collected through field survey along the alignment. Secondary data was collected from 15 km radial distance from the project site.

Flora: 38 number of trees are impacted in the project Right of way (RoW) i.e. 5 m on either side of centerline of alignment and proposed stations. 7 number of trees area enumerated from LTP to Tower-5 and 31 number of trees are enumerated from Tower-5 to Tower-13 including UTP. 154 flora species includes Trees, Shrubs, Bamboo and Grass are recorded from the 15 km radial distance from the project site.

Fauna: Fauna were studied through primary survey along the alignment & terminal locations duly supplemented by secondary data to cover study area of radius 15 km around the alignment. In Core zone (0.00m to 500m) 8 numbers of mammals, 8 numbers of birds and 2 species of reptiles are observed. The Schedule –I species recorded from Core zone are Indian Elephant, Indian Leopard, Swamp deer and Peacock. Altogether 32 species of Mammals, 68 species of Birds and 7 species of reptiles were recorded during present study in Buffer zone (500m to15000m). The strong plant-animal (birds) interaction was recorded on agro-ecosystem& forest ecosystem.

The Schedule-I Mammals reported in buffer zone are Indian Tiger, Indian Leopard, Leopard Cat, Hog Deer, Sloth Bear, Wolf, Blackbuck, Fishing cat, Indian Pangolin, Indian Elephant, Swamp Deer. Schedule –I Birds are Indian Peacock and Oriental pied Hornbill. Schedule –I Reptiles are Python, The Common Indian Monitor Lizard and Marsh Crocodile. Apart from that Monkey, Langur, Common Mongoose, two species of Otter, Wildcat, Indian red fox and Jackal are also reported which fall under Schedule –II. A total of 32 mammals, 07 Reptiles and 68 birds are reported in buffer zone.

Ecological Sensitive Area within 15 km: Ecological sensitive area within 15 km from proposed development activity includes buffer zone of Tiger reserve.

Socio-Economic Environment: Under the scope of Social Impact Assessment study, the demographic, socio-economic conditions of district and settlements located within 10 km radius, approach and methodology, potential social impacts, mitigation measures, benefits of the project and major findings of public consultation are discussed in this chapter. The secondary data was collected from district census handbook (DCHB) 2011, project literatures, ropeway guidelines and other related documents as part of pre-survey activities. The primary data was collected through public consultation and discussion with other stakeholders at project level. The field survey took place on July 2021.

0.4 IMPACT ASSESSMENT AND MITIGATION MEASURES

The impacts on the various environmental components have been assessed during various phase of the project cycle namely due to the location, project design, possible accident, construction and operation.

Impact Due To Possible Accidents

- **Landslide:** The area where ropeway is proposed is having minimum prone to landslides. Hence, there is no such impact is anticipated.
- **Earthquake:** Project site is located in the seismic zone IV as classified in IS: 1893:2002 which indicates the project area comes under the moderate damage risk zone.
- **Wind & Cyclone:** The project area falls under the high damage risk zone. During storm or cyclone passengers inside cable cars will experience horizontal movement of the connection between the track cable and the gondola. This situation may cause injuries to passengers.
- **Cloud Burst:** Chances of cloud burst impact will not anticipated in this region.
- **Fire Explosion:** Likely Threat of fire and explosion in lower and upper terminal being busy area and car parking and POL storage activities, however, in a ropeway project, fire can mainly cause due to electric spark in electrical room, fire in the surrounding forest area, fire in fuel storage places, etc. The Fire & explosion can cause suffocation due to harmful gases generation & panic in the minds of people that will lead to stamped at lower & upper terminal.
- **Flood:** All the structure will be developed according to the Uttarakhand Building Bye laws. Relevant local and Indian standard will be followed.
- **Electrical:** The ropeway will run on electricity & hence, electrical current can pass through cable cars & wires due to inadequate insulation or accidently.

Impact Due To Project Design:

As the ropeway consists of cable cars, rope, big and heavy machineries, mechanical hazards can cause risks to people working in the area during construction phase & people who will travel through the ropeway in operation phase. Mechanical hazards are like drive/ return sheave shaft failure/ tension system failure, mount assembly parts failure, rollback, slippage/ fall of cabin, entanglement of cabin, swinging of cabin resulting in fall of

passengers outside cabin, cabin derailment at station/ broken wires in service/ over speeding of ropeway, brake failure etc. may occur.

Impact During Construction Phase

- **Impacts on Topography, Drainage:** Development of Lower Terminal Stations and Upper terminal stations and 13 numbers of intermediate towers will change the topography of the area.
- The Tower will be located in the Dry river bed of Ganga . Water from the river Ganga is diverted to Har ki pauri near the Bhimgodda Barrage. Near Tower 2, 3 and 4, water will only be available at the time of opening of the gates of Bhimgoda barrage which is generally opened during the high water flow. Therefore, there is no such impact on the change of drainage.
- **Impact on Soil:** A mixture of sand and soil are present on the exact location of LTP however, soil in the vicinity of LTP is unfertile. No fertile soil was observed adjacent to UTP except some fine and coarse stones. The excavation activity involved for foundation of building and tower will cause generation of excavated soil. Near tower-5 Fertile soil was observed.
- **Impact on Land use:** Change of land use is expected due to the use of forest land and irrigation land for the purpose other than the defined purposes.
- **Impact on Water Environment:** Pile driving, dredging, sand compaction and other construction work in water cause resuspension of sediments and turbid water. Muck generation during the construction of Pile foundation at Stations and Towers. Site runoff and drainage may contain increased loads of suspended solids and contaminants. Increase of suspended solids concentration into the water will cause the undesirable taste to the water. Sewage and wastewater contain bacteria, fungi, parasites, and viruses that can cause intestinal, lung, and other infections. Leakage of lubricant oil and sewage to the surface water body, can threat the aquatic ecosystem.
- **Impact due to Solid Waste:** Improper management of construction waste can cause the inconvenience on roads, choking surface drains, disrupting traffic. Labour camp at the site may lead to sanitation problems in the absence of adequate facilities. Hazardous waste mismanagement ultimately leads major impact on the health and contaminates the water, soil and air environment.
- **Impact Due To Influx of People And Associated Developments:** Devotees are already reaching the temple with the existing ropeway and track. The development of Ropeway will not disturb the existing environment but will facilitate and provide an easy and fast access to the Temple directly from Har ki pauri to Chandi devi.
- **Ambient Air Quality**: During the construction phase, SPM is expected to be the main pollutant associated with on-site roads (paved and unpaved), stockpiles and material handling.
- **Ambient Noise Quality:** The project is expected construction activities. Sources of noise emissions are expected from various construction equipments.

- **Vibration:** Construction activity can result in varying degrees of ground vibration, depending on the equipment and methods employed. Operation of construction equipment causes ground vibrations which spread through the ground and diminish in strength with distance.

Impact On Biological Environment

- **Birds:** Potential impacts on birds include degradation of feeding habitat (1 km radial distance from LTP) in the short term resulting in habitat changes but after construction period is over the habitat will be rejuvenate. Construction may cause impact on food sources for birds. The predominant bird species observed at project site are Peacock, Myna, Spotted dove, Swift, Pigeon, Sparrow, common kingfisher and house crow. No migratory birds observed during field survey. There is a possibility that some groups of resident birds avoid the alignment area and move to other areas of Ganga River.
- **Mammals:** Three schedule I or REET (Rare, Endangered, Endemic and Threatened) species were recorded along proposed alignment. These animals are Indian Elephant, Indian Leopard and Swamp Deer. Many species will move away from the areas of disturbance, returning after habitat re-instatement.

Potential Social Impact

The social impacts of the ropeway project are assessed in three stages i.e. design, construction and operation. No private land, no private structures and families are affected. The existing trekking path at UTP station would be affected. One public toilet would be affected near proposed LTP station. Apart from this other indirect impacts are discussed in the chapter such as impact on laundry bay, socio-cultural disruption, health impacts, cultural conflicts, pressure on existing crowd, loss of income of auto drivers. The mitigation measures are also suggested accordingly in the report. Considering the project impacts, it is anticipated that there is no scope of rehabilitation and resettlement of families for the proposed project.

0.5 ANALYSIS OF ALTERNATIVES

During feasibility study 06 alignments were studied for the ropeway. The location of the terminal station towards Chandi Devi Mandir is same in all the options and study/survey was done for the terminal station towards Har Ki Pauri with 06 different locations. Out of the above 06 options, after preliminary study, 04 options were canceled and 02 options were studied in detail. Based on various surveys, feasibility study, ease of construction, ease of operation and discussion with other stakeholders, Alignment no 1 has been selected as the final preferred alignment.

0.6 ENVIRONMENTAL MONITORING PLAN

Water Quality: Monitoring will be conducted during construction to confirm that discharge from the sewage treatment plant and runoff from exposed areas. 3 monitoring locations for surface water and 2 locations for ground water are selected for the purpose of assessing the

measure implementations. Duration for Ground water Quality / Drinking water should be carried out at Twice in a year (Pre and Post monsoon) and for Surface Water Quality Four times in a year (Pre monsoon Once in a year for25 parameters, Post monsoon 3 times for 10 Parameter). The cost for water quality monitoring is estimated of **Rs. 4.8 Lakh.**

Air and Noise Quality: To assess the effectiveness of air and noise pollution control, ambient air quality and noise levels shall be monitored during the construction and for at least one year, once a month for three season after the completion of the project. The Parameters to be monitored for air quality are PM_{10}, $PM_{2.5}$, SO_2, CO, and NOx. As part of the environmental management, equipment brought on site for construction purposes is checked to determine whether it meets noise generation guidelines. The frequency and duration for noise quality monitoring is same as air. The cost for air and noise quality monitoring is estimated of **Rs. 8.25 Lakh.**

Soil Quality: Soil near to the construction area shall be monitored to ascertain presence of soil pollution due to construction activities. Soil will be monitored near to the LTP, Labour Camp, Tower 5 and UTP. The cost for soil quality monitoring is estimated of **Rs. 0.60 Lakh.**

Ecological Monitoring for Construction Phase: The avifauna and mammals monitoring is consider for 3 seasons in a year for 2 years. The monitoring will be done at Rajaji National Park, plantation sites and Bhimgoda barrage of Ganga River. During operation phase the avifauna and mammals monitoring is consider for 3 times in a year for 3 years.

Ecological Monitoring for Operation Phase: The avifauna and mammals monitoring is consider for 3 seasons in a year for 3 years. The monitoring will be done Rajaji National Park, plantation sites and Bhimgoda barrage of Ganga River. The estimated cost for ecology and biodiversity monitoring is **Rs 15.75 Lakh.**

Establishment of Environmental Cell: The project authority shall establish an Environmental cell in the initial stage of the project. The division shall have one Environmental Engineer/Officer. The task of the environmental Engineer/Officer shall be to supervise and co-ordinate environmental concerns, monitoring and implementation of mitigation measures. The officer will monitor the environmental works in coordination with the Project Head. Cost of such a division has been estimated as **Rs. 37.07 Lakh**.

0.7 ADDITIONAL STUDIES

Project level consultation process involved various groups such as shop keepers, devotees, pilgrims, tourists, drivers, hotel owners, monks and other stakeholders. Four public consultations were conducted in Deen Dayal Upaddhyay parking, Hari Ki Pauri, Chandi Devi temple and in existing ropeway parking area. The issues like awareness about project, increase in tourists and devotees, traffic issue, increase in income and shop keeping business, better integrated transportation, employment opportunity, loss of income of auto drivers, saving of time and money, crowd management, mobility, disaster management

measures, development of tourism, affordable travel fare, protection of wild animal, engagement of local labour etc were discussed. The presence of about 64 participants was ensured during focus group discussion and public consultation at project level. The field survey took place on 21st and 22nd July, 2021. The state government's COVID-19 guidelines, social distancing measures were taken care throughout the social survey.

Risk assessments include detailed quantitative and qualitative understanding of risk, its physical, social, economic and environmental factors and consequences. Risk assessment encompasses the systematic use of available information to determine the likelihood of certain events occurring and the magnitude of their possible consequences. The causes of risk may be:

Cable slipped out of the rails at the tower from the upper station can cause the carriages to be knocked off. The accident took place due to negligence.

Cabin lost its hold with the cable and collided with the one cabin of ropeway car and hit another on the way, Hill collapsed midway and trolleys were dangling in the air. Snapping of Rope wire, Power system failure, Collision with entering station: operator failed to slow the vehicle down upon entering the station it causes collision of the ropeway car at the entering station. Holding capacity of soil/Geological aspects, flood, soil erosion and seismicity are also considered during identification of risk.

Risk Assessment and Disaster Management Plan: The main aim of the disaster management plan is safety of the passenger, quick response to accident and treatment to casualties, evacuation of passengers to safe area, bring the disaster under control within short time and investigation of accident and prepare prevention plan.

Preventive Action: Once the likelihood of a disaster is suspected, action has to be initiated to prevent a failure. Manager responsible for preventive action should identify sources of repair equipment's, materials, labour and expertise for use during emergency.

Emergency Action Committee: To ensure co-ordination action, an Emergency Action Committee should be constituted. The civic administrator may be the Chairman of this Committee.

Emergency Measure: The emergency measures are adopted to avoid any failure in the system. The aim of Emergency Action Plan is to identify areas, population and structures likely to be affected due to a catastrophic event of accident. The action plan should also include preventive action, notification, warning procedures and co-ordination among various relief authorities.

Rescue Operation: Aerial ropeways shall be equipped with adequate and sufficient facilities which shall be readily available to clear the line of passengers and return them within a

reasonable time to a terminal, or location, where access for emergency services is available. Sufficient numbers of trained persons for carrying out the rescue operation (the rescue crew) shall be on duty when the aerial ropeway is in operation.

0.8 PROJECT BENEFITS

The proposed passenger ropeway is envisaged to boost up the better connectivity for the enhancement of tourism potential. This project will add up the new infrastructure to the area facilitating the local people as well as tourist visiting the Temple. This project will improve the basic facilities and resources of the villagers, better connectivity, employment opportunity, increase livelihood opportunities, increase tourism potential, control the labour migration. Being the eco-friendly mode of transport, carbon credit benefit is anticipated.

0.9 COST BENEFIT ANALYSIS

It is expected by the development of new ropeway will give economic return to the state. By encouraging more tourists throughout India, it is belief it will increase the demand for local industries especially in hotel and resorts, restaurants. The cost of the ropeway project is Approx. **Rs. 149.70 Cr.** The project has IRR of 28.6%. This level of return may be just sufficient to get nullify the same.

0.10 ENVIRONMENTAL MANAGEMENT PLAN

The environmental management plan spells out the set of measures to be undertaken during project construction and operation to mitigate or reduce the adverse environmental impacts and bring them to acceptable levels based on the proposed Environmental Management Plans. The most reliable way to ensure the implementation of EMP is that these plans are integrated into the overall project planning and implementation to make them as an integral component of the project. Environment management plan during construction and operation phase of the project is as follows and the cost of the Environmental management plan is **Rs 152.01 Lakhs**.

- **Ecology & Biodiversity Management**
- **Ecology & Biodiversity Management Compensatory Plantation:** About 38 trees are likely to be affected (All 38 trees are likely to be removed) due to construction of proposed project. Estimated cost of planting new trees, their maintenance & plantation is about 10.58 Lakhs.
- **Net Present Value (NPV):** The net present value of the 0.29 Ha of Shayampur reserve forest land diverted for the proposed development activity. Estimated cost of planting new trees, their maintenance & transplantation is about 1.81 Lakhs.
- **Cutting cost:** There are 31 trees impacted for the proposed development activity. The amount will be deposited for the values of trees are Rs 1.24 lakhs.

- **Conservation plan for wildlife:** The core and buffer zone is consisting of many Schedule –I & Schedule –II Fauna. Many species are impacted due to proposed

development activity. An amount of Rs 20.00 Lakhs need to be estimated for the utilization of wildlife conservation purposes in Shyampur range of Haridwar forest division, preferably in the buffer zone of RTR area surrounding the ropeway.

- **Waste Water Management and Water Conservation**: The waste generated during construction and operation is 5.6 KLD and 52.4 KLD respectively. This waste water will be treated through the mobile toilets during the construction phase and during operation phase by the Advanced Eco reactor. The estimate cost of proposed STP is Rs.30 lakhs.
- **Energy Conservation Measures:** Project area gets the sufficient sunlight during whole of the year. To reduce the power load at each station roof top Solar PV of 15 Kw of system has been proposed. This will generate 47,882 Kwh annually. Solar Roof PV will connect with the grid. BEE star rated DG sets shall be used in all compliant buildings (minimum 3-5 stars rating). The estimate cost of proposed solar panel is Rs.18 lakhs.
- **Solid Waste Management Plan:** After implementation of the recommended mitigation measures for the construction phase of the proposed project, there is no residual impacts will be expected from the project. Environmental monitoring will be necessary to ensure the implementation of correct disposal requirements for the various wastes generated from construction works. The estimate cost for solid waste management system is Rs. 1.4 lakhs.
- **Hazardous Waste Management:** The Contractor will ensure that hazardous wastes are labeled, recorded, stored in impermeable containment and for periods not exceeding mandated periods and in a manner suitable for handling storage and transport.
- **Traffic Circulation during Operation:** Pt. Deen Dayal Upadhyay parking has two levels of parking floor which will be extended to 4 levels in due course, increasing the current parking capacity of 1,000 to around 2,000 cars. Traffic will be coming to Pt. Deen Dayal Upadhyay Marg from national highway and from interior roads of Haridwar which will be easy to manage due to huge parking lot at Har Ki Pauri
- **Construction Material Management:** Procedures for storage, handling and transport of construction material shall be prescribed in SH&E method statement approved for construction. The construction material storage site is to be regularly inspected for the presence of uncontrolled construction waste and to set up procedures for mitigating the impacts. The scheduling of material procurement and transport shall be linked with construction schedule of the project.
- **Borrow Area Management:** No requirement of borrow area is anticipated for the project.
- **Air Pollution & Dust Control Measures**: Provisions for sprinkling of water may be requirement to control the dust pollution. Idling of delivery trucks will be prevented and material will be transported in covered truck. Low emission construction equipment and machinery will be used. Loose earth will not be left exposed. Good quality fuel, adequate stack height and periodic maintenance are requirement to

control the air pollution. Road should be properly maintained to prevent dust pollution.

- **Noise Control Measures**: Construct noise barriers, such as temporary walls or piles of excavated materials between noisy activities and noise-sensitive receivers**.**
- **Oil Spill control/Management**: To control the oil spill from equipment and machinery routine inspections/check up is mandated and good housekeeping will be provided. Temporary cement/metal platform will be provided below the construction machineries at maintenance site to capture the spill and the platforms should be at sufficient height to avoid the littering.
- **First Aid Health System:** All necessary first aid and medical facilities will be provided to the workers.
- **Training:** The training programs should be extended to the workers for their active participation in the project implementation especially following the guidelines for safety, measures of disaster prevention, action required in case of emergency, fire protection, environmental risk etc. The cost of training is kept Rs 2.5 Lakhs.
- **Soil Erosion Control:** Construction will be avoided in monsoon. The excavated soil will be stabilized immediately after the excavation or debris should be sent to disposal site as the earliest to make the site clean and to prevent soil erosion.

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Chapter 1

Introduction

CHAPTER 1 : INTRODUCTION

This Chapter provides an overview of the report outlining the purpose with a brief description & nature of the project, identification of project proponent and scope of the EIA study.

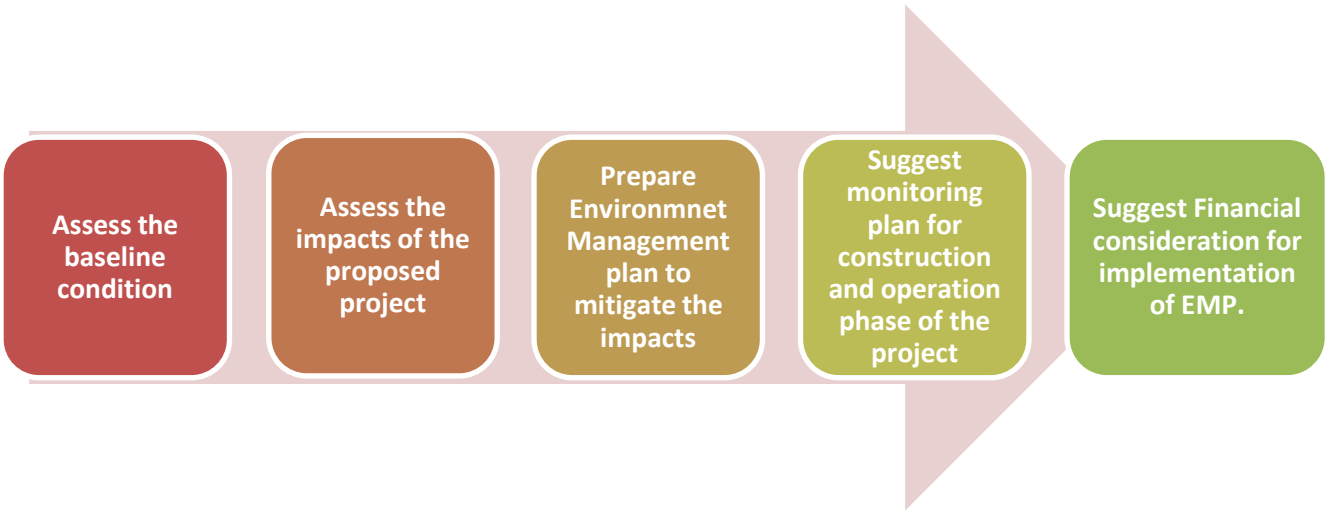
1.1 PURPOSE OF THE REPORT

In pursuance of the EIA notification issued by MoEF&CC in September 2006 along with the subsequent amendments, the ropeway project is required to obtain the Environment clearance from the Ministry of Environment, Forest and Climate Change (MoEF&CC). Further, as per the notification, the ropeway projects are classified under category 'A' in case the project attracts general conditions i.e. site is located in an ecological sensitive area and/or the elevation of the site is 1,000 m above the mean sea level. Such projects require prior environmental clearance from MoEF&CC, Government of India. As per the letter no. 1044/21-5 dated 24.08.2021 issued by Haridwar Forest Department the alignment is passing through the Buffer zone of Rajaji Tiger Reserve. Therefore, the proposed project attracts the general conditions of the said EIA notification and classified as Category "A", which requires environmental clearance from MoEFCC.

In order to comply with the standard procedure for project appraisal, the project proponent i.e. Uttarakhand Metro Rail, Urban Infrastructure & Buildings Construction Corporation Limited (UKMRCL) had submitted the application in the prescribed format of the MoEF&CC on Parivesh Portal for grant of ToR. Based on the application, MoEF&CC issued the standard ToR to UKMRC vide File No. 21-32/2021-IA-III dated 05 May 2021 for conducting the EIA/EMP studies for "Passenger Ropeway Facility from Har ki Pauri to Chandi Devi Temple in Haridwar City". This EIA report has been prepared based on the approved ToR issued by MoEF&CC, guidelines issued by the statutory bodies and Appendix-III of EIA notification 2006. The approved ToR issued by MoEF&CC for EIA studies of the project is placed at **Annexure 1.1** of the report.

The purpose of the EIA study is to assess and address the quality of the existing environment and impact due to the proposed project activities on the surrounding environment. In addition, it also provides a management plan for mitigating the negative impact by implementing suitable measures and maximizes the beneficial impacts of the proposed project. The following main objectives are considered for the preparation of this EIA is as follows given in **Figure 1.1**.

Figure 1.1: Broad Objectives For EIA Study



1.2 IDENTIFICATION OF PROJECT AND PROJECT PROPONENET

1.2.1 Project Proponent

Uttarakhand Metro Rail, Urban Infrastructure & Buildings Construction Corporation Limited (UKMRC) UKMRCL is formulated to plan, design, develop, construct, maintain or operate metro rail or other similar mass rapid transport system of all types and descriptions including mass movers either individually or in association with other undertakings and companies or persons in India and/or abroad.

To plan, construct, develop, administer, manage, control and / or maintain all types of buildings and township either individually or in association with other undertakings and companies or persons in India and/or abroad.

UKMRCL is now planning to develop a ropeway from Har ki Pauri to Chandi Devi Temple in Haridwar.

Assistant Manager Civil of Uttarakhand Metro Rail, Urban Infrastructure & Buildings Construction Corporation Limited, is the signing authority for the proposed project. The contact information is given below:

Name of Company: Uttarakhand Metro Rail, Urban Infrastructure & Buildings Construction Corporation Limited,
Applicant: Ajay Bir Singh Negi
Designation: Assistant Manager Civil
Email: amcivilukmrc@gmail.com
Telephone No: 0135-2719442
Fax No: 135-2719500

1.2.2 The Project

Haridwar city is a main pilgrimage place of Uttarakhand. Every year lakhs of pilgrims visit here and important events like Maha Kumbh and Ardh Kumbh are organized in this city and every year lakhs of devotees also visit Haridwar city in Kanwar fair. Most of the pilgrims coming to Haridwar also visit Chandi Devi and Mansa Devi after taking Har ki Pauri bath. At present, ropeway facility is available on Najibabad Road where the devotees reach after traveling a long distance by road to visit Chandi Devi Temple. There is also not enough space available for parking of vehicles at that place, due to which pilgrims have to face a lot of difficulties in going to visit Chandi Devi temple and it also takes a lot of time. Due to these difficulties many pilgrims are unable to visit Chandi Devi Temple. In order to ensure proper movement of such a large number of people, along with the development of other means of transport in the city of Haridwar, it is also necessary to provide the ropeway facility from Har ki Pauri to Chandi Devi.

In the meeting held on 08.07.2019 under the chairmanship of Hon'ble Chief Minister, Uttarakhand Government, approval was given to appoint a Consultant for the Feasibility to establish this ropeway. M/s Usha Breco Ltd was selected to prepare the feasibility report of the ropeway. The approval was given on the proposal of ropeway from Har Ki Pauri to Chandi Devi Temple on 11.06.2020, in the meeting of Unified Metro Politian Transport Authority (UMTA) chaired by Hon'ble Chief Minister, Government of Uttarakhand with terminal station to be constructed at the northern end of Pt. Deen Dayal Upadhyay Parking near National Highway.

The proposal is to facilitate the pilgrims visiting the city of Haridwar to visit Chandi Devi Temple. Establishment, operation and maintenance of ropeway will be done from the northern end of Pandit Deendayal Upadhyay parking to Chandi Devi temple, located near Har Ki Pauri and to be done through Public Private Partnership (PPP) model.

1.2.3 Consultant

RITES Ltd. (A Government of India Enterprise) was appointed by Uttarakhand Metro Rail, Urban Infrastructure & Buildings Construction Corporation Limited (UKMRCL), as consultant, for undertaking the Environmental Impact Assessment (EIA) study and preparation of the report for proposed Ropeway systems. RITES, Government of India enterprise was established in 1974. RITES is accredited for aerial Ropeway in “Category A” since 31st January 2011. RITES is accredited by NABET its accreditation number is **NABET/EIA/ 1922/RA/0193.**

An EIA study has been conducted and subsequently the this report has been prepared as per the approved Terms of Reference (TOR) issued by Expert Appraisal Committee (EAC) of Ministry of Environment, Forest and Climate Change (MoEF&CC) for obtaining the Environmental Clearance of the project.

1.3 BRIEF DECRIPTION OF NATURE, SIZE, LOCATION OF THE PROJECT AND ITS IMPORTANCE TO THE COUNTRY, REGION

1.3.1 Nature & Type of Project

The proposed project falls under **Category "A",** Sl. No. 7(g) Schedule: Aerial Ropeway of the "*list of project or activities requiring environment clearance"* of EIA notification 2006 and its amendments.

The proposed project is the independent new project of aerial ropeway from Har Ki Pauri to Chandi Devi Temple in Haridwar is started adjacent to Deen Dayal Upadhyay Parking at NH-34 to near Chandi Devi Temple at the junction point of pedestrian path, way to Chandi Devi Temple and way to Anjani Mata mandir at Haridwar city, Uttarakhand. This project is not interlinked with any of the project. Detail descriptions of the proposed project are given in Chapter 2 of this report.

1.3.2 Size Of The Project

The proposed Ropeway is designed for a capacity of 1800 Passengers Per Hour Per Direction (PPHPD). Project details are given in Chapter 2 of this report.

1.3.3 Importance to the Country/ Region

The project have following benefits

- Since the ropeway is at Har Ki Pauri to Chandi Devi Mandir itself, so it will connect more people to reach at Maa Chandi Devi temple directly for the pilgrims reaching Haridwar and coming at Har ki Pauri.
- This will reduce the time and effort of the people in reaching Maa Chandi Devi Temple.
- It will generate local employment opportunities during construction and operation of the said project.
- Due to Har Ki Pauri to Chandi Devi ropeway project, there will be increase in tourism in state of Uttarakhand due to better connectivity.

1.3.4 Location Of The Project

The proposed Passenger Ropeway from Har Ki Pauri to Chandi Devi Temple in Haridwar is started adjacent to Deen Dayal Upadhyay Parking at NH-34 to near Chandi Devi Temple at the junction point of pedestrian path, way to Chandi Devi Temple and way to Anjani Mata mandir. The proposed ropeway project is located at the Khasra No 7, Khevat No 2 of Laljiwala Pargana, Jwalapur village of Haridwar District of Uttarkhand. Coordinates of the project site is 29°57'13.18"N 78°10'23.77"E to 29°56'2.23"N 78°10'50.37"E.

1.4 LEGAL POLICY

The need for a well-developed legal mechanism to conserve resources, protect the environment and ensures the health and well being of the people in India was felt. Keeping the pace with international laws, the Ministry of Environment Forest and Climate Change enacted Environmental Protection Act in 1986. Over the years, the Government of India has framed several policies and promulgated number of Acts, Rules and Notifications aimed at management and protection of the environment. During last three decades an extensive network of environmental legislation has grown and presently it has a fairly complex body of environmental legislation aimed at ensuring that the development process meets the overall objective of promoting sustainability in the long run. The available legal Acts and Legislation referred during the study are:

- The Environment (Protection) Act, 1986, and its amendment.
- EIA Notification 2006 and its amendments,
- Indian Forest Act,1927,
- The Wildlife (Protection) Act ,1972 and its amendments,
- The Forest (Conservation) Act ,1980 and its amendments,
- Air (Prevention & Control of Pollution) Act, 1981,
- Water (Prevention & Control of Pollution) Act, 1974 and its amendments,
- The Ancient Monuments and Archaeological sites and Remains (Amendment and Validation Act) 2010 with Ancient Monuments and Archaeological Sites and Remains (Amendment) Act, 2017,
- The Water (Prevention and Control of Pollution) Rules, 1975 and its amendments,
- The Air (Prevention and Control of Pollution) Rules 1982 and its amendments,
- Forest Conservation Rules, 1981 and its amendments,
- Wild Life Protection Rules, 1995 and its amendments,
- Noise Pollution (Regulation and Control) Rules, 2000 and its amendments,
- Solid Waste Management Rules, 2016, and its amendments,
- Construction and Demolition Waste Management Rules, 2016, and its amendments,
- Plastic Waste Management Rules, 2016, and its amendments,
- E-Waste (Management) Rules, 2016 and its amendments,
- Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and its amendments.
- The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013
- EIA Guidance Manual 2010 for Aerial Ropeway
- Standard Term of Reference (TOR) for EIA/EMP Report for Projects/Activities requiring environmental clearance under EIA Notification, 2006
- Energy Conservation Building Code (ECBC), 2017

1.4.1 Environmental Clearance Process

As per EIA Notification, 2006 and its amendments all "Aerial Ropeway" project located at altitude of 1000 m and above and located in notified ecological sensitive areas are designated as 7(g) Category A projects and are required to obtain prior environmental clearance from MoEFCC. The application for Environmental clearance shall comprise submission of Form I and Pre-Feasibility Report with suggested ToR. Draft EIA/EMP report shall be prepared based on ToR conveyed to the applicant by the Expert Appraisal Committee or State Level Expert Appraisal Committee. The draft EIA/EMP report has to be then submitted to the Regional State Pollution Control Board (SPCB) or CPCB. The SPCB or CPCB will then conduct a public hearing as per the procedure laid down in EIA Notification 2006 and its amendments. The questions raised during by the public will form the part of the EMP. The inclusion of these public hearing proceedings and revised EMP will form the final EIA/EMP report. The final EIA/EMP and Form-2 will be submitted to the EAC/SEAC for appraisal and due recommendation and suggestions. Following the appraisal of the project to the satisfaction of the EAC/SEAC/SEIAA, Environmental Clearance shall be granted.

1.4.2 Water and Water Pollution

The use of water resources and also the discharge of polluted water are primarily regulated by the Water (Prevention and Control of Pollution) Act, 1974 amended in 1988. The Water Cess Act, 1977 amended in 1992 and 2003, including Rules 1978 and 1991 provides for levy and collection of Cess on water consumed with a view to generate resources for prevention and control of water pollution. The Act assigns functions and powers to the Central Pollution Control Board (CPCB) and SPCBs for prevention and control of water pollution.

The Environment (Protection) Act 1986 amended in 1991 and Rules also lays down specific standards for quality of water effluents to be discharged into different type of water bodies (sewers, surface water bodies like lakes, rivers, marine discharge etc). Additionally, the water supplied to users for drinking shall also conform to the National Drinking Water Standard, IS-10500-2012. **Annexure 1.2** summarizes the general standards for discharge of effluent in Inland Surface Water Bodies. To ascertain and categorize the existing water quality, the results of the analysis of water quality need to be compared with the water quality standards given in **Annexure 1.3.**

Off late, with rapid depletion of groundwater resources in several areas of the country, efforts have been initiated to regulate the use of groundwater resources. The focus of such acts and rules is to provide the mechanisms that would lead to replenishment of groundwater reserves through techniques like rainwater harvesting. The Central Ground Water Board, the statutory authority set up by the Central government has also restricted the drilling of tube wells and bore wells in certain water scarce areas in the country.

1.4.3 Air Quality

The Air (Prevention and Control of Pollution) Act, 1981 and amended in 1987 including Rules 1982 and 1983 was enacted to prevent, control and reduce air pollution. According to Section 21 of the Act, no person shall establish or operate any activity, which can cause air pollution without obtaining Consent to Establish (CTE) as per the Air Act. The Act also lays down national ambient air quality standards for pollutants like PM_{10}, $PM_{2.5}$, Sulphur dioxide, Oxides of Nitrogen, Carbon monoxide, Lead, Ozone, Ammonia, Benzene and Benzopyrene with the intent of managing air quality for different categories of areas (residential, industrial and sensitive).

Ambient Air Quality Standards have been notified by the CPCB vide Gazette Notification dated 16th November 2009, refer **Annexure 1.4.**

1.4.4 Noise Level

With the objective of regulating ambient noise level in the environment, the Central Government has notified the Noise Pollution (Regulation and Control) Rules, 2000 amended in 2002, 2006, 2010 and 2013 under the EPA. The noise standards for different category of areas are based on the weighted equivalent noise level (Leq). The EPR also lays down equipment noise standards for DG sets, Air conditioners and Construction Equipment, which would be in use for the project. Ambient Noise level standards have been notified by the MoEF&CC vide Gazette Notification dated 4thFebruary, 2000. It is based on the 'A' weighted equivalent noise level (L_{eq}). These are presented in **Annexure 1.5.**

1.4.5 Solid Waste Management

Project construction and operation generates solid waste at site. The UKMRCL would be responsible for collection and handling of solid waste as per the provisions of the Solid Waste Management Rules, 2016 and its amendment. Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and its amendments require facilities to classify wastes into categories, manage them as per the prescribed guidelines and obtain prior authorization from the SPCB for handling, treatment, storage and disposal of Hazardous Wastes. Construction and demolition wastes will be handled for disposal as per Construction and Demolition Waste Management Rules, 2016 and its amendments.

1.4.6 The Ancient Monuments and Archeological Sites and Remains Act, 2010

The Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010 has been enacted to amend the Ancient Monuments and Archaeological Sites and Remains Act, 1958 and to make provision for validation of certain actions taken by the Central Government under the said Act. The act has come into force on January 23, 2010. The Act states that the limits of prohibited area and regulated area around the monuments, archaeological sites and remains declared by the Central Government as protected have been specified in the principal Act as 100 m and 200 m respectively. The limits so fixed may be further extended on the basis of gradation and

classification of the monuments, archaeological sites and remains to be done by the National Monuments Authority, which is to be constituted by the Central Government by virtue of the Amendment in the principal Act. The Act defines regulated area and prohibited area as follows:

Prohibited Area: It is the area beginning at the limit of the protected area or the protected monument declared as of national importance and extending to a distance of 100 m in all directions. There is also a provision in the Act to further extend the prohibited area beyond 100 m having regard to the classification of any protected monument or protected area on the recommendation of National Monument Authority by the Central Government.

Regulated Area: It is the area beginning at the limit of the prohibited area in respect of every protected archaeological monument/site and remains and extending to a distance of 200 m in all directions. This 200 m regulated area could further be extended having regard to the classification of any protected monument or protected area on the recommendation of National Monument Authority by the Central Government. The regulated area has extent not only horizontally but also vertically and covers even below the surface. The Act provides that in exceptional cases where Central Government or DG/ASI is satisfied that the works/project is in public interest and does not have significant adverse impact on the monument/site, permission can be granted for such work in prohibited area. The Act provides that none other than an archaeological officer can carry out any construction in any prohibited area.

The Act provides that no permission, including carrying out any public work or project essential to the public or other constructions, shall be granted in any prohibited area on and after the date on which the Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010 comes in to force. Amendment to this Act vide The Ancient Monuments And Archaeological Sites And Remains (Amendment) Bill, 2017 defines “public works” to mean construction works related to infrastructure financed and carried out by any department or offices of the Central Government for public purposes which is necessary for the safety or security of the public at large and emergent necessity is based on specific instance of danger to the safety or security of the public at large and there is no reasonable possibility of any other viable alternative to such construction beyond the limits of the prohibited area. The Bill 2017 states that the clause in Act 2010 which barred permission to construct in prohibited area shall not apply to the public works.

1.4.7 The Building And Other Construction Workers Act, 1996

The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 aims to provide for regulation of employment and conditions of service of the building and other construction workers as also their safety, health and welfare measures in every establishment which employs or employed ten or more workers. The provisions in the Act for health and safety measures for the construction workers are in conformity with International Labour Organisation Convention.

1.4.8 Uttarakhand Ropeways Act, 2014

The safely of the proposed ropeway vied Uttarakhand Ropeways Act, 2014 will be monitored by The Chief Inspector and the District Inspector. They exercise such powers and perform such functions and duties as may be provided by or under the provisions of the Act. It shall also be the duty of any such Inspector from time to time and at least once a year in the case of the Chief Inspector and once in every six months in the case of the District Inspector to inspect the ropeways and to determine whether they are maintained in a fit condition and worked with due regard to the convenience and safety of the persons using them and of the general public, and consistently with the provisions of this Act.

Chief Inspector has reported in writing to the Licensing Authority:

a) that it has made a careful inspection of the ropeway and appurtenances;

b) that the moving and fixed dimensions and such other conditions as may be prescribed have been complied with;

c) that the ropeway is sufficiently equipped for the traffic for which it is intended;

d) that due compliance of the rules and conditions of license has been made;

e) that in his opinion sufficient measures have been taken to prevent and control the pollution caused or likely to be caused by the working of the ropeway; and

f) that in his opinion the ropeway is fit for traffic and can be used without danger to those using it, or to the persons employed thereon, or to the general public.

1.4.9 National Environment Policy, 2006

National Environment Policy 2006 is a response to India's national commitment to a clean environment, mandated in the Constitution in Articles 48 A and 51 A (g), (DPSP) strengthened by judicial interpretation of Article 21. The existing policies have recognized the need for sustainable development in their specific contexts and formulated necessary strategies to give effect to such recognition. The National Environment Policy seeks to extend the coverage, and fill in gaps that still exist, in light of present knowledge and accumulated experience. It does not displace but builds on the earlier policies. The objectives of the National Environmental Policy are:

- Conservation of Critical Environmental Resources
- Intra-generational Equity: Livelihood Security for the Poor
- Inter-generational Equity
- Integration of Environmental Concerns in Economic and Social Development:
- Efficiency in Environmental Resource Use
- Environmental Governance
- Enhancement of Resources for Environmental Conservation

The policy focuses on encouraging the regulatory authorities, Central and State, to institutionalize regional and cumulative environmental impact assessments to ensure that environmental concerns are identified and addressed at the planning stage itself. The policy adopts the civil liability for environmental damage that would deter environmentally harmful actions, and compensate the victims of environmental damage.

1.5 INSTITUTIONAL FRAMEWORK

Ministry of Environment, Forest and Climate Change (MoEF& CC) is the nodal agency in the administrative structure of the Central Government for planning, promotions, co-ordination and overseeing the implementation of India's environmental and forestry policies and programs. The major responsibilities of (MoEF& CC) include:

- Environmental resource conservation and protection, including environmental impact assessment of developmental projects;
- Co-ordination with the other ministries and agencies, voluntary organizations and professional bodies on environmental action plans;
- Promotion of research and development, manpower planning and training and creation of environmental awareness;
- Liaison and coordination with international agencies involved in environmental matters.

Developmental project proponents are also required to submit Environmental Impact Statements/Assessments to establish that adequate measures are planned for pollution control and environmental protection, and that effluent discharged into the environment will not exceed permissible levels. The project developer appraises these statements/ assessments to EAC for approval of the project from the environmental angles.

1.5.1 Central and State Pollution Control Boards

The Central Pollution Control Board is responsible for pollution control throughout the country. In addition to the control of air, noise and water pollution, they are also responsible for to ensure effective control on disposal of hazardous wastes and storage and handling of hazardous chemicals and substances. With the enactment of air and water pollution laws, States have set-up their own Pollution Control Boards (SPCBs) to monitor industrial emissions and effluents and to approve the operation of new industries after careful scrutiny. The functions of the SPCBs include:

- The planning of comprehensive state programs for the prevention and control of air and water pollution and to ensure the implementation thereof;
- Inspection of pollution control equipment/ plants for monitoring of their efficiency

The SPCB in consultation with the Central Pollution Control Board may establish norms for air quality, gaseous emission and noise etc.

1.6 SCOPE OF THE STUDY

The project proponent Uttarakahand Metro Rail Corporation Limited (UKMRC) had submitted the application in the prescribed format of the MoEF&CC on Parivesh Portal for grant of ToR. Based on the application, MoEF&CC issued the standard ToR vide File No. 21-32/2021-IA-III dated 05 May 2021 for conducting the EIA/EMP studies for "Passenger Ropeway facility from Har Ki Pauri to Chandi Devi Temple in Haridwar City". This EIA report covered the detailed scope of ToR and Appendix-III of EIA notification. Scope of the study is to carry out the EIA study according to the ToR issued by MoEF&CC.

- Assess the existing condition of the environment.

- Identify, predict and evaluate the potential environmental and socio- economic impacts,
- Propose suitable environmental measures to minimize it.

To prepare this report, literature review, consultation with various departments, ground truth and sampling were undertaken and laboratory analysis was carried out. The environmental baseline data was collected and compiled from primary and secondary sources. The primary sources included site visits, visual inspection, field studies, monitoring and analysis. The secondary sources included the books, reports, maps and documents from various government and non-government organizations and wherever applicable, more detailed information on methods used is included in the concerned paragraph in the main body of the report. The primary data collection from the study area has been carried out during the April - July 2021. The detailed approach and methodology followed for the study and collection of samples is given in the chapter-3 of this report.

1.7 REPORT COVERAGE

This EIA report presents the existing baseline environmental scenario and the results from the assessment and evaluation of the environmental impact that may arise during the construction and operation of the proposed project development. This report also highlights the environmental monitoring plan and environment management plan considered to be necessary during the construction and operation of the project.

CHAPTER-1	•Provides a general introduction of the project and location along with the objectives and Terms of Reference for the EIA study.
CHAPTER-2	•Concise documentation is given on the proposed project activities and facilities including site selection, project features and project cost estimates.
CHAPTER-3	•Summarizes environmental baseline data on physical, ecological and social parameters as collected prior to the commencement of the project
CHAPTER-4	•Highlights anticipated environmental impacts and its mitigation measures proposed.
CHAPTER-5	•Discussed the analysis of various alternatives for proposed ropeway site and technology.
CHAPTER-6	•Discussed the environmental monitoring program.
CHAPTER-7	•Additional Studies: Risk Assessment.
CHAPTER-8	•Project Benefits.
CHAPTER-9	•Cost Benefit Analysis.
CHAPTER-10	•Environmental Management Plans.
CHAPTER-11	•Presented the summary and conclusion of the EIA study conducted.
CHAPTER-12	•Disclosure of consultant engaged.

No.21-32/2021-IA-III

Goverment of India

Minister of Enviroment,Forest and Climate Change

Impact Assessment Division

***

Indira Paryavaran Bhavan,
Vayu Wing,3rd Floor,Aliganj,
Jor Bagh Road,New Delhi-110003
05 May 2021

To,

M/s UTTARAKHAND METRO RAIL, URBAN INFRASTRUCTURE AND BUILDINGS CONSTRUCTION CORPORATION LIMITED
4th Floor, SCI Tower, Opposite Mahindra Showroom, Haridwar Bypass road,
Dehradun-248121
Uttarakhand

Tel.No.0135-2719442; Email:amcivilukmrc@gmail.com

Sir/Madam,

This has reference to the proposal submitted in the Ministry of Environment, Forest and Climate Change to prescribe the Terms of Reference (TOR) for undertaking detailed EIA study for the purpose of obtaining Environmental Clearance in accordance with the provisions of the EIA Notification, 2006. For this purpose, the proponent had submitted online information in the prescribed format (Form-1) along with a Pre-feasibility Report. The details of the proposal are given below:

1. Proposal No.:	IA/UK/MIS/202744/2021
2. Name of the Proposal:	Passenger Ropeway Facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City
3. Category of the Proposal:	INFRA-2
4. Project/Activity applied for:	7(g) Aerial ropeways
5. Date of submission for TOR:	06 Apr 2021

In this regard, under the provisions of the EIA Notification 2006 as amended, the Standard TOR for the purpose of preparing environment impact assessment report and environment management plan for obtaining prior environment clearance is prescribed with public consultation as follows:

7(g): STANDARD TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENT IMPACT ASSESSMENT STUDY FOR AERIAL ROPEWAYS INFORMATION TO BE INCLUDED IN EIA/EMP REPORT

1) Examine and submit a brief description of the project-name, project site, geology, topography, nature, size, location of the project, project coverage, master plan, length of the proposed aerial rope way, details of ROW, height from MSL and its importance to the region/ State.

2) Any adverse impact of the works already carried out.

3) Submit the details of facilities viz. administration building, restaurant, toilets, waste collection and disposal etc at Lower terminal and upper terminal including parking area.

4) Submit the details of trees required to be cut for the project, including the type, girth size etc. Necessary permission from competent authority shall be obtained for tree cutting. Compensatory tree plantation shall be carried out and cost provision should be made for regular maintenance. Details to be submitted.

5) Examine and submit the likely impact due to influx of people and associated developments

6) Submit maps of the project area and 10 km surrounding area from boundary of the proposed/existing project area, thereby delineating project areas wild life sanctuaries notified under the wild life (Protection) Act, 1972/critically polluted areas as identified by the CPCB from time to time/notified eco-sensitive areas/inter state boundaries and international boundaries.

7) Submit baseline data and description of existing situation of the land at the proposed project site including description of terrain, hill slopes, inland topography, slope and elevation, rock types, regional tectonic setting (reported fractures/faulting/folding, warping), and history of any volcanic activity, seismicity and associated hazards.

8) Submit details of power requirement and source. Energy efficiency measures in the activity should be drawn up. PP should also submit details of D.G. Sets along with noise control measures.

9) Details of anticipated impact during construction stage and operation stage w.r.t. landslides, surface drainage etc., should be predicted. The existing surrounding features up to 1 km and impact on them should be addressed separately.

10) PP should examine and submit activities associated with aerial ropeway construction and operations and likely associated hazards and accidents. It is therefore desirable that based on the categories of hazards prevailing at the project site, risk assessment may be carried out by specialists in the field and recommendations may be implemented. Risk assessment should be carried out for seismicity, slope stability, soil erosion, and flood hazard.

11) Any litigation pending against the proposed project and/or any direction/order passed by any court of law against the project, if so, details thereof should be provided.

12) Submit Certificate from the competent authorities for safety of ropeway and its monitoring.

13) Public hearing to be conducted for the project in accordance with provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public should be addressed in the Environmental Management Plan. The Public Hearing should be conducted based on the ToR letter issued by the Ministry and not on the basis of Minutes of the Meeting available on the web-site.

14) A detailed draft EIA/EMP report should be prepared in accordance with the above additional TOR and should be submitted to the Ministry in accordance with the Notification.

****

ANNEXURE 1.2

DRINKING WATER QUALITY STANDARDS (IS 10500:2012)

S. No.	Characteristic	Requirement (Acceptable Limit)	Permissible limit in the absence of alternate source	Remarks
Essential Characteristics				
1	Colour, Hazen units, Max	5	15	Extended to 15 only, if toxic substances are not suspected in absence of alternate source
2	Odour	Agreeable	Agreeable	a) Test cold and when heated b) Test at several dilutions
3	pH Value	6.5 to 8.5	No relaxation	-
4	Taste	Agreeable	Agreeable	Test to be conducted only after safety has been established
5	Turbidity NTU, max	1	5	-
6	Total dissolved solids, mg/l, Max	500	2000	-
7	Aluminium (as Al), mg/l Max	0.03	0.2	-
8	Ammonia (as total ammonia-N), mg/l Max	0.5	No relaxation	-
9	Anionic detergents (as MBAS), mg/l, Max	0.2	1.0	-
10	Barium (as Ba), mg/l, max	0.7	No relaxation	-
11	Boron (as B), mg/l Max	0.5	1.0	-
12	Calcium (as Ca) mg/l, Max	75	200	-
13	Chloramines (as Cl_2), mg/l, Max	4.0	No relaxation	-
14	Chloride (as Cl) mg/l, Max	250	1000	-
15	Copper (as Cu) mg/l, Max	0.05	1.5	-
16	Fluoride (as F) mg/l, Max	1.0	1.5	-
17	Free residual Chlorine, mg/l, Min	0.2	1	To be applicable only when water is chlorinated. Tested at consumer end. When protection against viral infection is required, it should be minimum 0.5 mg/l
18	Iron (as Fe) mg/l, max	0.3	No relaxation	Total concentration of manganese (as Mn) and iron (as Fe) shall not exceed

S. No.	Characteristic	Requirement (Acceptable Limit)	Permissible limit in the absence of alternate source	Remarks
				0.3mg/l
19	Magnesium (as Mg) mg/l, Max	30	100	-
20	Manganese (as Mn) mg/l, Max	0.1	0.3	-
21	Mineral oil, mg/l Max	0.5	No relaxation	-
22	Nitrate (as NO_3) mg/l, Max	45	No relaxation	-
23	Phenolic compounds (as C_6H_5OH) mg/l, Max	0.001	0.002	-
24	Selenium (as Se), mg/l, Max	0.01	No relaxation	-
25	Silver (as Ag), mg/l, Max	0.1	No relaxation	-
26	Sulphate (as SO_4) mg/l, Max	200	400	May be extended to 400 provided that Magnesium does not exceed 30
27	Sulphide (as H_2S) mg/l, max	0.05	No relaxation	-
28	Total alkalinity as calcium carbonate, mg/l Max	200	600	-
29	Total Hardness (as $CaCO_3$) mg/l, Max	200	600	-
30	Zinc (as zn), mg/l, Max	5	15	-
31	Cadmium (as Cd), mg/l, Max	0.003	No relaxation	-
32	Cyanide (as CN), mg/l, Max	0.05	No relaxation	-
33	Lead (as Pb), mg/l, Max	0.01	No relaxation	-
34	Mercury (as Hg) mg/l, Max	0.001	No relaxation	-
35	Molybdenum (as Mo) mg/l, max	0.07	No relaxation	-
36	Nickle (as Ni), mg/l, max	0.02	No relaxation	-
37	Polychlorinated biphenyls, mg/l, max	0.0005	No relaxation	-
38	Polynuclear aromatic hydrocarbons (as PAH) mg/l, Max	0.0001	No relaxation	-
39	Total Arsenic (as As), mg/l, Max	0.01	0.05	-
40	Total Chromium (as Cr) mg/l, Max	0.05	No relaxation	-
41	Trihalomethanes Bromoform, mg/l, max Dibromochloromethane, mg/l, max Bromodichloromethane,	 0.1 0.1 0.06 0.2	 No relaxation No relaxation No relaxation No relaxation	-

S. No.	Characteristic	Requirement (Acceptable Limit)	Permissible limit in the absence of alternate source	Remarks
	mg/l, max Chloroform, mg/l, max			
42	Radioactive materials a) Alpha emitters Bq/l max b) Beta emitters pci/l, Max	 0.1 1.0	 No relaxation No relaxation	-

ANNEXURE 1.3

EFFLUENT DISCHARGE STANDARDS (INLAND SURFACE WATER)

S.No.	Parameter	Unit	Standards
1	Colour &Odor	--	All efforts should be made to remove colour and unpleasant door as far as practicable.
2	Suspended Solids Max.	mg/l	100
3	Particle size of Suspended Solids	--	Shall pass 850 micron IS Sieve
4	pH value	--	5.5 to 9.0
5	Temperature, Max.	^{o}C	Shall not exceed 5°C above the receiving water temperature
6	Oil and grease, Max.	mg/l	10
7	Total residual Chlorine, Max.	mg/l	1.0
8	Ammonical Nitrogen (as N), Max.	mg/l	50
9	Total Kjeldah Nitrogen (as N), Max.	mg/l	100
10	Free Ammonia (as NH_3), Max.	mg/l	5
11	Biochemical Oxygen Demand (5 days at 20°C), Max.	mg/l	30
12	Chemical Oxygen Demand Max.	mg/l	250
13	Arsenic (as As), Max.	mg/l	0.2
14	Mercury (as Hg), Max.	mg/l	0.01
15	Lead (as Pb), Max.	mg/l	0.1
16	Cadmium (as Cd), Max.	mg/l	2.0
17	Hexavalent Chromium (as Cr^{+6}), Max.	mg/l	0.1
18	Total Chromium (as Cr) Max.	mg/l	2.0
19	Copper (as Cu), Max.	mg/l	3.0
20	Zinc (as Zn), Max.	mg/l	5.0
21	Selenium (as Se), Max.	mg/l	0.05
22	Nickel (as Ni), Max.	mg/l	3.0
23	Cyanide (as CN), Max.	mg/l	0.2
24	Fluorides (as F), Max.	mg/l	2.0
25	Dissolved phosphates (as P), Max.	mg/l	5.0
26	Sulphides (as S), Max.	mg/l	2.0
27	Phenolic compounds (as C_6H_5OH), Max.	mg/l	1.0
28	Radioactive Materials α Emitters, μcurie/ml, Max. β Emitters, μcurie/ml, Max.	mg/l	 10^{-7} 10^{-6}
29	Bio-assay test	mg/l	90% survival of fish after 96 hours in 100% effluent
30	Manganese (as Mn)	mg/l	2.0
31	Iron (as Fe)	mg/l	3.0
32	Vanadium (as V)	mg/l	0.2
33	Nitrate Nitrogen	mg/l	10.0

ANNEXURE 1.4

NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Time Weighted Average	Industrial, Residential, Rural & Other Area	Ecologically Sensitive Area (notified by Central Government
Sulphur Dioxide (SO_2), □m^3	Annual 24 Hours**	50 80	20 80
Nitrogen Dioxide as NO_2, □m^3	Annual 24 Hours**	40 80	30 80
Particulate Matter (size less than 10□m) or PM_{10}□m^3	Annual 24 Hours**	60 100	60 100
Particulate Matter (size less than 2.5□m) or PM2.5 □m^3	Annual * 24 Hours**	40 60	40 60
Ozone (O3)□□m^3	8 hours** 24 Hours**	100 180	100 180
Lead (Pb)□□m^3	Annual * 24 Hours**	0.50 1.0	0.50 1.0
Carbon Monoxide (CO) mg/m^3	8 Hours** 1 Hour**	02 04	02 04
Ammonia (NH_3)□□m^3	Annual * 24 Hours**	100 400	100 400
Benzene (C_6H_6)□□m^3	Annual *	05	05
Benzo (a) pyrene (BaP)particulate phase only nm^3	Annual *	01	01
Arsenic (AS)□□nm^3	Annual *	06	06
Nickle (Ni) nm^3	Annual *	20	20

Source: Central Pollution Control Board Notification dated 18th November 2009

** Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week hourly at uniform intervals*

*** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.*

ANNEXURE 1.5

NATIONAL AMBIENT NOISE STANDARDS

Category of Zones	Leq in dB (A)	
	Day Time	Night Time
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

Source: Central Pollution Control Board

Day time shall mean from 6.00 a.m. to 10.00 p.m.

1. Night time shall mean from 10.00 p.m. to 6.00 a.m.
2. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority
3. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. A "decibel" is a unit in which noise is measured.

"A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq: It is energy mean of the noise level over a specified period

Chapter 2

Project Description

CHAPTER 2 : PROJECT DESCRIPTION

This chapter will describe the broad descriptions of the area in which aerial ropeway have been proposed. It covers the need for the project, project location, land availability, connectivity, activities and facilities including site selection, project features and project cost estimates.

2.1 TYPE OF PROJECT

Proposed project is the development of the passenger ropeway system from Har Ki Pauri to Chandi Devi Temple in Haridwar city, Haridwar District of Uttarakhand. As per the 7(g) of EIA notification 2006 and its amendments, the ropeway projects are classified under category 'A' in case the project attracts general conditions i.e. site is located in an ecological sensitive area and/or the elevation of the site is 1,000 m above the mean sea level. Such projects require prior environmental clearance from Ministry of Environment Forest and Climate change (MoEFCC), Government of India. As per the letter no. 1044/21-5. dated 24.08.2021 issued by Haridwar Forest Department the alignment is passing through the Buffer zone of Rajaji Tiger Reserve. Therefore, the proposed project attracts the general conditions of the said EIA notification and classified as Category "A", which requires environmental clearance from MoEFCC.

2.2 NEED FOR THE PROJECT

Haridwar city is a main pilgrimage place of Uttarakhand. Every year lakhs of pilgrims visit here and important events like Maha Kumbh and Ardh Kumbh are organized in this city and every year lakhs of devotees also visit Haridwar city in Kanwar fair. Most of the pilgrims coming to Haridwar also visit Chandi Devi and Mansa Devi after taking Har ki Pauri bath. At present, ropeway facility is available on Najibabad Road where the devotees reach after traveling a long distance by road to visit Chandi Devi Temple. There is also not enough space available for parking of vehicles at that place, due to which pilgrims have to face a lot of difficulties in going to visit Chandi Devi temple and it also takes a lot of time. Due to these difficulties many pilgrims are unable to visit Chandi Devi Temple. In order to ensure proper movement of such a large number of people, along with the development of other means of transport in the city of Haridwar, it is also necessary to provide the ropeway facility from Har ki Pauri to Chandi Devi.

In the meeting held on 08.07.2019 under the chairmanship of Hon'ble Chief Minister, Uttarakhand Government, approval was given to appoint a Consultant for the Feasibility to establish this ropeway. M/s Usha Breco Ltd was selected to prepare the feasibility report of the ropeway. The approval was given on the proposal of ropeway from Har Ki Pauri to Chandi Devi Temple on 11.06.2020, in the meeting of Unified Metro Politian Transport Authority (UMTA) chaired by Hon'ble Chief Minister, Government of Uttarakhand with terminal station to be constructed at the northern end of Pt. Deen Dayal Upadhyay Parking near National Highway.

The feasibility study of the above ropeway project was done. 06 Alignments were studied for the above ropeway. The location of the terminal station towards Chandi Devi Mandir is same in all the options and study/survey was done for the terminal station towards Har Ki Pauri with 06 different locations. Out of the above 06 options, after preliminary study, 04 options were canceled and 02 options were studied in detail.

The proposal is to facilitate the pilgrims visiting the city of Haridwar to visit Chandi Devi Temple. Establishment, operation and maintenance of ropeway will be done from the northern end of Pandit Deendayal Upadhyay parking to Chandi Devi temple, located near Har Ki Pauri and to be done through Public Private Partnership (PPP) model.

Pt. Deen Dayal Upadhyay Parking where there is adequate space for parking of vehicles on one hand, on the other hand this place is very close (300 meters) from Har ki Pauri, which is the main center of Haridwar. So, there will be a lot of convenience and time saved for the pilgrims to visit the Chandi Devi temple as well as there will be a lot of convenience in operating and maintaining the ropeway from this place, because the ropeway line is well connected from the national highway.

Benefits of the Project

- Since the ropeway is at Har Ki Pauri to Chandi Devi Mandir itself, so it will connect more people to reach at Maa Chandi Devi temple directly for the pilgrims reaching Haridwar and coming at Har ki Pauri.
- This will reduce the time and effort of the people in reaching Maa Chandi Devi Temple.
- It will generate local employment opportunities during construction and operation of the said project.
- Due to Har Ki Pauri to Chandi Devi ropeway project, there will be increase in tourism in state of Uttarakhand due to better connectivity.

2.3 LOCATION

The proposed Passenger Ropeway from Har Ki Pauri to Chandi Devi Temple in Haridwar is started adjacent to Deen Dayal Upadhyay Parking at NH-34 to near Chandi Devi Temple at the junction point of pedestrian path, way to Chandi Devi Temple and way to Anjani Mata mandir. Coordinates of the Tower and station locations is given in **Table 2.1**. Ropeway alignment is shown in **Figure 2.1**. Toposheet map of the study area showing project site and its surrounding within 10 km radius and eco sensitive features within 15 km radius is shown in **Figure 2.2**.

Table 2.1: Coordinates of The Project Site

S. No.	Longitude	Latitude	Description
1.	78°10'23.77"E	29°57'13.18"N	**Start Point**
2.	78°10'24.11"E	29°57'12.26"N	Tower 1
3.	78°10'24.58"E	29°57'11.02"N	Tower 2
4.	78°10'25.97"E	29°57'7.32"N	Tower 3
5.	78°10'27.7"E	29°57'2.69"N	Tower 4
6.	78°10'33.26"E	29°56'47.88"N	Tower 5
7.	78°10'35.8"E	29°56' 41.09"N	Tower 6
8.	78°10'38.58"E	29°56'33.69"N	Tower 7
9.	78°10'40.6"E	29°56'28.29"N	Tower 8
10.	78°10'42.89"E	29°56'22.2"N	Tower 9
11.	78°10'42.97"E	29°56'21.97"N	Tower 10
12.	78°10' 48.01"E	29°56'8.54"N	Tower 11
13.	78°10'48.13"E	29°56'8.23"N	Tower 12
14.	78°10'49.8"E	29°56'3.77"N	Tower 13
15.	78°10'50.37"E	29°56'2.23"N	**End Point**

2.3.1 Site Selection Criteria

Based on the requirement of the project, detailed reconnaissance had been carried out of the area. While selecting the appropriate alignment, following approach & methodology was adopted:

i) Availability of adequate space for terminals i.e. Lower Terminal and Upper Terminal.
ii) Easy land acquisition.
iii) Ropeway system matching with traffic and construction point of view.
iv) Easy connectivity to terminals from adjacent area.
v) Minimum rehabilitation and tree cutting.
vi) Easy traffic handling at terminal stations.

2.3.2 Selection of Alignment

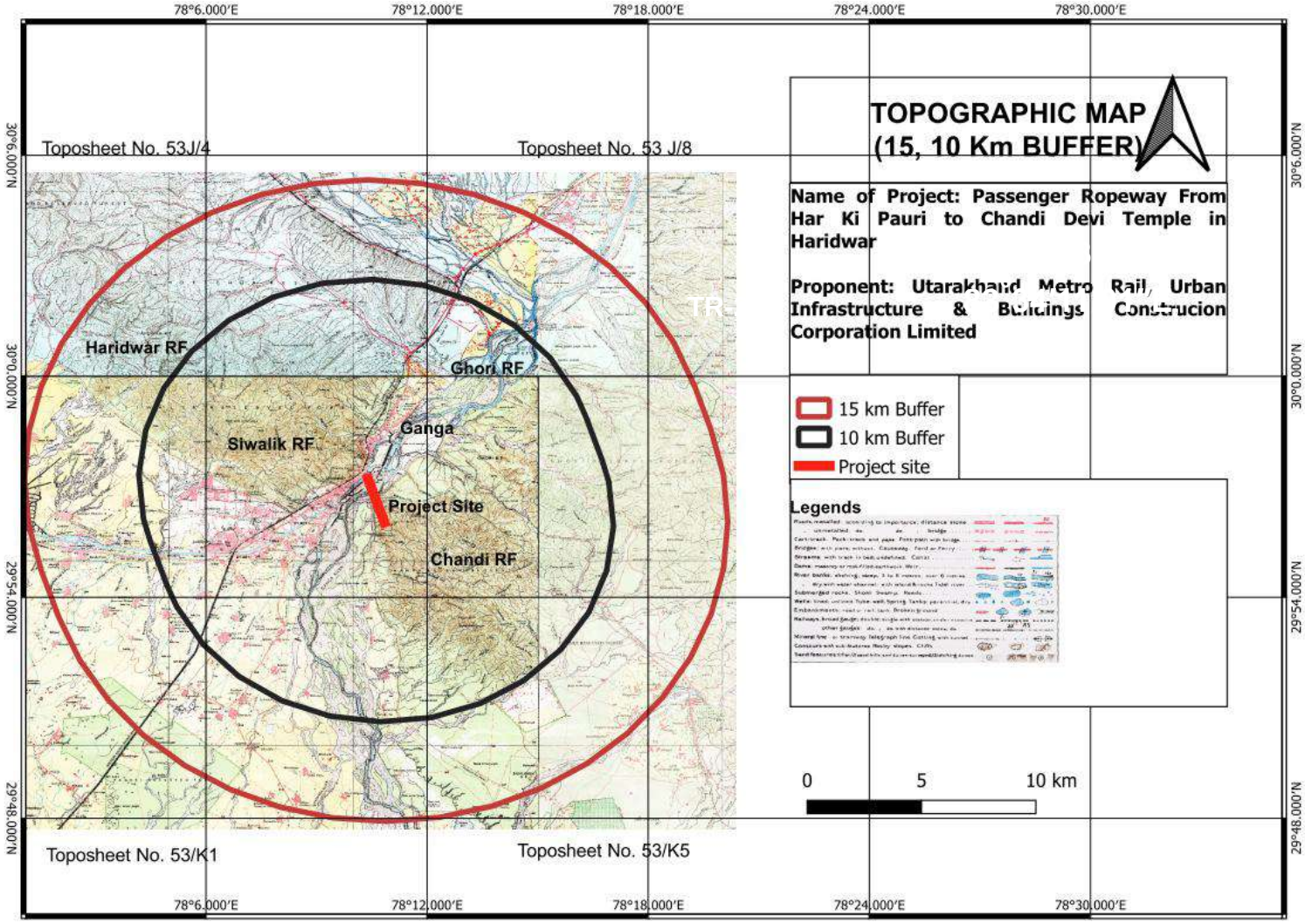
06 Alignments were studied for the ropeway during feasibility study. The location of the terminal station towards Chandi Devi Mandir is same in all the options and study/survey was done for the terminal station towards Har Ki Pauri with 06 different locations. Out of the above 06 options, after preliminary study, 04 options were canceled and 02 options were studied in detail. Detail of the alternatives are presented in Chapter 5 of this report.

2.3.3 Connectivity

Haridwar is about 230 Km from National Capital New Delhi and about 55 Km from State Capital, Dehradun. Haridwar is well connected with road and Indian Rail network. The Lower Terminal Point of the ropeway is adjacent to the NH-34. Nearest Railway station is Haridwar which is approx. 2 km (NW direction). Nearest Airport is Jolly Grant Airport Dehradun, at about 35 km.

Figure 2.1: Google Map of the Site and Surrounding Ropeway Alignment

Figure 2.2: Toposheet Map of The Site and Surrounding Within 15 Km



Source: RITES study

2.3.4 Land Details

Total land required for the development of the passenger Ropeway at Har ki pauri to Chandi Devi Temple is 6,210 m^2. It includes the Lower Terminal station (2400 m^2), Upper Terminal Station (1080 m^2) and 2,730 m^2 area for towers. This land belongs to the irrigation Department and Forest department. Diversion for the forest land is under process under the Forest Conservation Act, 1980.

2.3.5 Environment Sensitivity

The environment sensitivity near the project site is given at **Table 2.2**.

Table 2.2: Environment Sensitivity Near the Project Site

S. No.	Description	Direction
1.	Tiger Reserve	Buffer zone of the Tiger Reserve
2.	Raja Ji national Park	Alignment passing through the Buffer zone of the Tiger reserve
3.	Ganga River Basin	Within the project site
4.	Chandi Devi pedestrian Path	Crossing the site
5.	Cheela Dam Rishikesh Road	Crossing the site
6.	Chandi Devi Temple	10 m (South)

2.3.6 Existing Infrastructures

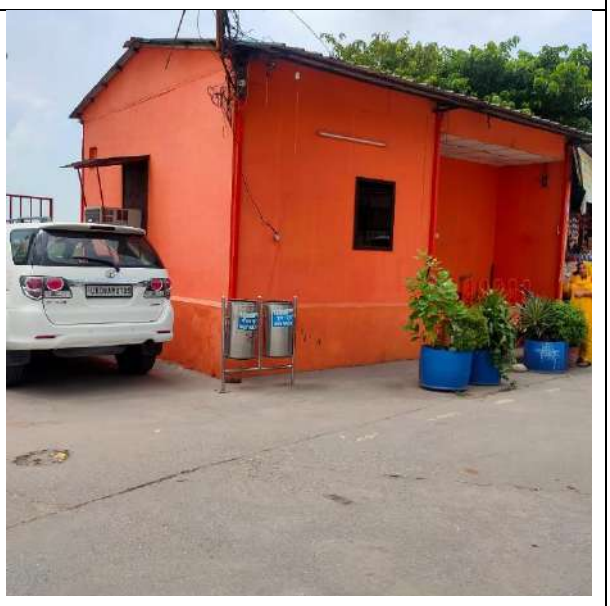
- **Road:** Proposed lower terminal is well connected with road.
- **Connectivity:** Foothills of the mountains a staircase path and ropeway is available to reach Chandi Devi Temple.
- **Toilet Block:** Toilets for ladies and gents is exist near the Lower Terminal and Upper terminal.
- **Solid Waste Management:** Solid waste collection system is available at Lower Terminal Parking.
- **Water supply:** Drinking water facilities at the upper terminal through by tube well.
- **Parking:** Existing parking at Lower terminals.

Figure 2.3: Existing Infrastructure Near to the LTP and UTP

Toilet Block Near the LTP Parking

Toilet Block Near the LTP

Solid Waste Bin Near the LTP Parking



Solid Waste Bin Near the LTP Parking

2.4 TRAFFIC DATA & ANALYSIS

During the feasibility study, team of experts has collected data about visit of tourist from 2015 to 2019. Based on the traffic data summary of the Traffic analysis is given in **Table 2.3**.

Table 2.3: Traffic Analysis Summary

1.	Expected Annual Traffic	=	1654587 (Year 2019-20)
2.	%age Ropeway User of Tourist Visiting	=	7.58% (of 21825499, 2019 Haridwar Tourist)
3.	Expected Average Monthly Traffic	=	1654587/12 = 137882
4.	Expected Minimum Monthly Traffic	=	1654587 x 3.38% = 55925 (3.38% of annual expected traffic)
5.	Expected Maximum Monthly Traffic	=	1654587 x 15.78% = 261094 (15.78% of annual expected traffic)
6.	Expected growth of traffic	=	3.07% (Traffic growth of Haridwar)
7.	Expected Annual Traffic by year 2030 - 31	=	2307516
8.	Exp. Min. Monthly Traffic by year 2030 - 31	=	77994
9.	Exp. Max. Monthly Traffic by year 2030 - 31	=	364126
10.	Expected Annual Traffic by year 2050 - 51	=	4224644
11.	Exp. Min. Monthly Traffic by year 2050 - 51	=	142793
12.	Exp. Max. Monthly Traffic by year 2050 - 51	=	666649

From the analysis of the traffic trend and projected growth, the following is the worked-out capacity:

Present Scenario:

Expected maximum traffic on a single day = 261094/30 = 8703

Expected minimum traffic on a single day = 55925/30 = 1864

If we consider 12 hours of operations,

The hourly capacity requirement will be 8703/12 = 725 Passengers.

We have considered the growth of passenger @ 3.07% per year. Therefore, maximum hourly traffic by 2030-31 will be 364126/30/12 = 1011 Passenger.

Similarly projected hourly traffic by 2050-51 will be 666649/30/12 = 1851 Passengers

Recommended optimum capacity of the system, should have designed capacity of 1800 Passengers Per Hour Per Direction (PPHPD) and initially, the system should be equipped with of cabins will be taken according to 1000 PPHPD. Capacity can be increased up to 1800 PPHPD by adding more number of cabins.

2.5 SIZE OR MAGNITUDE OF OPERATION

The proposed Ropeway is designed to carry the capacity of 1800 Passengers Per Hour Per Direction (PPHPD). It will be operated for 12 Hours. The technical details of the proposed ropeway are given in **Table 2.4**.

Table 2.4: Technical Details of Proposed Ropeway

S. No.	Details	Value	Unit
1.	**Layout**		
	Location of drive station	Bottom	--
	Location of return station	Top	--
	Location of the tensioning system	Bottom	--
	Type of tensioning	Hydraulic	--
	Direction of rotation	clockwise	--
2.	**Dimension**		
	Horizontal length	2281	m
	Vertical rise	209.35	m
	Inclined length	2305	m
	Track width	5	m
3.	**Transport Capacity**		
	Hourly capacity per direction	1800	PPH
	Uphill transportation	100	%
	Downhill transportation	100	%
	Drive speed, infinitely adjustable	1.0~5.0	m/s
	Trip time at max speed	~ 8	min
	Station speed	0.25 – 0.3	m/s
4.	**Main Drive**		
	Drive Machinery, Type	Overhead	
	Electric main drive:		
	Continuous Power Rating	300	kW
	Starting Power rating	360	kW
	Voltage	380 / 440	V
	Frequency	50	Hz
5.	**Evacuation Drive**		Unit
	Evacuation drive 1 (diesel hydraulic)	100	kW
	Evacuation drive 2 (electric)	~ 25	KW
	Evacuation speed, max.	~ 1.0	m/s
6.	**Carriers**		
	Carrier spacing	60	m
	Carrier interval	12	Sec
	Passengers per carrier	6	P
	Number of carriers	90	Nos.
	The number of other carriers:		
	Service Carrier	1	Nos.
	Freight Carrier	0	Nos.
7.	**Towers**		
	Number of towers	13	Nos.
8.	**Haulage rope**		

	Diameter	41	mm
	Actual Breaking Strength	1086	kN
	Tensile Strength	1860	N/mm2
	Tension Force	400	KN

2.6 PROPOSED SCHEDULE FOR APPROVAL AND IMPLEMENTATION

- The time for completion of the project is expected to be 24 months from the date of 'go ahead' signal given to the agency nominated for carrying out the work.
- Forest (F. No. FP/UK/Others/142130/2021, dated 07/05/2021) and wildlife clearance (F. No. FP/UK/Others/142130/2021, dated 10/05/2021) applied online.
- No litigation against the project.
- Consent to establish and Consent to Operate from Uttarakhand State Pollution Control Board (USPCB) will be taken after receiving Environment clearance from MoEFCC.

2.7 TECHNOLOGY AND PROCESS DESCRIPTION

As the project will be executed on PPP model, Hence, the selection of ropeway technology will be decided after the award of work. The system will be designed for 1800 Passengers Per Hour Per Direction (PPHPD) and initially, the system should be equipped with of cabins will be taken according to 1000 PPHPD. Capacity can be increased up to 1800 PPHPD by adding more number of cabins.

2.8 PROJECT DESCRIPTION

The L-section, Lower Terminal Plan (Road Level), Lower Terminal Plan (First Floor Level), Lower Terminal Plan (Boarding Level) and Upper Terminal Plan (Boarding Level) , Contour plan are given in Annexure 2.1, 2.2, 2.3, 2.4, 2.5 and 2.6. respectively.

A. Raw Material Required

The construction materials to be used for construction of proposed passenger Ropeway are Aggregates, Cement, Sand, Reinforcement Steel, Structural Steel, Hauling Rope etc. The approximate quantity and sources of construction material are given in **Table 2.5.**

Table 2.5: Quantity and Source of Construction Material

S. No.	Material	Quantity	Sources	Mode of Transportation
1	Structural Steel	100MT	Material will be procured from Local Vendors and Original Equipment Manufacturer (OEM).	Road
2	Reinforcement Steel	250MT		Road
3	Sand	1200 m^3		Road
4	Aggregates	1800 m^3		Road
5	Cement	30,000 bags		Road
6	Hauling Rope	5100 m		Road

B. Man Power Requirement

The construction period of the project will be 24 months. During Construction about 100 workers will be required for the development of Ropeway. During operation 15 numbers of staff will be deployed for the operation of ropeway.

C. Availability of Water its Source

During Construction: During construction water will be required for the construction activity at stations and tower and labour working on the site.. Construction phase will last for a period of approximately 24 months. About 100 workers will be working at site during peak construction. Water demand during construction for labours and construction activities are estimated about 9 KLD. During construction private water tanker and treated water from STP will be used for the p[urpose of drinking and construction activity respectively.

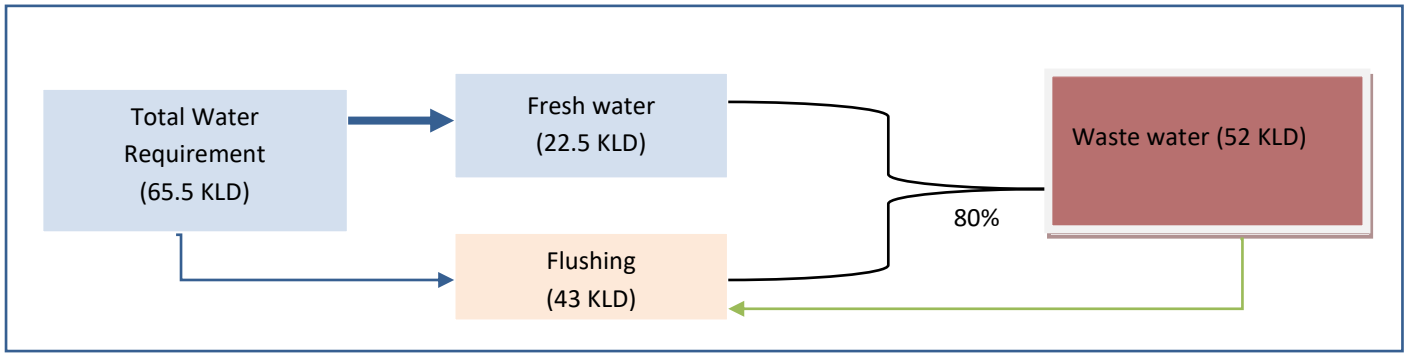
During Operation: Total water demand during operation of the project will be about 65.5 KLD. Out of which 23 KLD is the fresh water demand and 53 KLD is the flushing water demand. This is the one time demand after operation of the STP this demand will be reduced into 23 KLD. Water will be supply by Local Govt. Body (Uttarakhand Jal Nigam).

The demand for the project during operation phase is estimated on the basis of following assumptions:

- Staff and security person – 15
- Passenger Per hour- 1800
- Operation period- 12 Hours
- Water requirement for staff 45 lpcd and visitor 15 lpcd
- 20% of the passenger will be using the toilets

Water requirement for the staff and security would be 0.675 KLD considering the water requirement @ 45 lpcd. Water requirement for the tourist will be 64.8 KLD. Flushing water requirement for the project will be 42.57 KLD. After operation of the STP flushing demand of the project will be cater by the treated water.

Figure 2.4: Water Balance Diagram



D. Solid and Other Waste

During Construction:

Construction waste from this designated Project will include waste arising from land excavation, formation, civil/building construction activities. Waste includes various types of construction debris, rubble, earth, concrete, timber and mixed site clearance materials. The main construction wastes generated from these construction activities will be:

- Site clearance waste
- Excavated materials
- Concrete waste
- Wooden material
- Chemical waste
- Wheel wash waste
- Conduits, pipes, electrical fixtures, panels, etc
- Sewage
- Municipal/domestic waste
- Used oil from DG sets etc.

Hazardous waste: During construction DG sets are the source from which Hazardous waste will be generated. Hazardous wastes generated during maintenance of DG sets are as follows:

- Used oil- 32 L/Annum (Considering oil change interval of 500hr and 5.5 L sump size)
- Oil soaked cotton waste- 60 kg/ Annum

Other than this there are some other wastes that will be generated during the construction.

- Paint, Pigments
- Small amount of oil and grease from construction machinery
- Empty containers

Solid waste: About 100 numbers of labours will be required for construction of Ropeway. Considering an average contribution of 200 gm/person/day, 20 Kg/day of solid waste shall be generated from construction site. Most of the waste generated will be solid waste as major construction activities at site are assembling the structural steel components for towers and terminal stations.

Construction and Demolition waste: Construction and demolition waste will be generated from the project site. Demolition at LTP and near the Upper terminal will be carried out. Total demolition waste generated due to the existing toilet will be approx. 63 m3. This waste will be used in leveling of the site.

During operation:

Solid waste: During operation of the project the measure activity that enhance the waste generation in the area will be from the tourist and staff working in the Ropeway. About 15 persons per day are recommended in FR for operation of Ropeway systems. It is estimated

that about 3.0 kg per day of solid waste @ 200gm/day/person will be generated during the operation phase. Total solid waste generation due to tourist would be 432 kg/day considering the 4320 populations and 100 gm/day solid waste. Total solid waste generation during operation will be 435 Kg per day.

Hazardous waste: Used oil will be the main hazardous waste that will be generated due to the operation of DG sets in case of power failure. The power shall be supplied from main substations. Hence, operation of DG sets is negligible. However, for calculation purpose DG set operational time is considered as 1 hr; accordingly used oil generation will be 28 L/annum.

E. Liquid Waste

The waste generated during construction and operation is 5.6 KLD and 52.38 KLD respectively. This wastewater will be manage through Mobile toilets during the construction phase and during operation Advanced Eco reactor will be used for the treatment of waste water.

F. Power Requirement, Supply

Total power requirement for the project will be 15KW for Upper Terminal and 425KW for Lower Terminal. The power shall be supplied from main substations. During power failure 02 Number of DG sets of Capacity 625 KVA for Lower Terminal and 25 KVA for Upper Terminal will be provided. Standby DG set will require diesel fuel which will be procured locally.

G. Resources Optimization

The main resource required for operation of ropeway is electricity hence energy conservation measures require to optimize the resources. Energy conservation measures are often the easiest, quickest and cheapest way to reduce costs and implement environmentally pro-active Energy conservation program both on energy demand and supply. The amount of energy used for lighting varies from industry to industry, but typically, lighting accounts for approximately 50% of the electrical load in office building. By having an understanding of the lamps, ballasts, luminaries and control options available today as well as the techniques used to develop efficient lighting, lighting can be produced that is energy efficient, cost effective and yields a high quality of light.

An improvement in lighting efficiency would be adopted in the building/ terminal stations with measures as:

- The most efficient lamp for the purpose, taking into account size, shape, colour and output of the lamp.
- The high-efficiency spectacular reflectors or high-efficiency luminaries.
- Automatic control systems - installation of (a) timer circuits that switch lamps off during room vacancy times, (b) photoelectric sensors that sense the amount of daylight in the room

and either switch lamps on or off or adjust the lamp brightness accordingly and (c) occupancy sensors that switch lamps off when work stations are unoccupied.

- Localized switching - installing localized switches near work stations to control local lighting.
- Lighting design - (a) design lighting systems that maximize the use of daylight and (b) introducing local task lights (e.g. desks lights), allowing a reduction in general overhead lighting.
- Maintenance schedule - setting up a maintenance schedule to clean and replace lamps on a regular basis.
- Promoting employees awareness on energy conservation.
- Training staff on methods of energy conservation and to be vigilant to such opportunities

H. Project Cost

The estimated cost for proposed ropeway project is 149.70 Crore.

2.9 DESCRIPTION OF MITIGATION MEASURES INCORPORATED INTO THE PROJECT TO MEET ENVIRONMENTAL STANDARDS, ENVIRONMENTAL OPERATING CONDITIONS, OR OTHER EIA REQUIREMENTS (AS REQUIRED BY THE SCOPE)

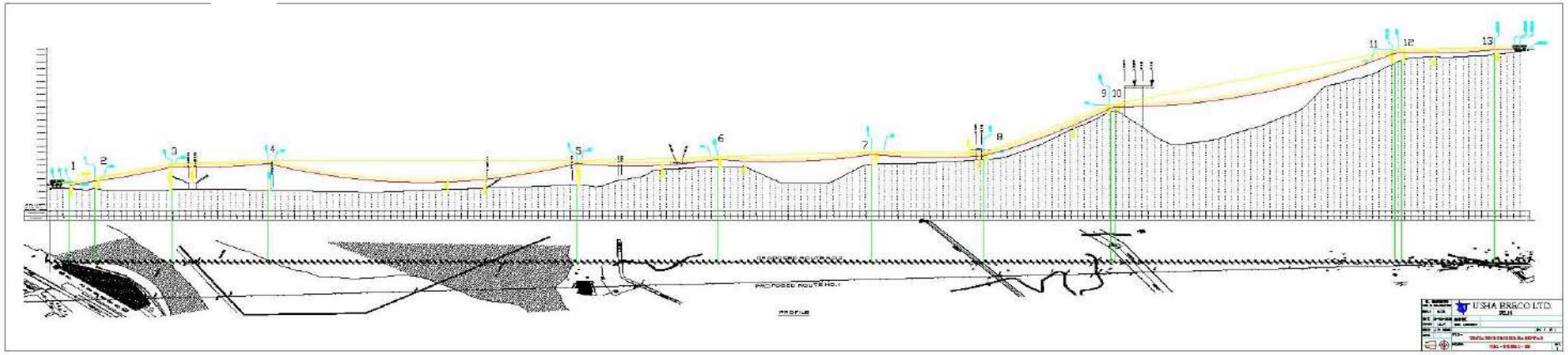
To meet the environmental standards for Air, Water, Noise etc mitigation measures has been proposed in the project. The details of the measures proposed to mitigate the impact are given in Chapter 4 and Chapter 10 of EIA.

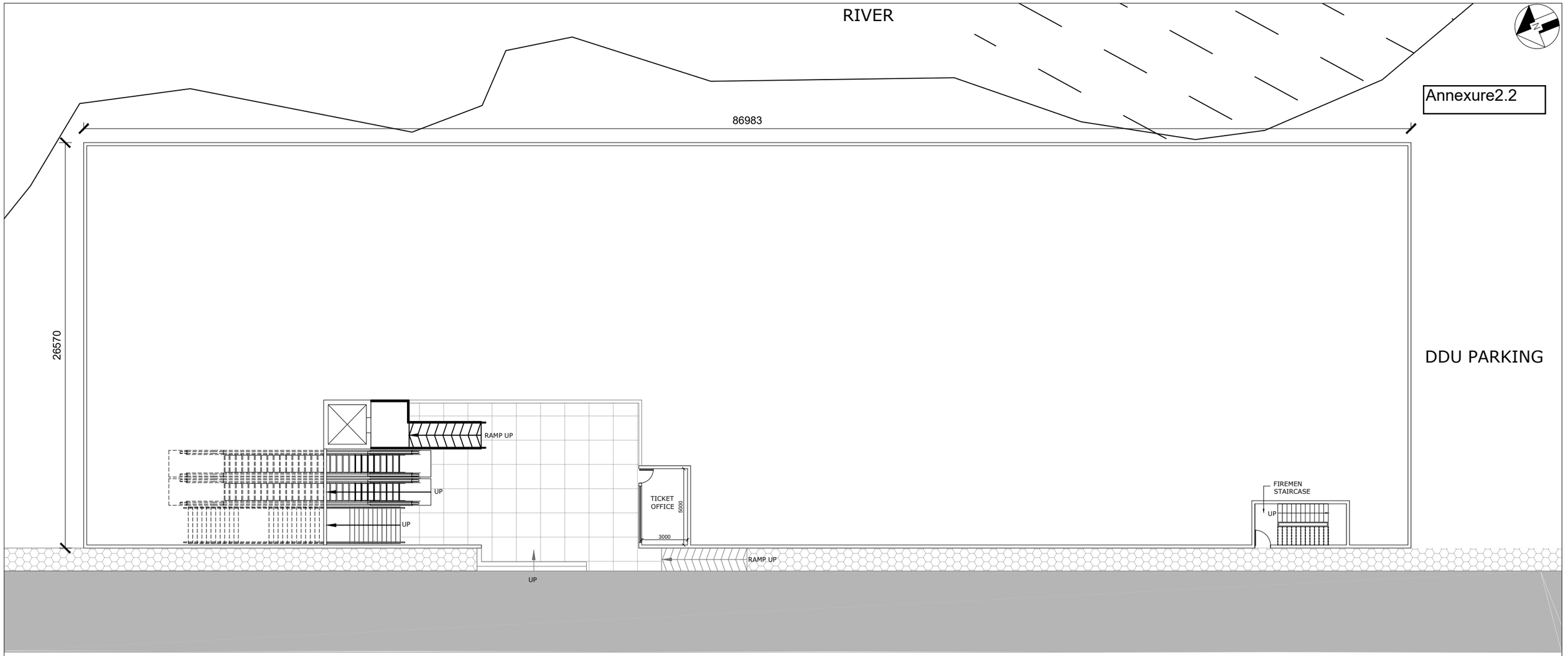
2.10 ASSESSMENT OF NEW & UNTESTED TECHNOLOGY FOR THE RISK OF TECHNOLOGICAL FAILURE

The technology envisaged for the project is proven. The technology is not new, easily available, applied all over the world and working successfully.

Annexure 2.1

L-Section





Annexure2.2

LOWER TERMINAL - ROAD LEVEL PLAN

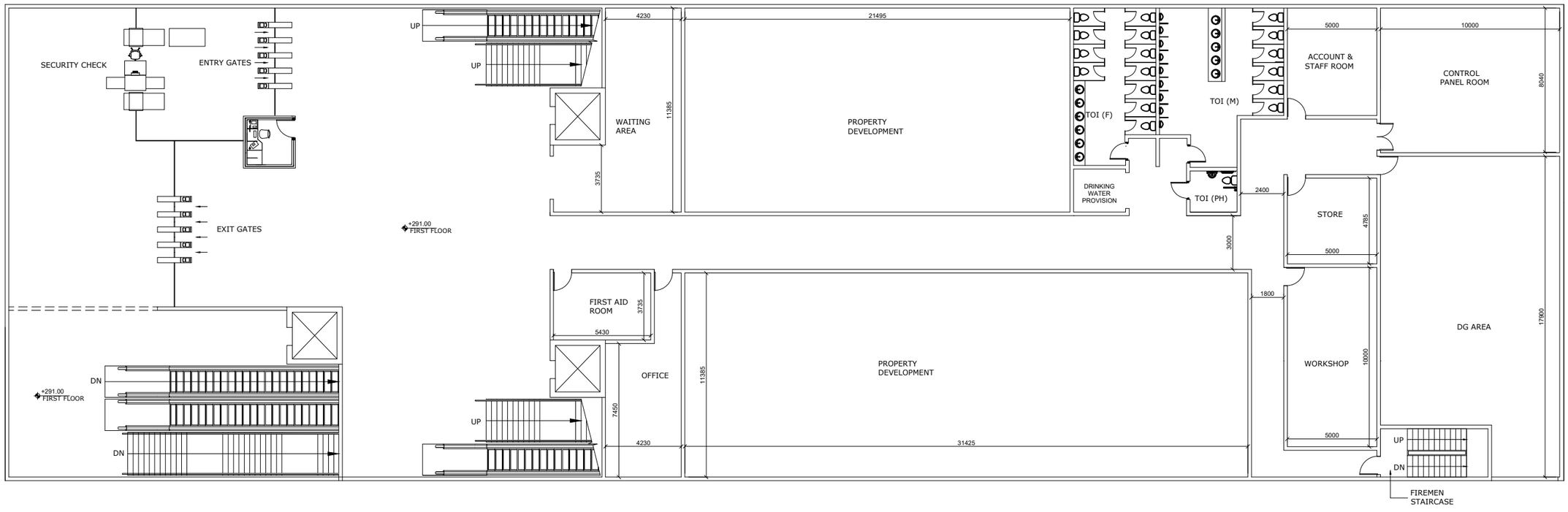
Annexure2.3

CLIENT: – UKMRC

ROPEWAY PROJECT
D.D.U.PARKING TO CHANDI DEVI TEMPLE HARIDWAR

DRAWING TITLE:
LOWER TERMINAL - ROAD LEVEL PLAN

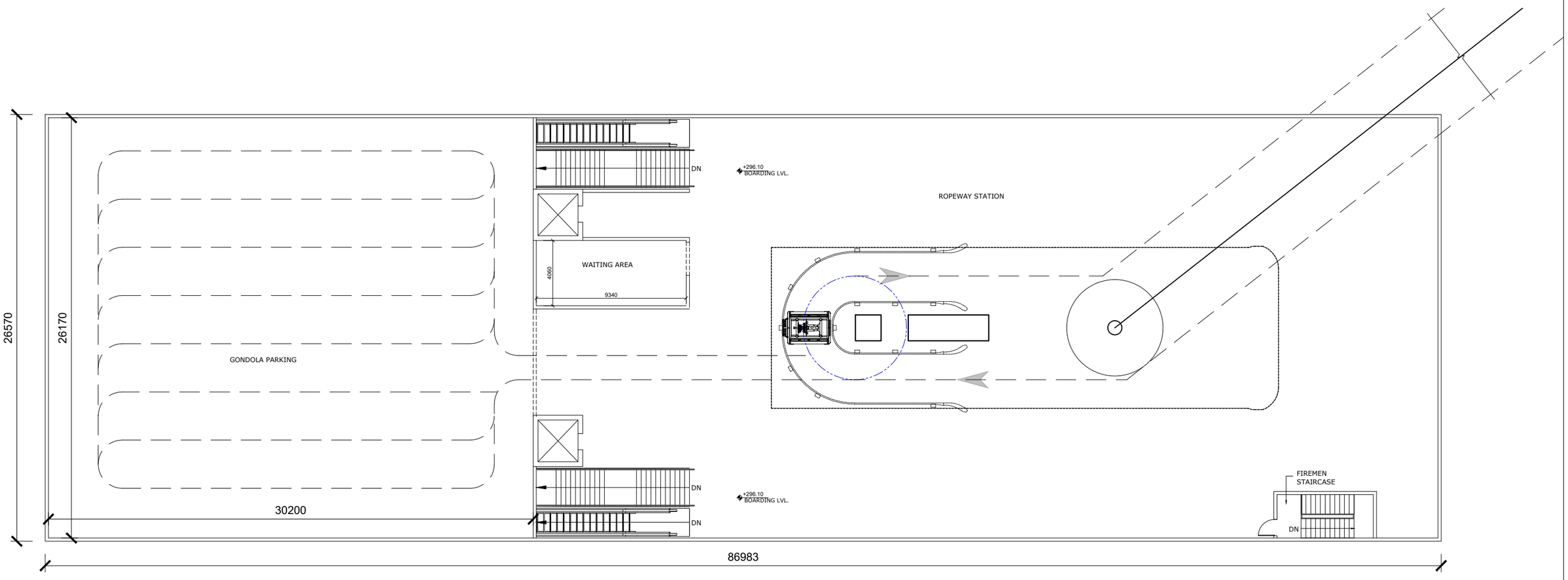
SCALE:	SHEET SIZE:
1:250	A3



LOWER TERMINAL - FIRST FLOOR LEVEL PLAN

CLIENT: –	UKMRC
ROPEWAY PROJECT	D.D.U.PARKING TO CHANDI DEVI TEMPLE HARIDWAR
DRAWING TITLE:	LOWER TERMINAL - FIRST FLOOR LEVEL PLAN
SCALE: 1:250	SHEET SIZE: A3

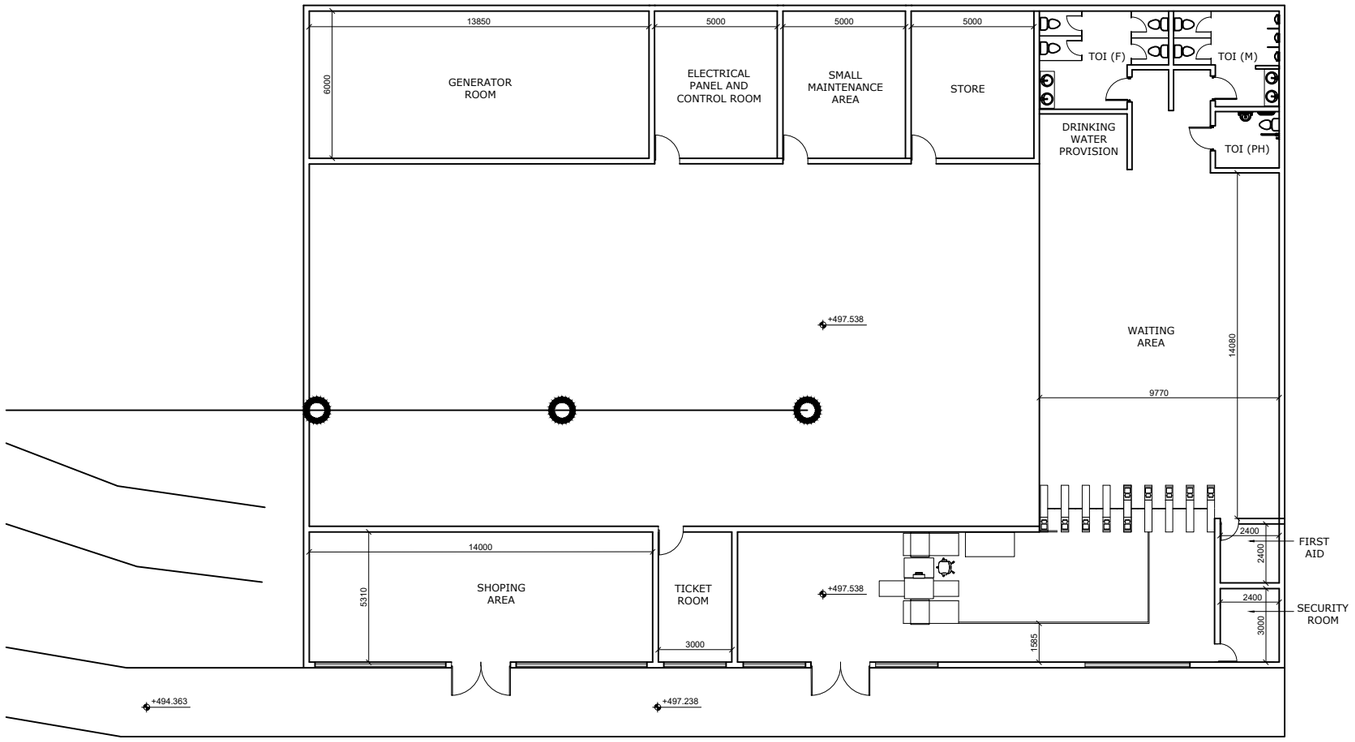
Annexure2.4



LOWER TERMINAL - BOARDING LEVEL PLAN

CLIENT: –	UKMRC
ROPEWAY PROJECT	D.D.U.PARKING TO CHANDI DEVI TEMPLE HARIDWAR
DRAWING TITLE:	LOWER TERMINAL - BOARDING LEVEL PLAN
SCALE: 1:250	SHEET SIZE: A3

Annexure2.5



CLIENT: – UKMRC

ROPEWAY PROJECT
D.D.U.PARKING TO CHANDI DEVI TEMPLE HARIDWAR

DRAWING TITLE:
UPPER TERMINAL - BOARDING LEVEL PLAN

SCALE:	SHEET SIZE:
1:250	A3

Annexure- 2.6 (1/3)

PROPOSED ROUTE NO.2
START POINT

TOWER-1

TOWER-2

TOWER-3

TOWER-4

PROPOSED ROUTE NO.2

CCR ROOM

PARKING

GANGA RIVER

GANGA RIVER

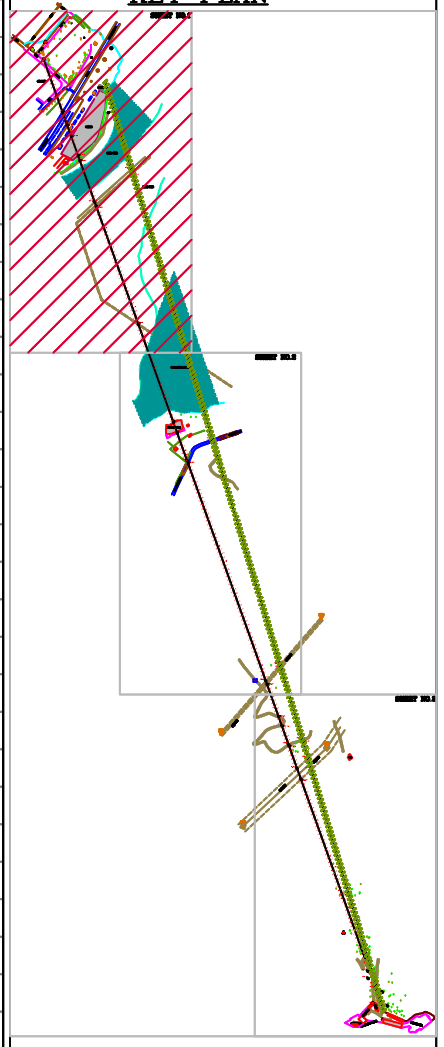
TO RUNKI

TO DEHRADUN

BRIDGE

GATE

KEY PLAN



LEGEND

1.	PROPOSED ROUTE	
2.	ROAD	
3.	BUILDING	
4.	PLINTH/OTTA	
5.	WATER TANK (WT)	
6.	TREE	
7.	ELECTRIC POLE	
8.	COMPOUND WALL	
9.	PERMANENT BENCHMARK	
10.	BRIDGE	
11.	PARKING	
12.	STEP	
13.	HT-LINE	
14.	FENCING	
15.	RIVER	

PBM LIST

PBM NO.	EASTING	NORTHING	ELEVATION
1.	227619.673	3314827.911	504.285
4.	227706.668	3315033.462	489.140
6.	227043.546	3317106.332	287.199
7.	227012.920	3317088.814	287.051

CLIENT:- USHA BRECO LIMITED

HARIDWAR-UTTARAKHAND

TOPOGRAPHICAL & CONTOUR SURVEY PLAN

SURVEY BY:- MAHESH

DRAWN BY:- HITESH

MONTH :- DECE.-2019

SCALE :- 1CM = 10MTR.

BY:-

MARVEL SURVEYORS

BLOCK NO.111, VRUNDAVAN PARK-1
OPP.S.T.DIVISION, LATHI ROAD.
AMRELI - 365601.
Contect No: 9925005155
Email: marvelsurveyors@gmail.com.

REV. NO. :-00

JOB. NO. :-00

Annexure- 2.6 (2/3)

GANGA RIVER-DEEP WATER

TOWER-5

TOWER-6

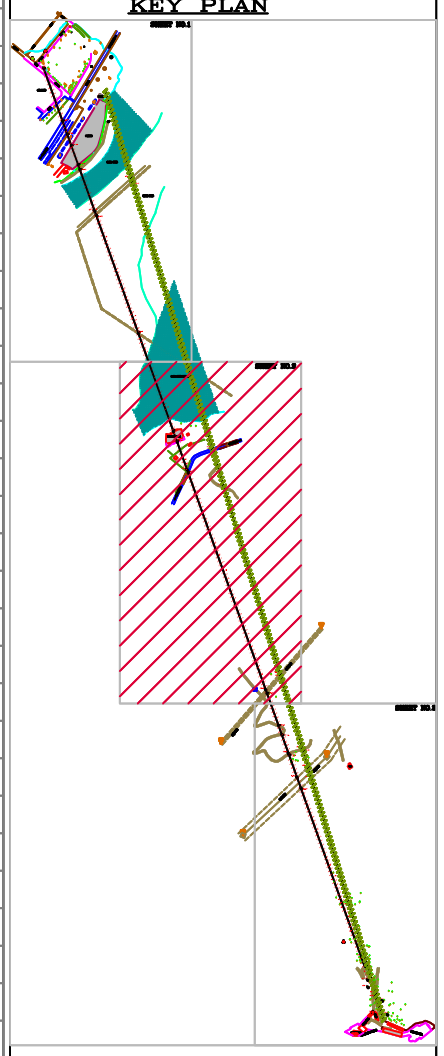
TOWER-7

TOWER-8

PROPOSED ROUTE NO.2

H.T.LINE

KEY PLAN



LEGEND

1.	PROPOSED ROUTE	
2.	ROAD	
3.	BUILDING	
4.	PLINTH/OTTA	
5.	WATER TANK (WT)	
6.	TREE	
7.	ELECTRIC POLE	
8.	COMPOUND WALL	
9.	PERMANENT BENCHMARK	
10.	BRIDGE	
11.	PARKING	
12.	STEP	
13.	HT-LINE	
14.	FENCING	
15.	RIVER	

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6.	227043.546	3317106.332	287.199
7.	227012.920	3317088.814	287.051

CLIENT:- USHA BRECO LIMITED

HARIDWAR-UTTARAKHAND

TOPOGRAPHICAL & CONTOUR SURVEY PLAN

SURVEY BY:- MAHESH	MONTH :- DECE.-2019
DRAWN BY:- HITESH	SCALE :- 1CM = 30MTR.

BY:-

MARVEL SURVEYORS

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OPP.S.T.DIVISION, LATHI ROAD.
AMRELI - 365601.
Contact No: 9925005155
Email: marvelsurveyors@gmail.com,

REV. NO. :-00 | JOB. NO. :-00

Annexure- 2.6 (3/3)

TOWER-9

TOWER-10

H.T.LINE

PROPOSED ROUTE NO.2

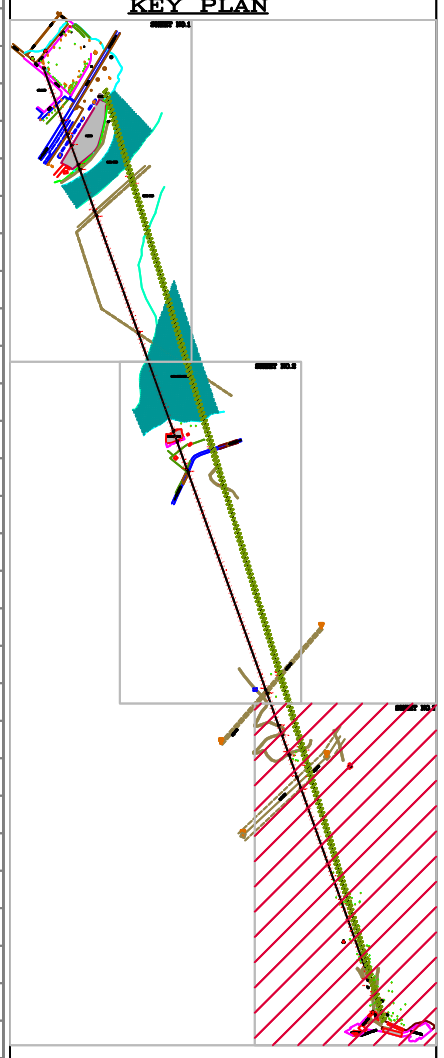
TOWER-11

TOWER-12

TOWER-13

END POINT

KEY PLAN



LEGEND

1.	PROPOSED ROUTE	
2.	ROAD	
3.	BUILDING	
4.	PLINTH/OTTA	
5.	WATER TANK (WT)	
6.	TREE	
7.	ELECTRIC POLE	
8.	COMPOUND WALL	
9.	PERMANENT BENCHMARK	
10.	BRIDGE	
11.	PARKING	
12.	STEP	
13.	HT-LINE	
14.	FENCING	
15.	RIVER	

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4.	227706.668	3315033.462	489.140
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7.	227012.920	3317088.814	287.051

CLIENT:- USHA BRECO LIMITED

HARIDWAR-UTTARAKHAND

TOPOGRAPHICAL & CONTOUR SURVEY PLAN

SURVEY BY:- MAHESH	MONTH :- DECE.-2019
DRAWN BY:- HITESH	SCALE :- 1CM = 30MTR.

BY:-

MARVEL SURVEYORS
BLOCK NO.111, VRUNDAVAN PARK-1
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REV. NO. :-00 | JOB. NO. :-00

Chapter 3

Description of the Environment

CHAPTER 3 : DESCRIPTION OF THE ENVIRONMENT

3.1 INTRODUCTION

This chapter deals with the description of existing environment conditions for the proposed project facilities in and around the project sites. A scoping matrix was formulated to identify the attributes likely to be affected due to the development of proposed project. The scoping matrix for the project is presented in **Table 3.1**. Based on environmental scoping matrix and project settings the attributes likely to be affected are identified under baseline data generation. Information presented in this chapter is collected from various primary as well as secondary sources. Land use data is compiled from geographical Information System (GIS); data on physiography and geology are collected from various reports/publications. RITES have carried out field studies to generate primary data on soil, water, air, meterology and noise quality at the project site. Field study is also carried out for assessing the ecological status in the study area. Additional data, wherever necessary, is collected from various reports, literatures, books and maps, and through discussions with various stakeholders.

Table 3.1: Scoping Matrix For The Project

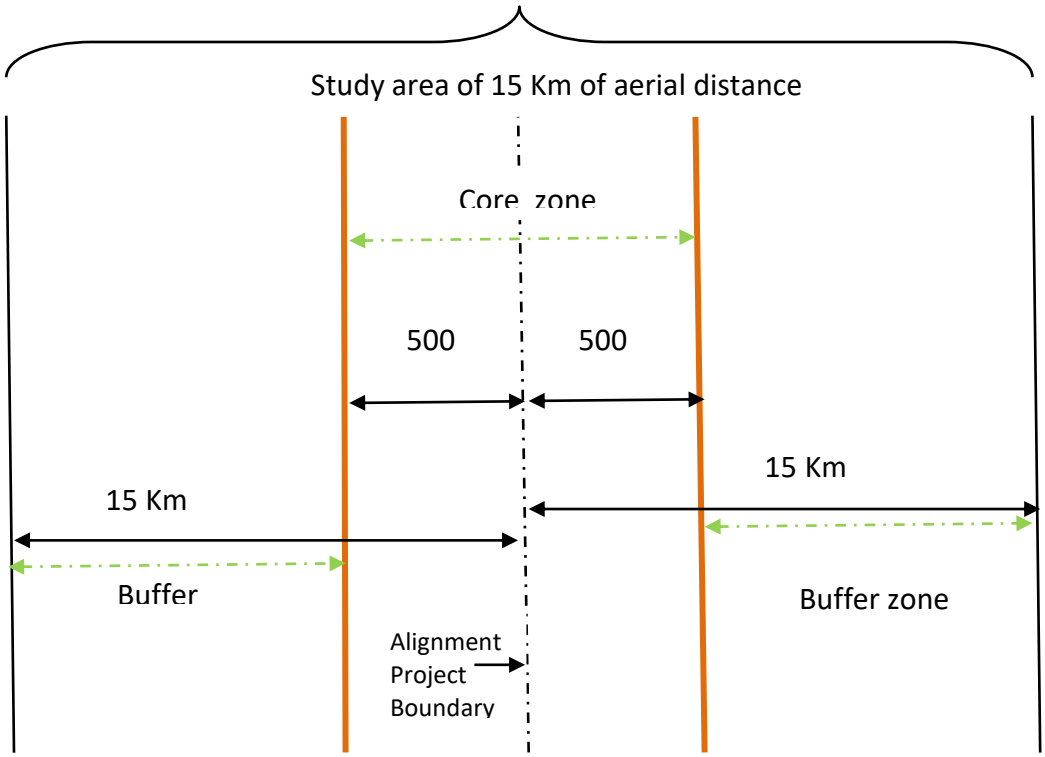
Aspect of Environment	Likely Impacts	Baseline Data Collection
A. Land Environment		
Construction Phase	Increased soil erosion	-Present Landuse -Soil Characteristics -Physiography
	Pollution by construction spoils	
	Use of land for Labour colonies	
	Solid waste from Labour colonies, construction	
B. Water Resources & Water Quality		
Construction Phase	Water quality impacts due to disposal of wastewater from labour colonies and construction sites.	-Meteorological data -Water Quality
Operation Phase	Disposal of wastewater	
	Run off Drainage problems	
C. Air Pollution		
Construction Phase	Impacts due to emissions generated by construction activities & machineries	Ambient Air Quality at different locations
	Emissions from DG set	
Operation	Fugitive emission due to DG set	
D. Noise Pollution		
Construction Phase	Noise due to operation of various equipment and machinery, DG sets	Noise levels at different locations in the area
Operation Phase	Noise due to DG set, Operation of Ropeway	
E. Terrestrial Ecology		
Construction Phase	Loss of biomass	-Trees in the area -Type of tree species
Operation Phase	Plantation of trees	
F. Socio-Economics		

Aspect of Environment	Likely Impacts	Baseline Data Collection
Pre-Construction Phase	Change of land use from forest department, state government etc. to the Ropeways	- Field observations, socio-economic survey and consultations
Construction Phase	Generate employment for unskilled and skilled local people	
Operation Phase	Fast, easy, sustainable and Environment friendly mode of communication to the people and goods,	
	Create sustainable transportation,	
	Increase trade and commerce	
	Increase overall growth of the region	

3.1.1 Study Area

The project study area is within 500 m radius from the project boundary as per EIA Guidance Manual, however 10 km radius of the study area is considered for the proposed ropeway to collect primary and secondary data and 15 km area is considered for the eco sensitive features around the project area. The study area for the project is showen in **Figure 3.1.**

Figure 3.1: Study Area for the Project



3.1.2 Monitoring Period

The primary data collection was carried out in the months of **April-2021 to July-2021.** The primary data was collected for meteorological conditions, air quality, noise levels, water quality, soil quality, ecological environment and socio-economic conditions during the study period.

3.1.3 Environmnetal Components

Environmental baseline data include the physical, biological and socio-economic data. The environmental baseline data is compiled for:

- Land Environment (Physiography, Geology, Seismicity and Soils)
- Water Environment (Water Resources, Water Use, Water Quality)
- Air Environment (Meteorology and Air Quality)
- Noise Environment (Noise Levels)
- Ecological Environment (Flora and Fauna)
- Socio-Economic Environnent (Demographic, Socio-economic environment, Village profile of project influence area, public consultation at village level etc)

3.1.4 Methodology

The methodology adopted for data collection is highlighted wherever necessary and the frequency adopted for data collection for environmental attributes is summarized in **Table 3.2.**

Table 3.2: Environmental Attributes And Frequency Of Monitoring

S No	Environmnetal Component	Parameter	Sampling Period	Sampling Location	Frequency	Detection Limit	Methodology
Land Environment							
1	Land Use	Land use pattern	-----	----	10 km around the project site	----	GIS studies & field observations
2	Geology	Geological history	-----	-----	---	---	Field survey, Secondary sources
3	Soil	Physical and chemical constituents	Grab sampling	5	Once during Study period	Variable according to the parameters.	Field studies & secondary sources
4	Seismology	Seismic Hazard	-----	---	---	---	Seismic zoning map of India
Water Environment							
5	Water Quality	Physical, chemical and biological parameters	Grab Sampling	8	Once during Study period	0.001 to 2mg/l. Variable according	Field studies and secondary sources.
Air Environment							
6	Ambient Air Quality	$PM_{2.5}$, PM_{10}, SO_2 , NO_X & CO	Two days per week for 3 months	4	24 Hourly		Field studies
7	Meteorology	Wind Speed, Wind Direction, Temperature (max and Min), Relative Humidity, Rainfall, Atm. Pressure	3 months	1	Hourly		Field studies, Secondary sources
Noise Environment							
8	Noise	L_{eq}, L_{10}, L_{50}, L_{90}, L_{max}, L_{min}, L_{day}, $L_{night.}$, L_{DN}	48 Hour	4	Once during study period	-----	Field studies

S No	Environmnetal Component	Parameter	Sampling Period	Sampling Location	Frequency	Detection Limit	Methodology
Ecology Environment							
9	Ecology	Flora & Fauna	-----	Project site	Once during study period	------	Field studies, secondary sources
Socio-Economic							
10	Socio-economic environment	Demographic and Socio-economic profile of the settlements, project level public consultation	-----	Within the core zone	Once during study period	Within 10 km	Field studies, consultations and secondary sources.

3.2 LAND ENVIRONMENT

Parameters involved in land environment are physiography, geology, soils, land use pattern and seismicity. These are discussed in following paragraphs.

3.2.1 Physiography & Topograhy

The proposed Ropeway project is located in the Haridwar District of Uttarakhand. Haridwar District lies in the south- western part of the state in between latitude 29°35' N & 30°40'N longitudes 77°43' E & 78°22' E. The physiography of the project area is showen in **Figure 3.2.**

Haridwar District is bounded on North by the Dehradun district; on North- East by Pauri Garhwal district; on South and western side by the Uttar Pradesh State. The total geographical area of the District is 2360 sq. kms. District is well connected through by the network of metalled road and railway lines.

Figure 3.2: Physiography of the Project

Source: RITES study

The physiography of the Haridwar distirct comprises is plain except the presence of Shiwalik Mountain range. There is no void features except that the presences of nalla and River. Physiography of the district can be categorized into three.

Structural Hills: Northern and northeasternpart of the district is covered by the structural hills. This part shows the high and deep incised drainage with steep and sharp slopes. The major parts of the structural hills composed of sand stones, sand, clay, silt etc.

Upper Piedmont: Just below the Structural hills the upper piedmont kind of physiography found in the region. These are characterized by the Boulders, cobbles, Pebbles, sand and clays etc. At upper piedmont the higher elevation and steeper gradient around 10 to 20 meters/km is found. This Bhabar area covers most of the Bhagwanpur block and some part of Bahadrabad block.

Lower Piedmont Plains: Just below the Upper Piedmont the plain surface sloping towards the south with very low gradient. This area is characterized by the fune grained sand, gravels, clays etc. This plain is further divided into the lower piedmont plains, older alluvial plains, and younger alluvial plains.

The elevation map of the study area shows that most of the study area is a plain terrains following by the structural hills. The general elevation of the district with respect to mean sea level is 237m – 1,355m. Structural hills are predominant near the Dehradun in North eastern side of the district. Near the Siwalik Hills the gradient is quiet steep that varies from 538-807msl. Topography of the project site is flat upto the Cheela dam Road and undulating at the southern side of the project site. The elevation of the project site is 283.74 - 498.50 msl. Elevation map of the study area showing the project location and its surrounding is given in **Figure 3.3.**

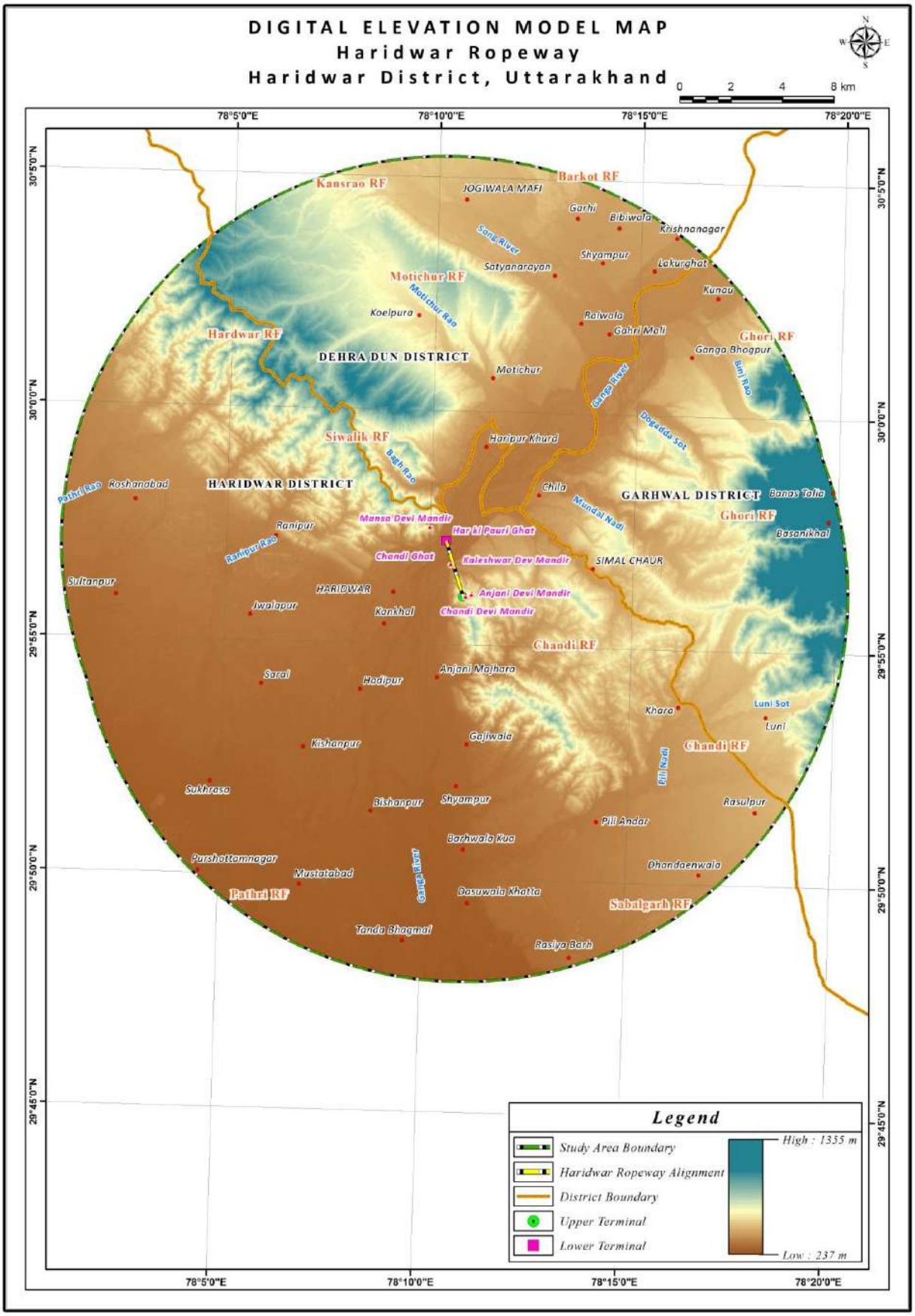
3.2.2 Geology

The Haridwar district is a part of west Indogangetic plain which is composed of Pleistocenec and subrecent alluvium material brought down by river from Himalayan region. The geology of the region belongs to the Cenozoic era.

The upper Siwaliks are mostly redaceous consisting of sand stone, boulders, pebbles, conglomerates, shale, slit and clay. The middle Siwaliks in this area is largely consists of lower alterations of clay and sand stone sequence and an upper sequence of massive sand stones. Just below the Siwaliks are the Bhabar area which is characterized by the alluvial, consists of boulder, cobbles, pebbles, gravel with clay and silts.The alluvium has been extended down to south in complete district. The older and younger alluvial plains consist of various grades of sands, grave, silt and clay. The sand bars, flood plains, point bars, palaeochannels meanders has been created by the riverine agencies in younger alluvium along the rivers. In general the geological sequence in the Haridwar district is given as below in **Table 3.3.**

The geological map of Haridwar district is given in **Figure 3.4.** The proposed ropeway site lies in the Pliestocene to Early Pliestocene age where the rock formation measurly of sedimenatries.

Figure 3.3: Elevation Map of the Study Area



Source: *RITES study*

Table 3.3: General Stratigraphic sequence of Haridwar District

Era	Period	Age	Formation	Group	Lithology
Cenozoic	Neogene	Holocene	Younger alluvium Terraces, channels, flood plains, fans, paleochannels	Newer/Younger Alluvium	Sands of various grade, silt and clays
		Middle to Upper Pliestocene	Older Alluvium (Bhabber and Terai)	Ramnagar/ Varanasi/ Ambala	Boulders, Cobbles, Pebbles, Gravels, Sand, Silt & Clay
		Pliestocene to Early Pliestocene	Sedimentaries	Middle Siwaliks	Sandstone with boulders,cobbles, Pebbles, Conglomerate and associated Clay
				Upper Siwaliks	Conglomerates, Sandstones, Siltstones, Shales with boulders,Pebbles, Sands and Clay

Minerals: Important minerals that are found to occur in the State are high-grade limestone in Almora, Bageshwar, Dehradun, Nainital, Pauri-Garhwal, Pithoragarh & Tehri-Garhwal districts; magnesite and steatite in Almora, Bageshwar, Chamoli & Pithoragarh districts; and tungsten in Almora district. Other minerals that occur in the State are: asbestos in Chamoli district; barytes and marble in Dehradun district; copper in Almora, Dehradun & Pithoragarh districts; dolomite in Dehradun, Nainital and Tehri-Garhwal districts; graphite in Almora district; gypsum in Dehradun, PauriGarhwal & Tehri-Garhwal districts; lead-zinc and silver in Dehradun & Pithoragarh districts; and rock phosphate in Dehradun & Tehri-Garhwal districts. Only minor minerals are found in the Haridwar district.

3.2.3 GeoHydrogeology

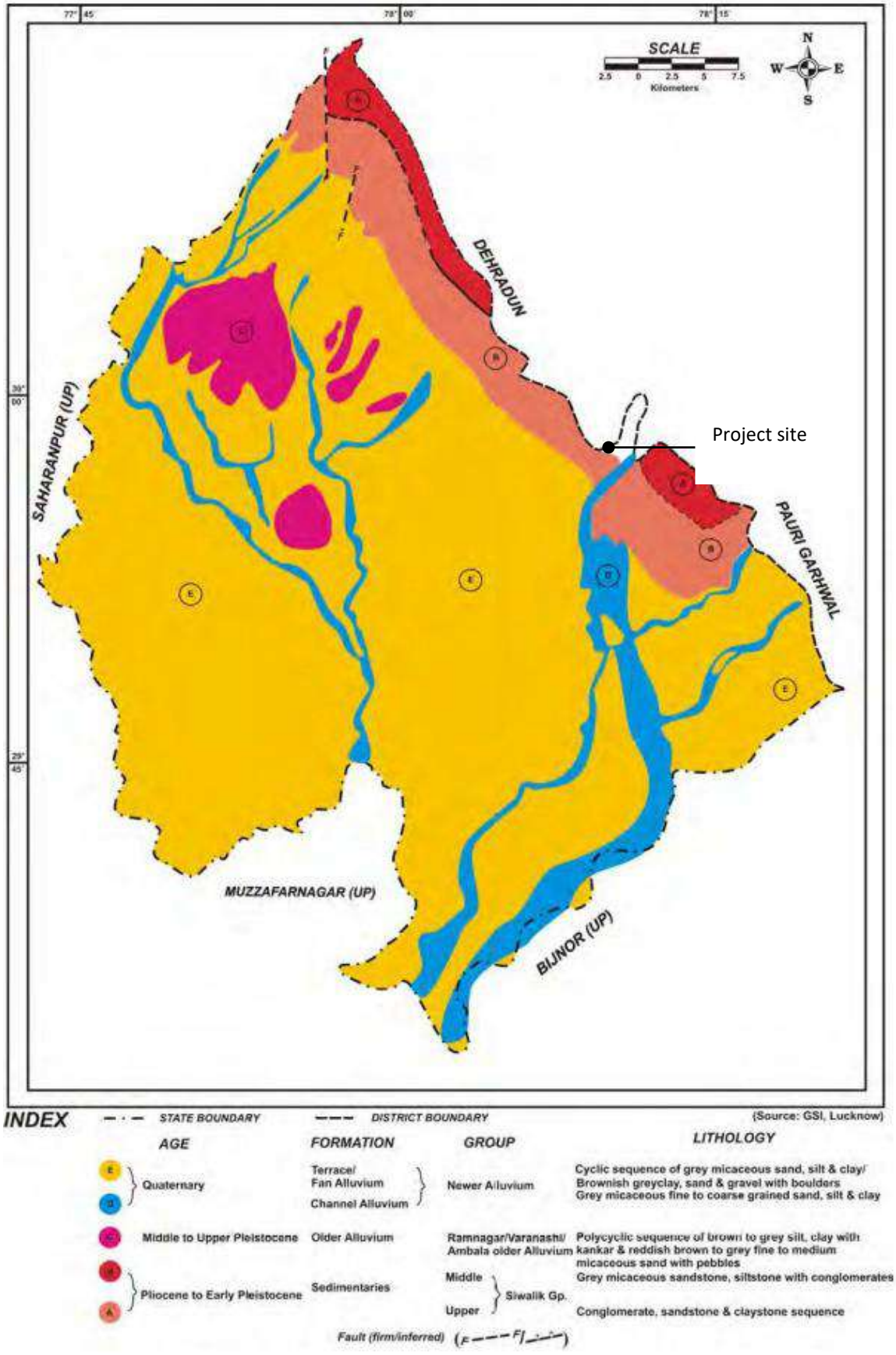
The groundwater conditions of the Haridwar district influenced by the lithology of the subsurface formation. It has been observed that the strata exihibit great variation both literally and vertically due to nature of deposit in Indogangetic plain. Two types of Aquifers have been reported in the Haridwar District. [1]

- Shallow unconfined Aquifer: Extend to depth of 25 km.
- Deeper Aquifer: Confined to semi confined in nature and located at depth about 25 to 150 m.

Water table contours in the areas indicates the southward trend of ground water flow both in unconfined and confined aquifers.

[1] (Singh , et all 1979)

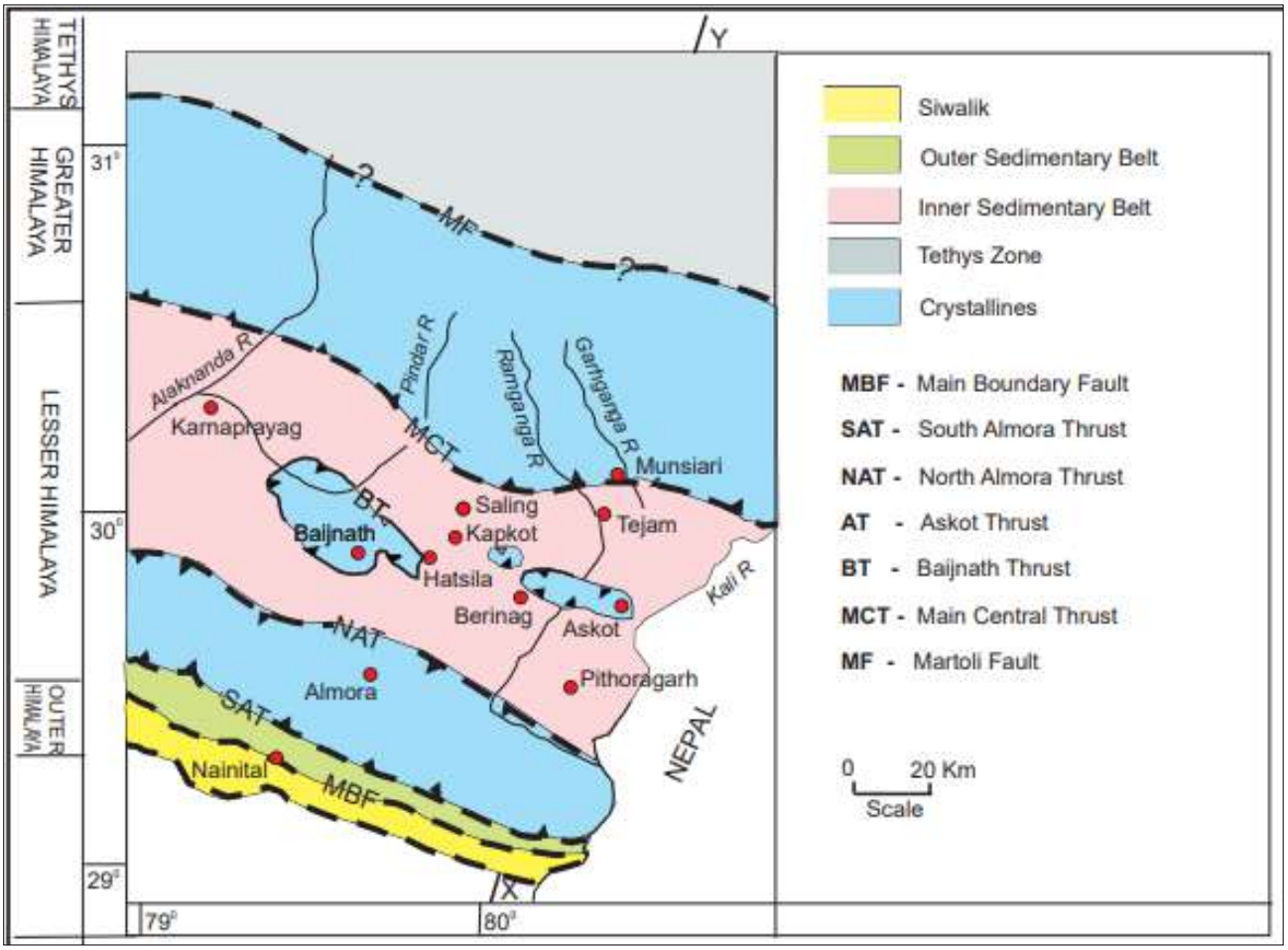
Figure 3.4: Geological Map of the Haridwar District



Source: *CGWB*

3.2.4 Landslide Zone

Uttarakhand state is prone for landslide there are number of landslide evidences occur in the Uttarakhand state. The major landslides that have affected the uttarakhand state are given below in **Table 3.4**. Lanslide are particularly common in Uttarakhand along Two zone olying in close proximity of two major tectonic discontinuities- Main boundary Thrust (MBT) and Main Central Thrust (MCT).



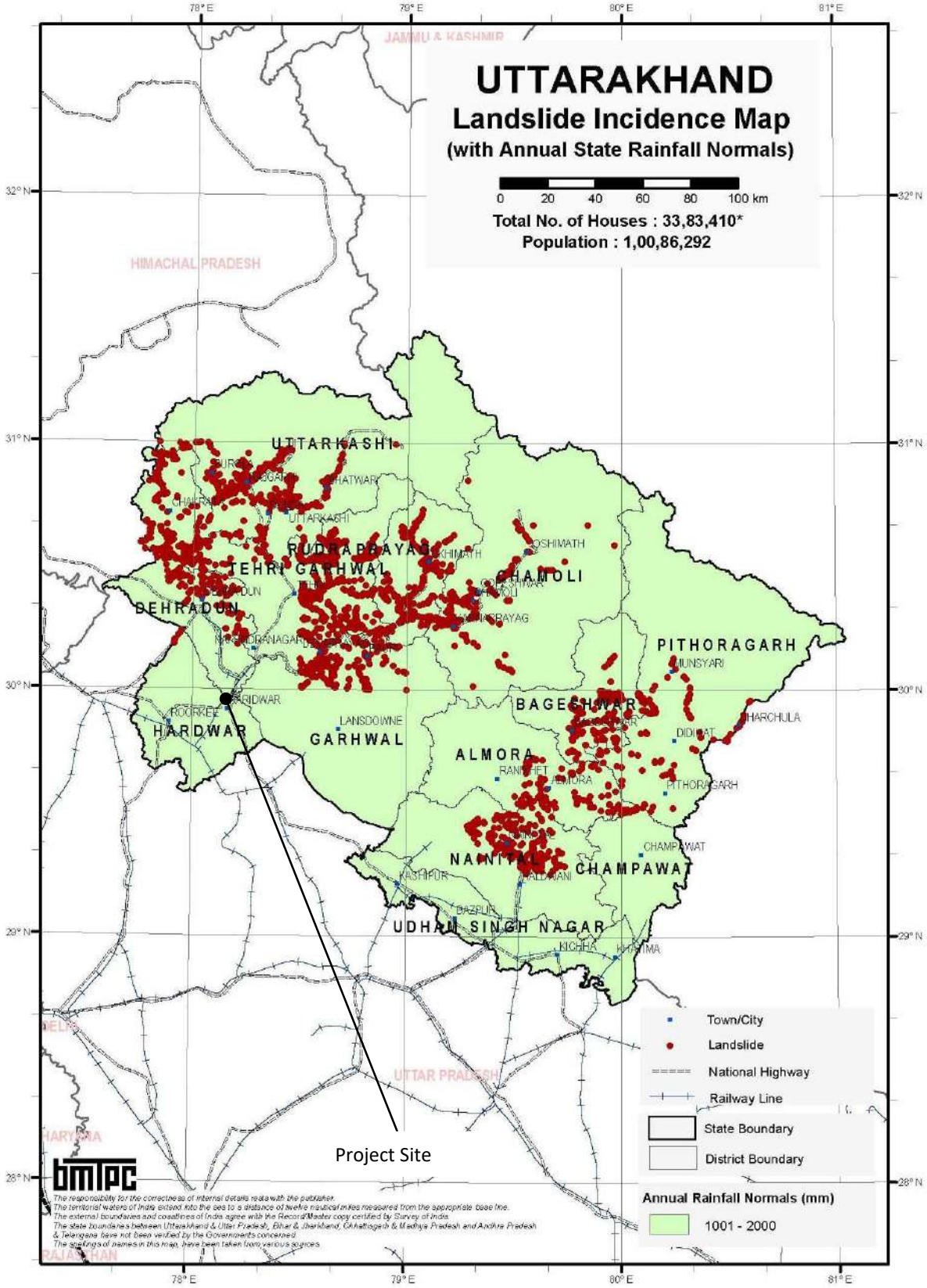
Source: NIDM

Landslide map of the uttarakhand showing the project site is given in **Figure 3.5.** According to the strategic plan of the Uttarakhand state Disaster Management Authority Landslides are not a significant risk in Haridwar and landslides have been ranked under the the Low Risk status. Landslides are not a significant risk in Haridwar district.

Table 3.4: List of Major Landslides of Uttarakahnd

Years	Name of the Landslide
1816	Pauri landslide
1842	Joshimath landslide
1857	Massive landslide blocked the flow of the Mandakini River
1868	Landslide at Chamoli blocked the Alaknanda river
1880	Landslide in Nainital Town
1893	Landslide blocked Bihari Ganga and formed lake near Gohna Village
1894	Breach of Gohna lake causing "Bihari Disaster" in Alaknanda Valley
1906	Helang Landslide
1945	Patalganga landslide
1963	Nainital landslide
1963	Kaliasaur Landslide
1965	Karanprayag Landslide
1970	Landslides formed lake in the upper catchment of Alaknanda river
1979	Ukhimath Landslide 1981 Uttarkashi-Kedarghati Landslide
1986	Landslide Jakholi (Tehri Garhwal) and Devaldhar (Chamoli)
1991	Gopeshwar Landslide
1996	Bhimtal Landslide and slide in Ukhimath area blocking the Madhyamaheshwar
1998	Malpa Landslide (Pithoragarh)
2001	Phata Byung Gad Landslides
2002	Landslides at Budhakedar and Khetgaon
2003	Uttarkashi Landslide
2004	Amparav Landslide
2005	Ramolsari Landslide
2009	Pithoragarh Landslide
2010	Landslides at Khankra, Srinagar, Joshimath, Badrinath, Bageshwar, Chamoli, Rishikesh Gangotri road, and Almora due to cloud Burst.
2012	Landslide at Okhimath, Rudrapayag

Figure 3.5: Historic Landslide Map Of Uttrakhand



BMTPC: Vulnerability Atlas - 3rd Edition: Peer Group, MoHUA,GOI; Map is Based on digitised data of SOI; Landslide Incidence data GSI; Annual Rainfall data IMD. Houses/Population as per Census 2011; * Houses including vacant & locked houses. Disclaimer: The maps are solely for thematic presentation.

Source: BMTPC

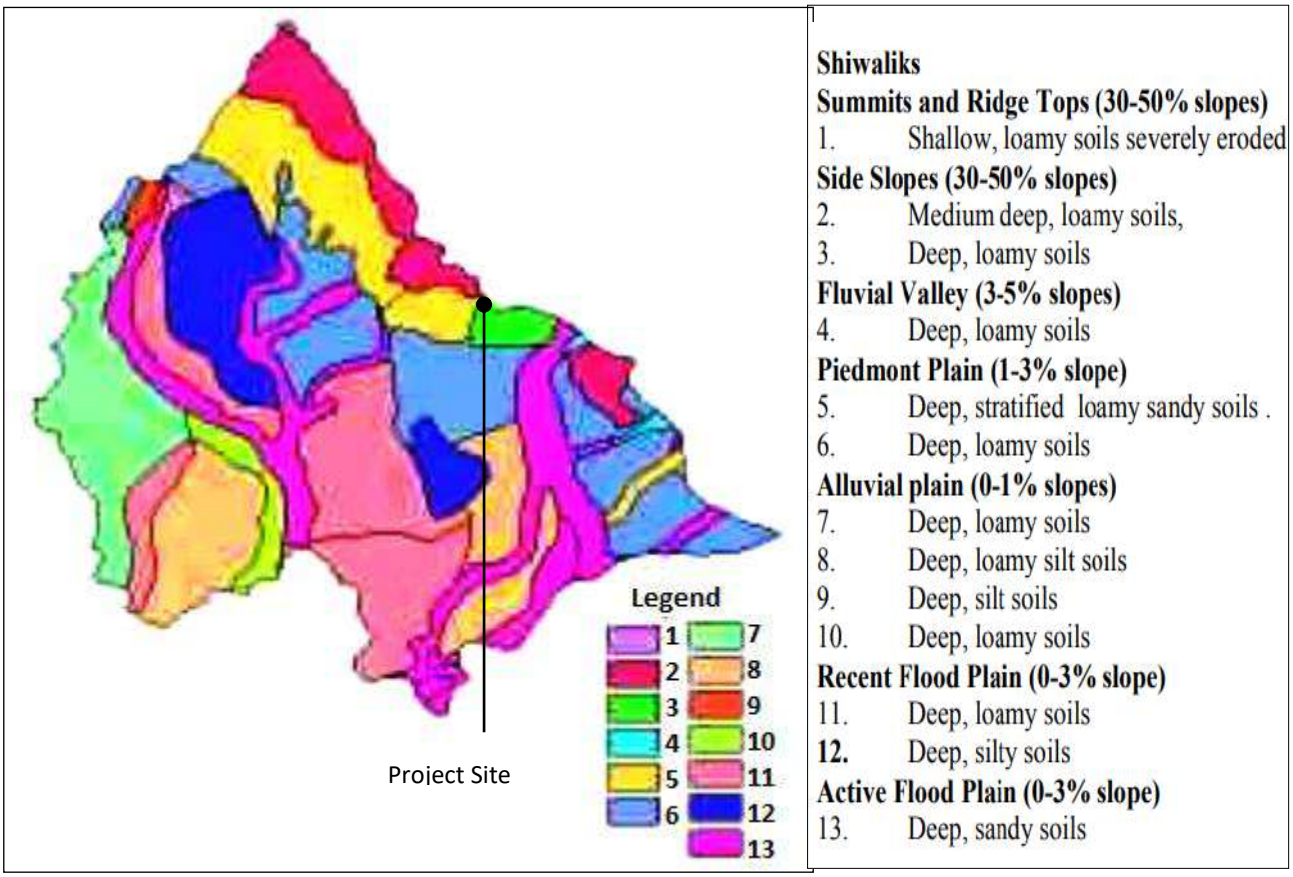
3.2.5 Soils

The soil of the Haridwar has been classified into three broad categories based on the characteristics and relationship with topographic set up. These are as follows:

1. Ultisols: These soils are brown in colour mainly found in the structural hills (Siwaliks) region. These are the soils with a horizon of clay accumulation and low base supply.
2. Entisols: Entisols are found along the foothills of Siwaliks and extends up to Tarai. These consist of boulders, pebbles, sand, silt and clay soils.
3. Molisols soil: These soils are black in colour. This kind of soil occurs in the southern part of the district. It consist fine-gained sand, silt and clay.

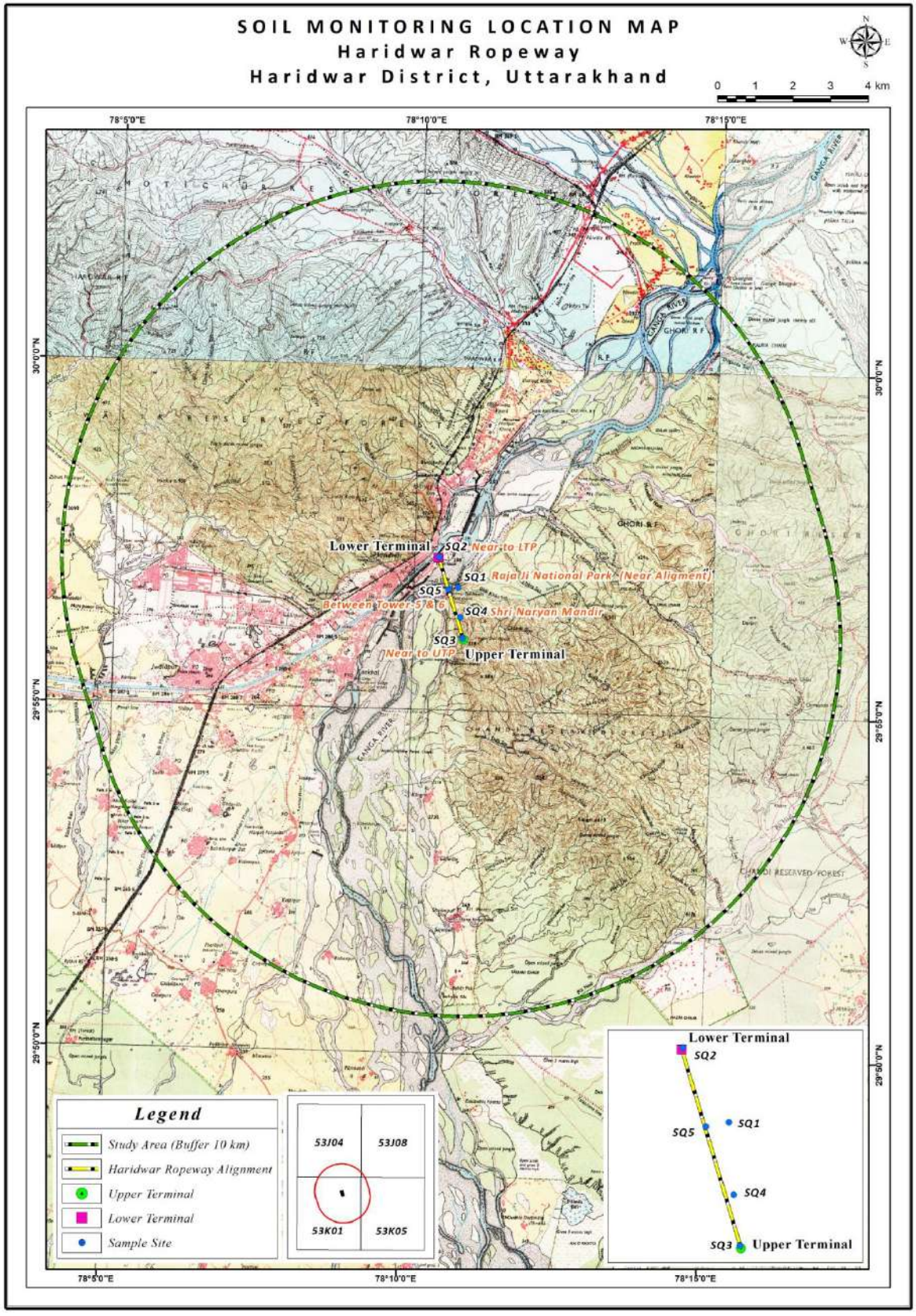
A mixture of sand and soil are present on the exact location of LTP however, soil in the vicinity of LTP is unfertile. No fertile soil was observed adjacent to UTP except some fine and coarse stones. Soil map of the Haridwar District is given below in **Figure 3.6.** During study it was observed that the stratum near the LTP mainly consist of Gravel mix clay soil.

Figure 3.6: Soil Map of the Haridwar District



Source: agricoop

Figure 3.7: Soil Monitoring Locations Map



Source: RITES study (SQ1- Raja Ji National Park, (Near Aligment) SQ2- Near to LTP, SQ3- Near to UTP, SQ4- Shri Naryan Mandir, SQ5- between Tower-5 & 6)

Soil Quality: To understand the soil quality of the project site and surrounding the soil samples were collected. The location of the soil samples collected is given in the **Table 3.5** and depicted in **Figure 3.7.** Detailed methodology of soil sample collection is given below in subsequent paragraph.

Table 3.5: Description of Soil Sampling Locations

Sample	Location	Latitude and Longitude
SQ1	Raja Ji National Park (Near Aligment)	29°56'47.52"N, 78°10'43.93"E
SQ2	Near to LTP	29°57'13.93"N, 78°10'24.01"E
SQ3	Near to UTP	29°56'3.17"N, 78°10'49.90"E
SQ4	Shri Naryan Mandir	29°56'21.53"N, 78°10'46.72"E
SQ5	Between Tower-5 & 6	29°56'45.70"N, 78°10'34.47"E

Soil samples Near the Raja ji National park , Terminals, Tower 5-6

Methodology:

To analyse the quality of soil, five soil samples were collected using the Augur to a plough depth of 15 cm below the soil surface free from roots, sods and organic matters. The following procedure is followed for collecting the soil samples with the auger.

- Attach the auger bit to a drill rod extension, and attach the "T" handle to the drill rod.
- Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter).
- Begin auguring, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
- After reaching the desired depth, slowly and carefully remove the auger from the hole. When sampling directly from the auger, collect the sample after the auger is removed from the hole.
- Remove auger tip from the extension rods and replace with a pre-cleaned thin wall tube sampler. Install the proper cutting tip.
- Remove the tube sampler, and unscrew the drill rods.
- Remove the cutting tip and the core from the device.
- Discard the top of the core (approximately 1 inch), as this possibly represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container.

➢ After collection samples are labeled. This will cover the followings:
  - Sample code number
  - identifying location
  - date and time of sampling
  - source and type of sample

➢ After collection of samples from field samples are dried in shade by spreading on a clean sheet of paper after breaking the large lumps. Sieving of samples is carried out through 2mm sieve. Repeat powdering and sieving until only materials of >2 mm (no soil or clod) is left on the sieve. Collect the material passing through the sieve and store in a plastic container with proper labeling for laboratory analysis.

The samples were tested for physical and chemical properties according to the IS 2720. The brief of the sampling and analysis procedure is given in **Table 3.6**. Result of the soil sample analysis is given in **Table 3.7.**

Table 3.6: Soil Sampling and Analysis Procedure

Parameters	Standard Used	Sampling Procedure	Analysis Procedure
Physical Test pH, conductivity, texture, bulk	IS 2720	Sample taken from ~ 15 cm below the soil surface using sampler	Using various equipments

Parameters	Standard Used	Sampling Procedure	Analysis Procedure
density			
Ca, Mg, SAR, Al, Fe Mn, B and Zn	IS 2720	Sampling ~ 15 cm below the soil surface using sampler	Determined by colorimetric method using Spectrophotometer/Flame photometer/AAS
Organic matter	IS 2720	Sampling ~ 15 cm below the soil surface using sampler	Determined by titremetric method using K2Cr2O4 standard solution as titrant

Table 3.7: Soil Sample Analysis

S. No	Test Parameters	Unit	Results					Test Method
			SQ1	SQ2	SQ3	SQ4	SQ5	
1	pH (1:2	-	6.21	5.98	6.14	5.86	6.31	IS 2720(P-26)-
2	Electrical	µS/c	948	836	1146	496	646	IS 2720(P-21)-
3	Calcium (as Ca)	mg/kg	414	331	374	212	332	AAL/SOP/ENV/010
4	Potassium (as	mg/kg	171	204	192	93	92	AAL/SOP/ENV/010
5	Sodium (as Na)	mg/kg	201	321	292	180	103	AAL/SOP/ENV/010
6	Magnesium (as	mg/kg	81	77	72	61	72	AAL/SOP/ENV/010
7	Chloride (as Cl)	%	0.46	0.23	0.51	0.22	0.61	AAL/SOP/ENV/010
8	Bicarbonates	%	0.04	0.06	<0.01	<0.0	0.03	AAL/SOP/ENV/010
9	Sulphate	mg/kg	1414	1211	2042	1432	1506	IS 2720(P-27)-
10	Available	mg/kg	2180	1974	1236	834	2206	AAL/SOP/ENV/010
11	Nitrogen (as N)	mg/kg	2646	2768	1938	424	2432	AAL/SOP/ENV/010
12	Total	mg/kg	869	736	314	203	739	AAL/SOP/ENV/010
13	Organic Carbon	%	2.62	1.14	0.78	0.21	1.68	IS 2720(P-22)-
14	Organic Matter	mg/kg	5304	2138	1463	4190	3240	IS 2720(P-22)-
15	Othophosphat	mg/kg	BDL	BDL	BDL	BDL	BDL	AAL/SOP/ENV/010
16	Carbonates	%	0.69	0.42	0.56	BDL	0.73	AAL/SOP/ENV/010
17	Sulphur	mg/kg	BDL	BDL	BDL	BDL	BDL	AAL/SOP/ENV/010
18	Arsenic (as As)	mg/kg	BDL	BDL	BDL	BDL	BDL	AAL/SOP/ENV/010
19	Boron (as B)	mg/kg	BDL	BDL	BDL	BDL	BDL	AAL/SOP/ENV/010
20	Cadmium (as	mg/kg	BDL	BDL	BDL	BDL	BDL	AAL/SOP/ENV/010
21	Copper (as Cu)	mg/kg	48	26	14	11	33	AAL/SOP/ENV/010
22	Iron (as Fe)	mg/kg	326	BDL	214	112	294	AAL/SOP/ENV/010
23	Lead (as Pb)	mg/kg	49	31	23	31	36	AAL/SOP/ENV/010
24	Manganese (as	mg/kg	23	403	12	10	14	AAL/SOP/ENV/010
25	Mercury (as	mg/kg	BDL	BDL	BDL	BDL	BDL	AAL/SOP/ENV/010
26	Molybdenum	mg/kg	BDL	BDL	BDL	BDL	14	AAL/SOP/ENV/010
27	Nickel (as Ni)	mg/kg	19	17	14	BDL	84	AAL/SOP/ENV/010
28	Total Zinc (as	mg/kg	71	211	92	118	41	AAL/SOP/ENV/010
29	Silt	% by	20	14	14	11	33	IS 2720(P-4)-1985,
30	Sand	% by	44	52	52	51	54	IS 2720(P-4)-1985,
31	Clay	% by	36	34	34	38	13	IS 2720(P-4)-1985,

Source: *Field study by NABL accredited Lab* – Arihant Analytical Laboratory Pvt Ltd. *Certificate No. (TC-5826*)

**SQ1*- Raja Ji National Park, SQ2- Near to LTP, SQ3- Near to UTP, SQ4- Shri Naryan Mandir, SQ5- Between Tower-5 & 6.

Analysis of Soil Quality Monitoring Results: In the study area the soil varies from sandy clay at SQ1, sandy clay loam at SQ2, SQ3, SQ4 and sandy loam at SQ5. Orthophosphate, Cadmium, Boron, Arsenic, Sulphur and Mercury were below detecable limit in soils of both LTP and UTP. However soil reaction is slightly acidic. Between towers 5 and 6, abundant amount of Nitrogen and Phosphorous nutrients are present. These soils need to be used as plantation.

3.2.6 Land use pattern

The term "Land Use" relates to the human activity or economic function associated with a specific piece of land.

Methodology: The Land use map was prepared using on-screen visual interpretation technique using ERDAS Imagine and Arc GIS software.

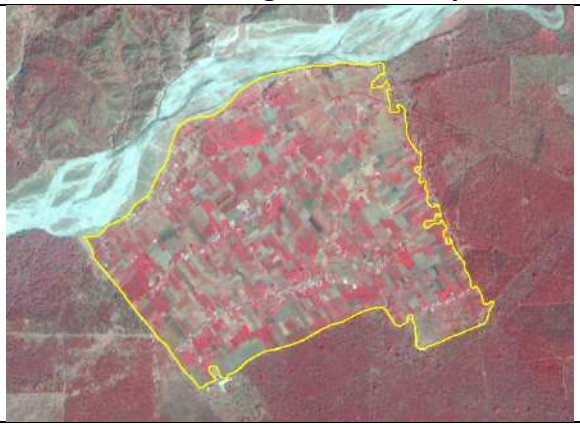
Satellite Image Used: The satellite image used in the current study includes one satellite sub-scenes (B) of LISS-IV data of resourcesat-2A which has a spatial resolution of 5.8 m for Level-II classification. National Resource Information System (NRIS) classification scheme has been followed for present landuse study. The satellite data was obtained from National Remote Sensing Centre (NRSC) Hyderabad.The entire data is in Lambert Conformal Conic (LCC) projection system with spheroid and datum as WGS84. The image was in false color composite, and hence was first geo-rectified and then processed to obtain the 10 km radius area covering the study area. All the processing and classification of the satellite images were performed in the ERDAS Imagine software.

Digital Image Analysis: Standard image analysis process has been followed.

Land Use Statistics

The land use classes that has been identified includes Agriculture, Barren, Canal, Dense Forest, Dry River Bed, Grassland, Industrial Area, Landslide, Moderate Dense Forest, Open Forest, Orchard, River Perennial, Scrub, Settlement, Waterbody and Wetland etc. Interpetation keys use for the preparation of landuse map is given in the **Figure 3.8.**

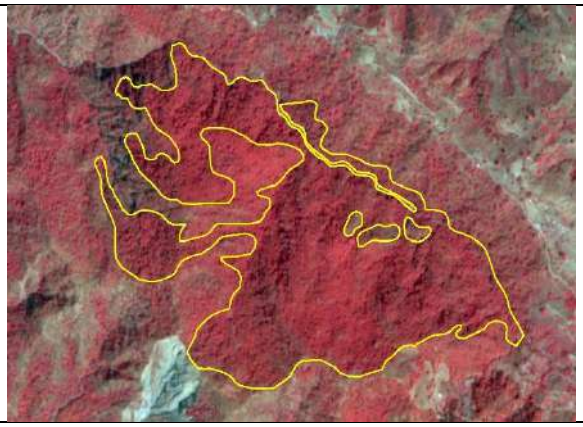
Figure 3.8: Interpetation Keys for Landuse Classification



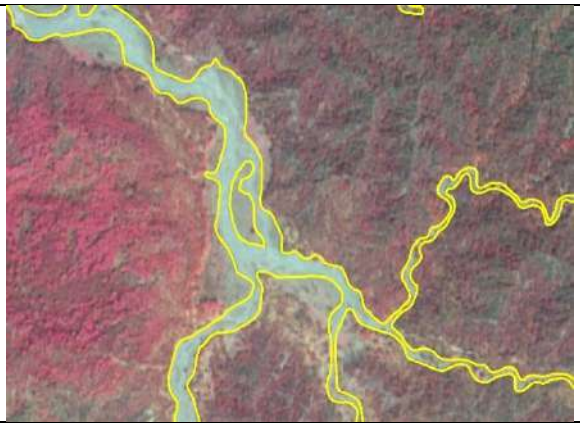
01 Agriculture

02 Barren

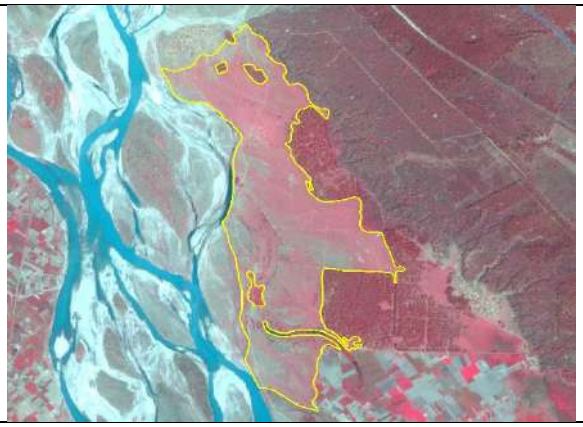
03 Canal



04 Grassland

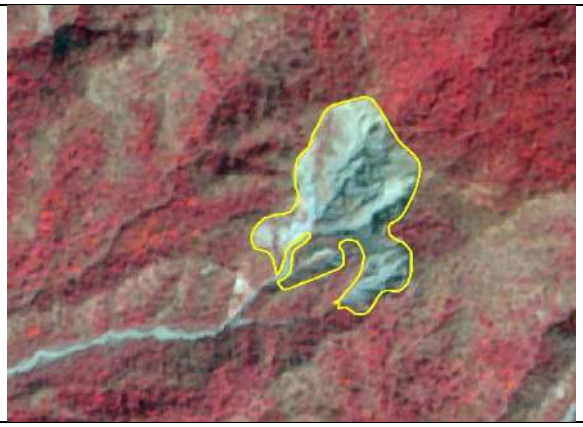


05 Dry River Bed

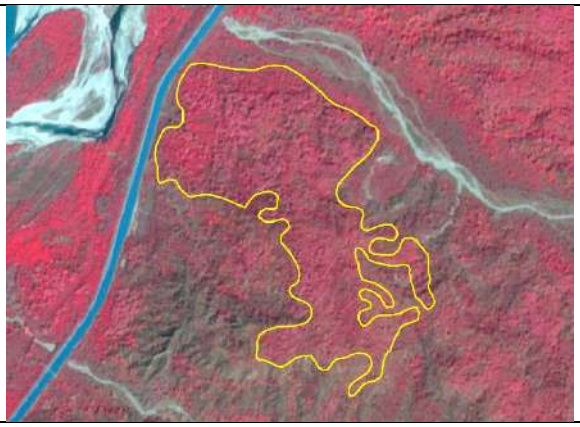


06 Grassland

07 Industrial Area

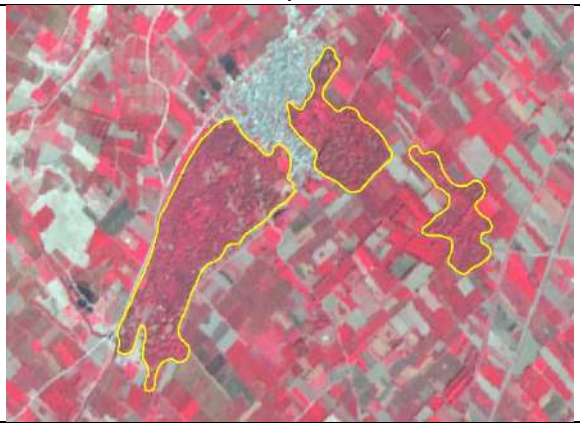


08 Landslide



09 Moderately Dense Forest

10 Open forest



11 Orchard

12 River Perennial

13 Scrub

14 Settlement

15 Waterbody

16 Wetland

Description of Landuse

Open Forest land covers the majority of the land which is about 28.67% of the study area. The second highest pattern of the landuse is moderately dense forest covering the 26.21% of the study area. Settlement covers the 8.88% of the area. Dry River bed covers the 7.38% of the study area while 1.81% is the river perennial in the study area.

Detailed Landuse classification data is given in **Table 3.8** and landuse map of the area is shown in **Figure 3.9.** The false color map is shown in **Figure 3.10.**

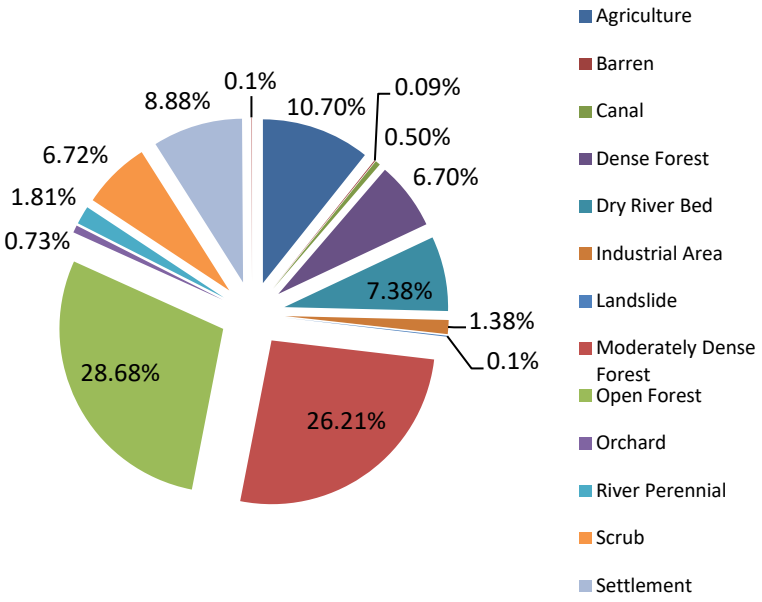
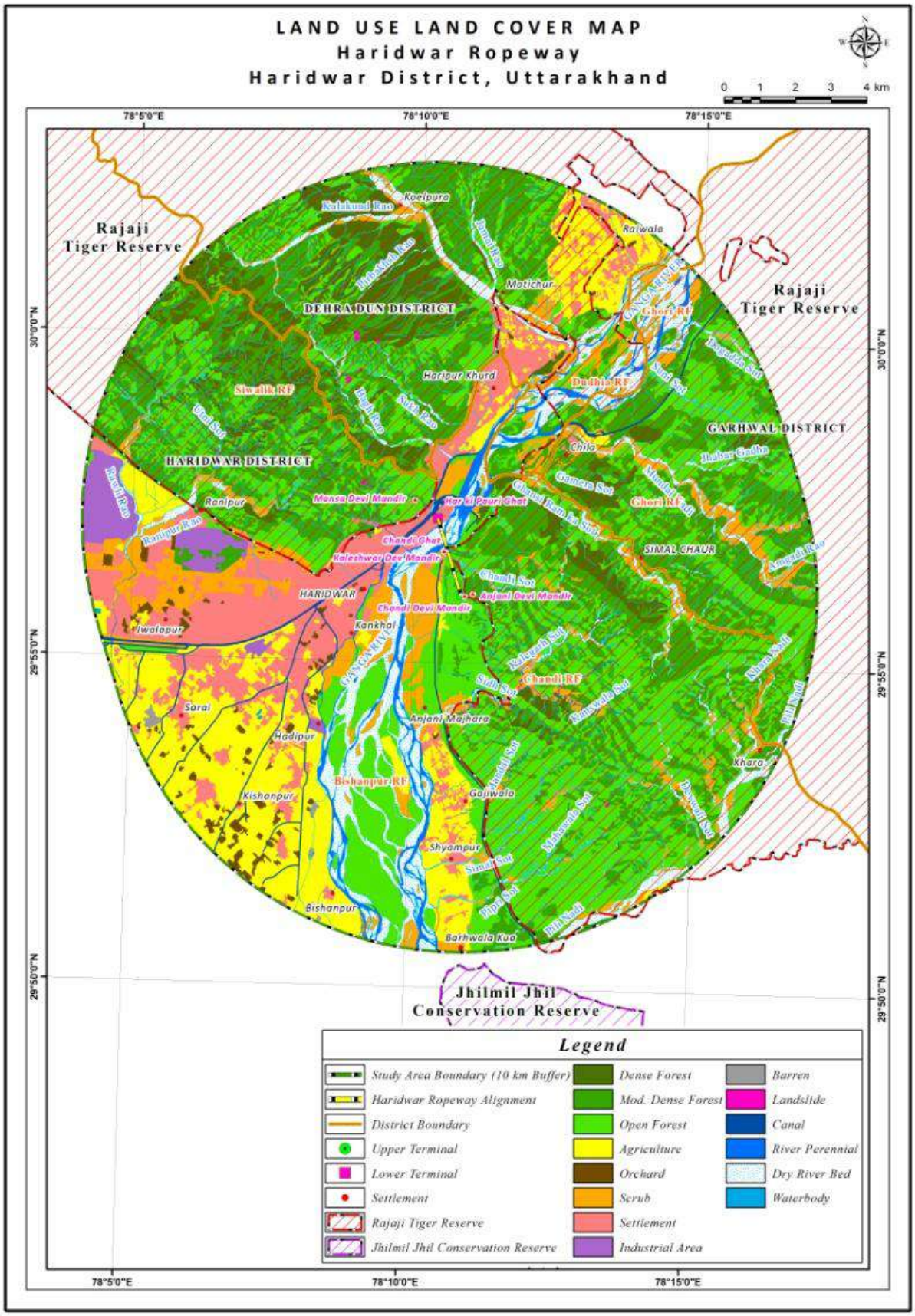


Table 3.8: Land Use Classification within the 10 km

S. No.	Land use/Land cover Classes	Area (in sq. km)	Area (%)
1	Agriculture	38.76	10.79
2	Barren	0.32	0.09
3	Canal	1.79	0.5
4	Dense Forest	24.38	6.79
5	Dry River Bed	26.53	7.38
6	Industrial Area	4.97	1.38
7	Landslide	0.15	0.04
8	Moderately Dense Forest	94.12	26.2
9	Open Forest	103	28.67
10	Orchard	2.64	0.73
11	River Perennial	6.49	1.81
12	Scrub	24.15	6.72
13	Settlement	31.89	8.88
14	Waterbody	0.08	0.02
15	**Grand Total**	**359.25**	**100**

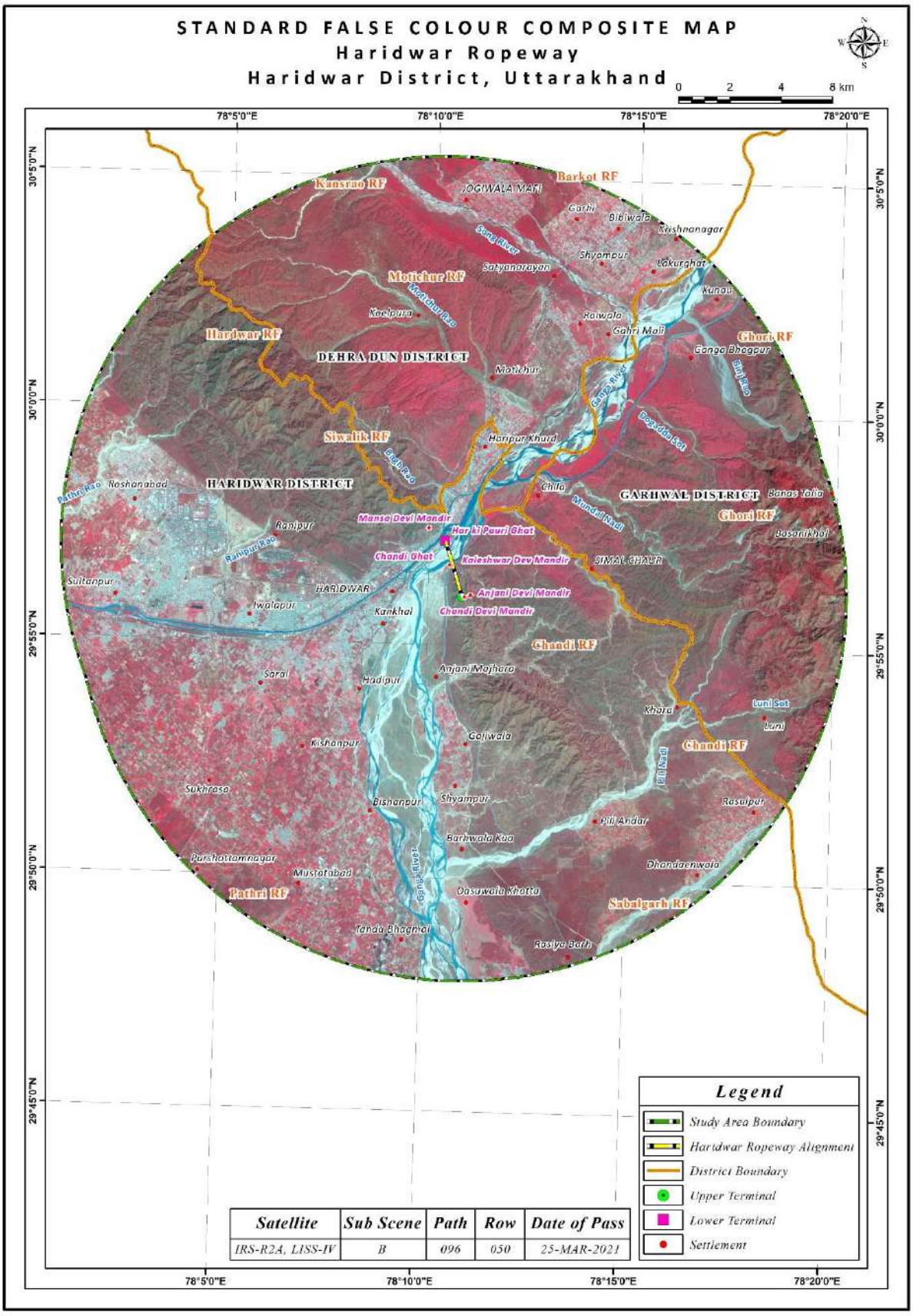
Existing Landuse Of The Project Area: The existing landuse of the project area lies in the Dry river bed of Ganga, river perennial, open forest**.**

Figure 3.9: Land Use/ Land Cover Map Of The Project Site & Surroundings



Source: RITES study (using ERDAS software & one satellite sub-scenes (B) of LISS-IV data of resourcesat-2A)

Figure 3.10: False Colour Map Of The Project Site & Surroundings

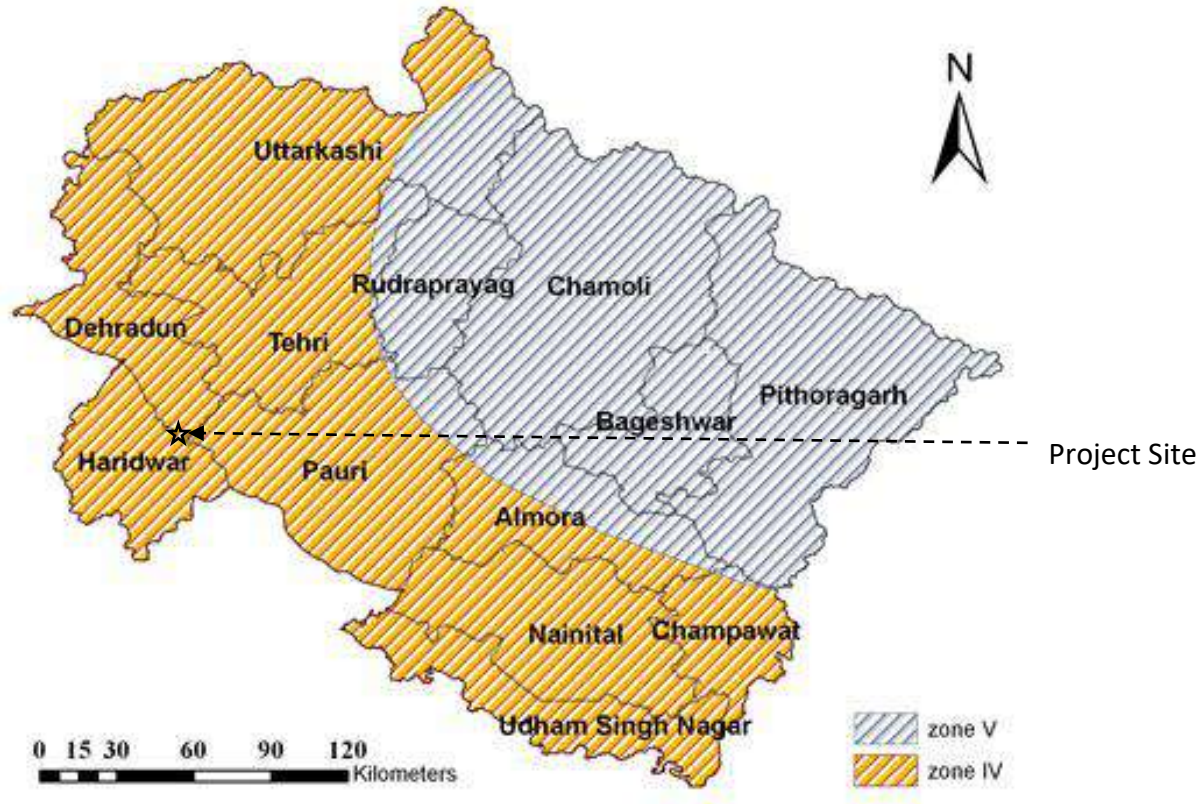


Source: RITES study

3.2.7 Seismicity

Project site lies in the **Seismic Zone IV** indicating High damage risk zone as per the IS: 1893-2002 (BIS, 2002) and corresponds to MSK intensity VIII. Seismic Zoning map of the Uttarakhand showing the project site is given in **Figure 3.11.**

Figure 3.11: Seismic Zoning Map Of Uttarakhand



Source: Disaster Mitigation and Management Center

3.3 WATER ENVIRONMENT

Water environment consists of water resources and its quality. Its study is important from the point of view to assess the sufficiency of water resources for needs of the project in its various stages and the impact of the project on water environment.

3.3.1 Hydro-geological Characteristics

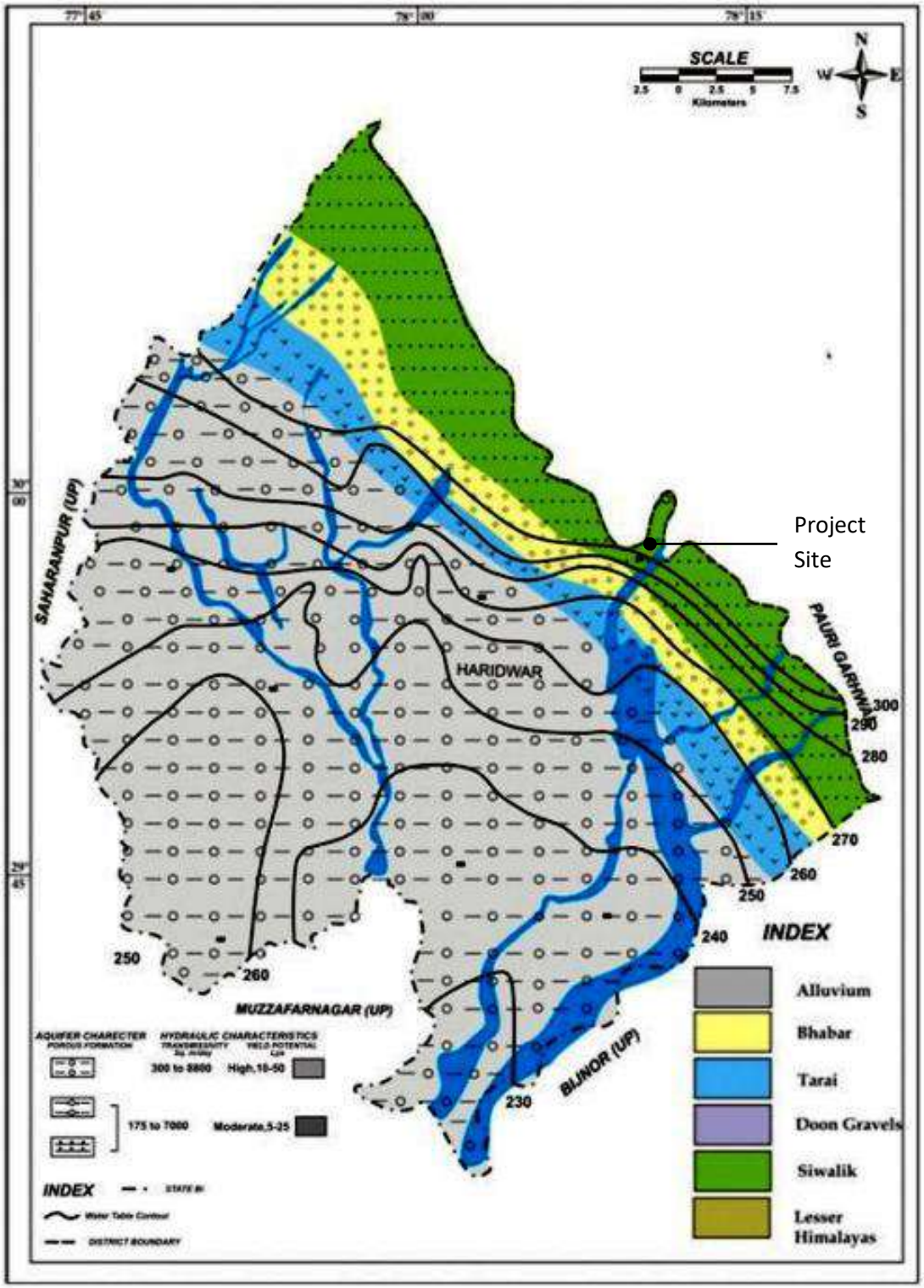
Haridwar district shows different hydrogeological conditions due to its variegated geological settings and topography.

- Shiwalik in extreme north where the ground water occurs in the form of spring and seepage.
- Bhbahr area just below the Shiwalik range having the boulder formation. Ground water in this zone is unconfined to semi-confined in nature. The hydraulic gradient or the water in the boulder formation is generally deep. The depth to water becomes comparatively shallower in the peripheral portion

- Tarai from a narrow belt along the northern margin of the Gangetic alluvium of newer quaternary age and older alluvium of middle to upper Pleistocene age and is separated by sporadic spring line.

The hydrogeological map of the district is given in **Figure 3.12.**

Figure 3.12: Hydrogeological Map of Haridwar District



Source: *CGWB*

The major part of the district is covered by drainage system of seasonal and perennial rivers causing different depth to water level in the area.

3.3.2 Water Resources

Haridwar district is rich in the water resources like ground water, surface water. The Groundwater is the main source of water for fulfilling the demands of irrigation, domestic and industrial purposes. Total water requirement of Haridwar district from agricultural side to industrial use has been estimated to be 1.798 BCM. This requirement has been further distributed as 0.073 (Domestic), 1.645 (Crop), 0.067 (Livestock) and 0.013 (Industrial). It clearly indicates that agricultural and related works are major sectors for water resource utilization.[2] The common generic water sources used for water supply schemes over the districts are:

i. Deep Tube-well,
ii. Shallow Tube-well,
iii. Treated surface water
iv. Other than this water supply schemes are operational through water from Infiltration well, Ponds, and open-well.
v. The total number of operational water schemes in Haridwar district harvesting natural water resources is noted to be 1272.
vi. Deep Tube-well(72.2%)followed by Shallow tubewell(24.8%)andTreated surface water(2.5%)are noted to be highly tapped for water schemes in Haridwar.
vii. The Khanpur block has the highest water dependency on Deep tube-well, approx.78% of total water supply schemes is dependent on Deep tube-well.
viii. No block in the Haridwar district is directly harvest Springs for water supply.

The major part of the Haridwar district shows shallow water levels in the range of 10-15mbgl. The northern part of the district occupie the shallowest water level in the range of 10-15m. While at southernpart of the District the water level found in the range of 0- 5mbgl. The deepest water level in the range of more than 15m occurs as patches in western part (Landhaura-Shikhar-Imlikhera – Iqbalpur- Imlikhera- Bhagwanpur areas) of the district[3].

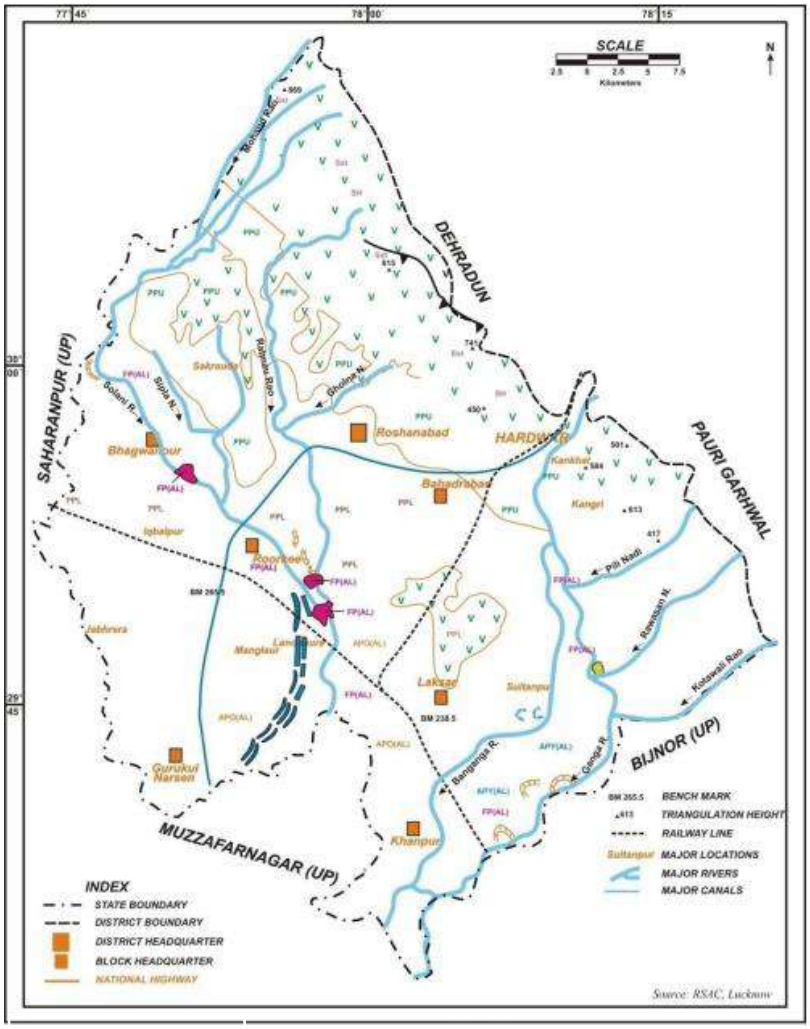
3.3.3 Drainage

River Ganges and Solani are the two perennial rivers which are flowing in the Haridwar district. River Ganga is the major drainage system of the area It enter the district boundary and flows southwardly draining the eastern part of the district. KotwaliRoa, Rasawan Nadi and Pili Nadi emerging from Siwalik Hills in the eastern part of the district are the tributary of River Ganga.

[2] CGWB
[3] GROUND WATER YEAR BOOK UTTARAKHAND(2019-2020)

The Solani River originates from Saharanpur. Sipla Nadi joins Solaniriver between Bhagwanpur and Roorkee. MohandRoa, ChillawalRoa, the seasonal tributaries meets Solani River at the northern part of the district. These rivers originate from Siwaliks at the northern end and passes through the Bhabar belt lying below the 21 foothills of Siwaliks. The other major tributaries of Solani River are Ratmau Rao and GholnaRao, Apart from these rivers other seasonal river/nalas also contributes the river Solani. Drainage map of the Haridwar district is given in **Figure 3.13.** The Drainage map of the 500 m from the project aligment and surrounding drainage system near to the project site is given below in **Figure.3.14.**

Figure 3.13: Drainage Map of the Haridwar District

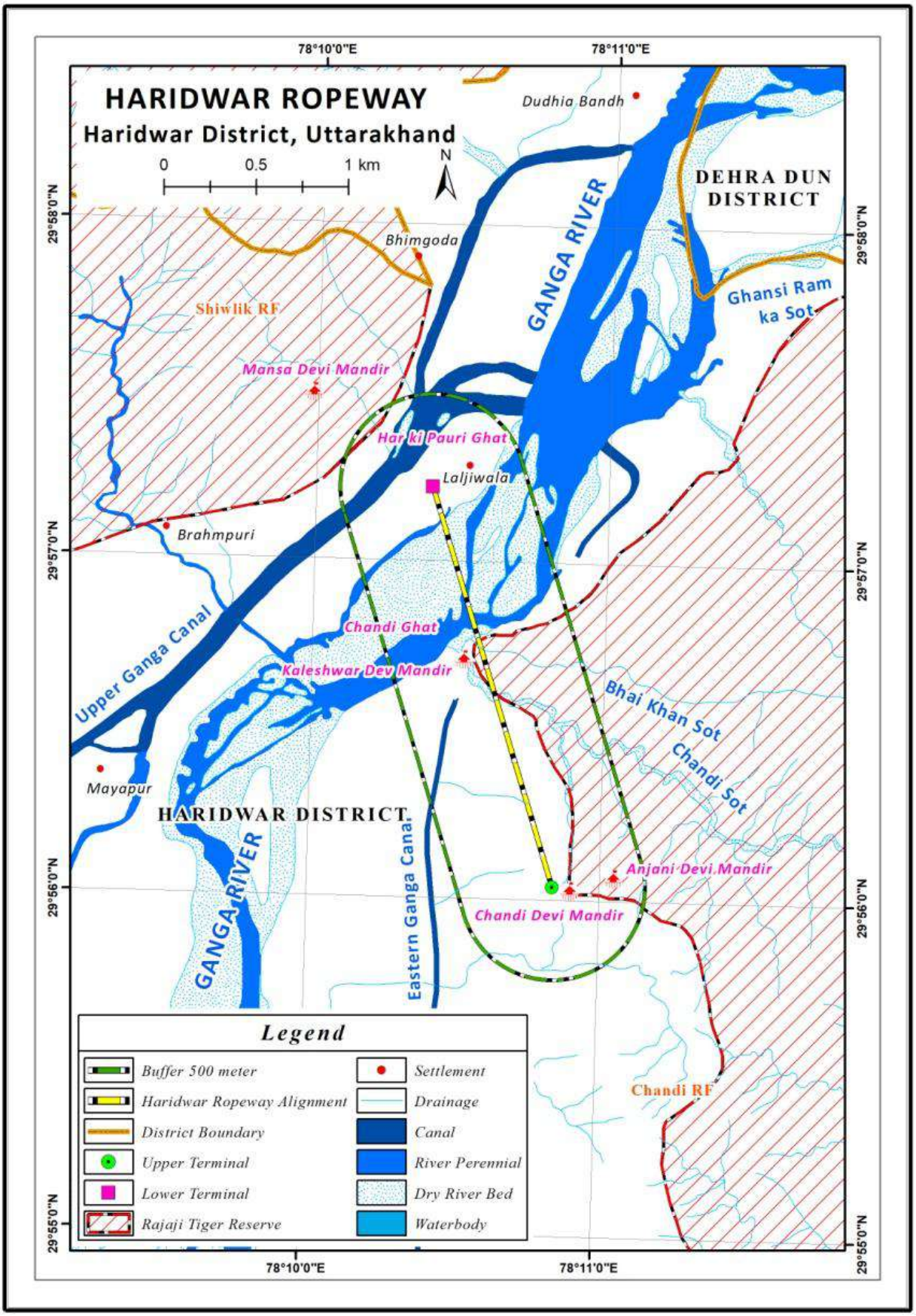


Source: CGWB

Drainage map of the study area of 15km radius is given below in **Figure 3.15.**The Drainage map of the study area was prepared using 1:50,000 Scale topographical sheet of survey of India and updated using the satellite images as of the present condition, the entire study area is covered under the open series topographical sheet number NH44G04(53J04), NH44G08(53J08), NH44M01(53K01), and NH44M05(53K05). The drainage was digitized using heads-up digitization technique using ArcGIS software. The drainage map shows that there are many streams and water bodies within the 15 km of the study area.

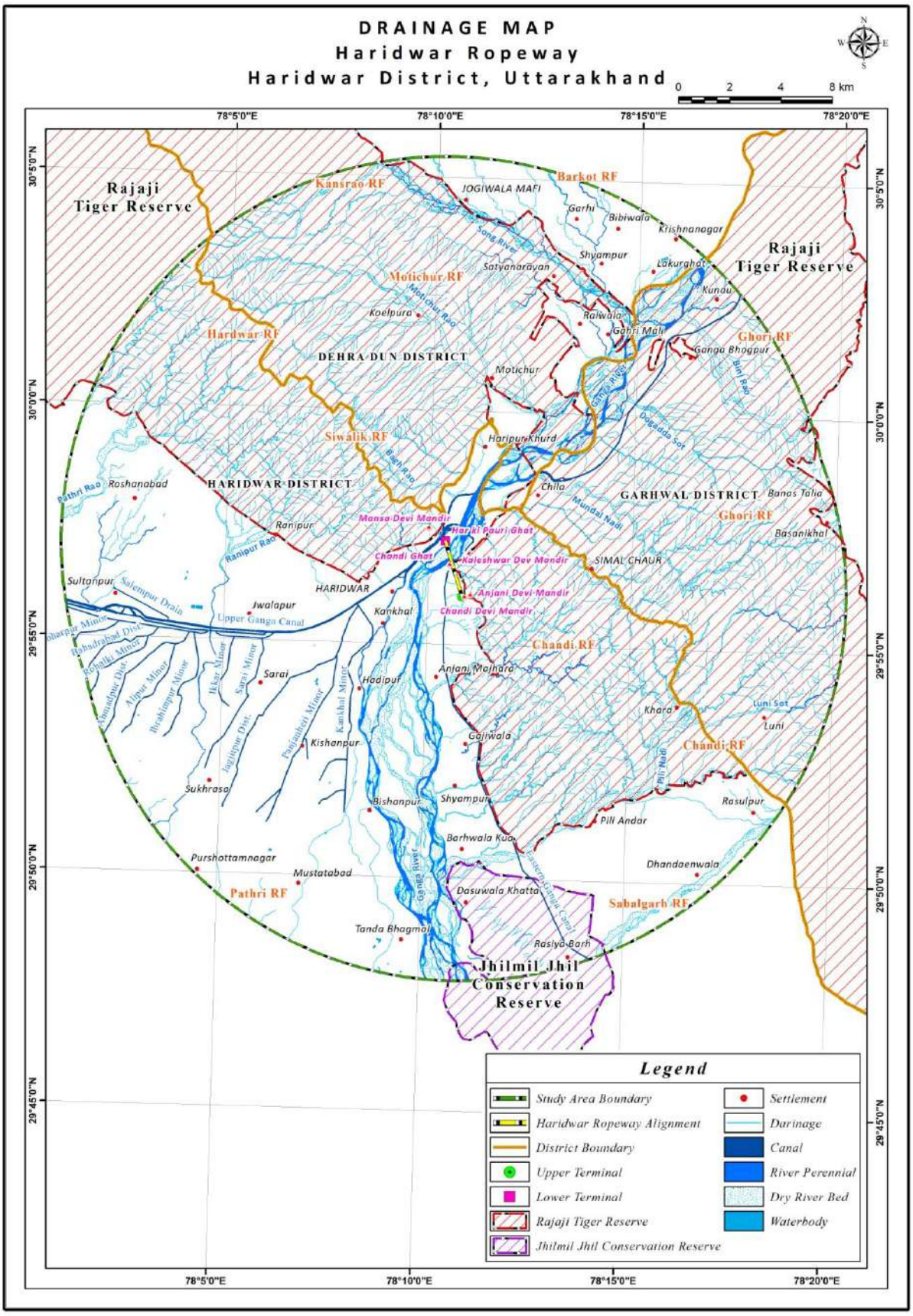
Ropeway Aligment from Tower 1 to Tower 5 is passing through the Dry river bed of the Ganga River as shown in the **Figure 3.14.** During the survey it was also observed that there is no water near Tower1 to Tower 4. Water from the river Ganga is diverted to Har ki pauri near the Bhimgodda Barrage. Near Tower 2, 3 and 4, water will only be available at the time of opening of the gates of Bhimgoda barrage which is generally opened during the high water flow. Even in the month of August, when the rainfall was at its peak in Haridwar and Ganga was also flowing at its peak, it was observed that the location of the Tower was still in the dry bed area.

Figure 3.14: Drainage Map Of The Core Area



Source: *RITES study*

Figure 3.15: Drainage Map of the Study Area



Source: *RITES study (using heads-up digitization technique & ArcGIS software)*

3.3.4 Flood

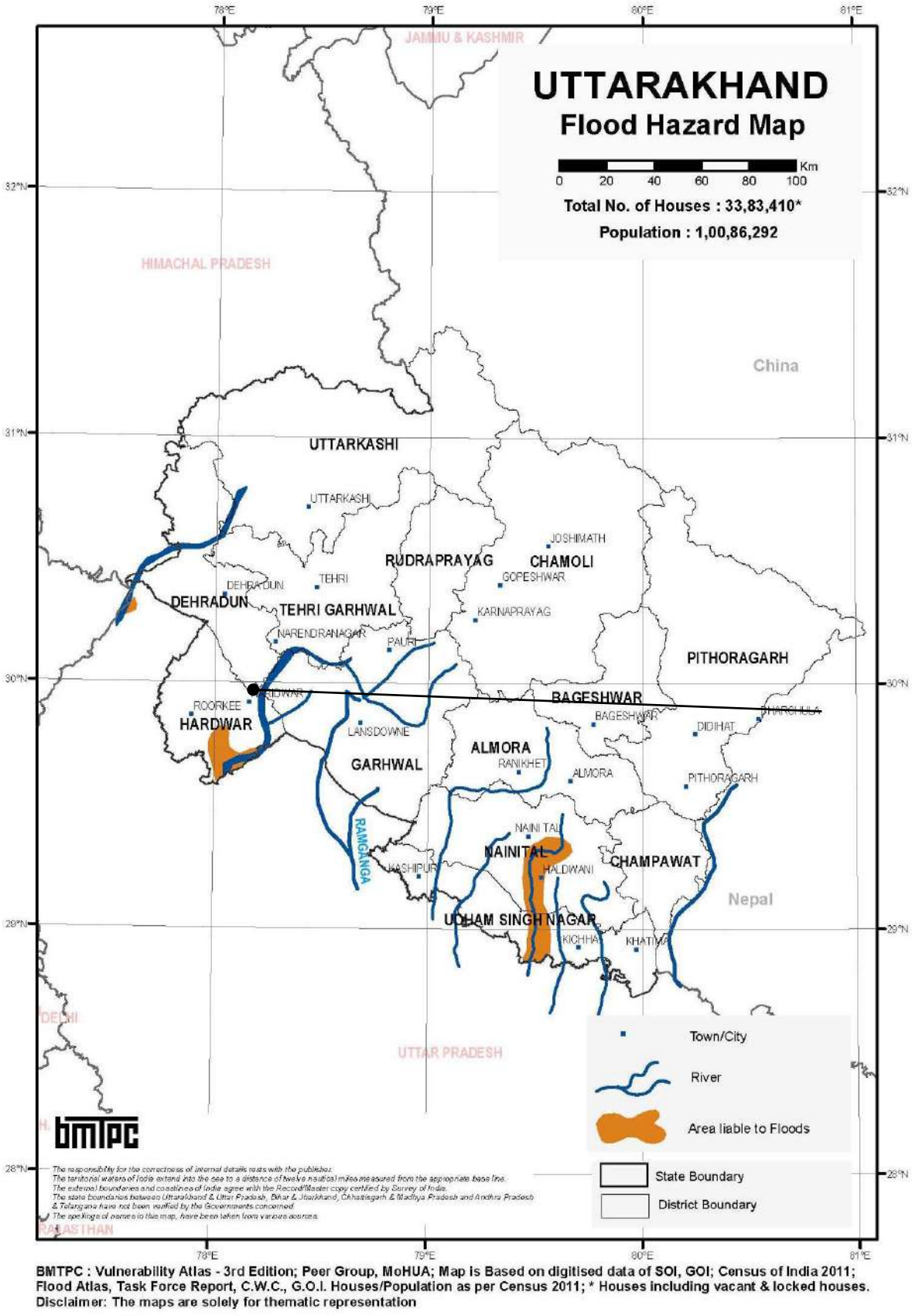
Uttarakhand state is prone to the flood. Three kinds of flooding is basically found in the Uttarakhand region i.e Fluvial floods, Flash floods, Pluvial floods. The hilly regions present higher exposure to destructive or deadly flash floods (deep and high velocity flows) in very localized zones of concentration. The agriculture sector is most exposed in Bagheswar, Tehri Garhwal, Pauri Garhwal and Uttarkashi with considerable variation within each district. Residential assets are exposed across all districts and especially in Dehradun and Pithoragarh. Transport infrastructure is most exposed to flash flood in the higher and steeper Himalayan region of Uttarkashi, Chamoli and Pithoragarh. Tourists and tourism revenues are predominantly exposed in the Upper Ganga River basin (Uttarkashi, Rudraprayag and Chamoli districts). Losses in the residential sector are again dominant in the districts of Haridwar and Dehradun most largely exposed to fluvial flooding. The major flash flood reported in the Uttarakhand State is given in **Table 3.9.**

Table 3.9: Major Flood Events in Uttarakhand

Year	Locations	Year	Locations
1989	Chamoli	2005	Rudraprayag
1991	Uttarkashi	2007	Pithorgarh
1994	Almora	2009	Chamoli, Pithorgarh
1997	Near Neelkanth, Haridwar	2010	Pauri, Rudrapur, Udham Singh Nagar, Khatima, Dehradun, Nainital, Chamoli, Pauri, Chapawat, Jawalpur Kasim Haridwar,
2001	Rudraprayag	2011	Dehradun, Bageshwar,
2003	Pithorgarh	2012	Uttarkashi
2004	Bageshwar	2013	Bageshwar, Chamoli, Pithorgarh, Rudraprayag, Uttarkashi

The Tehri Dam, optimally managed for flood control throughout the monsoon season, could additionally allow reducing peak flood probability by half in the downstream area of Rishikesh and Haridwar where tourism, agriculture, residential and population exposure are highest in the State. According to the Disataer Risk assessment carried out by the Uttarakhand Disaster Management Authority the flood risk in Haridwar is Moderate. The Higheset Flood level recorded in the Haridwar is 296.3m on 20th September 2010. Flood hazard map of the Haridwar district is given in **Figure 3.16**.

Figure 3.16: Flood Hazard Map of Haridwar District



BMTPC : Vulnerability Atlas - 3rd Edition; Peer Group, MoHUA; Map is Based on digitised data of SOI, GOI; Census of India 2011; Flood Atlas, Task Force Report, C.W.C., G.O.I. Houses/Population as per Census 2011; * Houses including vacant & locked houses.
Disclaimer: The maps are solely for thematic representation

Source: *Flood hazard atlas, 2020*

3.3.5 Water Quality

The term water quality is defined as "those physical, chemical and biological characteristics of water by which the user evaluates the acceptability of water. To understand the water quality of the study area 8 water samples are collected from the project site and its surroundings.

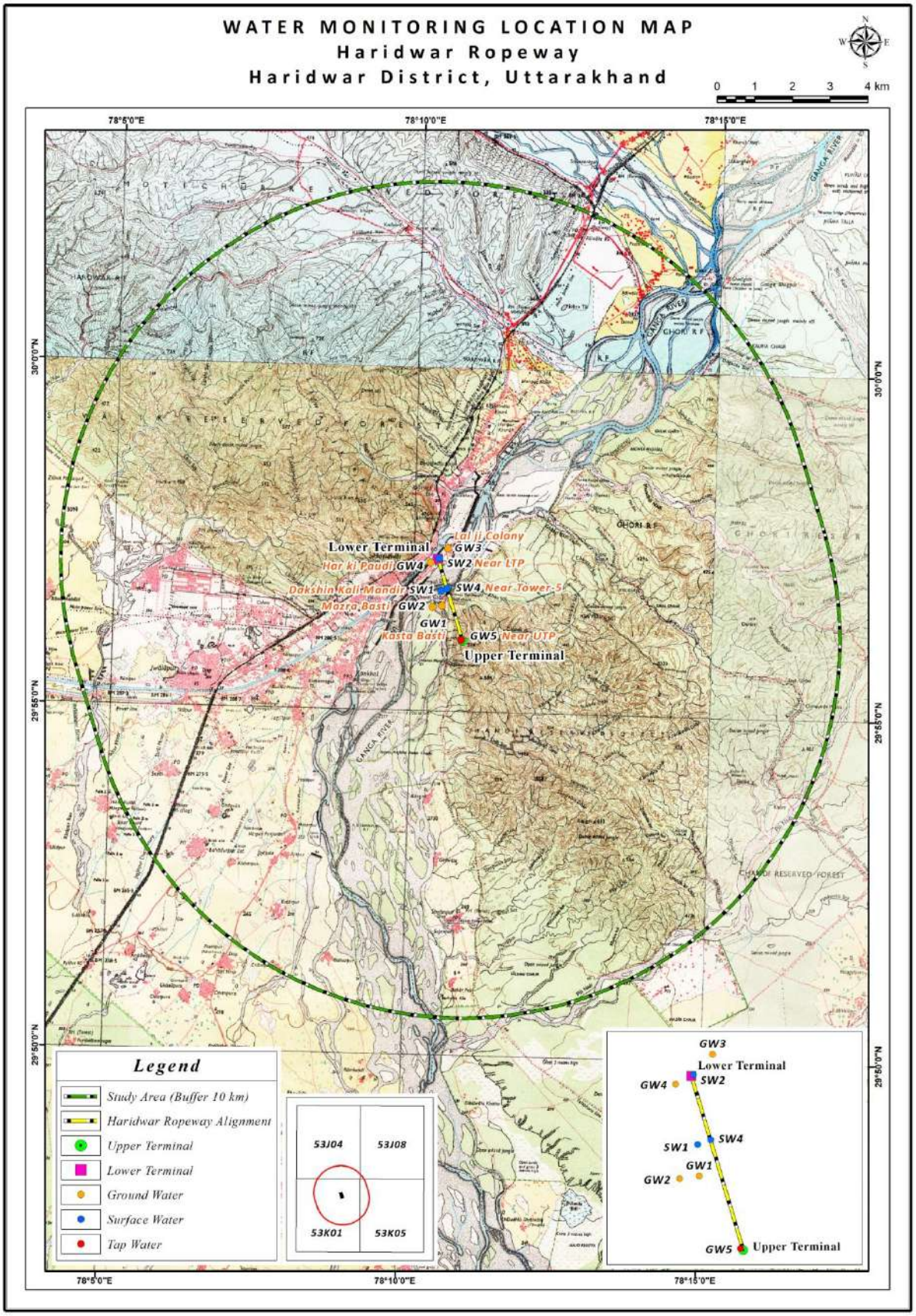
Methodology:

- In order to assess the existing water quality in the study area grab samples are collected from the ground and surface water. The detailed location of water sample collection is given in **Table 3.10** and shown in **Figure 3.17.**

Table 3.10: Water Sampling Location

Sample	Type Of Water	Description Of Location	Latitude And Longitude
GW1	Ground water	Kasta Basti	29°56'32.24"N, 78°10'28.76"E
GW2	Ground water	Mazra Basti	29°56'30.82"N, 78°10'19.58"E
GW3	Ground water	Lal ji Colony	29°57'22.34"N, 78°10'33.48"E
GW4	Ground water	Har ki Paudi	29°57'9.66"N, 78°10'16.43"E
GW5	Ground Water	Near UTP (Tap Water)	29°56'2.87"N, 78°10'49.10"E
SW1	Surface water	Ganga River Near Dakshin Kali Mandir	29°56'45.10"N, 78°10'27.60"E
SW2	Surface water	Ganga River Near LTP	29°57'13.73"N, 78°10'24.76"E
SW4	Surface water	Near Tower-5 (Spring Water)	29°56'47.24"N, 78°10'33.69"E

Figure 3.17: Water Monitoring Location Map



SW1- Near Dakshin Kali Mandir, SW2- Ganga River Near LTP, SW4- Near Tower-5GW1- Kasta Basti, GW2- Mazra Basti, GW3- Lal ji Colony, GW4- Har ki Paudi , GW5- Near the LTP Supply water

- Before sampling, the sampling containers are well sterilized. Glass bottles are cleaned with detergent to remove dust etc. then these containers are cleaned with chromic acid before thoroughly rinsed with distilled water. Plastic containers are generally cleaned by filling 1N HNO3/HCL followed by thorough rinsing with distilled/deionized water.

- Ground water samples are collected from the hand pump. Samples will be collected after running the hand pump for about 5 minutes. The sample bottle is rinsed with the same water. Sample details are recorded. For bacteriological samples the outlet of the pump is sterilized under flame by spirit lamp before collection of sample in container.

- The bottles are labeled directly with a water-proof marker. This will cover the
    - sample code number (identifying location)
    - date and time of sampling
    - source and type of sample
    - pre-treatment or preservation carried out on the sample
    - sampler's name
- The samples should be placed in an insulated ice box for transportation. These samples were analyzed for physical, chemical and biological constituents according to the IS: 3025 "Standard methods for the examination of water and wastewater" published by by American Public Health Association (APHA).

- Surface water collected from well-mixed section of the river (main stream) 30 cm below the water surface. For bacteriological samples the outlet of the pump is sterilized under flame by spirit lamp before collection of sample in container. DO is determined in a sample collected in a DO bottle. The DO in the sample was fixed immediately after collection, using chemical reagents. These samples are placed in an insulated ice box for testing. These samples are analysed for physical, chemical and biological constituents according to the IS: 3025 and "Standard methods for the examination of water & wastewater" published by American Public Health Association (APHA).

The results of water analysis are given in **Table 3.11** and **3.12** for ground water and surface water respectively. These results are compared with IS: 10500-2012 and Drinking Water Standards.

Table 3.11: Ground Water Quality At Project Site And Surroundings

S. No.	Test parameters	Unit	Results					Testing Method	Requirements As per IS: 10500-2012	
			GW1	GW2	GW3	GW4	GW5		Acceptable	Permissible
1	pH Value	-	7.33	7.38	7.42	7.46	7.35	IS 3025(P-11)-1983	6.5-8.5	No relaxation
2	Turbidity	NTU	<1.0	<1.0	<1.0	<1.0	<1.0	IS 3025(P-10)-1984	1	5 Max.
3	Total Dissolved	mg/l	232.0	248.0	257.0	268.0	314.0	IS 3025(P-16)1984	500	2000 Max.
4	Aluminium (as Al)	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-55)-2003	0.03.	0.2 Max.
5	Barium (as Ba)	mg/l	BDL	BDL	BDL	BDL	BDL	IS:15302-2003	0.7	No relaxation
6	Boron (as B)	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-57)-2005	0.5	2.4 Max.
7	Calcium (as Ca)	mg/l	26.0	29.0	24.0	23.0	34.0	IS 3025(P-40)-1991	75	200 Max.
8	Chlorides (as Cl)	mg/l	19.0	21.0	23.0	20.5	24.0	IS 3025(P-32)-1988	250	1000 Max.
9	Copper (as Cu)	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-42)-1992	0.05	1.5
10	Fluoride (as F)	mg/l	0.15	0.17	0.14	0.14	0.18	IS 3025(P-60)-1984	1	1.5
11	Residual free	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-26)-1986	0.2	1.0
12	Iron (as Fe)	mg/l	0.12	0.14	0.13	0.13	0.15	IS 3025(P-53)-2003	1.0	No relaxation
13	Magnesium (as Mg)	mg/l	12.6	12.6	18.2	20.4	25.0	IS 3025(P-46)-1994	30	100
14	Manganese (as Mn)	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-59)-2006	0.1	0.3
15	Phenolic Compound	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-43)-1992	0.001	0.002
16	Selenium(as Se)	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-56)-2003	0.01	No relaxation
17	Silver (as Ag)	mg/l	BDL	BDL	BDL	BDL	BDL	Annex J of IS 13428-2005	0.1	No relaxation
18	Sulphate (as SO4)	mg/l	12.6	14.4	15.6	18.6	14.6	IS 3025(P-24)-1986	200	400
19	Sulphide (as H2S)	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-29)-1986	0.05	No relaxation
20	Total Alkalinity (as	mg/l	89.0	93.0	97.0	110.0	154.0	IS 3025(P-23)-1986	200	600
21	Total Hardness (as CaCO3)	mg/l	117.0	124.0	133.0	142.0	188.0	IS 3025(P-21)-2009	200	600

S. No.	Test parameters	Unit	Results					Testing Method	Requirements As per IS: 10500-2012	
			GW1	GW2	GW3	GW4	GW5		Acceptable	Permissible
22	Zinc (as Zn)	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-49)-1994	5	15
23	Cadmium (as Cd)	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-41)-1992	0.003	No relaxation
24	Cyanide (as CN)	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-27)-1986	0.05	No relaxation
25	Lead (as Pb)	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-47)-1994	0.01	No relaxation
26	Mercury (as Hg)	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-48)-1994	0.001	No relaxation
27	Nickel (as Ni)	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-54)-2003	0.02	No relaxation
28	Total Arsenic (as As)	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-37)-1988	0.01	No relaxation
29	Total Chromium (as	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-52)-2003	0.05	No relaxation
30	Chromium (as Cr+6)	mg/l	BDL	BDL	BDL	BDL	BDL	IS 3025(P-52)-2003	-	-
31	Vanadium (as V)	mg/l	BDL	BDL	BDL	BDL	BDL	APHA 23rd Ed.	-	-
32	Temperature	0C	23.2	23.7	23.8	24.2	23.2	IS 3025(P-9)-1984	-	-
33	Conductivity at 25ºC	µmhos/cm	429	460	478.0	496	581	IS 3025(P-14)-1984	-	-
34	Total Suspended Solids	mg/l	<1.0	<1.0	<1.0	<1.0	<1.0	IS 3025(P-17)-1984	-	-
35	Oil & Grease	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	IS 3025(P-39)-1991	-	-
36	Biochemical Oxygen	mg/l	<2.0	<2.0	<2.0	<2.0	7.2	IS 3025(P-44)-1993	-	-
37	Chemical Oxygen	mg/l	<8.0	<8.0	<8.0	<8.0	<2.0	IS 3025(P-58)-2006	-	-
38	Total Phosphate (as	mg/l	<0.1	<0.1	<0.1	<0.1	<8.0	IS 3025(P-31)-1988	-	-
39	Total Kjeldahl	mg/l	<1.0	<1.0	<1.0	<1.0	<0.1	IS 3025(P-34)-1988	-	-
40	Ammonical	mg/l	<1.0	<1.0	<1.0	<1.0	<1.0	IS 3025(P-34)-1988	-	-
41	Sodium (a Na)	mg/l	17.8	18.6	16.5	20.2	<1.0	IS 3025(P-45)-1993	-	-
42	Potassium (as K)	mg/l	1.33	1.42	1.12	1.06	19.4	IS 3025(P-45)-1993	-	-

S. No.	Test parameters	Unit	Results					Testing Method	Requirements As per IS: 10500-2012	
			GW1	GW2	GW3	GW4	GW5		Acceptable	Permissible
43	Nitrate (as N)	mg/l	1.2	1.5	1.7	2.2	1.87	IS 3025(P-34)-1988	-	-
44	Nitrite (as NO2)	mg/l	<0.5	<0.5	<0.5	<0.5	2.04	IS 3025(P-34)-1988	-	-
45	Total Nitrogen (as N)	mg/l	<5.0	<5.0	<5.0	<5.0	<5.0	IS 3025(P-34)-1988	-	-
46	Total Coliform	per 100ml	Absent	Absent	Absent	Absent	<2.0	IS:1622-1981	Shall not	Shall not
47	Faecal Coliform	per 100ml	Absent	Absent	Absent	Absent	<2.0	IS:1622-1981	-	-

GW1- Kasta Basti, GW2- Mazra Basti, GW3- Lal ji Colony, GW4- Har ki Paudi , GW5- Near the LTP Supply water

Source: *Field study by NABL accredited Lab* – Arihant Analytical Laboratory Pvt Ltd. *Certificate No. (TC-5826*)

Within the acceptable limits

Table 3.12: Surface Water Quality At Project Site And Surroundings

S. No.	Test parameters	Unit	Results			Testing Method	Tolerance Limit as Per IS 2296-1982 ()				
			SW1	SW2	SW4		Class A	Class B	Class C	Class D	Class E
1	pH Value	-	7.31	7.34	7.28	IS 3025(P-11)-1983	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
2	Turbidity	NTU	4.5	5.3	2.5	IS 3025(P-10)-1984	-	-	-	-	-
3	Total Dissolved Solids	mg/l	98.0	122.0	302.0	IS 3025(P-16)1984	500	-	1500	-	2100
4	Aluminium (as Al)	mg/l	BDL	BDL	BDL	IS 3025(P-55)-2003	-	-	-	-	-
5	Barium (as Ba)	mg/l	BDL	BDL	BDL	IS:15302-2003	-	-	-	-	-
6	Boron (as B)	mg/l	BDL	BDL	BDL	IS 3025(P-57)-2005	-	-	-	-	2
7	Calcium (as Ca)	mg/l	6.0	8.0	32.0	IS 3025(P-40)-1991	80	-	-	-	-
8	Chlorides (as Cl)	mg/l	13.0	15.0	23.0	IS 3025(P-32)-1988	250	-	600	-	600
9	Copper (as Cu)	mg/l	BDL	BDL	BDL	IS 3025(P-42)-1992	1.5	-	1.5	-	-
10	Fluoride (as F)	mg/l	0.12	0.15	<0.1	IS 3025(P-60)-1984	1.5	1.5	1.5	-	-

S. No.	Test parameters	Unit	Results			Testing Method	Tolerance Limit as Per IS 2296-1982 ()				
			SW1	SW2	SW4		Class A	Class B	Class C	Class D	Class E
11	Residual free chlorine	mg/l	BDL	BDL	BDL	IS 3025(P-26)-1986	-	-	-	-	-
12	Iron (as Fe)	mg/l	0.10	0.13	<0.1	IS 3025(P-53)-2003	0.3	-	50	-	-
13	Magnesium (as Mg)	mg/l	5.5	5.8	20.3	IS 3025(P-46)-1994	24	-	-	-	-
14	Manganese (as Mn)	mg/l	BDL	BDL	BDL	IS 3025(P-59)-2006	0.5	-	-	-	-
15	Phenolic Compound	mg/l	BDL	BDL	BDL	IS 3025(P-43)-1992	0.002	0.005	0.005	-	-
16	Selenium(as Se)	mg/l	BDL	BDL	BDL	IS 3025(P-56)-2003	0.01	-	0.05	-	-
17	Silver (as Ag)	mg/l	BDL	BDL	BDL	Annex J of IS	-	-	-	-	-
18	Sulphate (as SO_4)	mg/l	6.70	9.4	12.5	IS 3025(P-24)-1986	400	-	400	-	1000
19	Sulphide (as H_2S)	mg/l	BDL	BDL	BDL	IS 3025(P-29)-1986	-	-	-	-	-
20	Total Alkalinity (as	mg/l	32.0	37.0	112.0	IS 3025(P-23)-1986	-	-	-	-	-
21	Total Hardness (as	mg/l	38.0	44.0	164.0	IS 3025(P-21)-2009	300	-	-	-	-
22	Zinc (as Zn)	mg/l	BDL	BDL	BDL	IS 3025(P-49)-1994	15	-	15	-	-
23	Cadmium (as Cd)	mg/l	BDL	BDL	BDL	IS 3025(P-41)-1992	0.01	-	0.01	-	-
24	Cyanide (as CN)	mg/l	BDL	BDL	BDL	IS 3025(P-27)-1986	-	-	-	-	-
25	Lead (as Pb)	mg/l	BDL	BDL	BDL	IS 3025(P-47)-1994	0.1	-	0.1	-	-
26	Mercury (as Hg)	mg/l	BDL	BDL	BDL	IS 3025(P-48)-1994	0.001	-	-	-	-
27	Nickel (as Ni)	mg/l	BDL	BDL	BDL	IS 3025(P-54)-2003	-	-	-	-	-
28	Total Arsenic (as As)	mg/l	BDL	BDL	BDL	IS 3025(P-37)-1988	0.05	0.2	0.2	-	-
29	Total Chromium (as	mg/l	BDL	BDL	BDL	IS 3025(P-52)-2003	-	-	-	-	-
30	Chromium (as Cr^{+6})	mg/l	BDL	BDL	BDL	IS 3025(P-52)-2003	0.05	0.05	0.05	-	-
31	Vanadium (as V)	mg/l	BDL	BDL	BDL	APHA 23rd Ed.	-	-	-	-	-
32	Temperature	^{0}C	26.4	26.7	25.4	IS 3025(P-9)-1984	-	-	-	-	-
33	Conductivity at 25ºC	µmhos/cm	184	224	530	IS 3025(P-14)-1984	-	-	-	1000	2250

S. No.	Test parameters	Unit	Results			Testing Method	Tolerance Limit as Per IS 2296-1982 ()				
			SW1	SW2	SW4		Class A	Class B	Class C	Class D	Class E
34	Total Suspended	mg/l	13.6	16.4	4.4	IS 3025(P-17)-1984	-	-	-	-	-
35	Oil & Grease	mg/l	<0.1	<0.1	<0.1	IS 3025(P-39)-1991	-	-	-	-	-
36	Dissolved Oxygen	mg/l	6.2	6.1	6.8	IS 3025 (P-38)-	6	5	4	4	-
37	Biochemical Oxygen	mg/l	2.4	2.6	<2.0	IS 3025(P-44)-1993	2	3	3	-	-
38	Chemical Oxygen	mg/l	15.6	17.4	8.4	IS 3025(P-58)-2006	-	-	-	-	-
39	Total Phosphate (as	mg/l	<0.1	<0.1	<0.1	IS 3025(P-31)-1988	-	-	-	-	-
40	Total Kjeldahl	mg/l	<1.0	<1.0	<1.0	IS 3025(P-34)-1988	-	-	-	-	-
41	Ammonical Nitrogen	mg/l	<1.0	<1.0	<1.0	IS 3025(P-34)-1988	-	-	-	1.2	-
42	Sodium (a Na)	mg/l	14.4	16.7	22.6	IS 3025(P-45)-1993	-	-	-	-	-
43	Potassium (as K)	mg/l	2.62	3.76	4.20	IS 3025(P-45)-1993	-	-	-	-	-
44	Nitrate (as N)	mg/l	2.4	2.7	<1.0	IS 3025(P-34)-1988	20	-	50	-	-
45	Nitrite (as NO_2)	mg/l	<0.5	<0.5	<0.5	IS 3025(P-34)-1988	-	-	-	-	-
46	Total Nitrogen (as N)	mg/l	<5.0	<5.0	<5.0	IS 3025(P-34)-1988	-	-	-	-	-
47	Total Coliform	MPN/100ml	110	140	33	IS:1622-1981	50	500	5000	-	-
48	Faecal Coliform	MPN/100ml	60	80	14	IS:1622-1981	-	-	-	-	-

SW1- Near Dakshin Kali Mandir, SW2- Ganga River Near LTP, SW4- Near Tower-5

Source: *Field study by NABL accredited Lab* – Arihant Analytical Laboratory Pvt Ltd. *Certificate No. (TC-5826)*

Classes of water use:-

Class-A: Drinking water source without conventional treatment but after disinfection
Class-B: Outdoor bathing (organized)
Class-C: Drinking water source with conventional treatment followed by disinfection
Class-D: Propagation of wild life, fisheries.
Class-E: Irrigation, industrial cooling, controlled waste disposal

Ground water quality of the area is compared with the drinking water standard 10,500-2012. All parameter physical parameter, Parameters concerning substances undesirable in excessive amounts, biological parameters are within the acceptable limits. Ground water quality of the Region is good enough for the purpose of drinking without any treatment.

Surface water quality is compared with the CPCB water quality standards to check the use based classification of surface waters. The analysed surface water of the Ganga River and its tributary lies in the class "B" it can be use for the purpose of Outdoor Bathing.

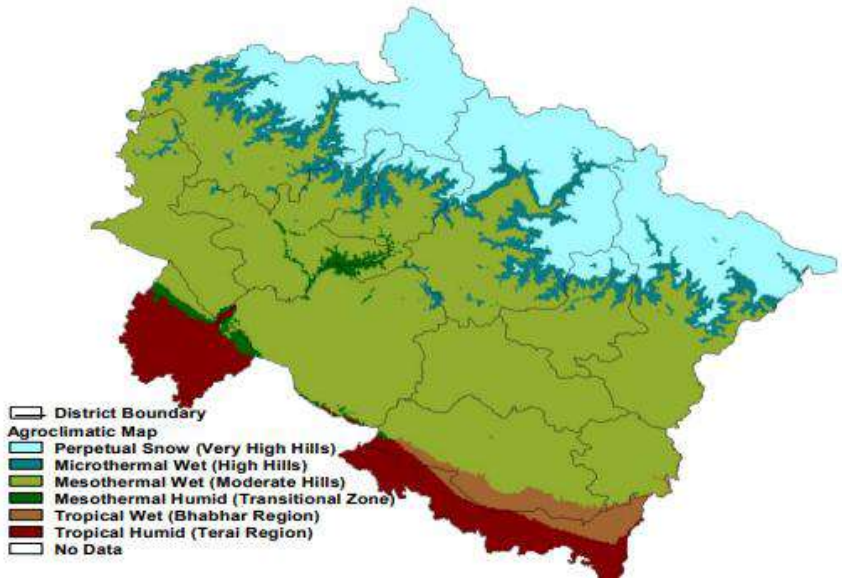
3.4 METEOROLOGY AND AIR ENVIRONMENT

Meteorology is an important parameter in Environmental Impact Assessment. All air pollutants emitted by point and non-point sources are transported, dispersed or concentrated. The dispersion and deposition are dependent on meteorological and topographical conditions of the area. The main parameters of meteorology are: Wind Speed, Wind Direction, Temperature, Relative humidity, rainfall, cloud cover. To assess the impact on existing ambient environment due to the project, it is necessary to have baseline status of ambient environmental parameters.

3.4.1 Climate

The climate of the district is hot sub-humid (dry) climate. It covers northern Indo-Gangetic Plain, including Piedmont Plain of the Western Himalayas. Also experiences moderate subtropical to humid climate with three distinct season's viz. summer followed by rainy and winter seasons. The temperature begins to rise from March (27.6^0C) and reaches to its maximum at during May (37.2^0C) with the commencement of monsoon season by the mid of June and the temperature begins to lower by the end of June. During the winter season in the month of December to February the temperature ranges between 24.7^0Cto $17.7\ ^0$C.

Figure 3.18: Climate Zone map of Uttarakhand



Source: Uttarakhand Action Plan for Climate Change

3.4.2 Rainfall

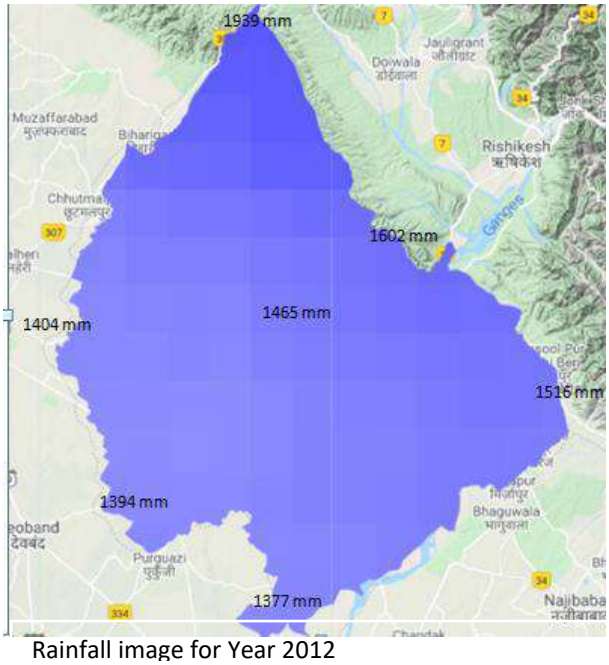
The Uttarakhand region receives rainfall mainly due to low pressure areas and monsoon depressions originating in the Bay of Bengal during the southwest monsoon season. During the monsoon season most of the depressions originating in the Bay of Bengal cross inland and move north westwards or westwards over the state, some of them reach near the hilly districts. The total annual rainfall for the state as a whole is about 133 cm and total annual number of rainy days are about 63. The precipitation in the state occurs in the form of rain and snow. The rainfall in the state varies from place to place due to its rugged topography.

The Rainfall data of the Haridwar District for the periods 2012-2021 is given in **Table 3.13.** The rainfall data of the district was analysed by using the Climate Hazards Group InfraRed Precipitation with Station data (CHRIPS) [4]dataset for a period of 2012 to 2021. In last 10 Years maximum rainfall was occurred during the year 2012.

Table 3.13: Rainfall in (mm)

Year	Maximum Rainfall	Minimum Rainfall	Average Rainfall
2021	653.05	1,019.14	832.48
2020	1,094.7	1,755.4	1,390.79
2019	1,073.05	1,603.6	1,328.3
2018	1,579.5	2,261.9	1,873.27
2017	1,269.2	1,820.9	1,545.23
2016	912.95	1,364.8	1,160.57
2015	1,116.7	1,792.7	1,435.69
2014	849.20	1,434.8	1,140.90
2013	1,406.4	2,141.6	1,756.52
2012	1,953.3	1,333.7	1,530.265

Source: *RITES study using the Chrips Dataset*



Rainfall image for Year 2012

It is seen that the rainfall generally increases in the valley regions towards the hills and decreases beyond the highest range (leeward side).

3.4.3 Temperature

The temperature begins to rise from March (27.6 ˚C) and reaches to its maximum at during May (37.2˚C) with the commencement of monsoon season by the mid of June and the temperature begins to lower by the end of June. During the winter season in the month of December to February the temperature ranges between 24.7˚C to 17.7˚C.

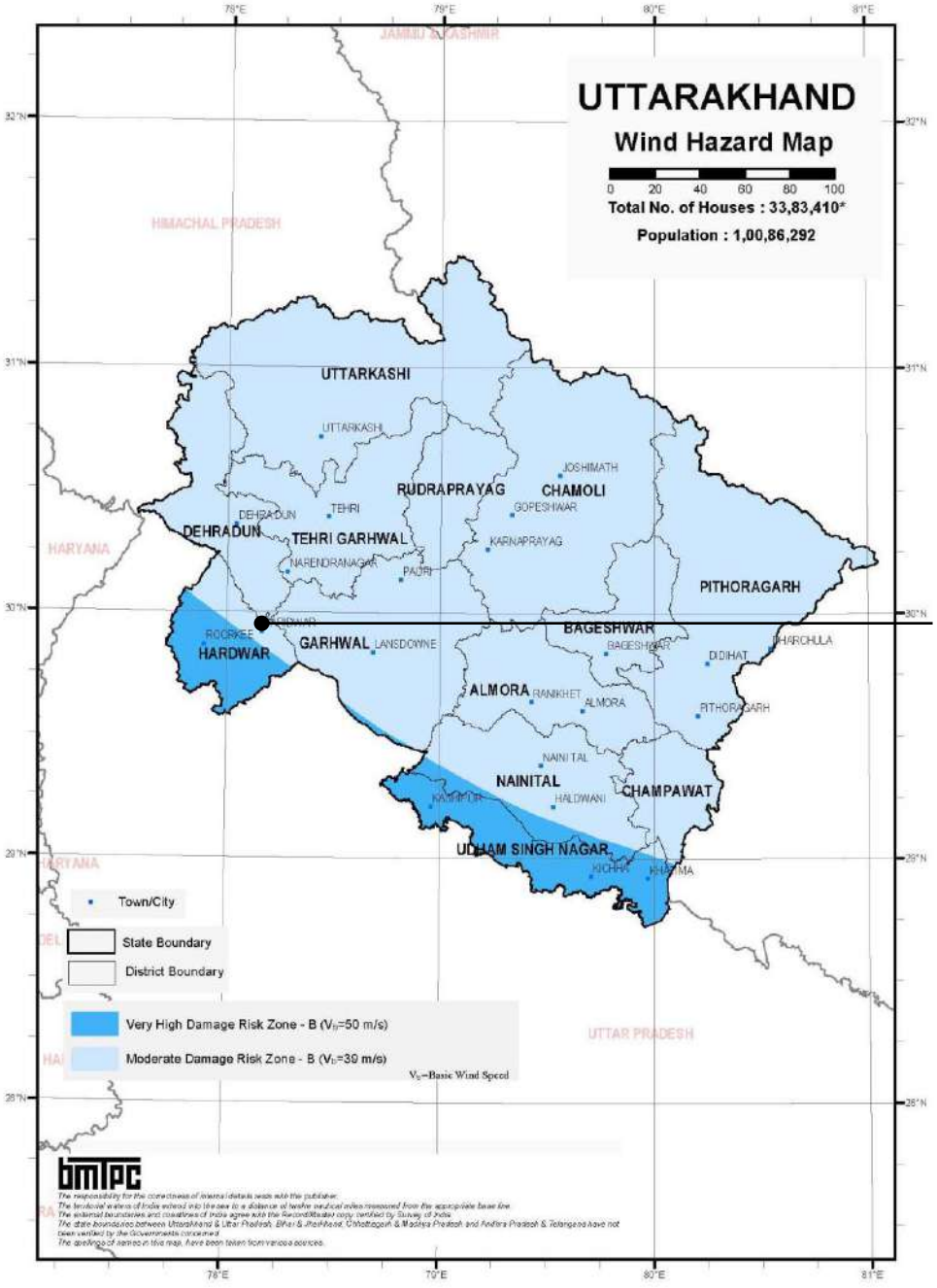
4

Funk, Chris, Pete Peterson, Martin Landsfeld, Diego Pedreros, James Verdin, Shraddhanand Shukla, Gregory Husak, James Rowland, Laura Harrison, Andrew Hoell & Joel Michaelsen. "The climate hazards infrared precipitation with stations—a new environmental record for monitoring extremes". Scientific Data 2, 150066. doi:10.1038/sdata.2015.66 2015.

3.4.4 Wind Speed

The macro-level wind speed zones of India have been formulated and published in IS: 875 (Part 3) - 1987 titled "Indian Standard Code of Practice for Design Loads (other than earthquakes) for Buildings and Structures, Part 3, Wind Loads". There are six basic wind speeds 'Vb' considered for zoning, namely 55, 50, 47, 44, 39 and 33 m/s. According to the macro level wind speed zone of India (IS: 875) Haridwar district comes under the Very High (50m/s) to Moderate damage risk zone (39m/s). *The project site lies at the Northern site of the District. It's come under the very high damage Risk Zone.* Hazard map of the Uttarakhand district showing the wind speed in Haridwar region is given in **Figure 3.19.** The onsite maximum wind speed was observed 8.5 m/s during the month of May and July.

Figure 3.19: Wind Speed of the Uttarakhand

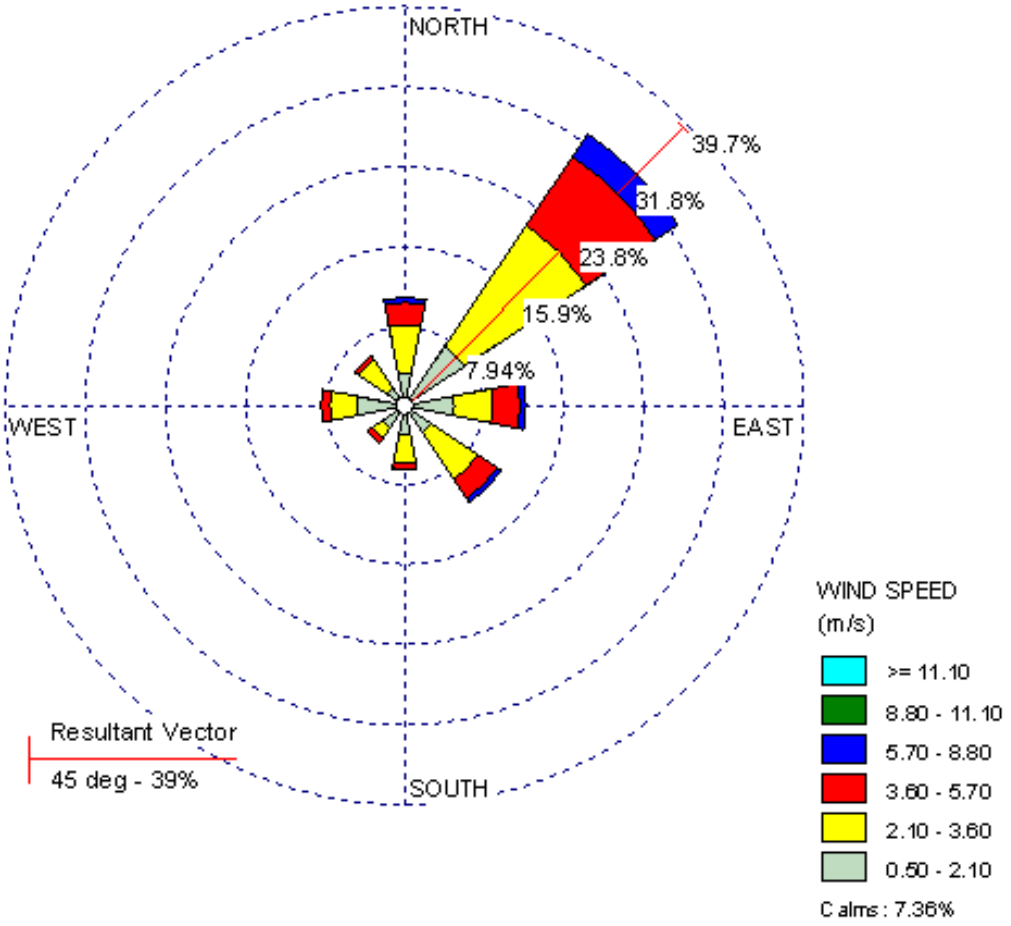


***Source*:** BMTPC

3.4.5 Wind Direction & Wind rose

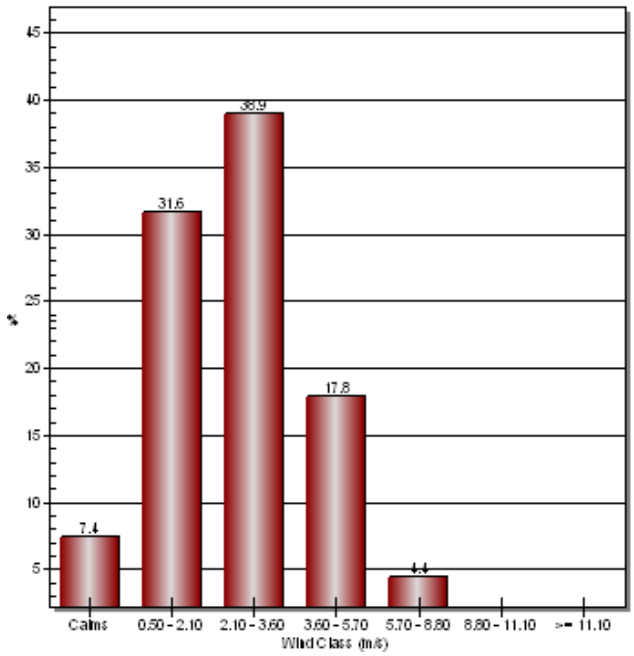
Wind direction is reported as the direction from which the wind blows and is based on surface observations. Over the course of a year, wind usually blows in all directions with varying frequencies. Certain direction, which occurs more frequently than others, is known as the prevailing wind direction. Wind speed and direction and their frequency during pre-monsoon season are represented by wind rose diagram. The wind rose denotes a class of diagrams designed to display the distribution of wind direction experienced at a given location over a period of time — long for a climatological record of prevailing winds or short to show wind character for a particular event or purpose. Wind rose summarizes a considerable amount of wind frequency information into a single graphic and shown in **Figure 3.20** below during the study period.

Figure 3.20: Wind Rose



The wind rose diagram reveals that wind was blowing predominantly from Northeast direction with frequency of approximately 33% respectively with speed in the range of 0.5-8.5 ms-1 during the monitoring period. The onsite average wind speed was observed 2.53 ms-1 with frequency of calm winds 7.36% during the study period. Wind class frequency distribution observed during the monitoring period is presented graphically as shown in **Figure 3.21** below.

Figure 3.21: Wind Class Frequency Distriburtion



3.4.6 On Site Meterological Condition

To understand the meterological conditions of the project site meterological data was collected during the study period (19th April to 19th July 2021). An auto weather monitoring station is installed during the study period to record various meteorological parameters on hourly basis to understand the wind speed & direction, temperature variation, rainfall and relative humidity at 1-hour interval. The monthly meterological data recorded are given below in **Table 3.14.**

Table 3.14: Onsite Meterological Data

Month	W. SPEED (m/s)			W. DIRECTION (Degrees)			TEMP (Kelvin)			R HUMIDITY (%)			RAINFALL Mm/hr			ATM. PRESSURE (mb)		
	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean
April	6.5	0.9	3.6	357.6	4.6	70.7	306.0	293.4	299.0	76.0	17.0	43.0	0.0	0.0	0.0	970.0	957.0	964.8
May	8.5	0.0	2.7	359.7	0.0	85.9	309.9	293.0	300.7	94.0	23.0	61.9	0.0	0.0	0.0	969.0	955.0	963.7
June	7.5	0.0	2.2	359.1	0.0	161.7	317.0	296.2	306.7	86.0	10.0	37.9	10.6	0.0	0.1	969.0	955.0	964.1
July	8.5	0.0	2.3	359.7	0.0	115.9	311.8	293.0	302.1	76.0	10.0	34.6	6.4	0.0	0.4	967.0	955.0	962.6

Source: *Field study by NABL accredited Lab* – Arihant Analytical Laboratory Pvt Ltd. *Certificate No. (TC-5826*)

3.4.7 Atmospheric Stability

A measure of the tendency of air to move upward or downward within the atmosphere generates turbulence. The atmosphere may be more or less turbulent at any given time, depending on the amount of incoming solar radiation as well as other factors. There are six defined Pasquill atmospheric stability classes, from A to F, each representing a different degree of turbulence in the atmosphere. When moderate to strong incoming solar radiation heats air near the ground, causing it to rise and generating large eddies, the atmosphere is

and C. In this stability class air has strong tendency to move up or down, and the atmosphere is more turbulent. When solar radiation is relatively weak or absent, air near the surface has reduced tendency to rise and less turbulence develops. In this case, the atmosphere is considered stable, the wind is weak, and the stability class would be E or F. Stability classes D represents conditions of neutral stability (moderately turbulent). Neutral conditions are associated with relatively strong wind speeds and moderate solar radiation. The frequency of stability classes during the study period is provided in **Table 3.15.**

Table 3.15: Frequency Of Stability Class

Stability Class	Frequency (%)
A – Extremely Unstable	17.4
B – Unstable	20.3
C – Slightly Unstable	9.3
D – Neutral	4.8
E – Slightly Stable	13.8
F – Stable	34.4

This data indicates that over the monitoring period, the site exhibits trends of stable atmospheric conditions with 34.4% time during monitoring period. Stable conditions exhibit poor vertical mixing, and low levels of contaminant dispersion. Use of this stability data for modeling purposes will produce higher concentrations of pollutants at a given receptor (i.e. more conservative results).

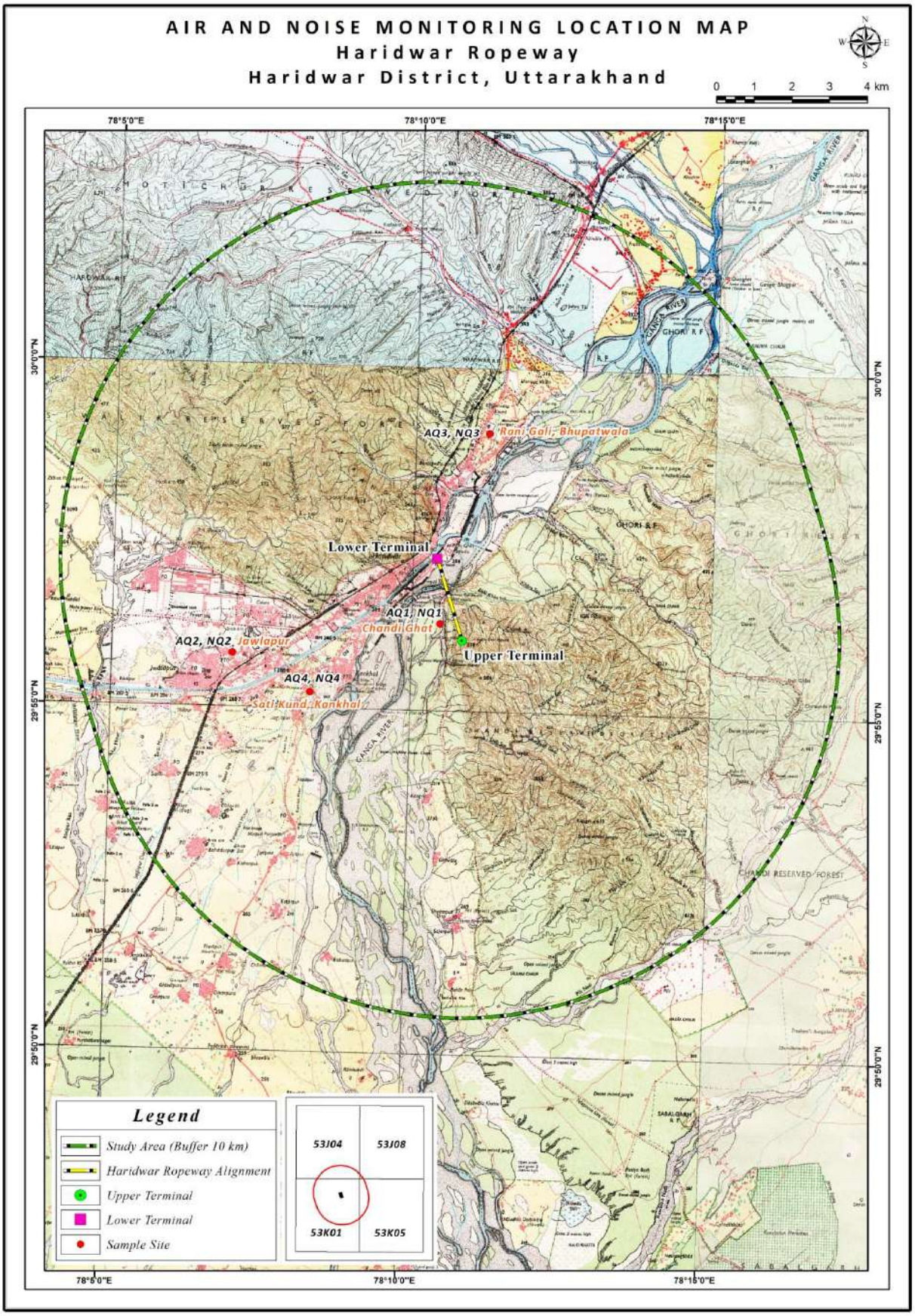
3.4.8 Mixing Height

Mixing Height (MH) is the vertical extent through which the contaminant plume can be mixed. Forecasting of mixing height is done with the aid of the vertical temperature profile. The MH is a function of stability. In unstable air the MH is higher and in stable air the MH is lower. With a lower MH, there is a smaller volume of air in which the pollutant can be dispersed, resulting in higher concentrations in the ambient environment. There is a seasonal variation of MH. During summer daylight hours, MH can be few thousand feet whereas for winter it can be a few hundred feet. It varies also in the course of a day. It is lowest at night and increases during the day. Secondary information has been used to determine the mixing height over the study region for the study period (Apr-July) and it varies from 50-2500 meter (IMD).

3.4.9 Ambient Air Quality

To assess the ambient air quality of the project site and surroundings the monitoring stations are selected on the basis of topography and meterology of the area. Four monitoring stations are selected. Locations of the monitoring stations are given in **Table 3.16** and shown in **Figure 3.22.** Five parameters ($PM_{2.5}$, PM_{10}, CO, SO_2 and NO_2) are selected and monitoring was carried out for 2 days in a week for 3 months.

Figure 3.22: Air And Noise Monitoring Map



AQ1, NQ1- Chandi Ghat AQ2, NQ2- Jawlapur AQ3, NQ3- Rani Gali, Bhupatwala AQ4, NQ4- Sati Kund, Kankhal

Table 3.16: Ambient Air and Noise Quality Monitoring Stations

Sample	Station Name	Latitude and Longitude
AQ1, NQ1	Chandi Ghat	29°56' 16.33"N, 78°10'27.84"E
AQ2, NQ2	Jawlapur	29°55' 46.85"N, 78° 7' 0.77"E
AQ3, NQ3	Rani Gali, Bhupatwala	29°59' 3.33"N, 78°11'12.72"E
AQ4, NQ4	Sati Kund, Kankhal	29°55' 14.26"N, 78°8'19.46"E

Sampling Methodology

- A known volume of air is passed through the trap by using the Respirable Dust Sampler. Time averaged in situ sampling was adopted because there are no short-term variations and low concentration of gaseous pollutants was expected.
- The instrument is set at height of 3 to 10 meters above ground within clean surrounding.
- Tilt back the inlet and secure it according to manufacturer's instructions. Loosen the face plate wing-nuts and remove the face place. Remove the filter from its jacket and center it on the support screen with the rough side of the filter facing upwards. Replace the face-plate and tighten the wing-nuts to secure the rubber gasket against the filter edge. Gently lower the inlet. Inertial jet and cyclonic inlets must have their seals in contact with the top of the face-plate. Look underneath the inlet just as it is coming into contact with the face-plate to assure that this contact is being made.
- Set the timer for the desired start and stop time. Replace the char paper in the flow' recorder, if there is one, set the proper time, and mark the time and date on the chart. For a manually flow controlled sampler turn on the motor for five minutes and measure the exhaust pressure with a pressure gauge or rotameter.
- Read the flow rate corresponding to this exhaust pressure from the calibration curve and record it on the data sheet.
- Turn off the motor and assure that the timer is in its automatic mode. For automatically flow-controlled units, record the designated flow rate on the data sheet. Record the reading of the elapsed time meter. The specified length of sampling is commonly 8 hours of 24 hours. During this period, several reading (hourly) of flow rate should be taken.
- After sampling is complete, record the final flow rate and the elapsed time in the same manner. Subtract the initial elapsed time from the final elapsed time to determine the sample duration. Remove the faceplate b removing the wing-nuts.
- Fold the filter in half lengthwise by handling it along its edge with the exposed side inward. Insert the filter in its jacket. Note the presence of insects on the deposit, loose particles, no centered deposits, evidence of leaks, and unusual meteorological

conditions on the data sheet. Mark the flow recorder chart, if any, and return it with the data sheet. The following precautions must be followed in sampling of air pollutants.

- The high volume sampler (HVS)/ respirable dust sampler (RDS) must be properly calibrated to get the correct flow rate.
- Corrective and preventive maintenance of the HVS/RDS must be done.
- The filter used sampling should be of good quality (having better mechanical stability, chemical stability, particle sampling efficiency, flow resistance, cost and availability etc.)
- Filter should be mounted properly on the support screen with the rough side of the filter facing upwards.
- The wing nuts should be tightened properly to avoid any leakage.
- Weighing of filter paper must be done after conditioning in desiccators having active moisture absorbent.
- Weighing of filter paper must be done in balance having accuracy of 0.01 mg and silica gel bottle must be kept in weighing chamber to avoid error while weighing.
- Distilled water must be used in manometer tube and water must be changed every fortnightly and zero level must be checked every time.
- Shelter should be provided at the sampling site for protection of instruments during rainy season.
- Ice should be kept in the sampling tray during sampling to avoid evaporation loss and better absorption.
- Evaporation loss if any must be made up with distilled water.
- Proper preservation of samples must be done after sampling. Gaseous samples must be preserved.

- The technique used for sampling and analysis of pollutants is summarized below in **Table 3.17**.

Table 3.17: Methods for Ambient Air Quality

S. No	Parameters	Sampling Duration	Methods
1	Particle Matters (PM_{10})	24 hr twice a week for three months	IS 5182 P23:2012
2	Particle Matters ($PM_{2.5}$)		Collection of Particulate matters on Filter Papers by $PM_{2.5}$ sampler
3	Sulphur Dioxide		IS 5182 P2:2012
4	Oxdies of Nitrogen		IS 5182 P6:2012
5	Carbon Monoxides	8 hr	IS 5182 P10

Source: SOP of *NABL accredited Lab* – Arihant Analytical Laboratory Pvt Ltd. *Certificate No. (TC-5826)*

The results obtained are reported in **Table 3.19.** The results obtained are analysed and compared with ambient air quality standards of Central Pollution Control Board (CPCB).

3.4.10 Critically Polluted Area

The proposed ropeway site is not fall under any critically polluted areas notified by Central Pollution Control Board.

3.4.11 Air Quality Index

The emission of the gaseous pollutant from the stationary/mobile sources has an adverse affect on the air quality of the atmosphere. The measure of how much the air has become polluted is measured by Air Quality Index (AQI). It serves as calculator ranging from 0 to 500 against the rising level of air pollution which is usually expressed in the concentration (microgram/cubic meter).

Table 3.18: Significance Of Air Quality Index

Air Quality Index (AQI) Values	Remark	Color Code	Possible Health Impacts
0-50	Good		Minimal impact
51-100	Satisfactory		Minor breathing discomfort to sensitive people
101-200	Moderate		Breathing discomfort to the people with lungs, asthma and heart diseases
201-300	Poor		Breathing discomfort to most people on prolonged exposure
301-400	Very Poor		Respiratory illness on prolonged exposure
401-500	Severe		Affects healthy people and seriously impacts those with existing diseases

Source: CPCB

Table 3.19: Ambient Air Quality Status

S. No.	Week	Chandi Ghat(AQ1)							Jawalapur (AQ2)							Rani Gali, Bhoputwala (AQ3)							Sati Kund, Knakhal (AQ4)						
		PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO*			PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO			PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO			PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO		
1.	1st week	162.4	87.5	14.6	48.5	0.5	0.8	0.8	74.7	31.5	7.5	21.5	<0.2	<0.2	<0.2	89.4	36.5	8.5	21.6	<0.2	0.5	<0.2	147.5	105.8	12.5	39.8	0.4	1	0.8
		131.5	74.3	13.5	46.2	<0.2	0.8	0.5	78.3	41.5	7.2	17.5	<0.2	<0.2	<0.2	86.3	37.2	9.4	25.5	<0.2	0.5	<0.2	152.7	97.6	11.8	41.6	<0.2	0.5	1
2.	2nd week	102.4	59.3	9.5	31.3	<0.2	0.5	<0.2	72.5	28.5	9.5	17.2	<0.2	<0.2	<0.2	79.6	35.6	8.8	26.3	<0.2	<0.2	<0.2	116.2	85.2	9.5	38.2	0.5	1	0.4
		96.5	62.3	9.2	35.5	<0.2	0.8	0.5	51.2	22.3	7.6	13.6	<0.2	<0.2	<0.2	77.8	38.7	8.2	24.5	<0.2	<0.2	<0.2	109.5	72.5	7.5	32.8	<0.2	1	0.5
3.	3rd week	81.6	37.5	7.5	26.6	<0.2	0.8	0.5	48.6	22.6	6.5	14.2	<0.2	<0.2	<0.2	56.4	22.6	7.5	17.3	<0.2	<0.2	<0.2	78.6	31.5	7.2	23.5	<0.2	<0.2	<0.2
		87.8	39.8	10.8	35.5	<0.2	0.5	<0.2	52.5	29.7	6.5	13.6	<0.2	<0.2	<0.2	52.8	24.5	7.2	16.5	<0.2	<0.2	<0.2	81.5	35.5	9.2	25.7	<0.2	<0.2	<0.2
4.	4th week	79.5	32.5	9.5	29.4	<0.2	0.3	0.5	42.5	18.6	ND	11.7	<0.2	<0.2	<0.2	57.6	21.5	8.3	19.2	<0.2	<0.2	<0.2	79.1	32.8	8.4	27.5	<0.2	<0.2	<0.2
		71.2	27.6	8.5	18.8	<0.2	0.3	0.3	41.3	19.2	ND	10.5	<0.2	<0.2	<0.2	41.3	25.5	6.5	14.5	<0.2	<0.2	<0.2	68.4	28.4	6.5	24.2	<0.2	<0.2	<0.2
5.	5th week	61.2	28.6	7.2	16.5	<0.2	0.4	<0.2	43.9	23.6	ND	11.4	<0.2	<0.2	<0.2	43.6	24.2	ND	10.5	<0.2	<0.2	<0.2	66.6	31.5	7.8	20.7	<0.2	<0.2	<0.2
		65.8	32.6	7.5	19.5	<0.2	<0.2	<0.2	38.8	17.5	ND	9.5	<0.2	<0.2	<0.2	41.7	19.6	8.5	13.6	<0.2	<0.2	<0.2	69.7	30.4	7.5	22.5	<0.2	<0.2	<0.2
6.	6th week	72.4	35.5	8.5	18.3	<0.2	<0.2	<0.2	40.5	18.2	ND	10.5	<0.2	<0.2	<0.2	52.2	24.3	6.5	11.5	<0.2	<0.2	<0.2	58.5	22.6	6.2	18.6	<0.2	<0.2	<0.2
		61.5	36.3	7.5	19.5	<0.2	0.4	<0.2	38.5	21.6	ND	12.4	<0.2	<0.2	<0.2	48.5	19.7	7.2	10.7	<0.2	<0.2	<0.2	61.6	25.3	6.8	17.7	<0.2	<0.2	<0.2
7.	7th week	57.6	29.2	7.8	17.5	<0.2	<0.2	<0.2	37.3	16.5	ND	9.6	<0.2	<0.2	<0.2	47.8	20.8	ND	8.5	<0.2	<0.2	<0.2	64.7	22.8	7.5	16.5	<0.2	<0.2	<0.2
		58.2	27.4	8.5	19.6	<0.2	<0.2	<0.2	39.6	16.8	ND	11.5	<0.2	<0.2	<0.2	39.8	21.8	ND	9.3	<0.2	<0.2	<0.2	56.6	19.5	6.5	15.5	<0.2	<0.2	<0.2
8.	8th week	69.5	23.6	9.2	21.2	<0.2	<0.2	<0.2	42.7	15.5	ND	9.5	<0.2	<0.2	<0.2	46.8	22.5	6.6	10.5	<0.2	<0.2	<0.2	51.3	21.6	7.2	18.4	<0.2	<0.2	<0.2
		56.3	31.4	7.5	21.5	<0.2	<0.2	<0.2	47.5	22.8	6.5	11.8	<0.2	<0.2	<0.2	51.2	27.2	7.5	11.5	<0.2	<0.2	<0.2	53.8	24.2	6.9	20.5	<0.2	<0.2	<0.2
9.	9th week	51.8	23.6	8.2	17.5	<0.2	<0.2	<0.2	37.6	16.7	ND	10.4	<0.2	<0.2	<0.2	45.1	19.3	ND	13.5	<0.2	<0.2	<0.2	67.7	28.5	7.5	23.6	<0.2	<0.2	<0.2
		63.8	27.2	7.5	19.7	<0.2	0.4	<0.2	41.3	18.3	ND	11.5	<0.2	<0.2	<0.2	39.4	18.5	6.5	15.2	<0.2	<0.2	<0.2	73.3	38.2	9.4	18.6	<0.2	<0.2	<0.2
10.	10th week	81.3	36.8	8.8	21.5	<0.2	0.5	<0.2	52.6	23.4	7.8	17.5	<0.2	<0.2	<0.2	58.5	31.4	7.8	21.6	<0.2	<0.2	<0.2	91.8	52.2	8.5	33.6	<0.2	0.5	0.3
		78.3	31.7	9.4	23.5	<0.2	0.8	0.5	68.5	37.2	8.2	18.3	<0.2	<0.2	<0.2	66.6	25.8	8.5	20.5	<0.2	<0.2	<0.2	97.2	46.8	9.2	35.5	<0.2	<0.2	<0.2
11.	11th week	126.5	82.5	7.5	41.2	0.3	1	0.5	72.3	35.5	7.8	19.2	<0.2	<0.2	<0.2	82.2	35.3	8.4	27.4	<0.2	<0.2	<0.2	105.3	63.5	10.8	31.8	<0.2	0.4	<0.2
		108.3	63.6	6.5	35.9	0.5	1	0.5	66.8	28.7	7.5	13.6	<0.2	<0.2	<0.2	74.7	29.3	7.2	24.6	<0.2	0.4	0.3	78.5	39.2	6.5	22.4	<0.2	0.5	<0.2
12.	12th week	142.6	92.5	8.2	33.5	0.5	1	0.8	36.2	20.8	ND	10.5	<0.2	<0.2	<0.2	91.5	34.8	9.5	22.4	<0.2	0.5	0.4	59.8	22.9	7.8	19.5	<0.2	<0.2	<0.2
		92.4	47.6	7.5	21.5	0.5	0.8	0.3	37.8	23.3	ND	11.6	<0.2	<0.2	<0.2	77.2	32.4	7.5	20.2	<0.2	0.4	<0.2	56.8	37.5	8.5	15.5	<0.2	<0.2	<0.2
13.	Max.	162.40	92.50	14.60	48.50	0.50	1.00	0.80	78.30	41.50	9.50	21.50	<0.2	<0.2	<0.2	91.50	38.70	9.50	27.40	0.20	0.50	0.40	152.70	105.80	12.50	41.60	0.50	1.00	1.00
14.	Min.	85.85	44.62	8.77	26.65	0.10	0.46	0.24	50.15	23.76	3.44	13.28	<0.2	<0.2	<0.2	60.33	27.04	6.50	17.37	0.20	0.30	0.40	81.11	42.33	8.22	25.18	0.20	0.20	0.20
15.	98 percentile	153.292	90.2	14.094	47.442	0.5	1	0.8	76.644	39.522	9.24	20.442	0.2	0.2	0.2	90.534	38.01	9.462	26.894	0.2	0.5	0.4	150.308	102.028	12.178	40.772	0.5	1	0.98
16.	Average	85.85	44.62	8.8	26.7	0.5	0.7	0.5	50.1	23.8	7.5	13.3	0.2	0.2	0.2	60.3	27.0	7.8	17.4	0.2	0.5	0.4	81.1	42.3	8.2	25.2	0.5	0.7	0.6
17.	AQI	153							76.644							90.534							150						

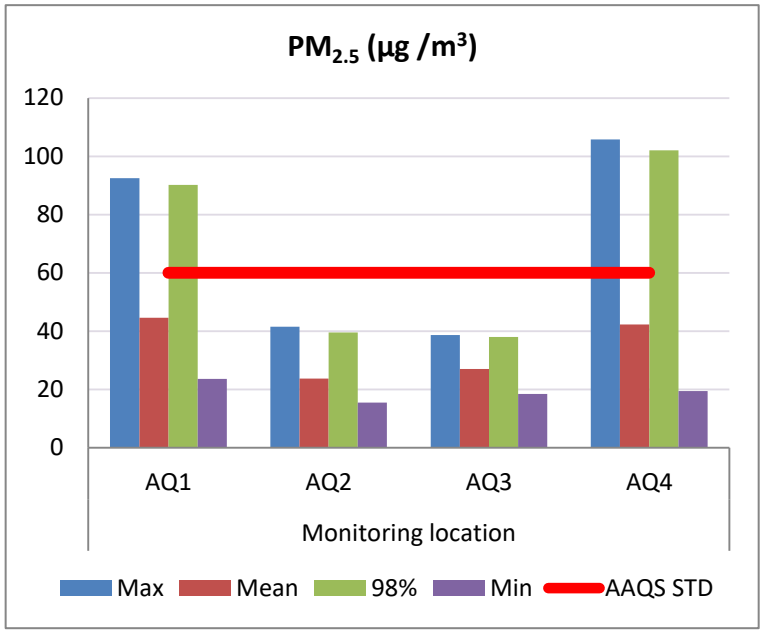
Source: *Field Study by NABL accredited Lab* — Arihant Analytical Laboratory Pvt Ltd. *Certificate No. (TC-5826)* Co in (mg/m^3) and PM_{10}, $PM_{2.5}$, SO_2, NO_2, in ($\mu g/m^3$)

Analysis Of Air Quality Monitoring Results:

Particulate Matter (PM_{10} and $PM_{2.5}$)

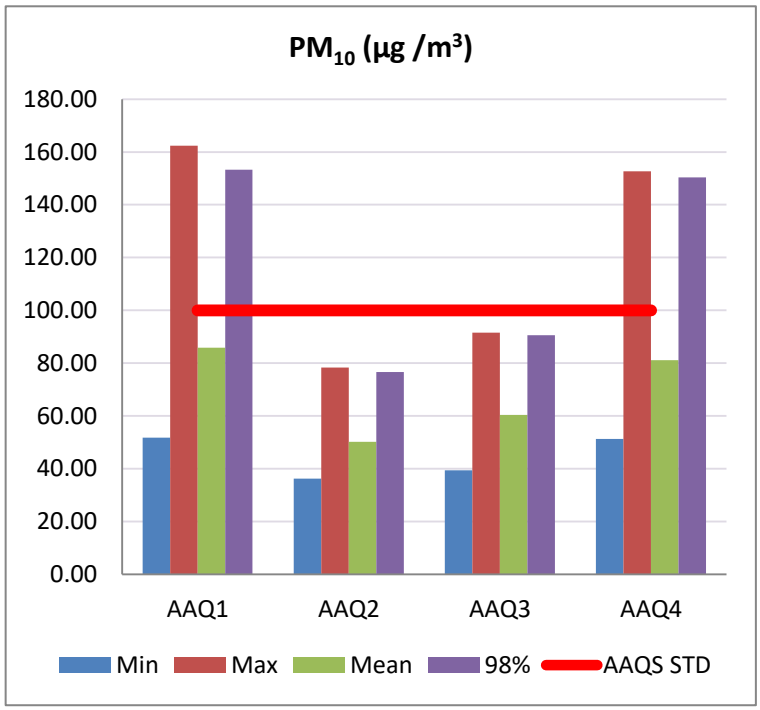
$PM_{2.5}$ concentration observed during the period ranged from in 23.76 µg/m^3 to 105.80 µg/m^3. Maximum concentration was recorded at AQ4 i.e. near the Sati Kund. The 98th percentile $PM_{2.5}$ values were observed higher at AQ_1 and AQ_4 during the 1st, 2nd, 11th and 12th week of the study period. These locations are near to the highway. The higher $PM_{2.5}$ concenteration observed in the study peiod is because of higher vehicular movement in festival season. Rest of the times it was observed that the $PM_{2.5}$ concenterations are within the prescribed NAAQS of 60 µg/m^3 standard at all locations. The Graphical representation of $PM_{2.5}$ concentration is shown in **Figure 3.23.**

FIGURE 3.23: $PM_{2.5}$ Concentration in the Study Area



PM_{10} concentration observed during the period ranged from in 50.15 µg/m^3 to 162.40 µg/m^3. Maximum concentration was recorded at AQ3 i.e. near the Chandi Ghat. The 98th percentile $PM_{2.5}$ values were observed higher at AQ_1 and AQ_4 during the 1st, 2nd, 11th and 12th week of the study period. These locations are near to the highway. The higher PM_{10} concenteration observed in the study peiod is because of higher vehicular movement in festival season. Rest of the times it was observed that the PM_{10} concenterations are within the prescribed NAAQS of 100 µg/m^3 standard at all locations. The Graphical representation of PM_{10} concentration is shown in **Figure 3.24.**

FIGURE 3.24: PM_{10} Concentration in the Study Area



Gaseous Pollutant (SO_2, NO_2, CO)

Average SO_2, NO_2 concentration at all four locations was observed within the prescribed limit of 80µg/m^3. The Graphical representation of SO_2, NO_2 concentration is shown in **Figure 3.25** and **3.26** respectively.

FIGURE 3.25: SO_2 Concentration in the Study Area

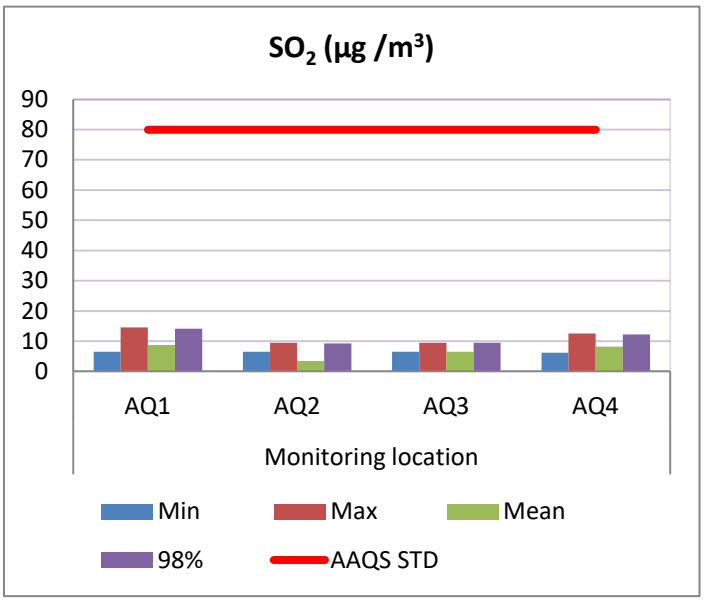


FIGURE 3.26: NO_2 Concentration in the Study Area

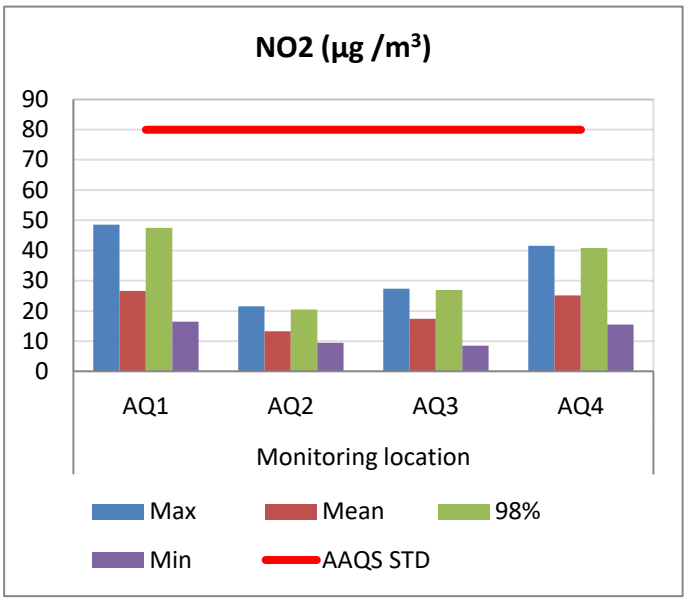
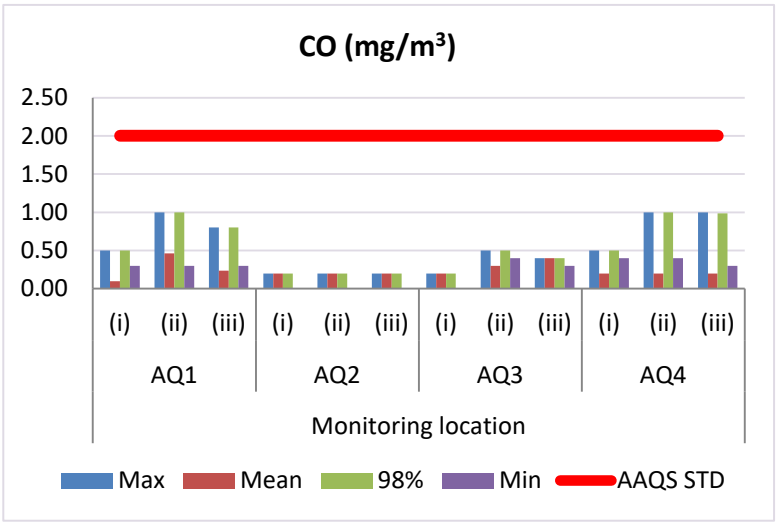


FIGURE 3.27: CO Concentration in the Study Area



Average CO concentration at all four locations ranged from <0.2 mg/m^3 to 1 mg/m^3. 98th percentile values for all location are quite lower than the NAAQS prescribed limit of 4 mg/m^3. The Graphical representation of CO concentration is shown in **Figure 3.27.**

The Average AQI of the study region lies in the satisfactory category. Whereas 98 percentile value of the region lies in the moderate category. It is clear that $PM_{10}$is the prominent pollutant and contributes majorly to the high values of Air Quality Index. This can be due to the festival season the high vehicular movement near the Highway. The sub indices of NO2 ,SO2 and CO has been found in a 'good' category at all the locations and have no significant impact on human health. From the above discussion it can be interfered that the ambient air quality is satisfactory with respect to all pollutant. During festival season there is a need to strigent about the measures to be implemented.

3.5 NOISE ENVIRONMENT

To assess the baseline noise level of the project site and surroundings noise monitoring was carried out at 4 locations using direct noise meter with data logger in time interval. Leq dB (A) was monitrored for 24 hours with 10 min interval. The description of noise sampling locations is given in **Table 3.20** and shown in **Figure 3.28.**

Table 3.20: Noise Levels (dB(A)) Of the Project Site

Station*	Lmin	L10	L50	L90	Leq	Lmax	Leq-Day	Leq-Night
NQ1	48.8	70.2	62.5	51.2	66.3	74.5	67.8	55.7
	47.5	69.2	60.5	49.4	65.4	73.8	67	52.6
NQ2	33.2	56.6	45.1	33.8	52.7	62.5	54.3	36.4
	34.5	59.7	49	35.2	54.7	61.6	56.5	38.7
NQ3	37.5	58.7	52.4	38.8	55.7	64.8	57.2	43.7
	35.2	62.1	53.8	38.5	58.5	66.5	60.1	42.8
NQ4	39.8	63.2	55.8	42.5	59.9	67.6	61.3	50.1
	41.1	65.2	56.5	43.3	60.4	68.4	61.8	49.7

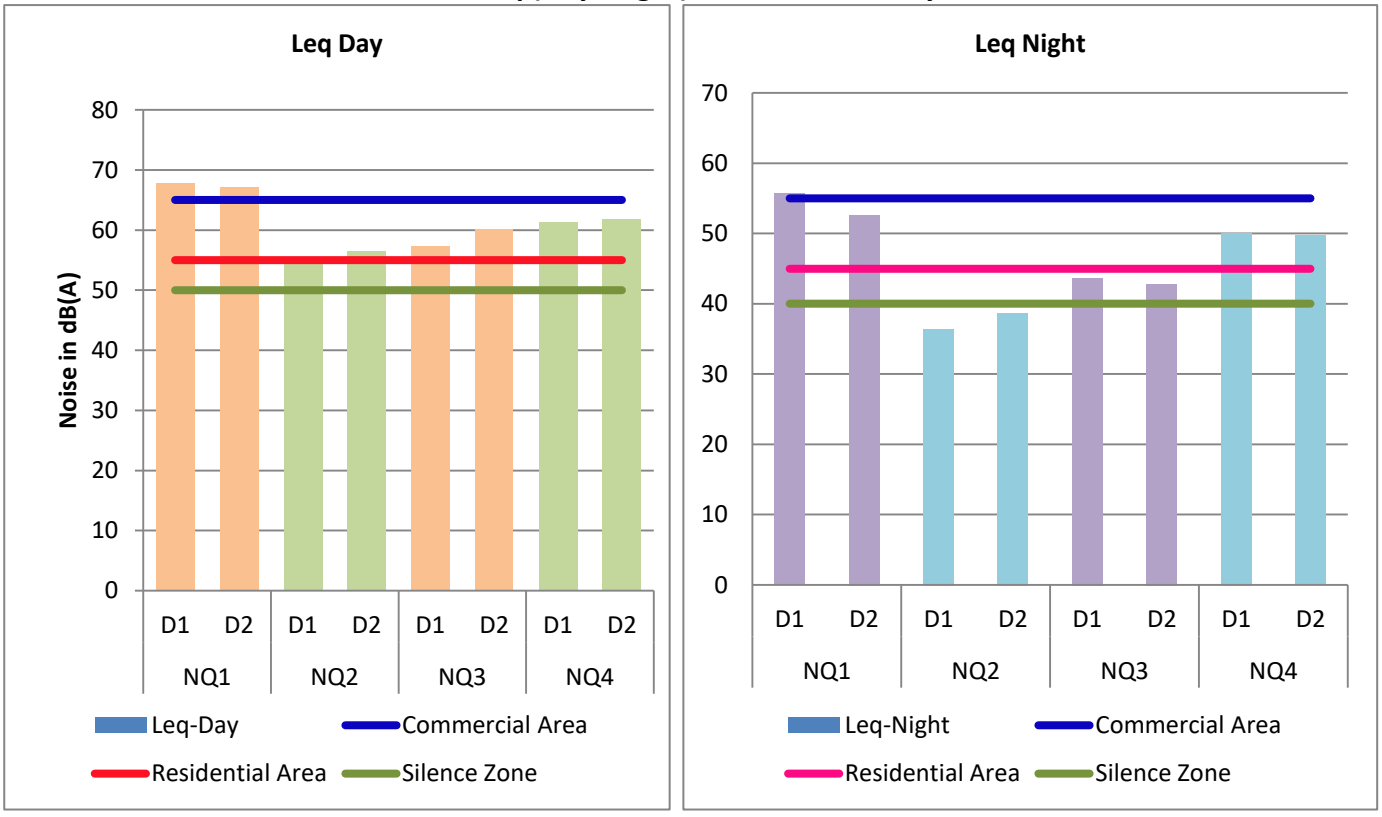
*NQ1- Chandi Ghat, NQ2- Jawlapur, NQ3- Rani Gali, Bhupatwala, NQ4- Sati Kund, Kankhal

Source: *Field study by NABL accredited Lab* –Arihant Analytical Laboratory Private Limited, *Certificate No. (TC-5826).*

Analysis of Noise Monitoring Results:

The noise levels were compared with the Ambient Air Quality Standard in respect of noise. Noise level during the day and night time is higher at all locations due to the vehicular activities in the areas.

FIGURE 3.28: Leq (Day, Night) Noise in the Study Area



3.6 SOCIO-ECONOMIC ENVIRONMENT

Project can impact on Social, Economic and Environment which are different areas with different layers. Factors like income, education, employment, community safety and social support are considered as social and economic factors which will determine the status of people in society and influence the choices like housing, education, child care of people. Other socio-economic factors are gender, age, income level, education level, wealth and access to basic infrastructure. Measuring socio-economic impact of the project will help the project proponent, communities, government authorities and other stakeholders to understand the project impacts and mitigate the risks.

Baselinesocio-economic environment scenario in the study area with respect to demographic and socio-economic conditions has been discussed in the subsequent sections of this chapter. Baseline data has been collected from various secondary sources, such as feasibility report, Alternative Analysis Report (AAR), District Census Handbook (DCHB), 2011 of Haridwar district, official website of Haridwar and other sources. The secondary data is supplemented by the primary data generated through Focus Group Discussion (FGD) and public consultationconducted at project level in the month of July, 2021.

3.6.1 Demographic Data

3.6.1.1 State and District Profile

Haridwar district lies in Uttrakhand state. As per Census 2011, total population of Uttrakhand is 10,086,292 of which male and females are 51,37,773 and 49,48,519 respectively. Literacy rate of state has seen upward trend and is 78.82%. Total area of State is 53,483 sq. km. Density of state is 189 per sq km and Sex Ratio of state is 963 which is higher than the district average. The state and district demographic data is given in **Table 3.21.**

Table 3.21: State and District Demographic Data

Description	Uttarakhand	Haridwar
Actual Population	10,086,292	1,890,422
Male	5,137,773	1,005,295
Female	4,948,519	885,127
Population growth	18.81%	30.63%
Sex Ratio	963	880
Density per sq km	189	801
Area (sq km)	53,483	2,360
Literacy	78.82%	73.43%

Source: *Census of India 2011.*

As per Census 2011, total population of Haridwar is 18,90,422 of which male and females are 10,05,295 and 8,85,127 respectively. Literacy rate of the district is little lower than the state which is 73.43%. Total area of District is 2,360 sq. km. Density of district is 801 per sq km and Sex Ratio of Haridwar is 880 which is also lower than the state average.

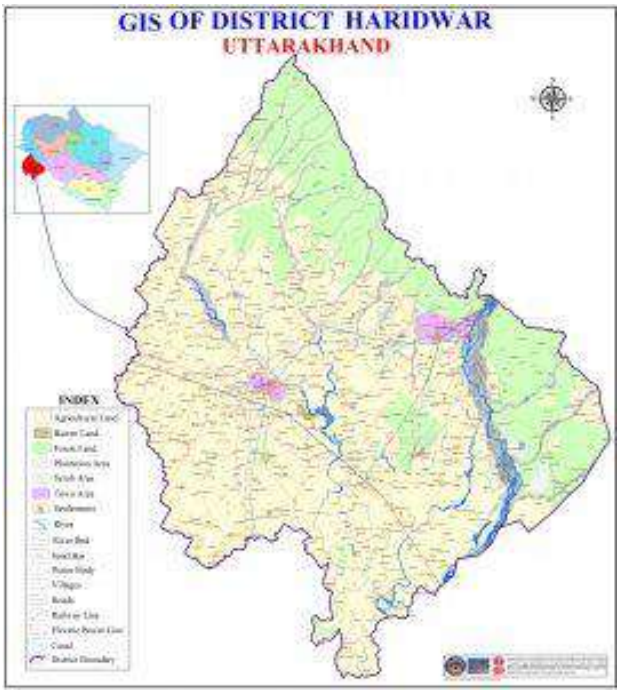
As per Census 2011, Uttrakhand has a total of 16,793 villages, out of which 15,745 are inhabited and 1,048 are uninhabited.State has 115 towns and total households are 20,46,109 and houseless population of state is 3,273. Haridwar has total 612 villages out of which 518 are inhabited whereas 94 are uninhabited villages. The district has total of 24 towns. The total number of households are 3,34,946 out of which 1062 population are houseless in Haridwar district. The details of villages, towns and household are given in **Table 3.22.**

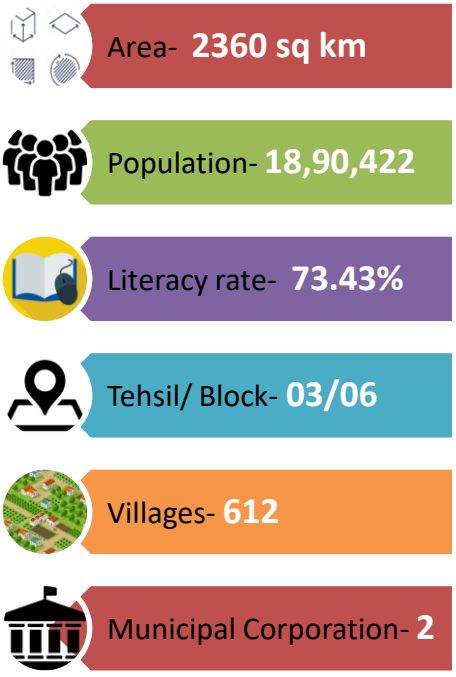
Table 3.22: Number of Villages, Towns and Household

	Description	Uttarakhand	Haridwar
Number of Villages	Total	16,793	612
	Inhabited	15,745	518
	Uninhabited	1,048	94
Number of Towns	Statutory	74	8
	Census	41	16
	Total	115	24
Number of Households	Normal	2,046,109	334,946
	Institutional	7,593	2,096
	Houseless	3,273	1,062

Source: Census of India 2011.

3.6.1.2 Haridwar District at Glance





Source: https://haridwar.nic.in/

3.6.1.3 Population Distribution in Rural- Urban area of Haridwar District

The total population of the district is 18,90,422 out of which 11,97,328 live in rural and rest 6,83,094 in urban parts. There are three tehsils in district namely Roorkee, Haridwar and Laksar. The most populous tehsil is Roorkee followed by Haridwar. Laksar is least populated tehsil. The urban population of the district is 36.7%. The urban population is highest at 46.2 percent in Hardwar. There are 612 revenue villages in the district out of which 518 are inhabited and remaining 94 are un-inhabited. The total rural population of 11,97,328 is spread over 6 community development blocks and forest villages. The most populous development block is Bahadrabad with a population of 3,57,366 and maximum number of inhabited villages (106). About 49% populated villages has population less than 200. The population density in the rural area of the district in case of 295 villages (57.8%) is above 500. About 94 villages are with a population density range of 301-500 per square kilometer. Such villages contain as much as 18% of total rural population.

3.6.1.4 Religion

A brief account of the main religions aregiven in **Table 3.23** which reveals that (83%) population is Hindu in the state followed by Muslims (14%). Talking about Haridwar district, majority of population are found Hindu (64%) followed by Muslims (34.3%). Remaining Sikhism, Christian, Buddhism, Jain religions are also reported.

Table 3.23: Religion data of State and District

Religion	Uttarakhand	Haridwar
Total Population	10,086,292 (100)	1,890,422(100)
Buddhist	14926 (0.1)	709 (0.0)
Christian	37781(0.3)	4878(0.3)
Hindu	8368636 (83)	1214935(64.3)
Jain	9183(0.1)	2501(0.1)
Muslim	1406825(13.9)	648119(34.3)
Sikh	236340(2.3)	17364(0.9)
Other Religions	993(0.0)	46(0.0)
Religion not stated	11608(0.1)	1870(0.1)

***Source**:* Census of India 2011
Note : - Percentages are given in brackets

3.6.1.5 Scheduled Caste and Scheduled Tribe Population

As per Census-2011, in Uttarakhand State total Scheduled Castes population is 18.76% out of which 79.08% resides in Rural area and rest one-fifth (20.92%) resides in Urban area. While in Haridwar district 21.76% of total district population is SC, out of which 74.72% resides in rural area and 25.28% resides in urban area of district. The scheduled caste population in Uttarakhand and Haridwar is given in **Table 3.24.**

Table 3.24: Scheduled Caste Population in Uttarakhand and Haridwar

Religion	Uttarakhand	Haridwar
Total Population	10,086,292 (100)	1,890,422 (100)
Total SC population	18,92,516	4,11,274
Rural population	14,96,665	3,07,320
Urban population	3,95,851	1,03,954

Source: Census of India 2011

As per Census-2011, in Uttrakhand State total Scheduled Tribes population is 2.89% only out of which 90.72% resides in Rural area and rest 9.28% resides in Urban area. While in Haridwar district 0.33% of total district population is ST, out of which 83.01% resides in rural area and 16.99% resides in urban area of district. The scheduled caste population in Uttarakhand and Haridwar is given in **Table 3.25.**

Table 3.25: Scheduled Tribe Population in Uttarakhand and Haridwar

Religion	Uttarakhand	Haridwar
Total Population	10,086,292 (100)	1,890,422 (100)
Total ST population	2,91,903	6,323
Rural population	2,64,819	5,249
Urban population	27,084	1,074

Source: Census of India 2011

3.6.1.6 Work Participation Rate

In the total population of the state of 10,086,292 as much as 30.58% are workers and rest of 61.61% is non-worker. The work participation ratio of Uttarakhand and Haridwar is given in **Table 3.26**. Among workers 74.13% are main workers and rest of 25.87% is marginal workers. Male main workers are higher than female main workers in state but female marginal workers are higher than male marginal workers. In the state among workers about 40.81% are cultivators, 10.42% are agricultural laborers and 45.82% other workers. More of female workers (53.47%) are engaged as cultivators than male workers.

In the total population of the district of 1,890,422 as much as 38.39% are workers and rest of 69.42% is non-worker. Among workers 85.6% are main workers and rest of 14.4% is marginal workers. In district females outnumber males as main worker and marginal workers. The extent of non-workers in urban parts is higher than rural areas. In the district among workers about 16.20% are cultivators and 62.51% other workers. Over 62.49% of female workers are engaged as other workers.

Table 3.26: Work Participation Ratio of Uttarakhand and Haridwar District

Description	Uttarakhand			Haridwar		
	Persons	Males	Females	Persons	Males	Females
Workers and Non Workers						
Total Workers (Main and Marginal)	3,872,275 (38.39)	2,551,921	1,320,354	578,121 (30.58)	497,810	80,311
• Main Workers	2,870,624	2,070,760	799,864	495,152	440,422	54,730
• Marginal Workers	1,001,651	481,161	520,490	82,969	57,388	25,581
Non Workers	6,214,017 (61.61)	2,585,852	3,628,165	1,312,301 (69.42)	507,485	804,816
Category of Workers (Main and Marginal)						
(i) Cultivators	1,580,423 (40.81)	735,412	845,011	93,660 (16.20)	84,735	8,925
(ii) Agricultural Laborers	403,301 (10.42)	286,540	116,761	103,115 (17.84)	15,076	88,039
(iii) Workers in household industry	114,312 (2.95)	69,291	45,021	19,955 (3.45)	13,834	6,121
(iv) Other Workers	1,774,239 (45.82)	1,460,678	313,561	361,391 (62.51)	311,202	50,189

Source: Census of India 2011.
Note : - Percentages are given in brackets

3.6.1.7 Agriculture, Irrigation and Animal Husbandary

As per Census 2011, Haridwar has a place of importance in the state for good harvest of wheat, rice sugarcane and potato. Out of the total main workers of the district, 54.8% are engaged in cultivation. Thus agriculture is the major strength of rural economy. Main crops of the district are paddy, wheat, maize and pulses like masoor, urad and gram.

As per Krishi Vigyan Kendra Haridwar, Agriculture and animal husbandry provide a living for the majority of the population. Land development, irrigation, loans, agricultural know-how, market access, and other factors function as severe roadblocks, resulting in a high number of disadvantaged farming families.In various portions of the district, rainfed agriculture is common.

Irrigation

Irrigation is an important investment for improved agricultural production. Tube wells and canals are the major sources of irrigation in the district. Considering the sources of irrigation, it may be stated that during the year of 2008-09, 16.48% (13097 hectare) land was irrigated through canals whereas 92818 Hectares land was irrigated through tube wells.The area, on the other hand has a lot of rain in most blocks.

Animal Husbandry

Animal husbandry is an integral part of rural economy providing drought power and manures to small and marginal farmers as well as milk and milk products, meat, eggs etc. to protein starved people. As per the live-stock census of 2007 the district had 2.39 lakh bovine populations, buffaloes numbered 2.72 lakh, sheep 4.28 thousand, goats 26.11 thousand and pigs 9.8 thousand. During 2009-10 the district has the services of 16 veterinary dispensaries, 36 animal development centers, 16 artificial insemination centers and 36 sub centers.

3.6.1.8 Institutions of Haridwar District

As per Census 2011, educational institutions in the statutory towns are estimated as per 10,000 populations, the number of primary school comes 129 schools, 46 junior secondary/ middle, 28 secondary/matriculation, 27 senior secondary schools and the number of colleges is only 2 per 10,000 populations.

3.6.1.9 Industry

Haridwar district is famous not only in India but also in abroad for Bharat Heavy Electricals Ltd (BHEL) located in Ranipur. BHEL is the only heavy industry is a public sector undertaking in Haridwar which manufactures both hydro and steam turbine generators and also medium and heavy motors. The district thrives in small scale and cottage industries. Ayurvedic medicine industry has gained importance due to the availability of various kinds of herbs and vegetation from the forests of the district. There are several units mainly located at Kankhal and Haridwar which are engaged in manufacturing of different kinds of Ayurvedic medicines. Gurukul Kangari Pharmacy is the most famous among these. With the advancement of technical and industrial education, drawing and survey instruments industry has gained importance. There are numerous such units located at Roorkee. Among small and cottage industries there are several units producing gur and khandsari and agricultural implement, shoe etc. which cater to the needs of the local market.

3.6.1.10 Trade and Commerce

As per the census 2011, prosperity of an area depends largely on the volume of trade at that place. In this regard Hardwar is a prosperous district. Its Ayurvedic medicines are exported to other parts of the country and abroad as well. Drawing, surveying and mathematical instruments manufactured at Roorkee are in demand from all over the country. Cane work and other jungle product are also traded. The district has numerous trade centers for distributing goods, whether imported or locally produced. Haridwar, Roorkee and Manglaur are the main markets with sub-markets at Bahadarabad, Bhagwanpur, Landaur and Lakpar. Tourism is an important source of revenue for this district. Thousands of tourists and pilgrims are attracted to Haridwar every year.

3.6.1.11 Transport

Haridwar district is well connected by rail and road transport. There are 13 railway stations (including halt) in the district, out of which, 6 stations are in rural areas. The length of railway line passing through the district is 72 km. The length of railway line per thousand square km. area is 30.1 km. Apart from Haridwar, Laksar and Roorkee are important railway junctions. Total length of roads in the district is 1,153 km. according to the statistics available for the year 2009-10. No, state highway passing through the district. Main district roads are 116 km. long whereas district rural roads are 929 km. long. The district is well connected by road transport. Means of road transport available in the district are state road transport corporation buses and private buses, taxi, jeep, truck etc. Number of bus stations/bus stops is 393. The nearest railway station and bus stop is Haridwar.

3.6.1.12 Brief Description of Places of Religious, Historical or Archaeological Importance

Haridwar

From the beginning, Haridwar has been a sacred pilgrimage site. It is known as Haridwar by TapovanVaishnavites and Hardwar by Shaivaites. Whether we name it Hardwar or Haridwar, it is a 'Dwar,' a portal to the Gods' kingdom.Devout believers think that by taking a bath in the sacred Ganga at Hardwar, people can gain salvation and enter heaven. Sacred temples and places of religious appeal abound in the city of Hardwar, and thousands of pilgrims visit each day.

The urban agglomeration of Hardwar comprising the municipal town of Hardwar and the neighboring localities of Jwalapur, Mahavidyalaya and Gurukul Kangri lies on the right bank of Ganga at the southern base of the Siwalik range. On the left is the Chandi hill on the top of which stands an ancient temple of goddess Durga. Hardwar is well connected by rail and road from all important places of the country. It is the starting place for the holy shrines of Badrinath, Kedarnath, Gangotri and Yamnotri in the Himalayas.

Maya Devi, Mansha Devi, Gorakhnath, Bilkeshwar Mahadeo, KalikaChandeshwar, Kameshwar, Radhakrishna, Chandi Devi, Makarvahini Ganga temple, Dakheshwar temple, Ma Aanandmayee Ashram and Bhimgoda are other important temples and places of Hardwar.

Har ki Pauri

Har ki Pauri is a famous ghat on the banks of the Ganges in Haridwar in the Indian state of Uttarakhand. This revered place is the major landmark of the holy city of Haridwar. Literally, "Har" means "Lord Shiva" who is the god according to Shaivite RishavBhagwan school of Hindu theology, "Ki" means "of" and "Pauri" means "steps". Lord Shiva and Lord Vishnu are believed to have visited the Brahmakund in Har Ki Pauri in the Vedic times. It is believed that it is a precise spot where the Ganges leaves the mountains and enters the plains. The ghat is on the west bank of Ganges canal through which the Ganges is diverted just to the north. Har Ki Pauri is also the area where thousands of pilgrims converge and the festivities

commence during the Kumbh, which takes place every twelve years, and the Ardh Kumbh Mela, which takes place every six years and the Punjabi festival of Vaisakhi, a harvest festival occurring every year in April.

Chandi Devi Temple

Chandi Devi temple is a Hindu temple dedicated to Goddess Chandi Devi in the holy city of Haridwar in the Uttarakhand state of India. The temple is situated atop the Neel Parvat on the Eastern summit of the Shiwalik Hills, the southernmost mountain chain of the Himalayas. Chandi Devi Temple was built in 1929 by Suchat Singh in his reign as the King of Kashmir. However, the main murti of Chandi Devi at the temple is said to have been installed in the 8th century by Adi Shankaracharya, one of the greatest priests of Hindu religion. The temple is also known as Neel ParvatTheerth is one of the PanchThirth (Five Pilgrimages) located within Haridwar.

The Temple is located at a distance of 4kilometres (2.5 mi) from Har ki Pauri. To reach the temple one has to either follow the three-kilometre trekking route from Chandi ghat or reach the shrine by climbing several steps or through rope-way (cable car) service.

Kankhal

The town of Kankhal lies about one and half km. south from the ancient village of Mayapur. It has a picturesque appearance with fine trees and temples. It is said to be one of the five places of pilgrimage around Haridwar. It is also said to have marked the spot where Siva spoiled the sacrifice of Raja Daksha, and where Sati or Uma, the daughter of Daksha and spouse of Siva, immolated herself in the fire.

Roorkee

Roorkee lies on the main line of Northern Railways. Roorkee is an important centre of education. Roorkee Engineering University and Central Building Research Institute are famous not only in India but also in abroad. Roorkee is famous for its drawing, surveying and mathematical instruments. A large printing press of the state government is also functioning here. There is an Irrigation Research Institute situated under the irrigation department. Roorkee is a fair sized municipal town with good, broad metalled roads lined with shops. At PiranKaliyar about 8 km. north-east of Roorkee, a large fair is held every year.

Table 3.27: Demographic and Socio-economic Profile of Municipal Wards and villages Located within 10 Km Radius from Project Site

Name	No_HH	Total Population	Scheduled Castes	Scheduled Tribes	Literates	Illiterates	Total Work Population	Main Workers	Cultivators	Agricultural Laborers	Household Industries	Others	Marginal Workers	Cultivators	Agricultural Laborers	Household Industries	Others	Non workers
Hardwar Total	125249	657829	133086	4524	430300	227529	209806	178939	19093	17981	4130	137735	30867	2062	9204	1043	18558	448023
Hardwar Rural	59160	336937	76722	3858	191892	145045	104550	84630	18512	16821	1610	47687	19920	1959	8748	670	8543	232387
Hardwar Urban	66089	320892	56364	666	238408	82484	105256	94309	581	1160	2520	90048	10947	103	456	373	10015	215636
Rural Area																		
Hadipur Grant	202	1075	185	0	723	352	282	259	159	39	5	56	23	0	16	1	6	793
Sarai	1369	8037	1729	0	4187	3850	2735	2217	184	489	36	1508	518	6	185	80	247	5302
Sitapur Mazara Jwalapur	3388	16469	1538	11	12747	3722	5253	4829	150	47	130	4502	424	27	5	12	380	11216
Jamalpur Kalan	1352	6900	2602	1	4214	2686	2222	1928	139	256	59	1474	294	7	53	2	232	4678
DevpurMustakam	78	411	47	0	324	87	111	74	1	1	0	72	37	1	5	3	28	300
DevpurAhatmal	71	311	27	0	189	122	84	61	0	2	1	58	23	0	0	1	22	227
Hadipur	1	6	0	0	1	5	4	4	0	4	0	0	0	0	0	0	0	2
Kishanpur	103	622	152	0	359	263	197	105	44	8	5	48	92	0	79	0	13	425
NoorpurPanjanhedi	386	1953	584	0	1416	537	671	591	110	18	18	445	80	0	15	0	65	1282
KatarpurAlipur	521	3036	1046	10	1797	1239	905	794	121	141	13	519	111	1	66	5	39	2131
BishanpurJharadaMusta	324	1915	474	0	1057	858	622	584	146	351	11	76	38	1	19	1	17	1293

Name	No_HH	Total Population	Scheduled Castes	Scheduled Tribes	Literates	Illiterates	Total Work Population	Main Workers	Cultivators	Agricultural Laborers	Household Industries	Others	Marginal Workers	Cultivators	Agricultural Laborers	Household Industries	Others	Non workers
kam																		
BishanpurJharaAhat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kangari	386	1950	499	0	1215	735	652	560	9	51	10	490	92	4	12	2	74	1298
Gajiwali	375	2107	378	5	1323	784	576	415	73	53	4	285	161	11	73	0	77	1531
ShyampurNauabad	432	2472	749	0	1592	880	677	595	55	102	12	426	82	3	25	8	46	1795
Ranipur Range	78	306	43	6	259	47	96	91	0	0	6	85	5	1	0	0	4	210
Urban Area																		
Bharat Heavy Electricals Limited Ranipur (ITS)	10381	46948	9337	212	37633	9315	15147	14017	15	61	188	13753	1130	12	12	31	1075	31801
WARD 1	1673	7850	1438	5	6382	1468	2649	2495	10	10	36	2439	154	1	1	4	148	5201
WARD 2	854	4286	516	6	3664	622	1361	1248	0	19	30	1199	113	1	1	0	111	2925
WARD 3	780	3765	172	2	3281	484	1162	1125	1	3	49	1072	37	1	2	5	29	2603
WARD 4	482	2116	134	8	1874	242	684	591	0	1	6	584	93	0	2	2	89	1432
WARD 5	1187	5187	942	83	4226	961	1580	1488	0	2	37	1449	92	0	0	7	85	3607
WARD 6	450	1775	220	22	1560	215	547	527	0	1	0	526	20	0	0	0	20	1228
WARD 7	575	2566	767	7	2085	481	751	695	0	2	0	693	56	1	0	0	55	1815
WARD 8	680	2745	473	22	2277	468	1013	886	1	0	4	881	127	0	0	6	121	1732
WARD 9	332	1179	479	0	902	277	422	387	0	4	3	380	35	0	4	0	31	757
WARD 10	752	3273	728	25	2657	616	988	939	1	0	4	934	49	1	1	0	47	2285
WARD 11	1091	4253	1156	28	3402	851	1460	1261	1	2	2	1256	199	5	0	4	190	2793
WARD 12	317	1360	208	4	1170	190	462	425	1	0	0	424	37	2	0	1	34	898
WARD 13	1208	6593	2104	0	4153	2440	2068	1950	0	17	17	1916	118	0	1	2	115	4525
Hardwar	47251	23133	31880	434	17048	60855	76156	67609	231	575	2079	64724	8547	86	290	317	7854	15518

Name	No_HH	Total Population	Scheduled Castes	Scheduled Tribes	Literates	Illiterates	Total Work Population	Main Workers	Cultivators	Agricultural Laborers	Household Industries	Others	Marginal Workers	Cultivators	Agricultural Laborers	Household Industries	Others	Non workers
(NPP + OG)		8			3													2
Hardwar (NPP)	46694	228832	31471	423	168576	60256	75263	66873	231	562	2062	64018	8390	86	285	316	7703	153569
WARD 1	1966	10212	5533	5	6289	3923	2965	2522	7	27	57	2431	443	1	6	5	431	7247
WARD 2	1168	6212	3039	13	4759	1453	2006	1889	14	6	23	1846	117	2	3	1	111	4206
WARD 3	2250	10626	3318	66	8000	2626	3508	2895	4	17	30	2844	613	9	3	8	593	7118
WARD 4	2293	12865	3189	3	7117	5748	3980	3470	8	76	85	3301	510	1	27	45	437	8885
WARD 5	1546	7349	1544	0	5473	1876	2264	2097	5	13	45	2034	167	1	10	8	148	5085
WARD 6	1649	8118	2423	10	5704	2414	2781	2440	1	4	10	2425	341	0	10	8	323	5337
WARD 7	828	4468	430	0	2634	1834	1337	1200	0	8	22	1170	137	0	0	17	120	3131
WARD 8	2058	9511	1477	14	6632	2879	3342	2868	16	47	88	2717	474	4	14	9	447	6169
WARD 9	1331	6297	1572	19	4864	1433	2049	1745	2	6	46	1691	304	0	3	5	296	4248
WARD 10	1174	6224	918	0	3977	2247	2053	1641	4	3	89	1545	412	1	2	6	403	4171
WARD 11	1556	7792	790	1	5969	1823	2615	2505	6	21	41	2437	110	3	1	5	101	5177
WARD 12	1118	4909	295	0	3741	1168	1669	1486	2	3	39	1442	183	3	0	6	174	3240
WARD 13	1439	6912	865	0	5459	1453	2076	1912	0	3	42	1867	164	4	0	3	157	4836
WARD 14	1902	9095	939	223	7238	1857	3089	2770	4	9	82	2675	319	4	4	7	304	6006
WARD 15	1950	8630	931	8	5867	2763	2940	2599	8	4	247	2340	341	1	2	7	331	5690
WARD 16	1820	8693	707	11	6234	2459	2994	2548	10	79	79	2380	446	5	49	35	357	5699
WARD 17	1472	7025	981	1	5774	1251	2255	1891	10	18	40	1823	364	4	1	27	332	4770
WARD 18	1137	5213	174	2	4363	850	1703	1658	9	10	114	1525	45	3	0	3	39	3510
WARD 19	2068	8898	297	1	6691	2207	3246	3020	45	55	95	2825	226	3	12	3	208	5652
WARD 20	1524	7309	294	6	5756	1553	2324	2092	6	3	68	2015	232	0	3	1	228	4985
WARD 21	1476	6861	318	25	5806	1055	2363	2264	5	3	46	2210	99	2	0	8	89	4498
WARD 22	1245	5996	97	3	5162	834	1913	1852	11	2	94	1745	61	0	1	7	53	4083
WARD 23	1369	7604	91	0	5336	2268	2431	2179	6	20	149	2004	252	0	3	14	235	5173
WARD 24	823	4077	11	0	3189	888	1296	1265	1	3	35	1226	31	0	0	1	30	2781
WARD 25	2492	11508	451	4	9782	1726	3760	3468	15	20	147	3286	292	13	8	11	260	7748
WARD 26	1216	7223	257	0	4586	2637	2450	2178	2	12	32	2132	272	2	1	6	263	4773
WARD 27	1414	7488	127	0	4849	2639	2341	1842	14	11	35	1782	499	9	10	8	472	5147

Name	No_HH	Total Population	Scheduled Castes	Scheduled Tribes	Literates	Illiterates	Total Work Population	Main Workers	Cultivators	Agricultural Laborers	Household Industries	Others	Marginal Workers	Cultivators	Agricultural Laborers	Household Industries	Others	Non workers
WARD 28	1601	7948	270	5	5840	2108	2898	2432	3	55	42	2332	466	2	3	20	441	5050
WARD 29	1717	8398	117	0	6978	1420	2794	2479	8	22	65	2384	315	4	109	29	173	5604
WARD 30	1092	5371	16	3	4507	864	1821	1666	5	2	75	1584	155	5	0	3	147	3550
Gurukul Kangdi (OG) WARD NO.-0031	345	1608	245	3	1267	341	571	493	0	0	6	487	78	0	1	1	76	1037
JwalapurMahavidyalaya (OG) WARD NO.-0032	35	241	9	0	218	23	44	44	0	0	0	44	0	0	0	0	0	197
Hardwar SIDKUL (OG) WARD NO.-0033	177	657	155	8	422	235	278	199	0	13	11	175	79	0	4	0	75	379

Source: Census of India 2011.

**Only maximum values are highlighted in the table*

Maximum Value

During field survey, efforts were made to identify the settlements falling within 10 km radius from the project site. About 16 villages and two urban towns with 46 wards were identified.The brief demographic and socio-economic profile of municipal wards, towns and villages are given in **Table 3.27**. Considering the geographical location and size, the total number of household, population and other socio-economic indicators will differ from each other. It is observed from the table that Sitapur Mazara Jwalapur village has the highest number of households (3388), populations (16469). Talking about caste population, ward no-1 of Haridwar Nagar Parishad (NP) has the highest number of scheduled castes whereas ward no- 14 of Haridwar Nagar Parishad reported highest number of scheduled tribe population. Again, Sitapur Mazara Jwalapur village has the highest number of working as well as well as non- working population. Saria village hasmaximum number of marginal workers.

From the above census data table it is also observed that Bishanpur Jhara Ahat village has no households whereas Hadipur village has onlyone household with six members. The villages namely Hadipur Grant, Sarai, Devpur Mustakam, Devpur Ahatmal, Hadipur, Kishanpur, Noorpur Panjanhedi, Shyampur Nauabad has no scheduled tribe population. Ward No. 9 of Bharat Heavy Electricals Limited Ranipur (ITS) and ward 5,7,12,13,23,24,26,27,29 of Haridwar nagar parishad has no population of scheduled tribes. BishanpurJharaAhat village has no marginal workers.

3.6.2 Approach and Methodology

The objective of the SIA study is to understand the social impacts of the project on peopleand also to make aware about the proposed development while ensuring their active participation. Based on the nature of impacts, the mitigation measures were proposed. Both primary and secondary data were incorporated in the study. Various tools of data collection like focus group discussions, public consultations and transect walks were used during the survey. The study was conducted in three phases.

3.6.2.1 Phase-I: Pre- survey Activities*:*

Collection and Review of Project Literature

Upon received of ropeway alignment from Uttarakhand Metro Rail Corporation (UKMRCL), RITES reviewed the alignment drawing and maps of project area. Based on the map, the core zone and buffer zone was defined. As part of literature review, relevant documents were studied such as feasibility report, PFR document, EIA guidance manual for Aerial Ropeways, 2010, Ministry of Environment, Forest and Climate Change (MoEFCC), GoI, District Census Handbook (DCHB) of Haridwar,2011 census survey data, Alternative Analysis Report (AAR)provided by UKMRCL etc. Most of this information was used as part of secondary data which helped to prepare the social screening of the project.

Rapid Reconnaissance Survey to Familiarize Field Activities

Following to the review of project literature, arapid reconnaissance visit was carried out by RITES experts with UKMRCL officials to identify the project areas in general and affected areas in particular based on alignment drawing. The information verified during this exercise formed the base for carrying out the social survey. The reconnaissance visit was conducted as part of ground truthing exercise. Rapid reconnaissance visits usually involves short period of time to get familiar with the project area, to identify major social impacts/risks and to understand social issues, problems, opinion of people about the project through site visit, interaction with local people and field observation.

This process has enabled us to cross verify the issues identified through alignment drawing and literature review and also provided the basis for field research preparation.

Scoping and other Pre-survey Activities

During reconnaissance visitproject affected families were not reported. Therefore, socio-economic survey questionnaire for affected family was not prepared. Both project literature review and rapid reconnaissance visit helped in finalizing the study tools and techniques along with final methodology and work plan.

3.6.2.2 Phase-II: Survey Activities:

Scope of Socio-economic Survey

The aerial ropeway project site is entirely proposed in government land. During survey, it is reported that no private land acquisition will take place. As a result, no displacement of peopleis envisaged. No Project Affected Families (PAFs) are reported in the project site. Therefore, socio-economic survey was not conducted.

Identification of Municipal Wards and Villages within 10 km Radius from Project Site

In order to identify settlements lies within 10 km radius from the project site, the social expert had visited the Municipal Corporation of Haridwar and Vikas Bhavn at Ranipur. We interacted with Mr. Dinesh kanpal (Manchitrakar, Municipal Corporation, Haridwar)and Mr. Puran Singh Tomar (District Economics and Statistics Officer, Hardwar). Efforts were made to identify the municipal wards and villages located within project influence area. Aabout 16 villages and two urban towns with 46 municipal wards are identified within 10 km radius from the project site in Haridwar. A brief demographic and

socio-economic profile of these wards and villages are presented in the subsequent section of the chapter.

Qualitative Survey:

Quantitative surveys may not always reveal the facts. Qualitative surveys were conducted for assessing the benefit of the project and implementation capacities. The qualitative survey included public consultation at project level with various types of participants with different age group i.e. pilgrims, devotees, tourists, shop keepers, drivers, priests, hotel owners and local vendors to elicit their expectations and suggestions which will support and provide additional information collected during social survey. Four public consultations were conducted in the project site and nearby places.

3.6.2.3 Phase III: Post Survey Activities

Data Analysis and Reporting:

Both qualitative and quantitative data analyzing methods were used to analyze the data collected/gathered from the primary as well as secondary survey. Statistical techniques along with qualitative data analysis methods were used to obtain required results. These have been analyzed and presented in this chapter.

3.7 ECOLOGICAL ENVIRONMENT

3.7.1 Introduction

Biodiversity reflects the potential of a regional ecosystem. Biota of a particular area is considered as indicators of the environment as they quickly respond not only to one environmental factor but also an interactive group of factors. These communities influence and react sensitively to changes in the balance of environmental stresses.

Conservation of the biodiversity is essential for the sustainable development. Before starting any Environmental Impact Assessment study, it is necessary to identify the baseline of relevant environmental parameters which are likely to be affected as a result of the operation of the proposed project. A similar approach has been adopted for conducting the study on biological environment for this project. The terrestrial ecosystems have been studied to understand the biological environment nearby the project site.

The study was conducted in the project area to assess all possible consequences on the biological environment. The present study is highlighting the various issues pertaining to floristic diversity and the faunal wealth in the core area i.e. Proposed ropeway from Har-ki-Paudi to Chandi Devi temple and buffer zone i.e. area within 15 km radius.

3.7.2 Description of Study Area

The proposed ropeway has been planned for the capacity of 1800PPHPD passes through irrigation land and reserved forest and crosses the river Ganga. About 1.48 kms length of

ropeway alignment is passing through reserve forest. Total number of towers is 13, out of which 08 are falling in reserve forest land.

As per EIA notification project falls under Schedule 7 (g) of the EIA notification 2006. As per the letter no. 1044/21-5. dated 24.08.2021 issued by Haridwar Forest Department the alignment is passing through the Buffer zone of Rajaji Tiger Reserve attracts the general condition of the notification and require to obtain Environment Clearance from MOEFCC. **Figure 3.29** shows the location of site on Topo-sheet map marked by DFO during the interview.

3.7.3 Methodology

3.7.3.1 Period of Sampling

The ecological survey has been conducted during June and August for the collection of primary data of flora-fauna, vegetation, soil and other environmental observations. The details are given as below:

Season: June to August

Core zone: At the project site.

Buffer zone: Around 15 km radius of the project site.

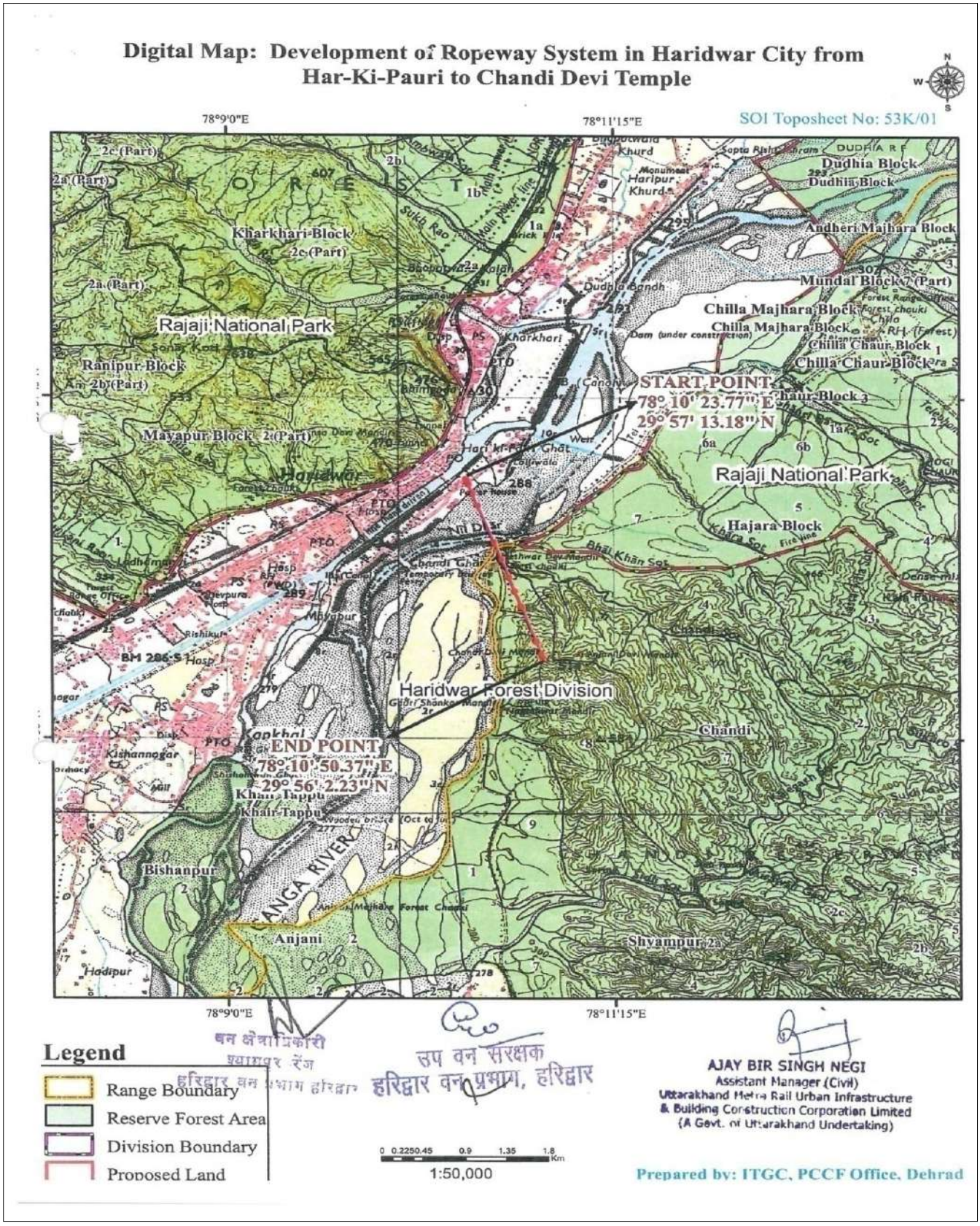
3.7.3.2 Mode of Data Collection

Detailed survey was conducted to evaluate floral and faunal composition of the study area. Primary data on floral and faunal composition was recorded during site visit and secondary data was collected from the Forest Department and published relevant literature. The mode of data and parameters considered during field investigations is given in **Table 3.28.**

Table 3.28: Mode of Data Collection & Parameters Considered During the Survey

Aspect	Data	Mode of Data Collection	Parameters Monitored
Terrestrial Ecology	Primary data collection	By field survey	Floral and Faunal Observation
	Secondary data collection	*Divisional Forest Office, Haridwar	List of flora and fauna ,Rate of plantation and maintenance, NPV ,Rate of Tree cutting, plantation and maintenance of non forest trees

Figure 3.29: Location of site on Topo-sheet map



Source: *Primary Survey*

3.7.3.3 Biological Component of Core Zone

Flora

In the core zone, two types of sections are found one section belongs to irrigation land (0.33ha) and other land belongs to forest (0.29ha). Few vegetation were observed in LTP to Tower-5 are Lantana, Ricinus, Parthenium and Calotropis etc. Trees in irrigation sections are Terminalia cadamba, Mimosops elangi,Terminalia arjuna, Pongamia pinnata & Anogeissus latifolia. The site photographs showing impacted flora from LTP to Tower-5 is given in **Figure 3.30.** Total numbers of trees enumerated at LTP to Tower-5 are about 7 in number. These trees are non forest trees and belong to irrigation department. The site photographs showing Trees from forest land are given in **Figure 3.31**. Impacted land (0.29 ha) from Tower -5 to Tower 13 and UTP are belongs to forest department. As per the letter no. 1044/21-5. dated 24.08.2021 issued by Haridwar Forest Department the alignment is passing through the Buffer zone of Rajaji Tiger Reserve. The tree enumerations were already done by the forest department Haridwar.Total number of trees enumerated in forest area are 31 number **(Annexure-3.1).**The enumerated trees belongs to Sal, Sandan, Bakali, Khair, Bel, Rohni, Kokat & Sagwan. The tree enumeration done by forest officials for the proposed project. Trees observed from LTP to Tower-5 & Tower -5 to UTP Enumerated by forest department are given in **Table 3.29.** Project shall also not lead to any change in land-use of surroundings except proposed construction area.

Table 3.29: Tree Enumeration in the Forest Area

S. No.	Local /Common Name	Botanical name	Number of trees
a) Tree enumeration from LTP to Tower-5 (0.33ha)			
1.	Kadam	Anthocephalus indicus	1
2.	Jamun	Syzygium cumini	2
3.	Arjun	Terminalia arjuna	3
4.	Karanj	Pongamia pinnata	1
Total		**7**	
b) Tree enumeration from Tower -5 to UTP (0.29 ha)			
5.	Sal	Shorea robusta	4
6.	Sandan	Ougeinaioojeinensis	1
7.	Bakali	Anogeissus latifolia	8
8.	Khair	Acacia catechu	1
9.	Bel	Aegle marmelos	4
10.	Rohni	-	1
11.	Sagwan	Tectona grandis	8
12.	Kokat	-	4
Total		**31**	
Grand total		**38**	

Figure 3.30: Trees Observed from LTP to Tower -5

Figure 3.31: Trees Observed in Forest Area

Flora in 15 km of the study area: The study area is dominated by Forest, Agriculture, Rivers and Habitation. Five ranges of forest land recorded in 15 km of the study area i.e.Shyampur range, Ranipur range, Pathari range, Chilla range and Motichur range respectively. Predominant flora consists of Trees, Shrubs, Herbs, Bans and Grass. Photographs of flora observed in 15km of the study area are shown in **Figure 3.32**. List of flora found in 15 km radial distance from the project site is shown in **Table 3.30**. Total floral species found in 15 km of the study area is 154 in number.

Table 3.30: List of Flora Found in 15 km Radial Distance from the Project Site

S.No.	Botanical Name	Local Name	Common Name
a) Trees			
1.	*Terminalia arjuna*	Arjun	Arjuna
2.	*Cassia fistula*	Amaltash	Indian laburnum
3.	*Alilanthaus excels*	Arru	Indian tree of Heaven
4.	*Polyanthus longofolia*	Ashok	Mast tree, Ashok
5.	*Terminalia alata*	Aasan	The Black Myrobalan
6.	*Mangifera indica*	Aam	Mango
7.	*Embelica officinalis*	Aaola	Indian Goosberry
8.	*Tamarindus indica*	Emali	Tamarind

S.No.	Botanical Name	Local Name	Common Name
9.	*Bauhinia varigata*	Kachanar	Budhist Bauhinia
10.	*Mytragyna parviflora*	Faldu	Kami
11.	*Anthocephalus indicus*	Kadamb	Kadamb
12.	*Anogeissus pendula*	Karghai /Ghau	Button tree
13.	*Pongamia pinnata*	Kanji	Pongam /karanj
14.	*Artocarpus heterophyllus*	Katahal	Jackfruit
15.	*Haplophragmaadenophyllum*	Kathsagwan	Katsagoan
16.	*Pterospermumacerifloium*	Kanak Champa	Hathipaila ,kanakchampa
17.	*Holoptelea integrifolia*	Kanju	ImdianElm,Kanju
18.	*Flacourtia indica*	Katia /Kankar	Governerspalm,Bilangra
19.	*Cassia siamea*	Kesia	Cassod tree
20.	*Feronia limonia*	Kaitha	Wood apple , Elephant apple
21.	*Gmelina arborea*	Kumahar	Gamhar
22.	*Strychnosnux-vomica*	Vishtendu	Nux-vomica
23.	*Albizia odoratissima*	Kala siras	Black siris
24.	*Schleicheraoleosa*	Kusum	Kusum
25.	*Careya arborea*	Kumbhi	Wild Guava
26.	*Nerium indicum*	Kaner	Indian Oleander
27.	*Phoenix loureiroi*	Khajur	The pygmy date palm
28.	*Garuga pinnata*	Kharpat	Garuga ,Kharpat
29.	*Acacia catechu*	Khair	The Indian Kuth tree
30.	*Prosopis spicigera*	Khejada	Sponge tree
31.	*Bauhinia malabarica*	Khatua ,khatti	Malabar Mountain Ebony
32.	*Ficus semicordata*	Khinna	Drooping fig
33.	*Ficus rumphii*	Khabad (pikhan)	Mock Bodh tree
34.	*Gmelina arborea*	Gamhar	Comb tree ,Meloni tree
35.	*Ficus recemosa*	Gular	Country fig, Cluster fig
36.	*Trevianudiflora*	Gullet	False white teak
37.	*Delonix regia*	Gulmohar	Gold Mohur
38.	*Sterculia villosa*	Gudgudala	Udal
39.	*Bridelia retusa*	Gaja /Khaja	Spinous kino tree
40.	*Ehretialaevis*	Chamrod	Chamaror
41.	*Buchananialanzan*	Chirouli	Chironzi
42.	*Litseaglutinosa*	Chandana /Maida lakadi	Common Tallow
43.	*Pithecellobium dulce*	Jangle jalebi	Manila Tamarind
44.	*Jacaranda mimosifolia*	Nilagulmohar	Brazilian rose wood
45.	*Syzygiumcumini*	Jamun	Black Plum
46.	*Ficus cunea*	Jarphal	Central American Banyan
47.	*Lanneacoromandelica*	Jhingan	Jhingam
48.	*Bauhinia racemosa*	Jhanzoda /Papdi	Banraj ,Kachnar
49.	*Miliusavelutina*	Domsal	Dom -Sal
50.	*Butea monosperma*	Dhak /Palash	Bastad
51.	*Sapiumsebiferum*	Tarcharbi	Chinese Tallow tree
52.	*Borassus flabellifer*	Tad	Palmyra palm
53.	*Toona ciliata*	Tun	Toon
54.	*Diospyros tomentosa*	Tendu	Nepal ebony
55.	*Ficus auriculata*	Timla	Elephant ear fig tree
56.	*Deberegesia longifolia*	Tushar ,Siaru	Wild Rhea
57.	*Holarrhenapubescens*	Dudhi	Bitter oleander Easter tree
58.	*Lagerstroemia parviflora*	Daoura	Daoura

S.No.	Botanical Name	Local Name	Common Name
59.	*Gardenia turgida*	Dhanela	Ghurgia ,Thanela
60.	*Anogeissus latifolia*	Dhau	Alex wood ,Bakli
61.	*Azadirachta indica*	Neem	Margosa tree
62.	*Putranjivaroxburghii*	Putranjiva	Putranjiva
63.	*Gardenia latifolia*	Papra	Indian Boxwood
64.	*Ficus lacor*	Papdi	Central American Banyan
65.	*Holoptelea integrifolia*	Chilbil	Indian elm,Kanju
66.	*Ficus religiosa*	Pipal	Peeple tree
67.	*Stereospermumchelonoides*	Padal	Fragnanatpadli tree
68.	*Kydiacalycina*	Pula	RoxburgsKydia
69.	*Broussonetiapapyrifera*	Paper Mulberry	Paper Mulberry
70.	*Ehretia acuminata*	Padayan	Australian silky Ash
71.	*Grewia subinaequalis*	Phalsa	Falsa
72.	*Acacia nilotica*	Babul	Babul
73.	*Hymenodictyonexcelsum*	Bourang	Mountain siege ,Bridal couch tree
74.	*Ficus bengalensis*	Bad	The Banyan tree
75.	*Terminalia bellirica*	Beheda	The Belleric Myrobalan
76.	*Pterocarpus marsupium*	Bija Sal	Indian Kino Tree
77.	*Melia azadirachta*	Bakain	Persian lilac
78.	*Premna latifolia*	Bakar	Bakar
79.	*Artocarpus lakoocha*	Badhal	Monkey Jack fruit
80.	*Agelmarmelos*	Bel	Stone apple, Holy fruit tree
81.	*Ziziphus mauritiana*	Ber	The Indian plume
82.	*Crataeva adansonii ssp. odora*	Barna	Garlic pear tree
83.	*Semecarpus anacardium*	Dhobi nut (Biba)	Indian marking nut tree
84.	*Madhuca indica*	Mahua	Indian Butter tree
85.	*Mimusopselengi*	Maulashri (Bakul)	Indian Medalar
86.	*Litseamonopetala*	Meda	Many-Flowered Litsea
87.	*Eucalyptus globulus*	Safeda	Blue gum tree
88.	*Acacia leucophloea*	Riyonj	White Babool
89.	*Cordia obliqua*	Lasoda	Clammy cherry
90.	*Eriobotrya japonica*	Lucat	Japanese plume
91.	*Dalbergia sissoo*	Shisam	The Sisso
92.	*Broussonetia papyrifera*	Shahatut	The Mulberry
93.	*Tectona grandis*	Sagaon	Chariot tree, Sandan ,Teak
94.	*Ceiba pentandra*	Safed Semal	The Kapok Tree
95.	*Boswellia serrata*	Salai	Salai Guggul
96.	*Albizia procera*	Safed Siris	White Siris
97.	*Bauhinia Retusa*	Semla	Devils tree
98.	*Bombax ceiba*	Semal	The red silk cotton tree
99.	*Moringa oleifera*	Saijan	The drum stick tree
100.	*Grevillea robusta*	Suru	Silver oak tree
101.	*Shorearobusta*	Sal	Sal
102.	*Terminalia chebula*	Harra	The chebulic Myrobalan
103.	*Haldina cordifolia*	Haldu	Yellow Teak
104.	*Nyctanthes arbor-tristis*	Harsingar	Night jasmine
b) **Shrubs**			
105.	Ricinus communis	Arandi	Castor oil plant

S.No.	Botanical Name	Local Name	Common Name
106.	*Calatropisprocera*	Oak /Madar	Dead silk apple
107.	*Mimosa himalayana*	Aal	Bashful mimosa
108.	*Adhatodazeylanica*	Adusa	Malabar Nut,Vasaka
109.	*Antidesmaacidum*	Aamli	Bignay ,Chinese laurel, Currant tree
110.	*Clerodendrum phlomidis*	Enni	Glory flower
111.	*Echinopsechinatus*	Gokhru	Camels Thistle
112.	*Flacourtia indica*	Kataiyya	Madagascar plum
113.	*Carrisaspinarum*	Karonda	Conkerberry /Bush Plum
114.	*Lantana camara*	Kuri	wild Sage
115.	*Clerodendrumviscosum*	Kadu	Glory tree ,Bhant
116.	*Helicteresisora*	Kapasi	Indian screw tree
117.	*Agave vera-cruz*	Kuwarbuti	Elephant aloe
118.	*Caesalpinia bonduc*	Karanji	Physic nut
119.	*Sida cordifolia*	Khareti	Country Mallow
120.	*Ziziphus nummularia*	Kantaber	Wild Jujube
121.	*Murrayakoenigii*	Gandhela	Curry leaf
122.	*Sphaeranthus indicus*	Gorakhmundi	East india globe Thistle
123.	*Cannabis sativa*	Bhang	Hemp
124.	*Cassia occidentalis*	Chakunda	Kasaundi
125.	*Greviatenax*	Chinari	White crossberry
126.	*Achyranthes aspera*	Chirchita	Prickly chalf flower
127.	*Mimosa pudica*	Chuimui	Touch me not plant
128.	*Tamarix dioica*	Jhau	Jhau
129.	*Hygrophila auriculata*	Talakhana	Marsh barbell
130.	*Deorogresia longifolia*	Tushara	Wild rhea
131.	*Cassia alata*	Badmari	Ringworm shrub
132.	*Streblus asper*	Dahia	Siamese rough bush
133.	*Woodfordiafruticosa*	Dhaolu	Fire flame bush
134.	*Cassia tora*	Panvar	Sicklepod
135.	*Glycosmis arborea*	Pilu	Toothbrush plant
136.	*Rumex hastatus*	Bhilmora	Bladder dock
137.	*Solanum nigram*	Makoy	Black nightshade
138.	*Murrayapaniculata*	Mirchiya	Orange jasmine
139.	*Lawsoniainermis*	Mehandi	Henna
140.	*Agave Americana*	Rambas	Americaln aloe
141.	*Smilex lantana*	Ramdaton	Ramdatun
142.	*Jatropha curcas*	Ratanjot	Barbados nut
143.	*Vitex nigundo*	Shivali	Niragundi
144.	*Asparagus recemosus*	Shatavar	Wild Asparagus
145.	*Desmodiumgangeticums*	Salparni	Salparni
146.	*Capparis zeylanica*	Harsa	Ceylon caper lruia
c) **Bamboo**			
147.	*Dendrocalamusstrictus*	Lathi bans	Solid Bamboo
148.	*Bambusaarundinacea*	Kanta bans	Spiny Bamboo
149.	*Dendrocalamushamiltonii*	Kako bans	Giant Bamboo
d) **Grass**			
150.	*Typha agustata*	Patera	Cattail narrow leaved
151.	*Heteropogoncontortus*	Pakhiasariwal	Spear grass
152.	*Thysanolaena maxima*	Poralu	Tiger grass

S.No.	Botanical Name	Local Name	Common Name
153.	*Cymbopogon martinii*	Mitiyagandh	Lemon grass
154.	Saccharum bengalense	Munj	Sarcanda ,sweetcane

Source: *Working plan Haridwar forest division*

Figure 3.32: Flora Found in 15 km Project Site

Fauna in core zone: The core zone is 0 to 500 m from the project site. During field survey Macaca mullata (Monkey) and Pavo cristatus (Peacock) was observed near proposed UTP and near Dakshin kali temple. The public consultation was organized near Proposed Tower 5 with temple Sadhu and other people present in temple. It was concluded that Indian Elephant, Indian Leopard, Nag and Barasingha was usually observed by temple people near the temple but no pugmarks, excreta or keeling of leopard observed during field survey. As per the letter no. 1044/21-5. dated 24.08.2021 issued by Haridwar Forest Department that

the alignment is passing through the Buffer zone of Rajaji Tiger Reserve**(Annexure-3.2).** In this range movement of wild animals especially Indian Elephant, Indian Leopard, Spotted deer and Sambar deer found by forest department Haridwar. Therefore, Haridwar forest department is expected proper mitigation measures for the animals impacted due to proposed development activity

The list of fauna observed and recorded in discussion with local elderly people is given in **Table 3.31.** Fauna recorded in core zone is shown in **Figure 3.33.** Ecological observation photographs in the study area are given in **Figure 3.34.**

Table 3.31: List of Fauna Core Zone (0.00 m -500.0m) of the Study Area

Sr. No.	Scientific Name	Common Name	Local Name	Schedule Of Wpa-1972
Mammals				
1.	*Elephas maximus indicus	Elephant	Hathi	Schedule I
2.	*Panthrapadrus	Leopard	Guldar	Schedule I
3.	*Rucervus duvaucelii	Swamp deer	Barahsingha	Schedule I
4.	Macaca mullata	Monkey	Monkey	Schedule II
5.	Presbytis entellus	Common Langur	Bandar	Schedule II
6.	Funambulus palmarum	Three-striped palm	Gilehari	Schedule IV
7.	*Axis axis	Spotted deer	Chital	Schedule III
8.	*Rusa unicolor	Philippine deer	Sambar deer	Schedule III
Birds				
1.	Pavo-cristatus	Pea-fowl	Mor	Schedule I
2.	Acridotheres tristis	Myna	Myna	Schedule IV
3.	Streptopelia chinensis	Spotted dove	Dove	Schedule IV
4.	Apus affinis	Little swift	Swift	Schedule IV
5.	Columba livia	Pigeon	Kabutar	Schedule IV
6.	Passer domesticus	House sparrow	Chidiya	Schedule IV
7.	Alcedoatthis	Common kingfisher	Kingfisher	Schedule IV
8.	Corvus splendens	House Crow	Kauva	Schedule IV
Reptiles				
9.	*Naja naja	Indian cobra	Nag	Schedule II
10.	*Bungarus fasciatus	Banded krait	Krait	Schedule IV

*Note: * found in discussion with temple people and As per Form-25 of forest, Haridwar Forest Division*

Figure 3.33: Fauna observed in Core Zone of the Study Area

Figure 3.34: Ecology observation in Study Area

Fauna in buffer zone: The fauna recorded from the buffer zone is taken from working plan of Haridwar forest division.32 Mammals, 68 birds & 07 reptiles are present in 15 km of the study area. It is home to Royal Bengal tiger, Indian Leopard, Indian Elephant. Rajaji national park has the largest population of elephants in Uttarakhand (over 352), Royal Begal Tiger 37 & 2 Tigress.

Rajaji national park is spread over 820 square kilometres and was formed in 1983 by merging three wildlife sanctuaries - Chilla, Motichur and Rajaji. The Ganges cuts through these forests and is home to a wide variety of fish like trout, mahseer and chilwa. List of fauna recoded from 15 km radial distance from the project site is given in **Table 3.32.**

Table 3.32: List of Fauna 15 km Radial Distance from the Project Site

S. No.	Scientific Name	Common Name	Local Name	Schedule Of WPA-1972
Mammals				
1.	*Lutra lutra*	Uad	Otter	Schedule II
2.	*Lutraperspicillata*	Uadbilao	Otter	Schedule II
3.	*Muntiacusmuntjak*	Kakad	Barking deer	Schedule III
4.	*Lepus nigricollis*	Kharaha	Indian hare	Schedule IV
5.	*Funambulus pennantii*	Five -striped palm squirrel	Gilehari	Schedule IV
6.	*Nemorhaedus goral*	Ghoral	Himalayan goat	Schedule III
7.	***Felis bengalensis***	**Chita billi**	**Leopard cat**	**Schedule I**
8.	*Rousettus leschenaultii*	Chamgadad	Fruit bat	Schedule V
9.	*Suncus murinus*	Chuchunder	The Asian house	-
10.	*Sus Scrofa*	Jangalisuar	Wild boar	Schedule III
11.	*Felis chaus*	Jangalibilli	Wild Cat	Schedule II
12.	*Herpestesedwardsii*	Nevala	Common mongoose	Schedule II
13.	*Boselaphustragocamelus*	Vanrose	Neelgai	Schedule III
14.	***Axis porcinus***	**Pada**	**Hog deer**	**Schedule I**
15.	*Pteropus giganteus*	Gadal	Indian flying fox	-
16.	***Panthera tigris***	**Bagh**	**Indian Tiger**	**Schedule I**
17.	***Melursus ursinus***	**Bhalu**	**Sloth Bear**	**Schedule I**
18.	***Canis lupus***	**Bhedia**	**Wolf**	**Schedule I**
19.	***Antilope cervicapra***	**Mrug**	**Blackbug**	**Schedule I**
20.	***Felis viverrina***	**Mach Billi**	**Fishing cat**	**Schedule I**
21.	*Hyaena hyaena*	Lakadbagha	Stripped Hyena	Schedule III
22.	*Vulpes vulpesmontana*	Lomadi	The red fox	Schedule II
23.	*Hystrix indica*	Sehi	Porcupine	Schedule IV
24.	***Manis crassicaudata***	**Sallu**	**Indian Pangolin**	**Schedule I**
25.	****Elephas maximus***	**Hathi**	**Indian Elephant**	**Schedule I**
26.	****Panthrapadrus***	**Guldar**	**Indian Leopard**	**Schedule I**
27.	****Rucervusduvaucelii***	**Barahsingha**	**Swamp deer**	**Schedule I**
28.	*Macaca mullata*	Monkey	Monkey	Schedule II
29.	*Presbytis entellus*	Common Langur	Bandar	Schedule II
30.	*Canis aureus*	Siyar	Jackal	Schedule II
31.	**Axis axis*	Spotted deer	Chital	Schedule III

S. No.	Scientific Name	Common Name	Local Name	Schedule Of WPA-1972
32.	**Rusa unicolor*	Philippine deer	Sambar deer	Schedule III
Birds				
1.	***Pavo-cristatus***	**Mor**	**Pea-fowl**	**Schedule I**
2.	*Ketupazeylonensi*	Amarai Ullu	Brown fish Owl	Schedule IV
3.	*Sturnus contra*	Abakali myna	Asian pied starling	Schedule IV
4.	*Eudynamys scolopaceus*	Koyal	Asian Koel	-
5.	*Spilornis cheela*	Kalgicheel	Crested serpent	Schedule IV
6.	*Francolinus francolinus*	Kala Titar	Black Francolin	Schedule IV
7.	*Picusxanthopygaeus*	Kodiyala Kathafoda	Streak Throated	Schedule IV
8.	*Dinopium benghalense*	Kalputhangara Kathafoda	Black rumped Flameback	Schedule IV
9.	*Cerylerudis*	Kerillakilkila	Pied Kingfisher	Schedule IV
10.	*Meropsles chenaulti*	Katha sir Patarang	Chestnut headed	Schedule IV
11.	*****Grus virgo***	**Karkara saras**	**Demoiselle crane**	**Schedule IV**
12.	*Egretta garzetta*	Karachia Bagula	Little egret	Schedule IV
13.	*Saxicoloides fulicata*	Kalachuri	Indian Robin	Schedule IV
14.	*Hypothemis azurea*	Kala Kathkathia	Black Naped	-
15.	*Pycnonotus cafer*	Bulbul	Red Vented Bulbul	Schedule IV
16.	*Bubulcus ibis*	Gay Bagula	Cattle egret	Schedule IV
17.	*Acridotheres ginginianus*	Ganga myna	Bank myna	Schedule IV
18.	*Tyto capensis*	GhasUllu	Grass Owl	-
19.	*Hemiprone coronata*	Chotidara babeel	Crested Tree swift	-
20.	*Anas crecca*	Choti Murgavi	Common teal	Schedule IV
21.	*Alauda gulgula*	Chota Bharat	Oriental Skylark	-
22.	*Microcarboniger*	Chota Pan-kawa	The little cormorant	Schedule IV
23.	*Pericrocotus cinnamomeus*	Chotarajalal	Small Minivet	-
24.	*Gallus gallus*	Jangali murga	Red Jungle fowl	Schedule IV
25.	*Glaucidium radiatum*	Jangali Ullu	Jungle Owlet	Schedule IV
26.	*Gallinula chloropus*	Jal murgi	Common Moorhen	Schedule IV
27.	*Sterna aurantia*	Jal Kurari	River Tern	Schedule IV
28.	*Corvus corax*	JangaliKauwa	Common Raven	Schedule V
29.	*Vanellus duvaucelii*	Jal -Titahari	River lapwing	Schedule IV
30.	*Turdoides striata*	Charakhi	Jungle Babbler	Schedule IV
31.	*Terpsiphone paradisi*	Dudhraj	Asian paradise	Schedule IV

S. No.	Scientific Name	Common Name	Local Name	Schedule Of WPA-1972
32.	*Copsychus saularis*	Dayal	Oriental Magpie Robin	Schedule IV
33.	Cyornisrubeculoides	Nilakanth Machariya	Blue –Throated flycatcher	Schedule IV
34.	Coracias benghalensis	Neelkanth	Indian Roller	Schedule IV
35.	**Anthracoceros albirostris**	**Purvi Abaloc Dhanesh**	**The oriental pied hornbill**	**Schedule I**
36.	Indicator xanthonotus	Pilpithimadhu	Yellow Rumped	Schedule IV
37.	Hydrophasianuschirurgus	Piho	Pheasant tailed jacana	Schedule IV
38.	Leiopicusmahrattensis	Pili chonchlambchupia	Yellow crowned woodpeacker	Schedule IV
39.	Sturnus malabaricus	Pawaimyna	chestnut-tailed starling	Schedule IV
40.	Sturnia pagodarum	Puhaiyya	Brahmany straling	Schedule IV
41.	Priniaflaviventris	Pipleti /Dumphudaki	Yellow bellied prinia	Schedule IV
42.	Motacilla flava	PilkhiaKhanjan	Yellow wagtail	Schedule IV
43.	Chrysocolaptes lucidus	Bada angaraKathaphoda	Greater Flameback	Schedule IV
44.	Dicrurusparadiseus	Bada bhimrajBhujanga	Greater Racket tailed Drongo	Schedule IV
45.	Pericrocotus flammeus	Bada pahadi Rajalal	Scarlet Minivet	Schedule IV
46.	Cuculusmicropterus	Bharatiya Kukku	Indian cuckoo	Schedule IV
47.	Streptopelia	Lal ghavarphakta	Red Collard Dove	Schedule IV
48.	****Dendronanthus indicus**	**Van khanjan**	**Forest waigtail**	**Schedule IV**
49.	Coturnix coturnix	Samanya Bater	Common quail	Schedule IV
50.	Grus grus	Samanya crane	Common crane	Schedule IV
51.	Antigone antigone	Saras crane	Saras	Schedule IV
52.	Milvus Migrans	Black kite	Samanyacheel	Schedule IV
53.	Ocycerosbirostris	Siletidhanesh	Indian Gray Hornbill	Schedule IV
54.	Turdoides striata	Sat bahin	Seven sisters	Schedule IV
55.	Saxicola torquatus	Samanyabhattpidda	Common stone-chaat	Schedule IV
56.	Parus major	Siletiramgangara	Great Tit	Schedule IV

S. No.	Scientific Name	Common Name	Local Name	Schedule Of WPA-1972
57.	Priniasocialis	Siletidumfudaki	Ashy prinia	Schedule IV
58.	Ploceusphilippinus	Samanya baya	Baya weaver	Schedule IV
59.	Upupa epops	Hudhud	Common Hoope	Schedule IV
60.	Meropsorientalis	Hara Pataranga	Green bee-eater	Schedule IV
61.	Tringaochropus	Hara chaubaha	Green sandpiper	Schedule IV
62.	Acridotheres tristis	Myna	Myna	Schedule IV
63.	Streptopelia chinensis	Dove	Spotted dove	Schedule IV
64.	Apus affinis	Swift	Little swift	Schedule IV
65.	Columba livia	Kabutar	Pigeon	Schedule IV
66.	Passer domesticus	Chidiya	House sparrow	Schedule IV
67.	Alcedoatthis	Kingfisher	Common kingfisher	Schedule IV
68.	Corvus splendens	Kauva	House Crow	Schedule IV
Reptiles				
1.	*Naja naja	Krushna sarp	Indian cobra	Schedule II
2.	*Bungarus fasciatus	Sakani	Banded krait	Schedule IV
3.	**Python molurus**	**Aajagar**	**Python**	**Schedule I**
4.	Xenochrophis piscator	Pani ka Sap	Common pond snake	Schedule II
5.	**Varanus bengalensis**	**Goha**	**The common Indian monitor lizard**	**Schedule I**
6.	Hemidactylus brookii	**Chipakali**	**Common house**	Schedule IV
7.	**Crocodylus palustris**	**Magar**	**Marsh crocodile**	**Schedule I**

*Note: * found in discussion with temple people and As per Letter-25 Forest department, Haridwar, ** Migratory Birds*

Forest clearance: The proposal FP/UK/Others/142130/2021, dated 7/05/2021 for the diversion of forest land of 0.29ha has been submitted and the forest clearance is under process. The proposal is pending with State Government.

Wildlife Clearance: The proposal FP/UK/Others/142130/2021, dated 10/05/2021 for the NOC from NBWL has been submitted and the Wildlife clearance is under process.

Migratory birds: Rajaji national park is the first staging ground for migratory birds once they cross over the Himalayas into the Indian subcontinent in the winter months. The radial distance of Bhimgoda barrage and proposed LTP is 650m. Birds feeding area in 1km radial distance from the project site is given in **Figure 3.35**. A large numbers of migratory birds are found to congregate on the Ganges, especially near the Bhimgoda Barrage in Haridwar before 2013. Larger Cormorant, Ruddy Shelduck, Red Crested Pochard, Common Pochard, Tufted Duck, Pintail, Gadwall, Mallard, etc. are some of the water birds that are reported in the Rajaji National Park during winter. These birds are attracted by the little food available to them in these semi-permanent streams. The migratory birds have not breed in the Rajaji national Park. But as per Prof Dinesh Bhatt (Ornithologist) *"The floods of 2011 and Kedar Valley disaster of 2013 have made them change the routes of their winter flight. The*

islands dotted with vegetation inside the Ganga riverbed have disturbed with time, making them to opt for Misserpur wetlands, some 10 kms away from the main Haridwar city". It was concluded that, No migratory birds are found in Core zone of Study area.

Figure 3.35: Birds Feeding Areas in 1 km Radial Distance from Project Site

Rajaji National Park: Rajaji National park (Now Rajaji Tiger Reserve) has inherited its name from Rajaji Sanctuary, which was one of the constituent unit by amalgamation in which the National Park was created in 1983, (Rasily 2008). Rajaji Sanctuary was named after Rajaji C. Rajagopalachari lovingly known as Rajaji, the first Governor General of independent India, as it was on his behest that this sanctuary was created in Uttarakhand state. The intent notification of Rajaji Sanctuary as Rajaji National Park was issued on 12th august 1983 and recently changed to Rajaji Tiger Reserve for conservation of viable population of tigers. The whole area encompasses the Shivalik range, near the foothills of Himalayas spread in 820.42sq km within the three districts i.e., Dehardun, Haridwar and Pauri Garhwal. The Rajaji Tiger Reserve (RTR) is an essentials part of the terai landscape between Sharda and Yamuna River in Shivalik landscape (Akash et al., 2018a). The Chilla forest range of the RTR lies in the east of the river Ganges and attached to the Garhwal forest Division at an elevation between 302 and 1000m above sea level. The Chilla range of the reserve is one of the great centres of attractions for tourists (Akash et al., 2018c). The RTR extends over the Shivalic range from Dehradun-Saharanpur road in the North West to the Rawasan River in the southeast, which falls within the Gangetic biogeographic zone (Rodgers et al., 2002).

The topography, altitude and climate of RTR vary greatly, due to which it supports a rich floristic diversity in Shivalik landscape.The reserve has ten forest ranges which are playing significant role in conserving of biodiversity. The Chilla range of the reserve is one of the

great centres of attractions for tourists (Akash et al., 2018b). The RTR is distinct in terms of scenic beauty and rich biodiversity which is foliated by number of different types of forest (Joshi et al., 2010). It includes northern dry deciduous and Acacia-Dalbergia forest, mixed forest of Shorea Mallotus and some area represents the Savannah. The area has the different weather condition. Winter start from November to February when the days are pleasant (approx. 20-250 C), nights are cold but low in humidity. The temperature rises rapidly from 400-450 C in the summer season (March to June) but the rainfall increases with the occasional thunderstorm. The level of humidity is high in the rainy season (July to October). The annual rainfall ranges from 1200-1500mm. Soils are generally poor and infertile, with accumulation of humus in only at few places of the tiger reserve.

The area has traditionally been inhabited by Gujjars (a pastoralist community). They herd buffalo between high Himalayan pastures in summer and lower foothills in winters. There are different types of Gujjar community settlements within the tiger reserve. The terai belt consists of dense tall grasses along with the Asiatic elephants and large number of mammalian fauna. Based on the Physiognomy, vegetation of the park may be classified broadly under the northern tropical moist deciduous forest and can be grouped according to (Champion et. al., 1988):

(a). Sal forest

(b). Mixed forest

(c). Riverine forest

(d). Scrubland

(e). Grassland

(f). Sub tropical Pine forest.

The Sal forest occupies the major part of the Rajaji national park and can be divided into two types; namely, tropical moist deciduous forest and tropical dry deciduous forest. The tropical moist deciduous forest is represented by the dominated tree species, Shorea robusta which forms pure tracts. The common species associated of the *Sal forest are Terminalia alata, Anogeissus latifolia, Adina cordifolia, Terminalia bellerica, Lannea corommandelica, Garuga pinnata, Sterospermum suaveolens, Mallotus philipensis etc. Whereas the tropical dry deciduous represents Terminalia bellerica, Cassia fistula, Mallotus phillipensis, Bombex ceiba etc.*

The mixed forest of the park is generally comprises of Anogeissus laitolia, Albiza procera, Mallotus phillipensis, Bombex ceiba, Terminalia bellerica, Acacia catechu, Mitragyna parviflora, Erythrina suberosa, Embilica officinalis, Bredeliasquamosa,Gmelina arborea, Listeaglutinosa, Trewianudiflora, Cassia fistula, Sterculia villosa, Zizypus xylopyra, Z. Mauritiana, Butea monosperma etc. The mixed forest community also faced species depletion by various activities of the locals (Johnsingh et al., 1990).

The Riverine forests occur in the low lying waterlogged areas, along nullahs, river bands and streambed and consist of evergreen species which are able to withstand the wetness of the occupied sites. *The common species of this forest are Syzagium cumini, Ficus racemosa, Bischofia javanica, Trewia nudiflora, Pterospermum acirifolium, Albizzia procera, Toona ciliata, Calamus tenuis etc.*

The Scrub forest of the park generally represents degradation of the dry deciduous forests which are formed due to the biotic stresses like overgrazing, lopping, felling and fires. Aegle marmelos, Lannea coromandelica, Erythrina suberosa, Cassia fistula, Flacourtia indica, Zizypus mauritiana, Z. xyloporaare the main tree species of this forest.

The Other plant communities of the park is Savannah (Grassland) which doesn't represent a climax stage in the park but have developed due to the various disturbance and anthropogenic disturbance on the natural flora. Desmostachya bipinnata, Phragmites karka, Cymbogon flexuosus, Digitaria spp, Eragrostris japonica, E. tennela, Setaria spp, Vetiveria zizaniodes,Heteropogon contortus, Butea monosperma, Acacia catechu, Helicteresis ora, Carrisa opaca, Dendrocalamus strictus are the important plant species of the Grassland community. The sub tropical Pine forest occurs between dry deciduous forest and sal forest. The extent of this forest is very small and Pinus roxburghii occurs on the higher slopes of the Shivaliks, mixed with stunted forests.

Ecological value of the Rajaji Tiger Reserve: RTR is an important ecosystem comes under Rajaji- Corbett elephant reserve which maintains the elephants population as single entity of about 90% of 1000 odd elephants in Northern India (Singh et al., 1986). The Asiatic elephants are the major attraction of the tiger reserve. In India it occurs in North-Western part. It has been estimated that, 800-1000 elephants occur in Rajaji- Corbett tiger reserve and the adjoining forest areas (Johnsingh et al., 1994). The turbulent Ganges emerges from the Himalayas and begins its journey through the Indo- Gangetic plains at the Rajaji national park. The junctions of the Gangetic plains and the Outer Himalaya give rich eco-tone habitat in RTR that is unique in its diversity. It has vegetation representation of several distinct habitats including Chir Pine forest, Scrublands; Broad leaves mixed forest, Riverine forest. Shorea robusta is the major dominant species especially along the Northern aspects. Thus unique to the rich biodiversity and the variety of ecological habitat, the RTR is unique repository of biodiversity in Northern India.

Annexure- 3.I

परियोजना का नामः— उत्तराखण्ड मेट्रो रेल, शहरी अवस्थापना एवं भवन निर्माण निगम लिमिटेड द्वारा जनपद हरिद्वार में हर की पौड़ी से चण्डी देवी मन्दिर तक रोपवे प्रणाली के विकास हेतु आरक्षित वन भूमि 0.29 हैक्टेयर का हस्तान्तरण प्रस्ताव।

कार्यालय उप वन संरक्षक,.....

संख्या—

दिनांक

प्रभावित होने वाले वृक्षों का विवरण

प्रश्नगत परियोजना के निर्माण हेतु दिनांक 07.09.2020 को किये गये संयुक्त निरीक्षण के अनुसार आवेदित वन भूमि पर प्रभावित होने वाले वृक्षों की गणना की गयी व निरीक्षण के दौरान प्रभावित होने वाले वृक्षों की निम्नानुसार गणना की गयीः—

टर्मिनल स्टे नः— चण्डी देवी GPS-N-29°56'2.23" E-78°10'50.37"

क्र0सं0	ब्लॉक	प्रजाति	व्यास वर्ग								योग
			0—1	1—2	2—3	3—4	4—5	5—6	6—7	7 से ऊपर	
1	चाण्डी वन ब्लाक	कोकाट	—	01	01	—	—	—	—	—	02
2		सांदन	—	—	—	—	—	01	—	—	01
3		साल	—	—	01	—	—	01	—	—	02
4		बाकली	—	—	01	01	—	—	—	—	02
योग			—	**01**	**03**	**01**	—	**02**	—	—	**07**

टॉवर नं0—13 GPS-N-29°56'3.77" E-78°10'49.8"

क्र0सं0	ब्लॉक	प्रजाति	व्यास वर्ग								योग
			0—1	1—2	2—3	3—4	4—5	5—6	6—7	7 से ऊपर	
1	चाण्डी वन ब्लाक	बाकली	—	—	02	01	—	—	—	—	03
योग			—	—	**02**	**01**	—	—	—	—	**03**

टॉवर नं0—11 GPS-N-29°56'21.97" E-78°10'42.97"

टॉवर नं0—12 GPS-N-29°56'8.54" E-78°10'48.01"

क्र0सं0	ब्लॉक	प्रजाति	व्यास वर्ग								योग
			0—1	1—2	2—3	3—4	4—5	5—6	6—7	7 से ऊपर	
1	चाण्डी	साल	—	—	01	01	—	—	—	—	02

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उप वन संरक्षक, हरिद्वार वन प्रभाग

Raghvendra Sharan Dubey
General Manager (Civil)
Uttarakhand Metro Rail Urban Infrastructure & Building Construction Corporation Limited

2	वन ब्लाक	खैर	—	—	01	—	—	—	—	—	01
योग			—	—	**02**	**01**	—	—	—	—	**03**

टॉवर नं0–09 GPS-N-29°56'28.288" E-78°10'40.6"

टॉवर नं0–10 GPS-N-29°56'22.2" E-78°10'42.89"

क्र0सं0	ब्लॉक	प्रजाति	व्यास वर्ग								योग
			0–1	1–2	2–3	3–4	4–5	5–6	6–7	7 से ऊपर	
1	चाण्डी वन ब्लाक	बाकली	—	—	—	02	—	—	—	—	02
2		बेल	—	—	01	-	—	—	—	—	01
योग			—	—	**01**	**02**	—	—	—	—	**03**

टॉवर नं0–8 GPS-N-29°56'33.69" E-78°10'38.58"

क्र0सं0	ब्लॉक	प्रजाति	व्यास वर्ग								योग
			0–1	1–2	2–3	3–4	4–5	5–6	6–7	7 से ऊपर	
1	चाण्डी वन ब्लाक	कोकाट	—	02	—	—	—	—	—	—	02
2		रोहणी	—	01	—	—	—	—	—	—	01
योग			—	03			—	—	—	—	03

टॉवर नं0–07 GPS-N-29°56'41.09" E-78°10'35.8"

क्र0सं0	ब्लॉक	प्रजाति	व्यास वर्ग								योग
			0–1	1–2	2–3	3–4	4–5	5–6	6–7	7 से ऊपर	
1	चाण्डी वन ब्लाक	सागौन	—	01	02	05	—	—	—	—	08
2		बेल	—	01	02	—	—	—	—	—	03
		बाकली	—	01	—	—	—	—	—	—	01
योग				**03**	—	**05**			—	—	**12**

उपरोक्तानुसार गणना किये गये वृक्षों का पातन किया जाना अपरिहार्य है।

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प्रभागीय वनाधिकारी
हरिद्वार वन प्रभाग, हरिद्वार

उप वन संरक्षक
हरिद्वार वन प्रभाग, हरिद्वार

वन क्षेत्राधिकारी
श्यामपुर रेंज
हरिद्वार वन प्रभाग

सेवा में, अधिशासी अभियन्ता हेलीपोर्ट विकास प्रभाग, इच्छापुरी देहरादून

विषय - हरिद्वार में दीन दयाल उपाध्याय पार्किंग से माँ चण्डी देवी मन्दिर रोपवे प्रणाली का निर्माण कार्य।

महोदय, उपरोक्त विषय के संबंध में मुझे यह कहने का आदेश हुआ है कि इच्छापुरी देहरादून के सर्वेक्षण के अनुसार दीन दयाल उपाध्याय पार्किंग से माँ चण्डी देवी मन्दिर तक रोपवे में निम्नलिखित टावरों की सूची निम्न प्रकार है।

क्र०	पहाड़ी	टावर (मीटर में)	व्यास	दशा	
1-	ढाल	1.75		ठीकठाक	चण्डी देवी 7
2-	-11-	0.80		सुलाकड़ा	
3-	चण्डी	1.05		ठीकठाक	
4-	-11-	0.85		-11-	
5-	-11-	0.80		-11-	
6-	-11-	1.00		-11-	
7-	-11-	0.65		-11-	
8-	धोबीघाट	0.85		-11-	चण्डी 7 व 8
9-	ढालदार	1.75		-11-	
10	चण्डी	0.50			
11-	खैर	0.90		-11-	
12-	ढलान	1.15		-11-	
13-	-11-	0.80		-11-	
14-	खेत	0.70		-11-	
15-	चण्डी	1.10		-11-	
16-	चण्डी	1.00		-11-	
17-	रोहिनी	0.75		-11-	चण्डी 6 व 7
18-	धोबीघाट	0.50		-11-	
19-	-11-	0.40		-11-	
20-	ढलान	0.85		-11-	
21-	-11-	0.95		-11-	
22-	-11-	1.15		-11-	
23-	-11-	0.75		-11-	
24-	-11-	0.60		-11-	

OK SURE.

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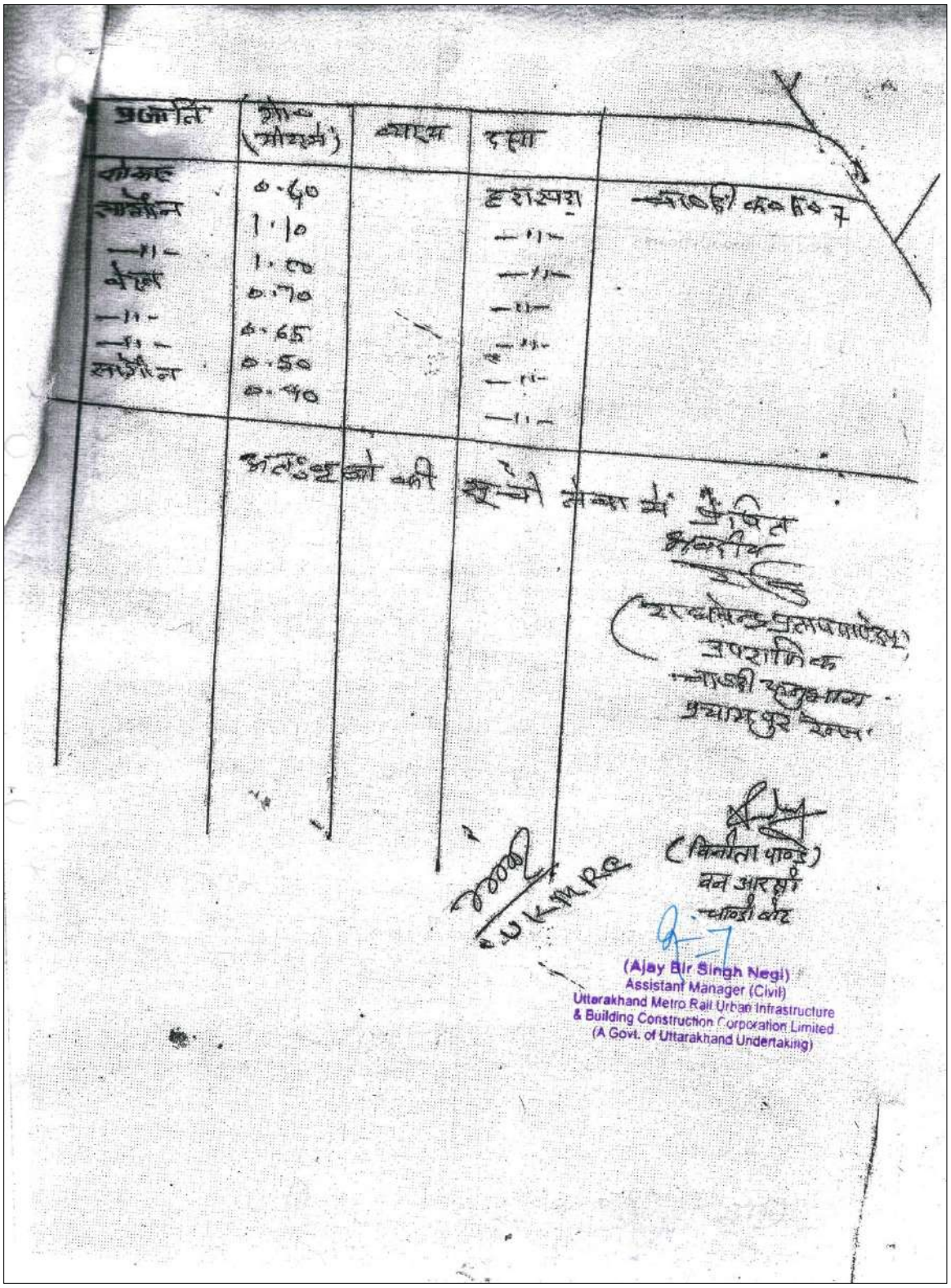
PTO



प्रजाति	गो० (मीटर्स)	व्यास	दशा	
[illegible]	0.40		हरा स्वस्थ	चण्डी क० 5 ० 7
सागौन	1.10		—"—	
—"—	1.00		—"—	
[illegible]	0.70		—"—	
—"—	0.65		—"—	
—"—	0.50		—"—	
सागौन	0.40		—"—	

अतः वृक्षों की सूची सेवा में प्रेषित

भवदीय

(राधेन्द्र प्रताप पाण्डेय)
उपरान्तिक
चण्डी अनुभाग
प्रयागपुर रेंज

(विनीता पाण्डे)
वन आरक्षी
चण्डी बीट

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Annexure 3.2

प्रपत्र–25

परियोजना का नाम – जनपद हरिद्वार में हर की पौड़ी से चण्डी देवी मन्दिर तक रोपवे प्रणाली के विकास हेतु आरक्षित वन भूमि 0.29 है0 का हस्तान्तरण।

प्रमाणित किया जाता है कि प्रश्नगत परियोजना के अन्तर्गत जनपद हरिद्वार के अन्तर्गत चण्डी देवी मन्दिर श्रद्धालुओं के लिए एक अत्यन्त महत्वपूर्ण धार्मिक स्थल है, जहां विभिन्न पर्वो में श्रद्धालु चण्डी देवी के दर्शनार्थ आवागमन करते हैं। प्रस्तावित रोपवे इस वन प्रभाग की श्यामपुर रेंज के आरक्षित वन क्षेत्र चाण्डी कक्ष संख्या 7 व 8 से होकर गुजरेगी। यह क्षेत्र राजाजी टाइगर रिजर्व के बफर जोन के अन्तर्गत आता है। क्षेत्र में वन्यजीवों विशेषकर हाथी, गुलदार, चीतल, सांभर आदि का आवागमन बना रहता है। अतः वन्यजीवों की सुरक्षा से सम्बन्धित उपचारों/सुझावों के लिए प्रयोक्ता अभिकरण को परियोजना निर्माण हेतु National Board for Wildlife से अनुमति लेनी अनिवार्य होगी। प्रयोक्ता अभिकरण द्वारा प्रस्तावित क्षेत्र के अन्तर्गत वन्यजीवों की सुरक्षा को दृष्टिगत रखते हुए उचित कदम उठाये जाते हैं तो इस स्थिति में प्रस्तावित रोपवे निर्माण की संस्तुति की जाती है।

Chief Wildlife Warden,
Uttarakhand, Dehradun
Chief Wildlife Warden,

(नीरज कुमार)
उप वन संरक्षक
हरिद्वार वन प्रभाग, हरिद्वार

पत्रांकः 1044 /21-5, दिनांकित। 24.8.21

प्रतिलिपिः प्रमुख वन संरक्षक (वन्यजीव)/मुख्य वन्यजीव प्रतिपालक, उत्तराखण्ड, देहरादून को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित।

(नीरज कुमार)
उप वन संरक्षक,
हरिद्वार वन प्रभाग, हरिद्वार

Chapter 4

Anticipated Environmental Impact & Mitigation Measures

CHAPTER 4 : ANTICIPATED ENVIRONMNENTAL IMPACT & MITIGATION MEASURES

4.1 ENVIRONMENTAL IMPACT

The primary function of an environmental impact assessment study is to predict and quantify the magnitude of impacts, evaluate and assess the importance of the identified changes and formulate plans to monitor and mitigate the actual changes. Environmental impacts could be positive or negative, direct or indirect, local, regional or global, reversible or irreversible. This chapter discusses the potential impacts on environment. Attempts have been made to predict the impacts due to the proposed project.

The impacts on the various environmental components have been assessed during various phase of the project cycle namely due to the location, project design, possible accident, construction and operation. The environment component consider for the impact assessment are as follows:

- Land Environment,
- Water Environment,
- Air Environment,
- Noise Environment,
- Biological Environment and
- Socio-Economic Environment

The pollutants generated at the proposed project premises during construction and operation phases are solid, liquid and gaseous in nature. Pollutants may be generated continuously, periodically or accidentally. Sources of pollutants and their characteristics during the construction and operation phase are given in **Table 4.1**. This section identifies and appraises the negative as well as positive impacts on various aspects of the environment likely to result from the proposed development.

Table 4.1: Pollution Sources And Characteristics

S. No.	Activity/ Area	Pollutant	Pollutant Characteristic	Frequency
CONSTRUCTION PHASE				
1	Construction activities on and off the construction site.	Air Emissions- $PM_{2.5}$, PM_{10}, CO, NO_x, SO_2	Dust from excavation, concrete mixing, material handling and other construction activities. Emissions from vehicles and machinery.	Temporary during construction phase only.
		Debris/Solid waste	Debris/leftover waste from construction activities. Garbage of construction works /office	Commensurate with the construction activities

S. No.	Activity/ Area	Pollutant	Pollutant Characteristic	Frequency
		Noise	Noise generated from construction equipment and machinery	Commensurate with the construction activities
		Wastewater	Construction office/workers camp	Temporary during construction phase only
OPERATION PHASE				
2	Vehicular movement	Air Emission and Noise	Vehicular emissions	Continuous/ Periodic
3	Diesel Generators	Air emission	SO_2, NO_X, SPM, CO from fuel burning	Intermittent/ Periodic
		Noise	Noise due to running of equipment	Intermittent/ Periodic
4	Office, etc.	Sewage	Domestic wastewater-BOD, Suspended solids, pathogens	Continuous
5	Open area	Wastewater, solid waste	Wash water and road sweepings	Intermittent/ Periodic
6	Storm water drains	Suspended Solid	Contaminated discharge from site – mainly suspended solids	During rainy season

4.2 IMPACT DUE TO PROJECT LOCATION

Impact: The proposed project site for development of proposed ropeway falling in the forest and irrigation land. The diversion of 0.29 Hectare forest area is required for the use of non forest purpose. The construction of ropeway on forest and irrigation land has irreversible impact by change of land use.

- **Impact on land:** The ropeway project is proposed in government land which belongs of various govt. departments. During field survey it is reported that no private land will be acquired for construction of the project.
- **Impact on structures:** During site visit it is reported that no structures would be affected.
- **Impact on Families:** During field survey no displacement of family is anticipated due to construction of the project.
- **Impact on Existing Footpath at UTP Station:** After verifying the layout plan of proposed UTP station during field study, it is anticipated that during construction the existing footpath to Chandi Devi temple hills will be altered due to lack availability of space.
- **Impact on Common Property Resources (CPR):** Two public toilets would be demolished near LTP stations.
- Site clearance works will involve the removal of vegetation (mainly grasses, shrubs, tree), and a small portion of the available topsoil.

- Clearance of vegetation will create soil erosion and sedimentation pollution due to runoff.
- Removal of vegetation can also alter flow pattern and induce or accelerate bank or bed erosion. This impact is not anticipated as construction will be carried out in Dry river bed.
- During survey it was observed that the present land is used by the pilgrims and other person for defecation. During monsoon washer man (Dhobis) also used this land for cloth washing. Due to these activity the Soil, Ganga water, surrounding environment have been polluted. Developing this land into the ropeway station will beautify the River bank, surrounding environment and also will improve the landscape of the Haridwar city.

Mitigation & Management measure: To mitigate the impact the following measures will be implemented:

- Compensatory plantation on 0.29 Ha of degraded Forest Land will be carried out by the forest department. Requested amount for the compensatory plantation will be submitted to the Forest department by UKMRCL.
- Toilet facility will be developed at Lower terminal and Upper terminal by the project proponent.
- Topsoil near the Tower location 5 and 6 will be stored properly and will be given to the farmer for the purpose of agriculture.
- River Improvement work will be carried out Near the Lower Terminal.
- Phase approach will be adopted to avoid the clearing the whole site at once to avoid the exposure of ground for long period of time.
- Site clearance will be carried out before monsoon.
- Biodegradable textiles will be used to protect areas of bare soil.

4.3 IMPACT DUE TO POSSIBLE ACCIDENTS

4.3.1 Landslides

Impact: The area where ropeway is proposed is having minimum prone to landslides. Hence, there is no such impact is anticipated.

Mitigation Measure: However, structural stability & safety is must to prevent ropeway damage due to landslides. Slope stability in the area shall be maintained at 45^0.

4.3.2 Risk due to Earthquakes

Impact: Project site is located in the seismic zone IV as classified in IS: 1893:2002 which indicates the project area comes under the moderate damage risk zone. Due to earthquake these are the aspect which may occur.

- Damage to Towers
- Damage to Terminal Stations
- Damage to cable Cars.

Mitigation Measure: All the components of structural design of foundation, elements of masonry, timber, are designed according to the provision mentioned in the IS: 1893:2002. Allowable bearing pressure shall be determined in accordance with IS: 6403 or IS: 1888.

4.3.3 Wind & Cyclone

Impact: The project area falls under the high damage risk zone. During storm or cyclone passengers inside cable cars will experience horizontal movement of the connection between the track cable and the gondola as shown in Figures 4.1 & 4.2. This situation may cause injuries to passengers.

Figure 4.1: Scheme of a Span Of Cable Ropeway

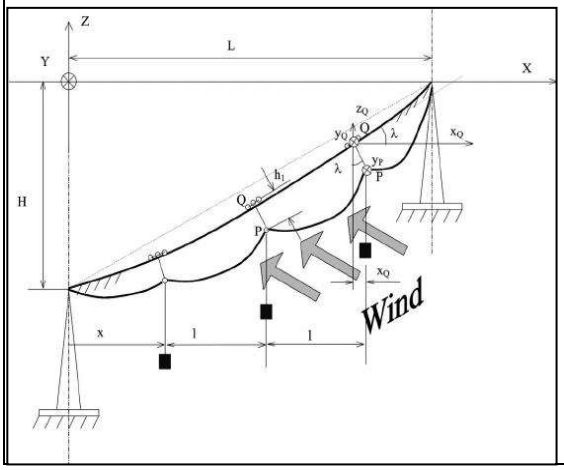
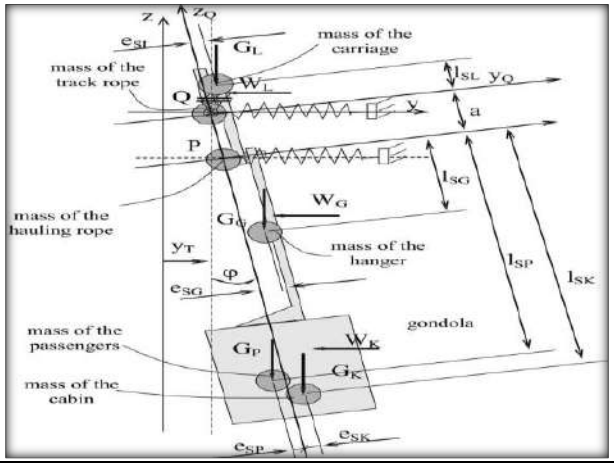


Figure 4.2: Horizontal Movement of the Connection between The Track Cable And The Gondola



Each of the two track cable sections serves for just one direction, and these are linked together in the upper and lower stations by the overhead monorails. In making this assumption, numerical studies can be reduced to one span (Figure 4.1 & 4.2) of the track.

In normal operation, the cabins move along the span with constant velocity. The trajectory along the span follows the elastic line of the track cable. The horizontal tension force and the dead weight of the cable and the cabins influence this line. For this simulation, it can be assumed that the elastic line of the track cable is constant and fixed in a vertical direction. This means that there are neither vertical oscillation effects nor swinging of the cabins in the x – z plane. Every gondola is modeled as a mechanical system with two degrees of freedom (DOFs)—rotation angle and horizontal movement of the connection between the track cable and the gondola, y.

Mitigation measure:

- The wind forces and their effects (static and dynamic) should be taken into account when designing the ropeways.

- The provisions mentioned in IS 875 (part 3), IS 802 (Part 1) - shall be followed. The ropeway design shall also consider seismic loads in accordance with IS 1893. In addition, other special loads in accordance with IS 875 (part 5) shall also be considered while designing the ropeway. The trestle shall be analyzed and designed for various load combinations as per IS: 802.

- The tubes used in the hangers shall have no longitudinal welds and preferably seamless. Their interior shall be protected against corrosion. If welded tubes are used, welding should be checked by Non-Destructive Testing (NDT).

- The project shall be provided with anemometers to monitor the wind speed. The anemometers shall be integrated with control panel to reduce operation speed to 50% in case wind velocity exceeds 50 km/h and stop the plant if the wind velocity exceeds 65-70 km/h.
- Aerial ropeways shall be closed down when the wind velocity reaches the design limit values, as agreed by the design verifier, the lift manufacturer and the lift controller, for the particular operating conditions and particular lift installation. For this purpose, suitable wind gauges like anemometer shall be installed at appropriate locations to ascertain wind velocity.

- Wind pressure shall be as per the relevant Indian Standard i.e. installation should not be in operation at 150km/hr wind speed.

- A band brake has been provided on C.I. Brake Rim fitted on the drive bull wheel. This comes in operation automatically when the wind speed exceeding set operating speed.

- The ropeway system would be provided vertical rescue system to facilitate the rescue of passengers who might remain trapped along the line on account of unforeseen stopping of the installation. The use of equipment shall not require the passenger should be rescued in a reasonable short time and in easiest and safest manner. Provision may be kept for keeping rescue apparatus like Polypropylene rope, safety belt, chair, pulleys etc

4.3.4 Cloud Burst

Impact: Chances of cloud burst impact will not anticipated in this region**.**

Mitigation measure: There is no cloudburst evidence in the region. Hence, mitigation measures are not required to propose**.**

4.3.5 Flood

Impact: submerge of the station and collapsing of tower will be anticipated due to the improper design.

Mitigation measures:

The following provisions will be followed during the detailed design for buildings in flood prone areas:

(a) Plinth levels of all buildings should be 0.6 m above the drainage/flood submersion levels under the mean annual flood.
(b) All the buildings should preferably be two or more storeys.
(c) First floor level in double-storey buildings will be kept above 100-year flood levels.
(d) All the structure will be developed according to the Uttarakhand Building Bye laws. Relevant local and Indian standard will be followed.

4.3.6 Fire Explosion

Impact: Likely Threat of fire and explosion in lower and upper terminal being busy area and car parking and POL storage activities, however, in a ropeway project, fire can mainly cause due to electric spark in electrical room, fire in the surrounding forest area, fire in fuel storage places, etc. The Fire & explosion can cause suffocation due to harmful gases generation & panic in the minds of people that will lead to stamped at lower & upper terminal**.**

Mitigation measure: The fire protection system shall be provided at all the stations as per local fire regulations and as required in the IS: 1648. Firefighting equipment including smoke detectors and audiovisual alarm system shall be planned and installed as per relevant sections of NBC.

Dry chemical extinguishers should be accessible for small fires. An adequate supply of handheld and wheeled types should be available. Hydrants should be strategically placed with adequate hoses near Terminals. Provision of sand earth, or other non-combustible absorbent material, and the area then flushed with water.

4.3.7 Electrical

Impact: The ropeway will run on electricity & hence, electrical current can pass through cable cars & wires due to inadequate insulation or accidently**.**

Mitigation measure: Electrical equipment will be explosion-proof to meet national electrical code requirements**.** Lightening arrestors shall be provided at all towers and stations to protect the plant and associated electronics. Adequate number of coal plus salt or chemical earth pits shall be provided at both stations and tower foundations.
Safety features will be provided in electrical system are as follows:

- Under / Over Voltage protection
- Overload / Over current
- Tension System interlock with system safety

- Cabin swing at tower
- Cabin entry sensing automatically
- Hydraulic pump healthiness check
- Rope earthling
- Lightening Protection
- Over Wind Speed
- Regenerative power control
- Phase sequence monitoring
- Transformer temperature monitoring
- Motor temperature monitoring
- Speed regulation of Over Speed

4.4 IMPACT DUE TO PROJECT DESIGN

Impact: As the ropeway consists of cable cars, rope, big and heavy machineries, mechanical hazards can cause risks to people working in the area during construction phase & people who will travel through the ropeway in operation phase. Mechanical hazards are like drive/ return sheave shaft failure/ tension system failure, mount assembly parts failure, rollback, slippage/ fall of cabin, entanglement of cabin, swinging of cabin resulting in fall of passengers outside cabin, cabin derailment at station/ broken wires in service/ over speeding of ropeway, brake failure etc. may occur.

Mitigation measure

- Materials for aerial ropeways shall be in accordance with the appropriate Bureau of Indian Standard, noting that for load-bearing parts, including towers, and drive and return terminal structures, the materials are to comply with the low temperature impact properties for the minimum operating ambient site temperature.
- The design, details, materials and construction features shall provide safety factors at least equivalent to those specified of Indian Standard.
- The ropes used shall conform to the relevant Indian Standards. (IS 7649) As far as possible, all wire ropes shall be in single piece and of non-rotating construction.
- Welded joints in the rope shall be spaced at least 6 times the pitch of the wire and their number in 500 m length shall not exceed the number of wires in the wire rope.
- The cabins will be designed to be closed type with proper ventilation facility.
- Each station will have a first-aid medical facility and the upper station at
- Upper Terminal would also be equipped with oxygen cylinders in case of any emergency situations.
- The automatic lock system will be such that it cannot be opened by the passengers.

- Cabin shall be provided with dual fixed grip per cabin wherein each grip will be capable of taking the entire laden weight of the cabin with passengers.
- The ropeway system will be provided with minimum of two braking system; Emergency Brake and Service Brake. Both brakes should be capable of functioning automatically as per operational and program logic of control system OR manually, in case the need arises.
- The ropeway system machine configuration shall comply to following minimum requirement:
- In event of main power supply failure, the system should have full rated Diesel Generator to carry on the commercial operation. The Diesel Generator should be de- rated by 30% or as recommended by the manufacturer to meet full load requirement of location altitude.
- In the event of main motor/ main gearbox failure, the emergency drive should be capable of bringing the stranded cabins on the line to Ropeway Terminals. The emergency drive can be in the form of gasoline/diesel engine or Hydraulic motor or Electric Motor. In case of Hydraulic or Electric Motor as emergency drive, the ropeway company is to ensure fitment of an additional Diesel Generator; over and above the Main Diesel Generator.
- Standard electrical safety and indicating devices shall be provided on ropeway. Special emphasis shall be paid to line de-ropement switches with independent control circuit to pin point the defect shall be used.
- As the ropeway terrain is difficult, each tower and sensitive location will be provided with pan/tilt/zoom type wired cameras to monitor the line status before starting the plant each day
- Rope catcher will be provided on mount beams on line trestle, P.F. and Stations to arrest/ support the hauling rope in case of de-ropement. Both drive and return bull wheel shall be provided with catcher device as well bull wheel arrestor device.
- Emergency push buttons will be provided at stations to stop the ropeway, if required. The ropeway shall also be provided with 50% station speed switches to reduce the speed of cabins in case of continuously circulating system.

4.5 IMPACT DURING CONSTRUCTION PHASE

4.5.1 Topography

Impact: Development of Lower Terminal Stations and Upper terminal stations and 13 numbers of intermediate towers will change the topography of the area.

Mitigation measure: The location of terminal stations and tower was selected on a mild slope or at plain area to keep the minimal cutting and filling having less impact on topography of the area. Level difference will be maintained for the natural flow of drainage. Cutting and filling will be balanced.

4.5.2 Drainage

Impact: The Tower will be located in the Dry river bed of Ganga . Water from the river Ganga is diverted to Har ki pauri near the Bhimgodda Barrage. Near Tower 2, 3 and 4, water will only be available at the time of opening of the gates of Bhimgoda barrage which is generally opened during the high water flow. Therefore, there is no such impact on the change of drainage.

Mitigation Measure: Construction will be carried out during the dry period when water is not available in the River.

4.5.3 Soil

Impact: A mixture of sand and soil are present on the exact location of LTP however, soil in the vicinity of LTP is unfertile. No fertile soil was observed adjacent to UTP except some fine and coarse stones. The excavation activity involved for foundation of building and tower will cause generation of excavated soil. Near tower-5 Fertile soil was observed.

Soil will be contaminated by oil spillage, digging and construction work. Construction work could lead to stockpiling on site which will lead to soil contamination during windy days & rainy days.

Mitigation measure: During excavation at tower-5 upper layer of (0-15 cm) soil will be stored for use of it after construction works to grow vegetation on it.

The excavated earth near the LTP, UTP and at tower locations will be used at sites for filling. The best practices will be followed to avoid the spilling and leakage during the construction period.

4.5.4 Impact Due to Muck Disposal

Impact: The alignment of the project is passing through the Dry river bed from 10m Chainage to 810 m. During Construction, pilling activities for construction and foundation of Tower and terminals will generate the muck. Muck disposal if not properly done can result in air and water pollution.

Mitigation: The excavated material will be graded such that part can be re-used in construction; balance will be disposed. Muck generated during the pilling activity will be treated and used at site.

4.5.5 Land use

Impact: Change of landuse is expected due to the use of forest land and irrigation land for the purpose other than the defined purposes**.**

Mitigation measure: To mitigate the impact compensatory plantation on 0.29 Ha of degraded Forest Land will be carried out by the forest department. The requested amount will be deposited by the UKMRCL. River Improvement measures will be constructed near the Lower Terminal.

4.5.6 Water Environment

During construction period there are many activities that directly or indirectly affect the water environment. In the proposed ropeway the major activities identified are as follows:

- In the proposed project Five (05) number of towers are located in the Ganga River where the foundation will be carried out by pile and well sinking foundation methodology.
- Dewatering up to the foundation level of station building during the excavation and foundation concreting work of Station Building works.
- Work vessels are a possible cause of oil spills, garbage discharge, and leakage of other substances into water.
- Diffusion from concrete work in water and overflows may be possible sources of water pollution.
- Use of water/Private water tanker for construction purpose.
- Use of water for drinking purpose.
- Sewage generation from the workforce.
- Runoff and erosion from exposed soil surface, earth working areas and stockpiles.
- Construction work and dredging disturb bottom sediments and induce resuspension, dispersal and settlement of such sediments. Dumping of dredged material directly alters bottom configuration and biota and may disperse toxic or harmful chemicals around the disposal site.

Impact:

- Pile driving, dredging, sand compaction and other construction work in water cause resuspension of sediments and turbid water. Resuspension of sediments in water leads to an increase in the level of suspended solids (SS) and in the concentration of organic matter, possibly to toxic or harmful levels.
- Muck generation during the construction of Pile foundation at Stations and Towers.
- Site runoff and drainage may contain increased loads of suspended solids and contaminants.
- Increase of suspended solids concentration into the water will cause the undesirable taste to the water. It also reduces sunlight penetration.

- Sewage and wastewater contain bacteria, fungi, parasites, and viruses that can cause intestinal, lung, and other infections. Bacteria may cause diarrhea, fever, cramps, and sometimes vomiting, headache, weakness, or loss of appetite. Some bacteria and diseases carried by sewage and wastewater are E. coli, shigellosis, typhoid fever, salmonella, and cholera.
- Leakage of lubricant oil and sewage to the surface water body, can threat the aquatic ecosystem. It will create the eutrophication in th Riverine system.
- Depletion of water resources.

Mitigation measure:

- To avoid the impact in River bed due to pile driving the construction will be carried out during the dry period.
- Provision of perimeter drains to intercept storm-runoff from outside the works area. These shall be constructed in advance of site formation works and earthworks. Earth bunds or sand bag barriers should be provided on-site to direct storm water to silt removal facilities. The design of the temporary on-site drainage system will be undertaken by the contractor prior to the commencement of construction.
- Sand/silt removal facilities such as sand/silt traps and sediment basins should be provided to remove sand/silt particles. The settled water will be reused for construction purposes and for sprinkling on haul roads to control dust emissions. The Contractor should ensure that all site runoff and drainage arising from the works areas are properly treated by the use of sedimentation tank, and that will meet the standards.
- Exposed slope/soil surface should be covered by tarpaulin as soon as possible to reduce the potential of soil erosion. Arrangements should always be in place to ensure that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm.
- Open stockpiles of construction materials or construction wastes should be covered with tarpaulin or similar fabric during rainstorms.
- However, impact due to runoff will be temporary in the nature and would be observed in first rain only and as soon as rain is over excavated soil at site would be stabilized.
- All equipment will be maintained in good proper running order to prevent leaking or spilling of potentially hazardous or toxic products. This includes hydraulic fluid, diesel, gasoline and other petroleum products.

- Excavation will be carried out during dry season and proper management of excavated soils.
- Debris and rubbish generated on-site should be collected, handled and disposed of properly to avoid being flushed.

- Dewatering water may not be required if required it will be carried out by the pumping. Dewatering water will not be directly discharged into the river body. It will be treated in the Sedimentation tank.
- Construction will not be carried out during the rainy period. However Cofferdam/ cassion/ silt curtain will be provided if during construction water will be found in the Dry river bed.
- Oils and fuels should only be used and stored in designated areas which have pollution prevention facilities. To prevent spillage of fuels and solvents, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas.
- Treated water from the existing STP will be purchased for the purpose of construction.
- Temporary sanitary facilities, such as Mobile toilets, should be employed on-site where necessary to handle sewage from the workforce.

To minimize the water uses for construction purpose some of the measures will be followed:

- Curing water will be sprayed on concrete structures and free flow of water not allowed. After liberal curing on the first day, all concrete structures will be painted with curing agents to save water.
- Concrete structures will be covered with thick cloth/gunny bags and then water sprayed on them to avoid water rebound and ensure sustained and complete curing. Ponds will be made using cement and sand mortar to avoid water flowing away from the flat surface while curing.
- During concrete preparation chemical admixture will be added to reduce the water demand.

Residual Impacts: *After implementation of the recommended mitigation measures for the construction phase of the proposed project, there is no residual impacts on water quality are expected; accept the depletion of the water resources. It is recommended that regular audit of the implementation of the recommended mitigation measures at the work area be carried out during the construction phase.*

4.5.7 Solid Waste

During the construction phase of the project the major solid waste generated from the project is given below in **Figure 4.3.**

Figure 4.3: Solid waste During Construction Phase

Impact:

- Improper management of construction waste can cause the inconvenience on roads, choking surface drains, disrupting traffic.
- Labour camp at the site may lead to sanitation problems in the absence of adequate facilities.
- Hazardous waste mismanagement ultimately leads major impact on the health and contaminates the water, soil and air environment.

Mitigation:

To minimize the construction waste from the project site these are the measures that will be followed to ensure the solid waste management:

- All construction wastes shall be sorted on site into inert and non inert components. Non inert materials (wood, glass and plastic) shall be recycled or reused . Inert materials (soil, rubble, sand, rock, brick and concrete) shall be separated and reused on or off site. In case of surplus inert material, it shall be recycled at the Construction and Demolition (C&D) Material Recycling Plant.
- Reusable steel and concrete panels shall be used as a preferred alternative to wooden formwork, falsework, and site fencing.
- Lubricants, waste oil, waste paints and solvents shall be collected by a licensed collector
- All vehicles leaving any of the works areas will pass through a wheelwash at the site access/exit. If, at any time, further entry/exit points are created, they will be provided with similar facilities. The wheelwash will be regularly cleaned to remove sediment, a process which may produce muddy wastewater. These wastewaters shall be directed into settlement ponds. Clarified wheel waste water will be recycled at the wheel wash facility. Settled sediments will be dried and disposed in the same way as inert excavated material. The maintenance of the wheelwash will be the responsibility of the Contractor undertaking the construction works.
- Provision of adequate toilet facilities and solid waste disposal system.

Form-3, Form-8, etc.) shall be maintained as per the requirements of Hazardous and other waste (Management, Handling and Trans-boundary Movement) Rules.

- Other Hazardous waste will be given to authorized recycler for proper disposal of hazardous waste.

4.5.8 Impact Due To Influx Of People And Associated Developments

During construction of ropeway, groups of local labours will be hired from the nearby villages but few technical staffs will also be engaged from outside. Both local villagers and technical staffs will be working together for construction. This may create disruption in social interactions and other activities of the villagers which is quite negligible.

Devotees are already reaching the temple with the existing ropeway and track. The development of Ropeway will not disturb the existing environment but will facilitate and provide an easy and fast access to the Temple directly from Har ki pauri to Chandi devi.

Mitigation: Due to development of ropeway there will be no disturbance of environment. The development of proposed ropeway will enhance the surrounding environment and infrastructure of the area. The proposed facilities to facilitate the surrounding environment and pilgrims are as follows:

- Solid waste management facility,
- Drinking water arrangement for pilgrism,
- Public toilets,
- Scientifically waste water management,
- River bank improvement.

4.5.9 Impact on Existing Features Within 1 km

The existing features at project site within 1 km radius are River, City, Protected Forest, National Park, Road & local market. The measures impact due to the proposed project is anticipated on the River, forest, soil, landscape of the area. The impact due to the proposed project on the forest, soil, villages are given in subsequent section in this chapter.

4.5.10 Ambient Air Quality

For air quality impact assessment, the air emission sources were examined for both construction and operational phases of the project. The modeling details are provided in the following Sections.

Impact: During the construction phase, SPM is expected to be the main pollutant associated with on-site roads (paved and unpaved), stockpiles and material handling. In this case, pollution emission sources shall be distributed throughout the project site and shall fall under the category of area source. The land acquired is fairly flat, so extensive formation work is not expected during this phase. It is assumed that most of the excavated material shall be used within the project, with minimal cut and fill material to come from outside the site.

Due to the confined nature of heavy construction activity during this limited period, tailpipe emissions from construction equipment are assumed to be essentially negligible.

In the absence of information regarding the quantity and type of construction equipment to be deployed at any particular time, emission factors for construction activities were used for emissions estimates. Overall SPM emissions were estimated using the emission factor of 1.2 tons SPM/month of activity/acre as per AP-42 Section 13.2.3.3 (U.S.EPA, 1995). This emission factor is most useful for developing estimates of overall emissions from construction throughout a geographical area and most applicable to construction operations with medium activity level, moderate silt contents, and semi-arid climate (U.S. EPA, 1995). The derivation of the factor assumes that construction activity occurs 30 days per month, making the above estimate somewhat conservatively high for total suspended particulate (U.S. EPA, 1995).

Phase wise development will be taking place on the project site; hence the entire site will not be simultaneously under heavy construction, different sections of the site generating SPM in a progressive manner. Thus, as a worst-case scenario, it is conservatively assumed that during the heavy construction period, one of the blocks of area 10000 m^2 will be actively emitting SPM. Assuming 24 hours of construction activity, and an area of 10000 m^2 is taken as for the air quality modelling. The emission rates for PM_{10} and $PM_{2.5}$ are calculated assuming 50% of SPM and 60% of PM_{10} respectively. Air quality modeling exercise is performed under the above discussed meteorological condition and maximum ground level concentrations of $PM_{2.5}$ and PM_{10} average over 24 hours are estimated about **545** and **909** $\mu g/m^3$ respectively and predicted to occur on the site itself. However, predicted incremental concentration is significant but it is temporarily. The spatial distribution of the incremental $PM_{2.5}$ and PM_{10} level without control on the impact zone area of 500 m x 500 km on modeling grid size of 100 m x 100 m around the proposed site are shown in **Figures 4.4 and 4.5** respectively. Under proper particulate matter mitigation measure plan, the dust emission during construction phase can be controlled by 95%.

Figure 4.4: Spatial Distribution of 24 Hour Average $PM_{2.5}$ conc. ($\mu g/m^3$)

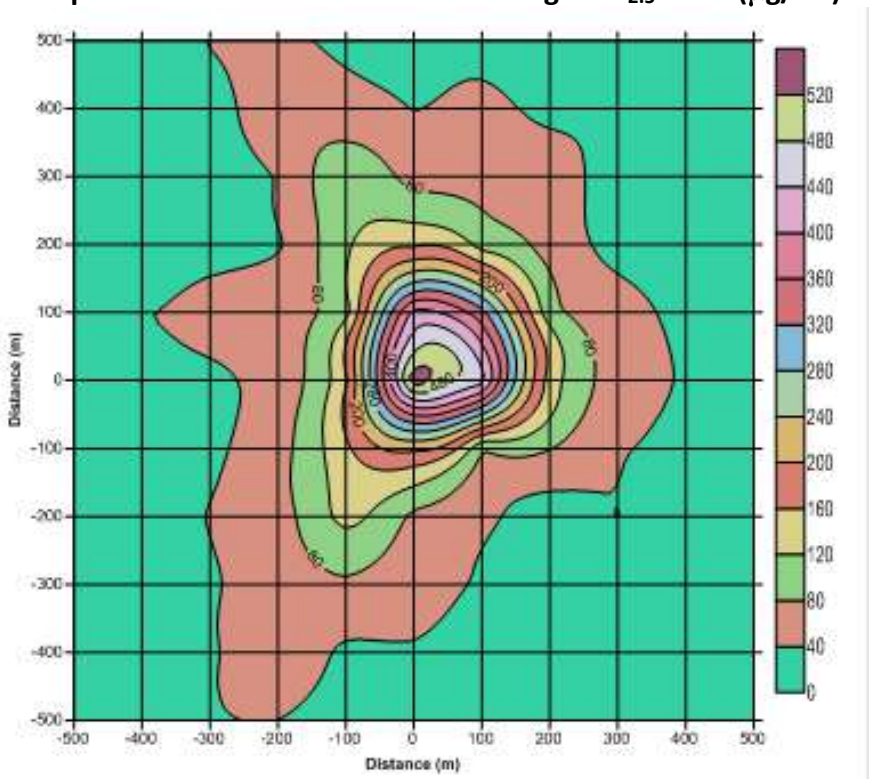
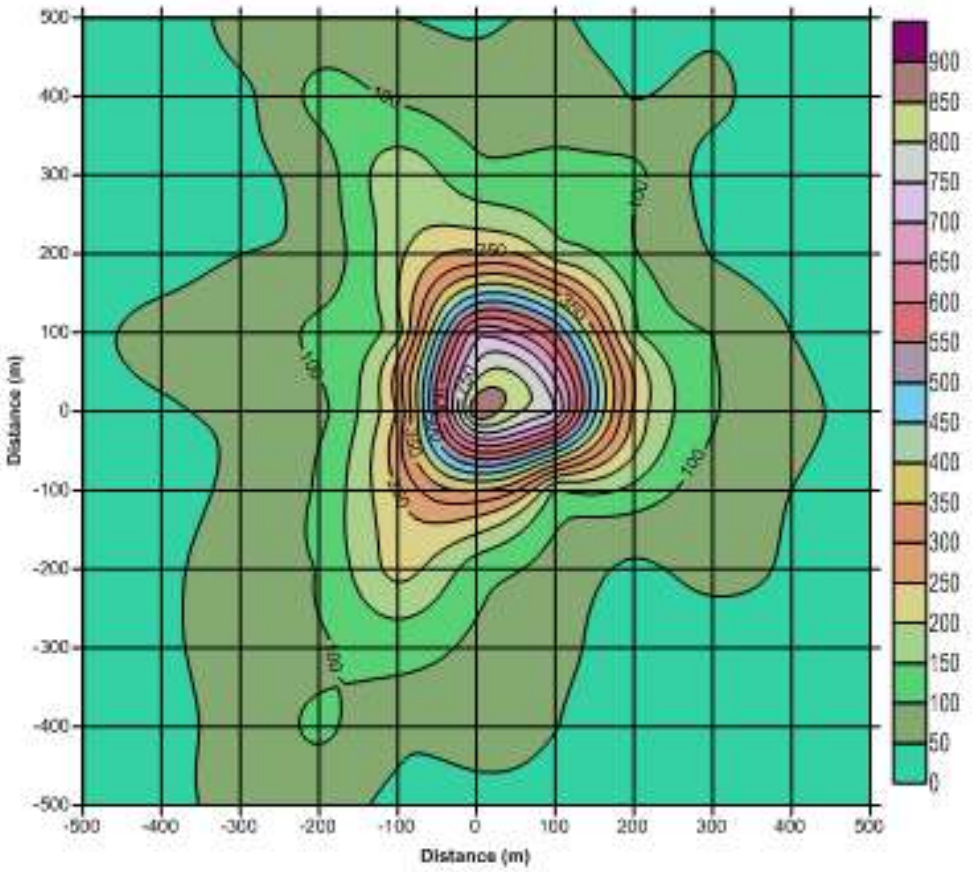


Figure 4.5: Spatial Distribution of 24-hour Average PM_{10} conc. ($\mu g/m^3$)



Mitigation measure

- During construction Phase the contractors are advised to use dust masks for the employed labour.
- Water sprinkling for suppression of dust during construction phase.
- Regular monitoring of emissions & control measures to reduce the emission levels.

4.5.11 Ambient Noise

Noise assessment has been undertaken to define the nature and scale of potential environmental impacts associated with the implementation of ropeway project specifically in terms of the effects in the vicinity of sensitive receivers. Both construction and operational phase impacts have been assessed and mitigation measures have been identified to determine whether residual impacts can be reduced to acceptable levels. The assessment of the impacts of noise on the surrounding community depends upon:

- Characteristics of noise source (instantaneous, intermittent, or continuous in nature)
- Time of day at which noise occurs
- Location of noise source with respect to noise receptor

For an approximate estimation of propagation of noise in the ambient air from the area or point source, a standard mathematical model for sound wave propagation used is as follows:

$$\text{Noise}_{(\text{Receptor})} = \text{Noise}_{(\text{Source})} - 20 \text{ Log } [\text{distance}_{(\text{Receptor})} / \text{distance}_{(\text{Source})}]$$

For the modeling purposes, terrain is considered flat and there are no sound absorptive materials are present in the direction of the sound wave propagation so as to formulate the worst-case scenario. For the modelling purposes, terrain is considered flat and there are no sound absorptive materials are present in the direction of the sound wave propagation so as to formulate the worst-case scenario. For predicting noise emissions impacts due to proposed project, the noise emission sources are examined during both construction and operational phases. The noise levels during both distinct phases are predicted using the CPCB approved noise model DHAWANI applicable for stationary point sources.

Impact

The project is expected to have large scale construction activities. Sources of noise emissions are expected from various construction equipments. The major noise generating sources envisaged during construction phase and their typical noise level value are given in **Table 4.2.**

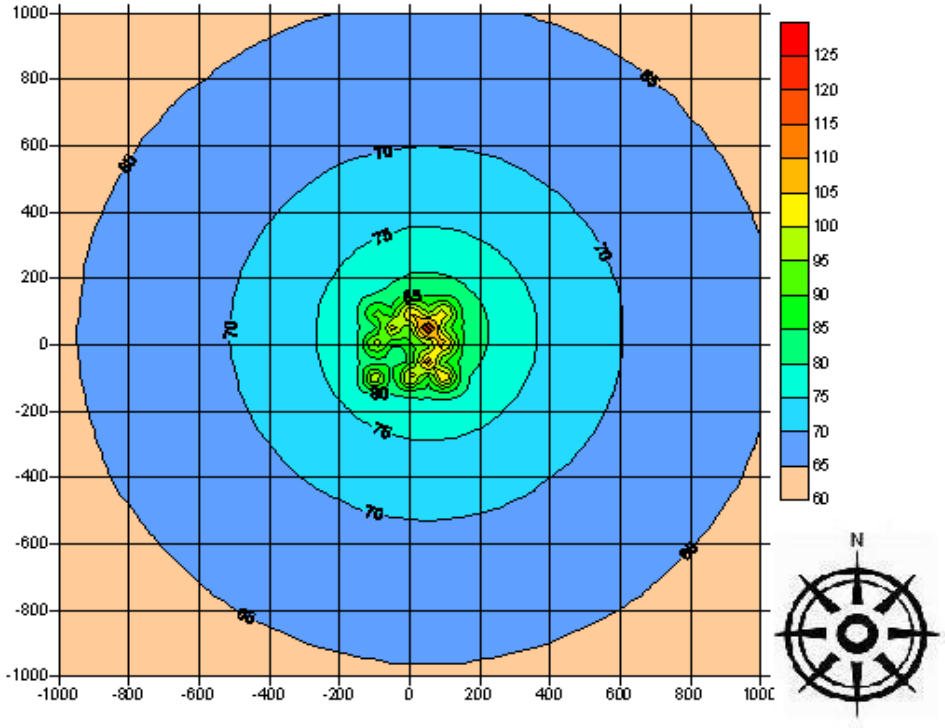
Table 4.2: Noise Levels Generated from the Construction Equipment

Name of Source	Noise Level at 1 m from source in dB (A)
Air Compressor	111
Back Hoe/Loader	105
Concrete Mixer Truck	109
Concrete Pumper	94
Concrete Vibrators	101

Cranes - mobile	105
Dump Truck	107
Generator	75
Hammering	110
Jackhammer	112
Pile Driver	124
Radial Arm Saw	104

Noise modeling was done assuming that all the above equipments emit noise simultaneously considering as worst-case scenario. The spatial variation of the predicted noise levels at an interval of 5 dB (A) without control around the project site on the area of 1 km x 1 km are shown in **Figure 4.6.**

Figure 4.6: Spatial Variation of Construction Equipment Noise Levels dB(A): Construction Phase



Modeling results shows that noise level meets the Ambient Noise Quality Standards (ANQS) 55 dB (A) at a distance of about 900 m. Uncontrolled noise levels generated from construction equipment, in the range of 94-124 dB (A) have been considered for prediction purpose. However, the CPCB standards specified for limited construction equipment reflect that noise emission specifications for such equipment should not exceed 75 dB (A). The noise levels predicted here is without mitigation measures. It is assumed that with the adoption of the mitigation measures noise levels will be further restricted within very short distances from the source. With respect to occupational exposure, the permissible threshold is 90 dB (A). Thus, based on the modelling results it can be concluded that all sensitive receptors (i.e. labour colonies) should be located beyond 125 meters from the noise generating source location during construction activities.

Mitigation Measure

After using above approach to estimate potential impacts from construction noise, the next step is to identify control measures. Three categories of noise control measures are discussed below:

1. **Design consideration and project layout**
   - Construct noise barriers, such as temporary walls or piles of excavated materials between noisy activities and noise-sensitive receivers.
   - Re-route truck traffic away from residential streets, if possible. Select streets with fewer homes, if no alternatives are available.
   - Site equipment on the construction plot as far away from noise-sensitive sites as possible.
   - Construct walled enclosures around especially noisy activities or clusters of noisy equipments.

2. **Sequence of operations**
   - Combine noisy operations to occur in the same time period. The total noise level produced will not be significantly greater than the level produced if the operations were performed separately.
   - Avoid nighttime activities. Sensitivity to noise increase during the nighttime hours in residential neighborhoods.

3. **Alternative construction methods**
   - Avoid impact pile driving where possible in noise-sensitive areas. Drilled piles or use of a sonic or vibratory pile driver are quieter alternatives where geological conditions permit their use.
   - Use specially quieted equipment, such as quieted and enclosed air compressor, mufflers on engines.
   - Select quieter demolition methods, where possible.

4.5.12 Vibration

Construction activity can result in varying degrees of ground vibration, depending on the equipment and methods employed. Operation of construction equipment causes ground vibrations which spread through the ground and diminish in strength with distance. Building founded on the soil in the vicinity of the construction site responds to these vibrations, with varying results ranging from no perceptible effects at the lower levels, low rumbling sounds and feeble vibrations at moderate levels and slightly damage at the highest levels. Ground vibrations from construction activities very rarely reach the levels that can damage structures, but can achieve the audible and feeble ranges in buildings very close to the site. A possible exception is the case of old, fragile buildings of historical significance where special care must be taken to avoid damage. The construction activities that typically generate the most severe vibration are blasting and impact pile driving.

Construction Vibration Impact Assessment: Construction vibration should be assessed in cases where there is a significant potential for impact from construction activities. Such activities include blasting, pile driving, demolition and drilling or excavation in close proximity to sensitive. As the primary concern with regard to construction vibration is building damage, construction vibration is assessed in terms of peak particle velocity (PPV) and applies the vibration damage threshold criteria and vibration potential to evaluate potential vibration impacts. Since the primary concern with regard to construction vibration is building damage, construction vibration is assessed in terms of peak particle velocity (PPV). Vibration source levels for typical construction equipment is provided in the **Table 4.3.**

Table 4.3: Vibration source levels for Construction Equipment*

Equipment		PPV at 25 ft (in/sec)	Approximate $L_v^{\#}$ at 25 ft
Pile Driver (impact)	upper range	1.518	112
	Typical	0.644	104
Pile Driver (sonic)	upper range	0.734	105
	Typical	0.170	93
Calm shove drop (slurry wall)		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	85
Jackhammer		0.0345	79
Small bulldozer		0.003	58
# RMS velocity in decibels (VdB) re 1 µinch/sec			

**References:*

- *D.J. Martin "Ground Vibrations from Impact Pile Driving during Road Construction" Supplementary Report 544, United Kingdom Department of Environment, Department of Transport. Transport and Road Research Laboratory, 1990*
- *J.F Wiss, "Vibration During Construction Operations. "Journal of Construction Division, Proc. American Society of Civil Engineers, 100, No. CO3, pp, 239-249, September 1974*
- *J.F Wiss, "Damage Effects of Pile Driving Vibrations, "Highway Research Record, No. 155, Highway Research Board, 1967.*
- *David A. Towers and Yuki Kimura, "Central Artery/Tunnel Project: Hydromill Vibration Testing" report prepared for Massachusetts Highway Department, February 1995.*

Vibration impact assessment during construction phase has been carried out with reference to equipment having maximum peak particle velocity i.e. Pile Driver (Impact) with upper range for conservative impact assessment. Spatial variation of estimated peak particle velocity (PPV) around continuous operation of the pile driver (impact) construction equipment is shown in Figure 4.7 below. The vibration amplitude at 150 m distance from continuous pile driving is predicted to be 0.04 in/sec and is well below the damage potential

threshold even for extremely fragile historic buildings, ruins, ancient monuments (0.08 in/sec). As there is no such building within this distance, hence potential for any structural damage is very low.

Moreover, **Table 4.4** suggests that continuous vibration amplitude 0.04 in/sec would be Barely perceptible; indicating that operation of pile driving could lead to annoyance of building occupants if living within 150 m.

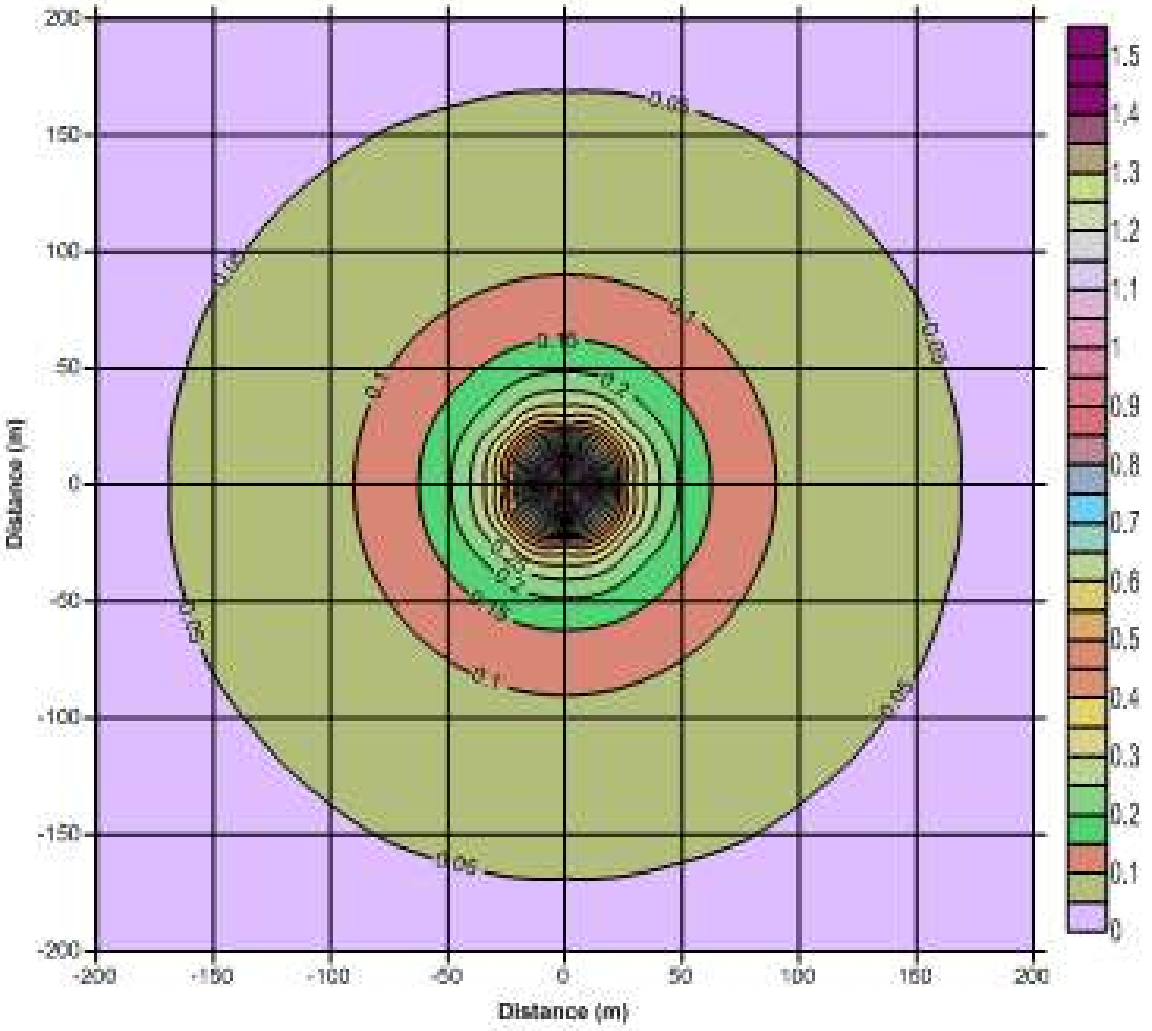
Table 4.4: Vibration Damage Potential Threshold Criteria

Structure and Condition	**Maximum PPV (in/sec)**	
	Transient Sources	**Continuous /Frequent intermittent Sources**
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Table 4.5: Vibration Annoyance Potential Criteria

Human Response	**Maximum PPV (in/sec)**	
	Transient Sources	**Continuous /Frequent intermittent Sources**
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.9	0.10
Severe	2.0	0.4

Figure 4.7: Spatial variation of PPV (in/sec): Construction Phase



Mitigation

After estimating potential impacts (or damage) from construction vibrations, the next step is to identify control measures. Mitigation of construction vibration requires consideration of equipment location and processes as follows:

1. **Design consideration and project layout**
   - Route heavily loaded trucks away from residential streets, if possible. Selects street with fewest homes, if no alternatives available.
   - Operate earthmoving equipment on the construction plot as far away from vibration-sensitive sites.
2. **Sequence of operations**
   - Phase demolition, earthmoving and ground-impacting operations so as not occur in the same time period. Unlike noise, the total vibration produced could be significantly less when vibration source operates separately.
   - Avoid nighttime activities. People are more aware of vibration in their homes during the nighttime hours.

3. Alternative construction methods

- Avoid impact pile driving where possible in vibration-sensitive areas. Drilled piles or use of a sonic or vibratory pile driver causes lower vibration levels where levels where geological conditions permit their use.
- Select demolition methods not involving impact, where possible.
- Avoid vibratory rollers and packers near sensitive areas.

4.5.13 Socio Economic

Impact: The impact during construction stage is as follows:

- **Impact on Common Property Resources (CPR):** During field survey it is identified that one public toilet would be affected due to the construction of proposed LTP station. The toilet is located near proposed LTP station. The toilet is getting used by numbers of the devotees, tourists and pilgrims on a regular basis.
- **Impact on Laundry Bay at LTP Station:** During field survey, it was reported that during monsoon season few people are uses Ganges water for laundry purposes near proposed LTP station. This is part of their livelihood. It is anticipated that during construction of the LTP station, they may not be able to use the Ganges water for laundry purposes which may affect their livelihood.
- **Socio-cultural Disruption:** During construction of ropeway, groups of local labours will be hired from the nearby villages but few technical staffs will also be engaged from outside. Both local villagers and technical staffs will be working together for construction. This may create disruption in social interactions and other activities of the villagers which is quite negligible.
- **Health Impacts:** The construction of proposed ropeway project may take longer time, during which manpower will be required for construction activities. A large force of labours may be required during construction of the project. Adverse health impacts are expected in the project area where construction and camps of workers and camp followers (families of workers and other service providers) are concentrated. These impacts would mainly result in sexually transmitted disease i.e HIV/AIDS, traffic and construction related accidents.
- **Cultural Conflicts:** Although the proposed construction activities shall be huge and time consuming, it is proposed that most of the labor requirement shall be fulfilled from the nearby wards or villages. It is reported that due to presence of Chandi Devi temple, the local laborers will be very much familiar with the presence of outsiders such as tourists, devotees, pilgrims and other workers. Thus, the cultural conflict between local villagers and devotees as well as tourists has not been anticipated.

Public Toilet and Laundry Bay at proposed LTP station

Mitigation:

First Aid with other Health Service: All necessary first aid and other medical facilities shall be available in place for the workers during emergency situation.

Training of Workers and Operators: The training programmes shall be provided to the workers as well as operators for their active participation in project implementation especially on guidelines for safety, measures for disaster prevention and action required in case of emergency, fire protection, environmental risk etc.

Labour Safety and Awareness on HIV/AIDS: All the safety measures of construction workers are to be ensured considering the labour welfare laws. The workers shall be made aware about the spread and preventive measures of HIV/AIDS if both male and female workers are hired and they stay in labour camps.

Environment Management Plan (EMP): Under the scope of Environment Management Plan, one gender friendly public toilets to be built by UKMRCL near proposed LTP station under property development activities.

Engagement of Local Labor: In order to avoid public protest and ensure local people's participation in the project, the local town or villagers shall be hired during construction as well as operation of the ropeway project considering the qualification and eligibility criteria.

4.5.14 Ecological Environment

Impacts on terrestrial Ecology: All development activities lead to impact on the existing flora and fauna. For the proposed Ropeway project, construction activities will involve site clearance for construction of terminals. The area for the terminal stations comprise mainly of common ,Trees, shrubs, weeds and grasses and do not support any ecologically sensitive flora and fauna. The impacts of construction on terrestrial ecology have been summarized in **Table 4.6.**

The proposed project may result in air, noise and water pollution, which may have an impact on the terrestrial ecology. However, the impact will last for small duration and will be minor in nature. No sensitive species for flora were recorded within the core zone during the survey. 4 species of fauna like Indian Elephant, Indian Leopard, swamp deer& spotted deer are reported near Core zone. The noise emissions during construction phase may have a minor impact on the fauna in the surrounding areas.

Table 4.6: Impacts on Ecology

S. No	Parameters	Magnitude	Duration
1.	Loss of plants of economic importance.	Yes	Long term
2.	Impact on the free movement of animals	Yes	Short term
3.	Loss of forest cover	Yes	Long term
4.	Habitat fragmentation and blocking of migratory of Wild animals and Birds corridors due to project activities	Nil	-
5.	Impact due to pollution on flora and Fauna	Minor	Short term
6.	Impact due to disturbance	Minor	Short term

7 numbers of trees enumerated in Irrigation land and 31 numbers in Shyampur reserve forest. Most of the trees having girth range from 30 cm to 70 cm. The numbers of trees likely to be removed are 38 numbers. The proposed project may result in air, noise and water pollution, which may have an impact on the terrestrial ecology. However, the impact will last for small duration and will be minor in nature.

Impact on Fauna: Potential impacts on birds include degradation of feeding habitat (1 km radial distance from LTP) in the short term resulting in habitat changes but after construction period is over the habitat will be rejuvenate. Construction may cause impact on food sources for birds.

Three schedule I or REET species were recorded along proposed alignment. These animals are Indian Elephant, Indian Leopard and Swamp Deer. Many species will move away from the areas of disturbance, returning after habitat re-instatement.

Encroachment into Wildlife Habitat/Corridor, Migratory corridor: The proposed project site is located in Buffer zone of Tiger Reserve, and there is no wildlife corridor, migratory corridor in the study area. Hence it is anticipated that no substantial encroachment into wildlife habitat will occur due to the project.

Mitigation: Following measures are proposed as mitigation measures as under. The mitigation measures and performance indicator is given in **Table 4.7.**

Table 4.7: Mitigation Measures And Performance Indicator

S. No	Mitigation Measures		Performance Indicator
1.	Forest	Mitigating measures to compensate the loss of forest cover by 10 times plantation & maintenance for 8 years.	Raising and maintaining the compensatory plantation will be monitored after 1st year to 8th year
2.	Flora	Compensatory plantation of all 310numbers of tree species in forest area and 70 trees in open area is proposed.	Survival rate will be monitored after 1styear of transplantation up to 8th year. The amount for plantation of Rs 93100 will be deposited for plantation of non forest trees and Rs 832500 will be deposited for plantation + Maintenance of forest trees
3.	Fauna	Wildlife clearance is awaited for the Conservation of Schedule –I Species & Schedule –II Species	These species will be protected as per the Wildlife conservation plan given below. NPV is about (Rs 1.81 Lakh) of the forest is deposited to the forest department for the conservation of wildlife.
4.	Avifauna	Only peacock present in Schedule –I of WPA 1972	These species are protected as per the Wildlife conservation plan.

4.6 IMPACT DURING OPERATION PHASE

4.6.1 Water Environment

During operation of the Ropeway there are certain activities that will affect the water environment. These are as follows**:**

- **Water Consumption:** During operation of the project staff and passenger will use the existing resources for the purpose of Drinking. To meet the demand existing resources will be depleted.
- **Storm water:** Falling of storm water near the station and tower may weaken the rock and lead instability of structure**s.**
- **Wastewater:** Poor maintenance, leakage from waste water collection system can impact the ground water. It will directly affect the health of the person.

Mitigation Measure:

- Water required during the operation phase will be minimized by recycle and reuse of the water. Flushing requirement will be meet by the treated water.
- Sewage generated from the proposed project will be treated by the Modular STP for the treatment of the wastewater.

- All the station structures and trestles shall be designed, supplied and constructed to withstand the effects of geo technical conditions etc. likely to be prevalent at the site. For stability of the building Indian standard IS:875 will be followed.
- In addition to that Invert level of the stations building will be like that it will not cause flooding in the nearby area.
- To avoid the leakage/spilling from the STP some of the measures will be adopted:

✓ Maintenance of each equipment is carried out as the recommendations of manufacturer.

✓ Periodically inspection of the STP for any leakage/ spilling. If any leakage spilling found in the system EMC will take corrective measures.

✓ Logbook will be maintained.

4.6.2 Solid Waste

Impact: The outcome of indiscriminate disposal of solid wastes exposes human to environmental degradation such as flooding, drainage obstruction, widespread of infectious diseases, cholera, diarrhea, typhoid fever, waterway blockage which leads to infestation of flies, ticks and breeding of mosquitoes.

Mitigation/ Management: It is a holistic approach to deal with the issues of management of solid waste in an environmentally sustainable and economically feasible and socially acceptable manner. It requires an integration of various processes associated with solid waste management planning process like

- Minimization
- Collection and segregation
- Awareness
- Treatment
- Disposal

In this project these hierarchy systems are followed to manage the waste generated from the project.

Solid waste: In Haridwar city, Haridwar Nagar Palika Parishad [HNPP] involves in the Waste collection and disposal of solid waste. Waste is mostly collected through community bins/containers and road sweeping. HNPP sweepers and sanitary workers engaged by the MSS sweep the streets. They accumulated the collected waste into small heaps and subsequently loaded manually or mechanically onto the community containers/bins or directly loaded onto the solid waste transportation vehicles for onward transportation to the disposal site.

In the proposed project collection and segregation will be carried out at site by providing the separate bins. Bins will be provides at terminal stations. Waste will be segregated into

Bio-degradable, recyclable and non-recyclable wastes. Non recyclable waste will be given to the authorized vendors.

Biodegradable and recycle waste will be given to the existing treatment facility near the Sarai Jawalpur for final treatment and disposal of the waste.

Hazardous waste: These wastes will be collected in HDPE drum and given to authorized vendors. To reduce the consumption of the Oil soaked cottons drip tray uses and regular checkup of leakage will be carried out. Records of the Hazardous waste will be maintained according to the Hazardous waste management and Handling Rule 2016 and its amendments.

Construction and Demolition waste: C&D waste will be used within the site for filling of the site.

4.6.3 Air Environment

DG Set Emission Modeling

During operation phase of project, 1x625 KVA DG set at LTP (Lower Terminal Point) will be expected as the main air pollution source. DG set will be expected to run as back-up power supply during power failure. Thus, for air quality modeling study under worst-case scenario, it is assumed that the DG sets will operate 24 hours continuously. PM2.5, PM10, SO_2, NO_x and CO will be expected as prime criteria air pollutants during the operation phase of the project. Emission Source characteristic used for atmospheric dispersion modeling is provided in the following **Table 4.8.**

Table 4.8: Emission Source Characteristics

Stack No.	DG (kVA)	Stack Characteristics								
		$PM_{2.5}$ (g/s)	PM_{10} (g/s)	SO_2 (g/s)	NO_x (g/s)	CO (g/s)	Height (m)	velocity (m/s)	Temp (k)	Diameter (m)
1	1x625	0.008	0.014	0.15	0.09	0.49	9	18.8	730	0.35

Model is simulated under observed meteorological condition and incremental maximum ground level concentrations for $PM_{2.5}$, PM_{10}, SO_2 and NOx average over 24 hours are predicted to be about 0.15, 0.26, 2.82 and 10.52 μg/m3 respectively and expected to occur at a distance about 224 m in the Southwest direction from the source location. Maximum ground level CO concentration average over 8 hours is predicted to be about 18.81μg/m^3 but will be expected to occur at the distance about 224 m in the Southeast direction from the DG set location. The spatial distribution of ground level incremental concentrations of $PM_{2.5}$, PM_{10}, SO_2, NOx, and CO due to proposed ropeway operation on the impact zone area of 1 km x 1 km on modelling grid size of 100 m x 100 m around the proposed site are shown in **Figures 4.8** through 4.12 respectively. Predicted ground level concentration of PM2.5, PM10, SO2, NOx and CO along with background and resultant (B+P) concentrations at the

discrete receptor locations around the project site is presented in the **Table 4.9**. Model simulated result envisages that incremental ground level concentrations of criteria pollutants SO2, NOx and CO due to plant operation may be expected minimal and the resultant concentration may also be expected within the NAAQS. Higher resultant concentrations of $PM_{2.5}$ and PM_{10} pollutants at discrete receptors locations may be attributed to high background monitored concentration. Predicted concentrations of criteria pollutants, however, may be further reduced under proper control measures.

Figure 4.8: Spatial Distribution of 24-hour Average$PM_{2.5}$ Conc. (μg/m^3)

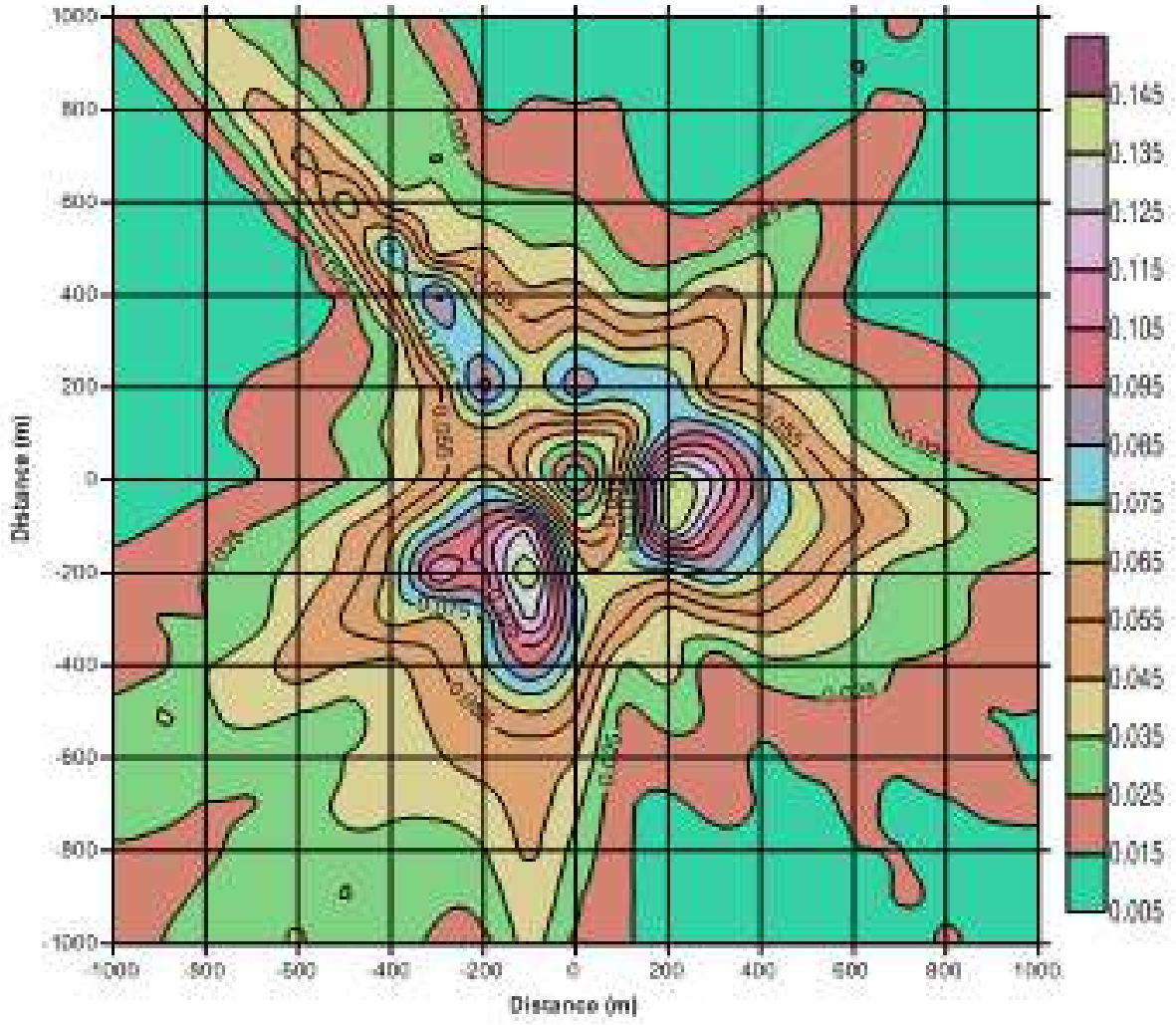


Figure 4.9: Spatial Distribution of 24-hour Average PM_{10} Conc. ($\mu g/m^3$)

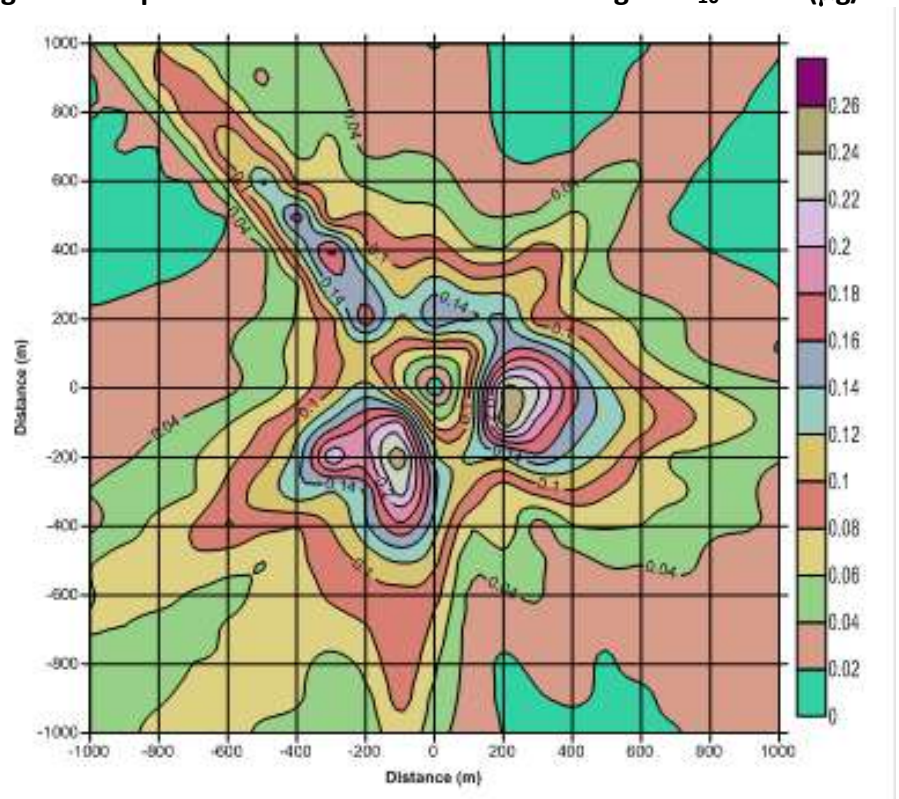


Figure 4.10: Spatial Distribution of 24-hour Average SO_2 Conc. ($\mu g/m^3$)

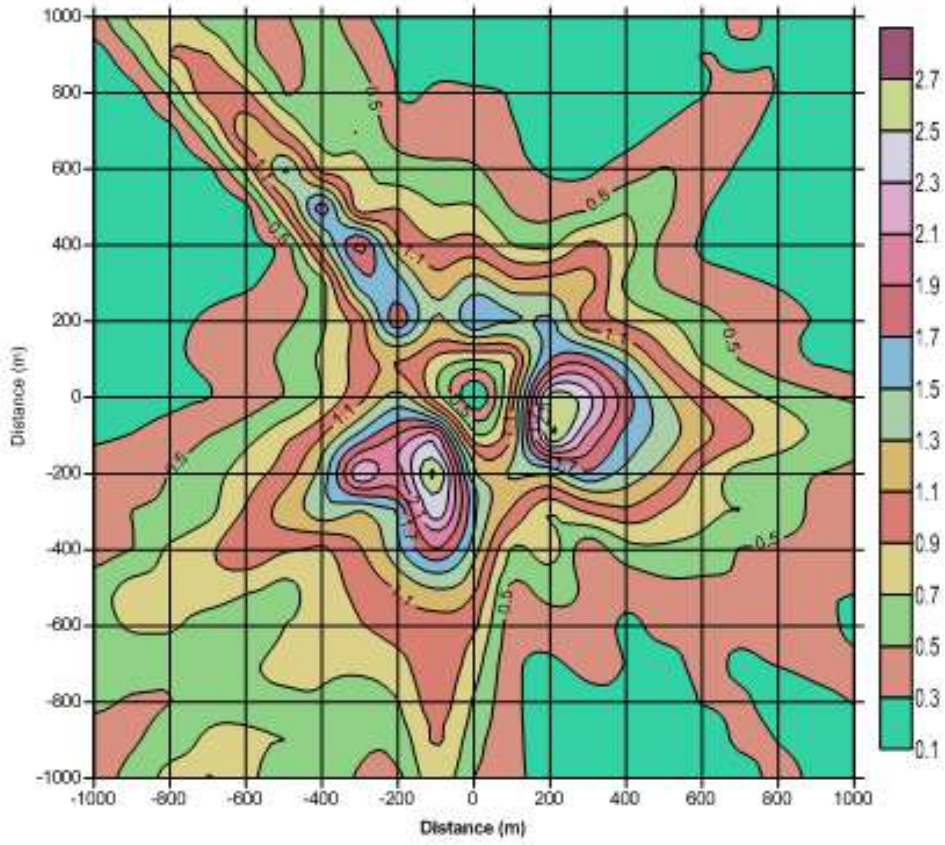


Figure 4.11: Spatial Distribution Of 24-Hour Average Nox Conc. (μg/m^3)

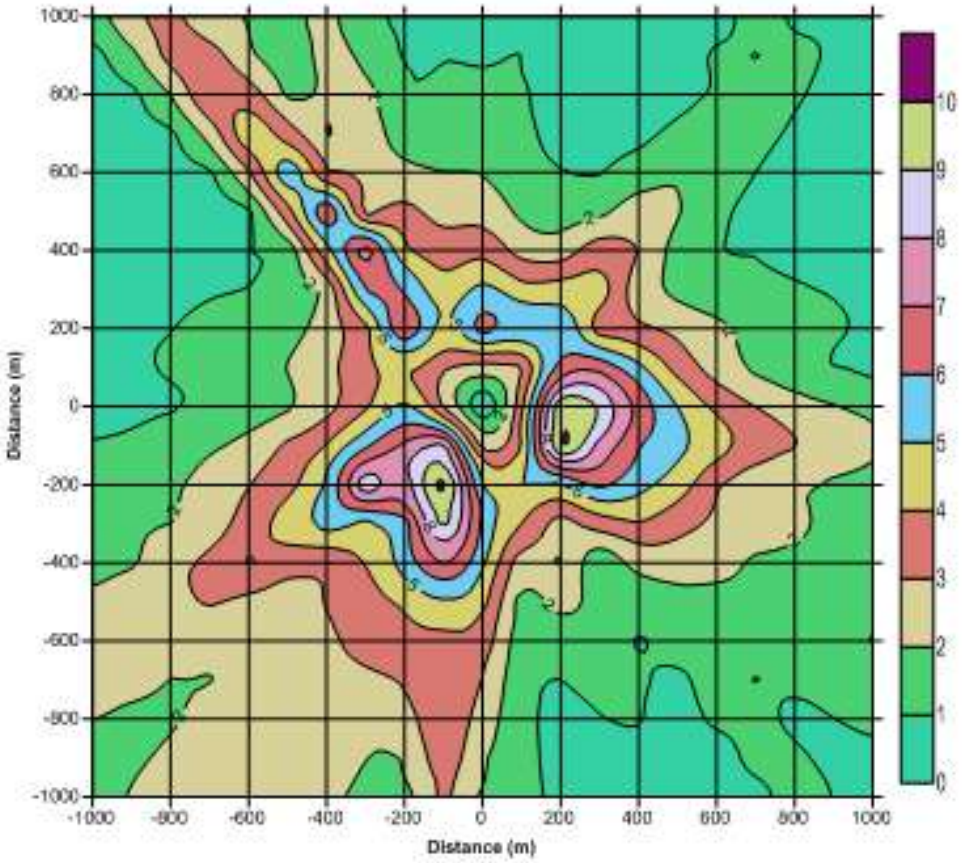


Figure 4.12: Spatial Distribution of 8-hour Average CO Conc. (μg/m^3)

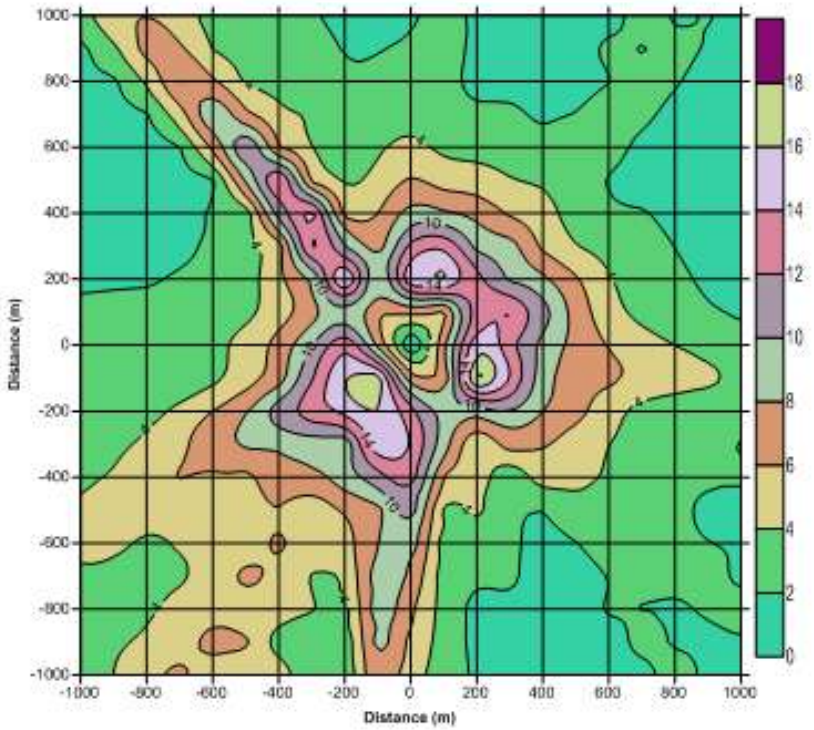


Table 4.9: Modelling Results (μg/m^3) At Discrete Receptor Locations

Pollutant	AQ1 (Chandi Ghat)			AQ2 (Jawalapur)			AQ3 (Ranigali Bhoputwala)			AQ4 (Sati Kund, Knakhal)		
	Background	Predicted	Resultant	Background	Predicted	Resultant	Background	Predicted	Resultant	Background	Predicted	Resultant
$PM_{2.5}$	92.5	0.018	92.518	41.5	0.007	41.507	38.7	0.010	38.010	105.8	0.012	105.812
PM_{10}	162.4	0.032	162.432	78.30	0.014	78.314	91.5	0.017	91.517	152.7	0.022	152.722
SO_2	14.6	0.390	14.990	9.50	0.156	9.656	9.5	0.198	91.517	12.5	0.251	12.751
NO_x	48.5	1.275	49.775	21.5	0.549	22.049	27.4	0.667	28.067	41.6	0.862	42.462
CO	1000	2.22	1002.22	200	1.26	201.26	500	2.04	502.04	1000	1.79	1001.79

Mitigation

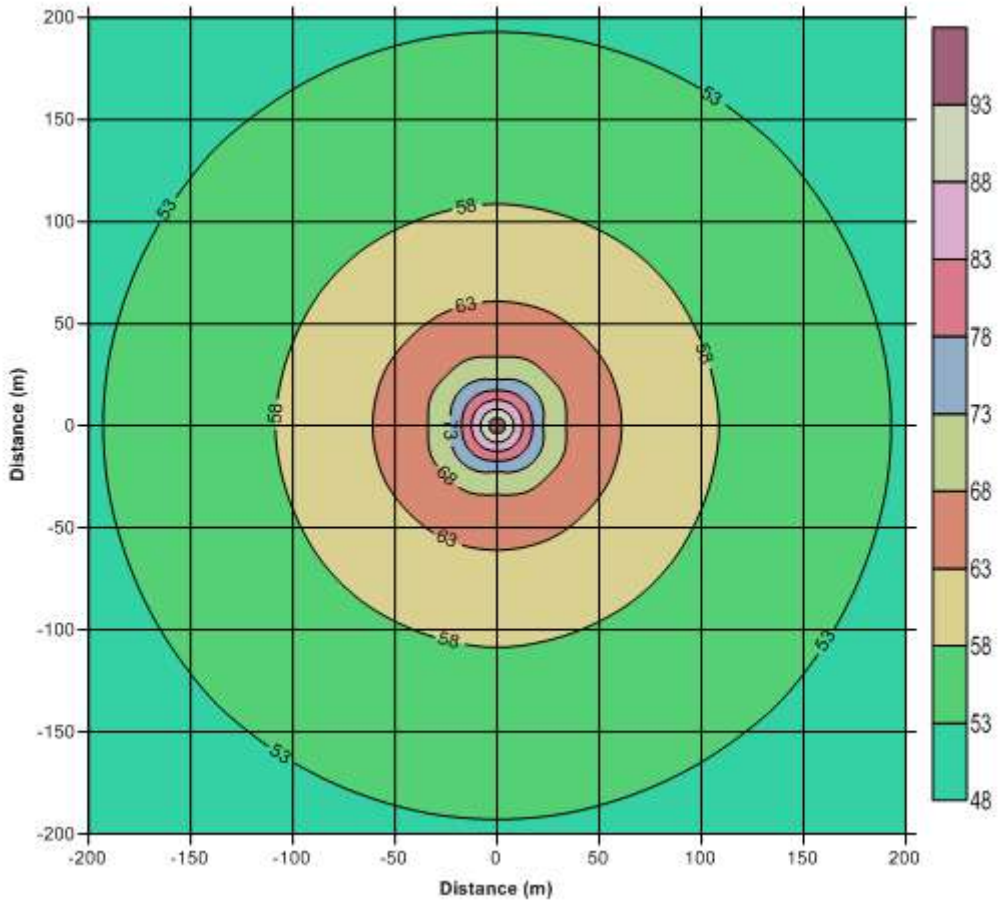
- Use of ultra low Sulphur diesel.
- Use of cleaner fuel if available.
- Adequate stack height.
- Green cover also works as pollution reducer.

4.6.4 Noise Environment

During the operational phase, noise generated from the operation of the project essentially relates to the use of mechanical equipment at the terminal, and the wheel chatter from the cable car runners passing over the ropeway.

During the operational phase, conveyer belt, generator, hoist and winch for the proposed ropeway project can be considered as the major noise pollution sources. Typical maximum noise level from conveyer belt, generator, hoist and winch considered for noise impact assessment considered as 90, 75, 95 & 95 dB(A) respectively at 1 m from the source. The impact assessment due to these major noise sources has been carried out with the help of CPCB approved DHAWANI noise model. Based on model simulated results, the spatial variation of noise level at an interval of 5 dB (A) around the source on the area of 200 m x 200 m during operation phase is shown in **Figure 4.13.**

Figure 4.13: Spatial Variation Of Noise Level dB(A): Operation Phase



As it can be seen from the above noise level isopleths, the maximum incremental noise level which is 98.7 dB (A) at 1m distance from the source is attenuated to 53 dB (A)) at a distance of about 200 m from the source location and meet daytime noise level 55 dB (A). Based on the modelling results it can be inferred that the resultant noise level will be expected well within the prescribed limit of 90 dB (A) near to ropeway operation site as prescribed by OSHA (Occupational Safety & Health Administration) for the 8 hours of exposure period.

Mitigation Measures: With the mitigation measures proposed such as housing all mechanical equipment inside a concrete building or using suitable material (i.e. installation of acoustic enclosure of the electrical motor at the terminals) so that noise generated as a result of this project would meet the required standards.

4.6.5 Socioeconomic Environment

Impact: The impact during construction stage is as follows:

Pressure on Existing Crowd: Presently, there is limited space available for construction of proposed UTP station due the presence of existing foot path, public toilet and forest area. Particularly, during festive seasons, large number of devotees, pilgrims and tourists visit Chandi Devi temple using the foot path and existing ropeway facility. So, long ques along

with crowed are observed. However, the public crowd management measures shall be taken into consideration during planning, construction and operation of the project.

Loss of Income of Auto Drivers: During consultation it is reported that the devotees and tourists mostly hire auto to reach to the existing ropeway station. Taking the devotees from Har ki Pauri to Chandi Devi temple is one of the major source of income for the auto drivers. However, it is anticipated that after construction of the proposed ropeway the devotees and tourists will use the ropeway service directly from the parking area. This may result in loss of loss of income to the auto drivers.

4.7 EPILOGUE

As discussed above, insignificant negative impacts on land, water, air and noise environment, basically related to the construction stage, are anticipated from the project, which could be mitigated through simple/ good construction and project management practices. There will be no major impact anticipated during operation stage of the project. On the other hand, the project would lead to long term socio-economic benefits. Incorporation of the environmental management plan would certainly enhance the sustainability of the project.

Chapter 5

Analysis of Alternatives

CHAPTER 5: ANALYSIS OF ALTERNATIVES

This chapter of the EIA will covers the alternative of sites considered for selecting the proposed ropeway. The feasibility study of the ropeway project was done. 06 Alignments were studied for the ropeway. The location of the terminal station towards Chandi Devi Mandir is same in all the options and study/survey was done for the terminal station towards Har Ki Pauri with 06 different locations. Out of the above 06 options, after preliminary study, 04 options were canceled and 02 options were studied in detail. The details are given in subsequent section.

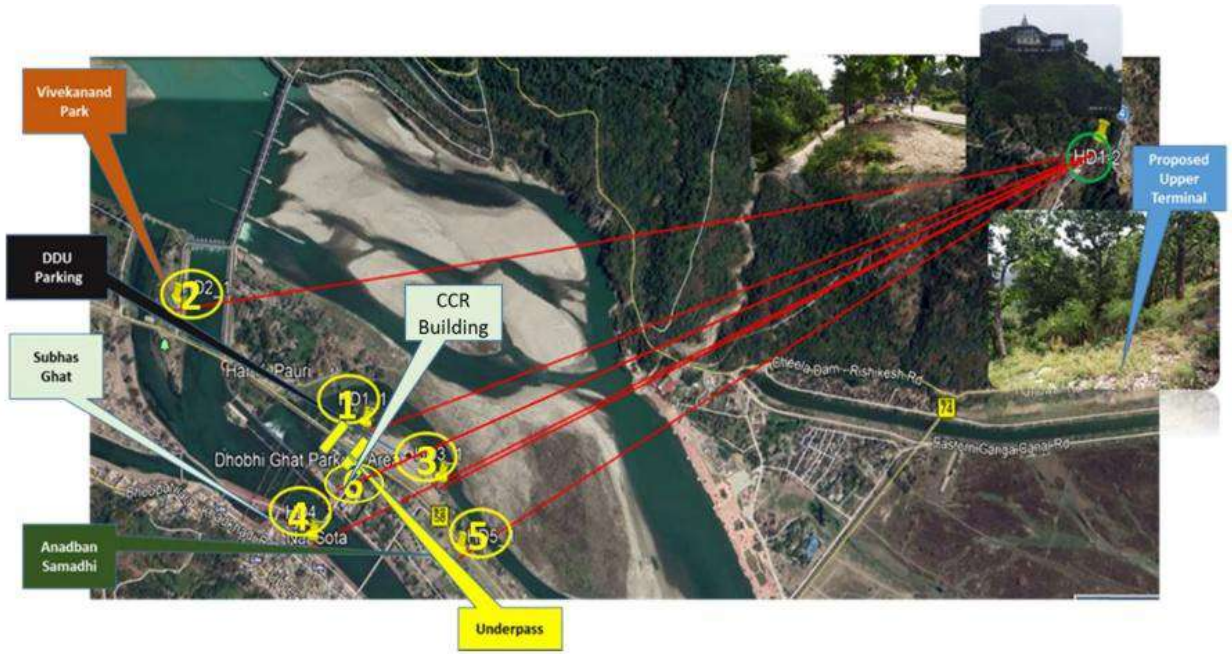
5.1 Site Alternative

Following 06 different alignments were identified:

1. Starts adjacent to Deen Dyal Upadhyay (DDU) parking area at NH 34 (North end).
2. Starts from Swami Vivekanand Park at NH 34
3. Starts from Deen Dyal Upadhyay (DDU) parking area at NH 34 (South end).
4. Starts from Subhash Ghat (Har Ki Pauri).
5. Starts from Rodi Belwala near Anand Ban Samadhi at NH 34.
6. Starting from the right side of the watchtower (CCR Building), near Har ki Pauri

The location of the alignments is shown in the **Table 5.1** and **Figure 5.1.**

Figure 5.1: Alternative Alignments



Source: Feasibility Report for construction of Ropeways at Har ki Pauri, Haridwar & Rishikesh, July 2020

Table 5.1: Alternate Site Details

S. No.	Ropeway Starting	Point	Length	m	Elevation
1.	Adjascent to Deen Dyal Upadhay (DDU) parking area at NH 34 (North End).	2300	200	29°57'13.18"N 78°10'23.76"E	29°56'2.23"N 78°10'50.37"E
2.	Swami Vivekanand Park at NH 34	2770	203	29°57'31.80" N 78°10'34.96" E	29°56'2.23"N 78°10'50.37"E
3.	Deen Dyal Upadhay (DDU) parking area at NH 34 (South End).	2100	201	29°57'5.52" N 78°10'18.43" E	29°56'2.23"N 78°10'50.37"E
4.	Subhash Ghat (Har Ki Pauri)	2520	194	29°57'18.01" N 78°10'12.75" E	29°56'2.23"N 78°10'50.37"E
5.	Rodi Belwala near Anand Ban Samadhi at NH 34	2130	198	29°57'3.57" N 78°10'11.77"E	29°56'2.23"N 78°10'50.37"E
6.	At north sideof CCR Building (watch tower), Near Har Ki Pauri	2400	202	29°57'14.86"N 78°10'18.24"E	29°56'2.23"N 78°10'50.37"E

Source: Feasibility Report for construction of Ropeways at Har ki Pauri, Haridwar & Rishikesh, July 2020

5.2 Further Study

During Feasibility study, after the joint visit with a team of UKMRCL officials, out of above six alignments, Alignment no.1 and 6 were found suitable in terms of approach, ease of construction, availability of space, tourist survey for alignment choice etc. Details of these 2 alignments are given below and shown in **Figure 5.2**.

Alignment-1: Starting from Deen Dyal Upadhyay Parking (North End)
Alignment-6: Starting from Northside of CCR Building (Watch Tower) Plan of the Alignment – 1 and 6:

Figure 5.2: Alignement location

5.2.1 Details of Alignment 1

Location of Lower Terminal: Starts from location, adjacent to Deen Dyal Upadhyay (DDU) parking (North end) at NH 34 as shown in **Figure 5.3**.

Nature of Land: Irrigation Department / Tourism Department

Figure 5.3: Location of Lower Terminal for Alignment 1

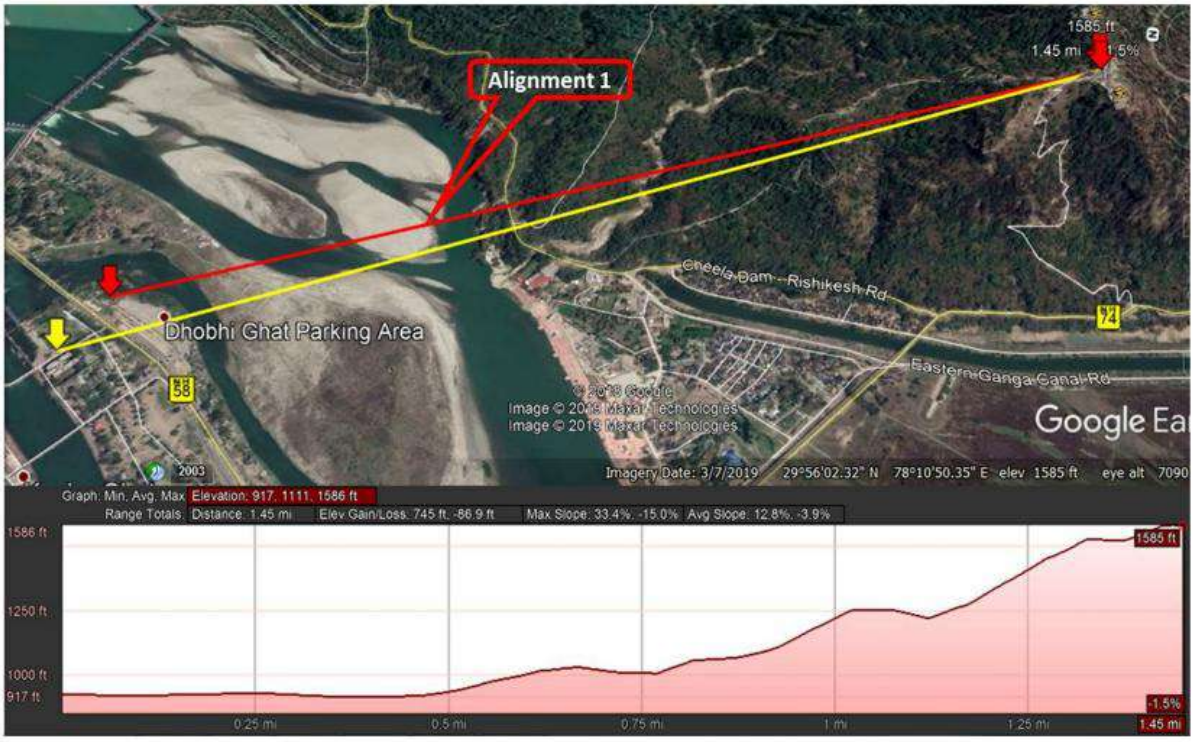
Location of Upper Terminal: Near Chandi Devi Temple, at the junction point of pedestrian path, way to Chandi Devi Temple and way to Anjani Mata Mandir, as shown in the **Figure 5.4**.

Nature of Land: Forest Department

Figure 5.4: Location of Upper Terminal and Other Land Marks for Alignment 1

Elevation Profile of Alignment-1 is shown in **Figure 5.5.**

Figure 5.5: Elevation Profile of Alignment-1



Nature of Land of Corridor: Forest Department and Irrigation Department

Advantages of Alignment 1:

- The starting point is next to NH 34.
- Integration with existing parking (DDU parking).
- Easy connectivity with Har ki Pauri through the subway.
- The ropeway is not crossing the NH, therefore clearance & protection over NH is not required.
- During construction and operation & maintenance of ropeway, there will be no interference with the NH.

Limitations of Alignment 1:

- About 300m away from Har ki Pauri.
- Being the bank of the river, due care to be taken for construction of terminal building & foundation.

The Technical Details of Ropeway Proposed for Alignment – 1 is given in Table 5.2.

Table 5.2: Technical Details of Ropeway Proposed for Alignment – 1

Details	Value	Unit
Layout		
Location of drive station	Bottom	--

Details	Value	Unit
Location of return station	Top	--
Location of the tensioning system	Bottom	--
Type of tensioning	Hydraulic	--
Direction of rotation	Clockwise	--
Dimensions		
Horizontal length	2281	m
Vertical rise	209.35	m
Inclined length	2305	m
Track width	5	m
Transport Capacity		
Hourly capacity per direction	1800	PPH
Uphill transportation	100	%
Downhill transportation	100	%
Drive speed, infinitely adjustable	1.0~5.0	m/s
Trip time at max speed	~ 8	min
Station speed	0.25 – 0.3	m/s
Main Drive		
Drive Machinery, Type	Overhead	
Electric main drive:		
Continuous Power Rating	300	kW
Starting Power rating	360	kW
Voltage	380 / 440	V
Frequency	50	Hz
Evacuation Drive		**Unit**
Evacuation drive 1 (diesel hydraulic)	100	kW
Evacuation drive 2 (electric)	~ 25	KW
Evacuation speed, max.	~ 1.0	m/s
Carriers		
Carrier spacing	60	m
Carrier interval	12	Sec
Passengers per carrier	6	P
Number of carriers	90	Nos.
The number of other carriers:		
Service Carrier	1	Nos.
Freight Carrier	0	Nos.
Towers		
Number of towers	13	Nos.
Haulage rope		
Diameter	41	mm
Actual Breaking Strength	1086	kN
Tensile Strength	1860	N/mm2
Tension Force	400	KN

Highest Flood level (HFL) of Haridwar

Site Name: Haridwar
District Name : Haridwar
Warning Level (WL): 293.0 Meters (m)
River Name: Ganga
Danger Level (DL): 294.0 Meters (m)
Basin Name: GANGA
Division Name: Himalayan Ganga Division (HGD), Dehradun
Highest Flood Level (HFL): 296.3 Meters (m)
HFL Attained date: 19-09-2010

5.2.2 Details of Alignment 6

Location of Lower Terminal: Starting from the north side of CCR Building (watchtower), near Har ki Pauri as shown in **Figure 5.6**.

Nature of Land: Irrigation Department (Reserve/restricted land for Kumbh Mela)

Figure 5.6: Location of Lower Terminal for Alignment 6

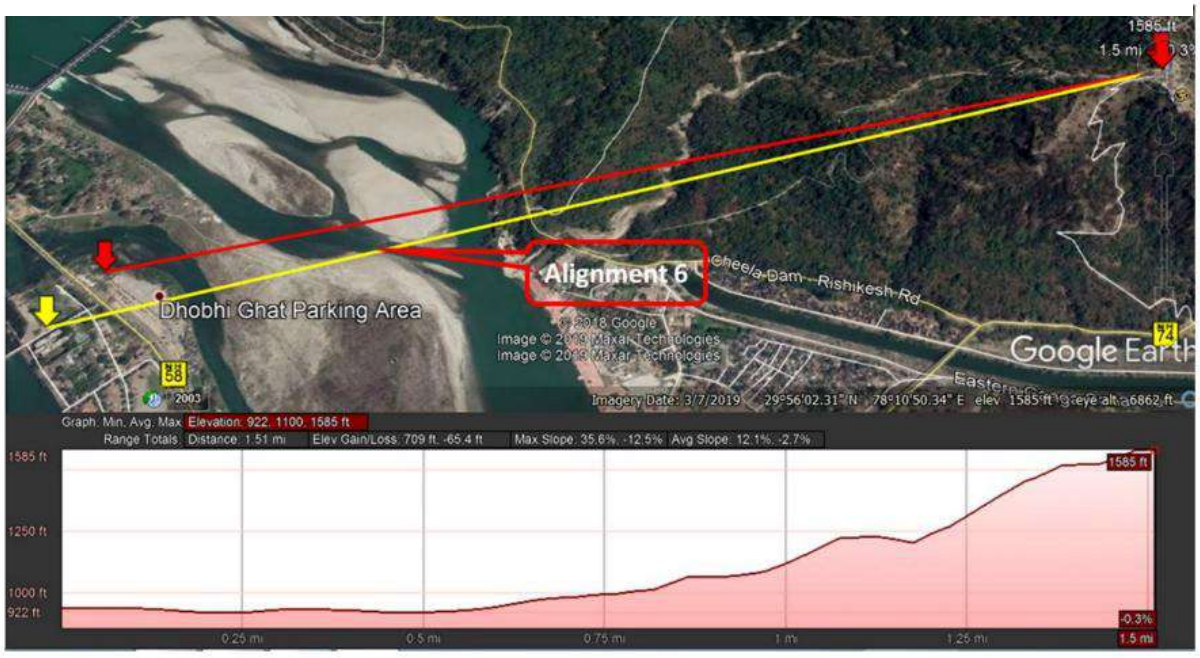
Upper Terminal for all the alignments: Near Chandi Devi Temple, at the junction point of pedestrian path, way to Chandi Devi Temple and way to Anjani Mata Mandir, as shown in **Figure 5.7**.

Nature of Land: Forest Department

Figure 5.7: Location of Upper Terminal and Other Land Marks for Alignment 6

Elevation Profile of the Alignment- 6 is shown in **Figure 5.8.**

Figure 5.8: Elevation Profile of the Alignment- 6



Nature of Land for Corridor: Forest Department and Irrigation

Advantages of Alignment 6:

- The starting point is closer to Har ki Pauri
- Location is well connected with Har ki Pauri.
- Adequate land is available for the development of the terminal station.
- Parking is available at 100m distance

Limitations of Alignment 6:

- The ropeway is crossing the NH, therefore clearance of NH will be required.
- At the same time, operation and maintenance will interfere with the NH. Suitable protection will be required.

The Technical Details of Ropeway Proposed for Alignment – 6 is given in Table 5.3.

Table 5.3: Technical Details of Ropeway Proposed for Alignment – 6

Details	Value	Unit
Layout		
Location of drive station	Valley	--
Location of return station	Top	--
Location of the tensioning system	Valley	--
Type of tensioning	Hydraulic	--
Direction of rotation	Clockwise	--
Dimensions		
Horizontal length	2402	m
Vertical rise	207.05	m
Inclined length	2425.36	m
Track width	5	m
Transport Capacity		
Hourly capacity per direction	1800	PPH
Uphill transportation	100	%
Downhill transportation	100	%
Drive speed, infinitely adjustable	1.0~5.0	m/s
Trip time at max speed	~8.3	min
Station speed	0.25-0.3	m/s
Main Drive		
Drive Machinery, Type	Overhead	
Electric main drive:		
Continuous Power Rating	300	kW
Starting Power rating	360	kW
Voltage	380/440	V
Frequency	50	Hz
Evacuation Drive		**Unit**
Evacuation drive 1 (diesel hydraulic)	100	kW
Evacuation drive 2 (electric)	~25	KW
Evacuation speed, max.	~1.0	m/s
Carriers		
Carrier spacing	60	m
Carrier interval	12	Sec
Passengers per carrier	6	P
Number of carriers	90	Nos.
The number of other carriers:		

Details	Value	Unit
Service Carrier	1	Nos.
Freight Carrier	0	Nos.
Towers		
Number of towers	13	Nos.
Haulage rope		
Diameter	41	mm
Actual Breaking Strength	1086	kN
Tensile Strength	1860	N/mm2
Tension Force	400	KN

5.3 Final Alignment Evaluation

After the assessment, various exercises were carried out to finalize the ropeway alignment. An extensive customer survey was carried out to understand the preference of potential users. A customer survey was conducted for the choice of alignment, Alignment-1 and Alignment-6 has a maximum preference which is 33% and 39% respectively, as per the following survey details:

Table 5.4: Survey Data for Alignment selection

	Type of People Surveyed	Number	Percentage (%)
1	Tourist	2524	84
2	Local	476	16
Total Sample Size		3000	100

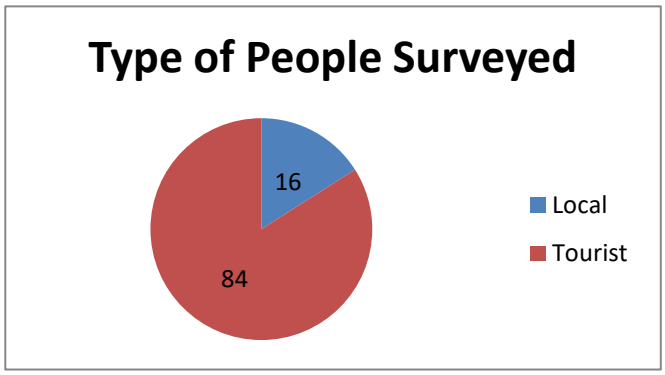
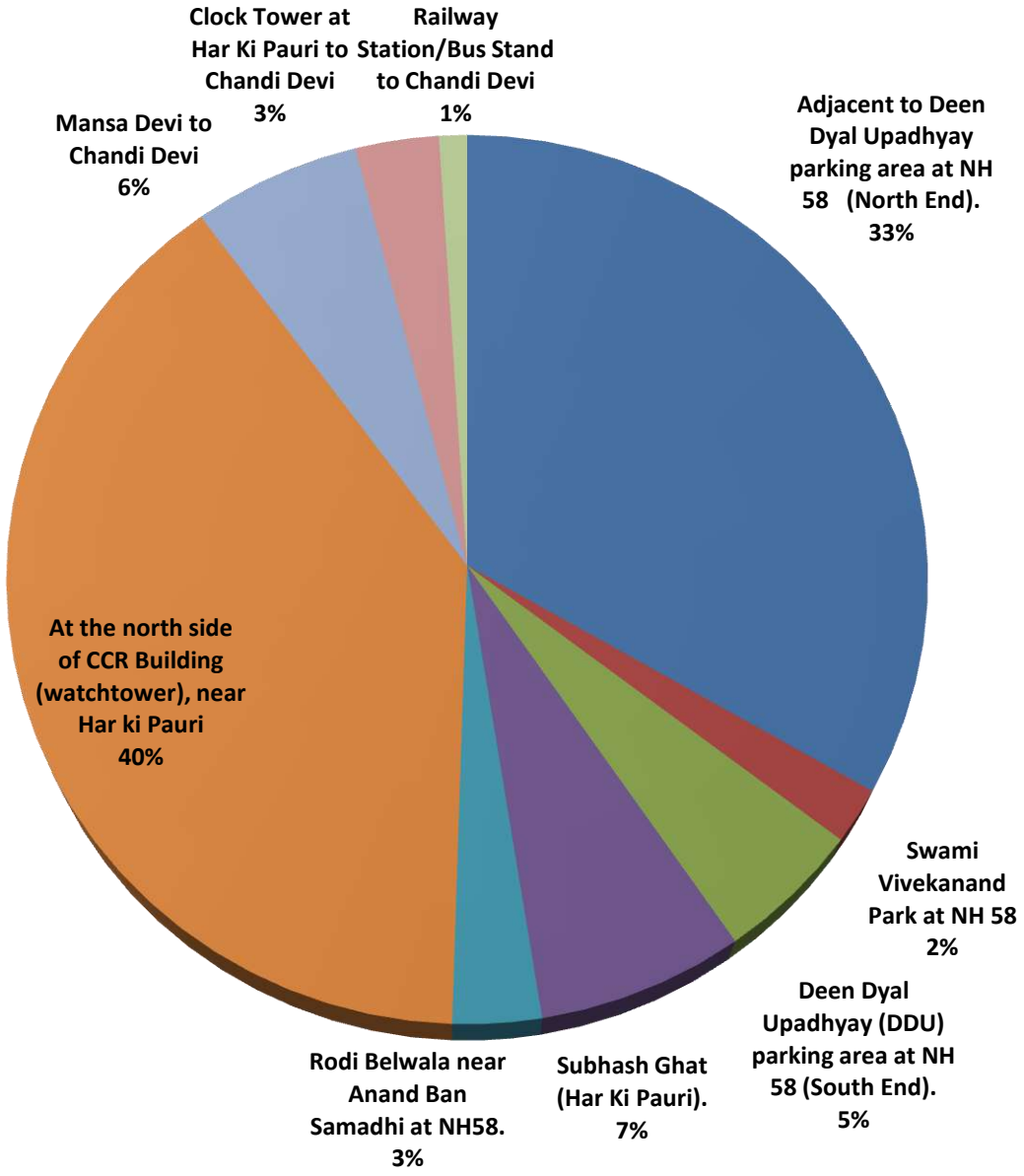


Table 5.5: Choice of Alignment for Har Ki Pauri to Chandi Devi

Choice Of Alignment For Har Ki Pauri to Chandi Devi		Number	Percentage (%)
1	Adjacent to Deen Dyal Upadhyay parking area at NH 34 (North End).	989	33
2	Swami Vivekanand Park at NH 34	68	2
3	Deen Dyal Upadhyay (DDU) parking area at NH 34 (South End).	162	5
4	Subhash Ghat (Har Ki Pauri).	219	7
5	Rodi Belwala near Anand Ban Samadhi at NH 34.	96	3
6	At the north side of CCR Building (watchtower), near Har ki Pauri	1164	39
Others:			
A. Mansa Devi to Chandi Devi		181	6

B. Clock Tower at Har Ki Pauri to Chandi Devi	93	3
C. Railway Station/Bus Stand to Chandi Devi	28	1
Total	**3000**	**100**

Figure 5.9: Survey Results



Final Alignment selection:

Based on various surveys, feasibility study, ease of construction, ease of operation and discussion with other stakeholders, Alignment no 1 has been selected as the final preferred alignment.

5.3.1 Broad Characteristics of Selected Alignment

The broad characteristics of the recommended alignment are given in **Table 5.6.**

Table 5.6: Broad Characteristics of the Alignment

Details	Value	Unit
Layout		
Location of drive station	Bottom	--
Location of return station	Top	--
Location of the tensioning system	Bottom	--
Type of tensioning	Hydraulic	--
Direction of rotation	Clockwise	--
Dimensions		
Horizontal length	2281	m
Vertical rise	209.35	m
Inclined length	2305	m
Track width	5	m
Transport Capacity		
Hourly capacity per direction	1800	PPH
Uphill transportation	100	%
Downhill transportation	100	%
Drive speed, infinitely adjustable	1.0~5.0	m/s
Trip time at max speed	~8	min
Station speed	0.25-0.3	m/s
Main Drive		
Drive Machinery, Type	Overhead	
Electric main drive:		
Continuous Power Rating	300	kW
Starting Power rating	360	kW
Voltage	380/440	V
Frequency	50	Hz
Evacuation Drive		**Unit**
Evacuation drive 1 (diesel hydraulic)	100	kW
Evacuation drive 2 (electric)	~25	KW
Evacuation speed, max.	~1.0	m/s
Carriers		
Carrier spacing	60	m
Carrier interval	12	Sec
Passengers per carrier	6	P
Number of carriers	90	Nos.
The number of other carriers:		
Service Carrier	1	Nos.
Freight Carrier	0	Nos.
Towers		
Number of towers	13	Nos.
Haulage rope		

Details	Value	Unit
Diameter	41	mm
Actual Breaking Strength	1086	kN
Tensile Strength	1860	N/mm2
Tension Force	400	KN

Chapter 6

Environmental Monitoring Plan and Cost

CHAPTER 6 : ENVIRONMENTAL MONITORING PLAN AND COST

6.1 INTRODUCTION

The environmental monitoring programme is a vital process for the Environmental Management of infrastructure project. It is important to check the effectiveness of mitigation measures. This helps in signaling the potential problems that would result from the construction and operation of the proposed project and will allow for prompt implementation of corrective measures. This section outlines a suggested program of sampling, analysis and monitoring frequency. Actual sampling, analysis and monitoring frequency will be conducted as per the requirements of the various certificates of approval issued for the construction phase. Compliance monitoring will provide data on the quantity and quality of various discharges to the environment, including:

- Airborne contaminants and noise
- Sewage treatment plant/ Labour camp discharge and runoff from active construction sites
- Water quality and quantity
- Soil quality

6.2 Air Quality Monitoring

During construction phase, the primary sources of air contamination are particulates from earthmoving, quarrying operations, and exhaust fumes from the equipment on site, and from traffic. From a health viewpoint, the finer particulate fraction is of greatest concern; whereas total suspended particulate (TSP) is a good indicator of the nuisance impact, particularly from earthmoving operation. To analyze the ambient air quality 4 monitoring locations are selected. The monitoring schedule is given in **Table 6.1**. These locations are selected on the basis of the impact of local sources of particulate, vehicle access.
These are as follows:

1. Near Upper Terminal Point
2. Near Lower Terminal Point
3. Loading unloading area and near to the haul road.

6.3 Noise Quality Monitoring

The proximity of the Ropeway to a residential and Eco-sensitive area, it is desirable to obtain quantitative information on the noise levels in the nearby community and in project site. During Construction phase the primary sources of noise are earthmoving equipment, and general construction activity.

Four Monitoring locations are selected for assessing the noise quality of the area. As part of the environmental management, equipment brought on site for construction purposes is checked to determine whether it meets noise generation guidelines. Spot checking is conducted to confirm that noise abatement equipment is effective and being properly maintained. The monitoring schedule is given in **Table 6.1**. After construction noise will be monitored regularly for 1 year. If it is exceeded the permissible level mitigation measures will be further evaluated.

6.4 Water Quality Monitoring

Monitoring will be conducted during construction to confirm that discharge from the sewage treatment plant and runoff from exposed areas. The surface water monitoring program is designed to determine any direct effects from construction activity on surface water quality. Groundwater monitoring is conducted to identify any contamination of the groundwater arising from hydrocarbon spills or mobilization of heavy metals during the earthworks and other activities. 3 monitoring locations for surface water and 2 locations for ground water are selected for the purpose of assessing the measure implementations. The monitoring schedule is given in **Table 6.1**.

6.5 Soil Quality Monitoring

Soil near to the construction area shall be monitored to ascertain presence of soil pollution due to construction activities. Soil will be monitored near to the LTP, Labour Camp, Tower 5 and UTP. The monitoring schedule is given in **Table 6.1**. The soil quality monitoring result are compared with the baseline result of soil monitoring to see the impact on soil due to construction and operation of project.

6.6 Ecological Monitoring

The avifauna and mammals monitoring are considered for 3 seasons in a year during entire construction period. The monitoring will be done at Rajaji National Park, plantation sites and Bhimgoda barrage of Ganga River. During operation phase the avifauna and mammals monitoring is consider for 3 times in a year for 3 years Rajaji National Park, plantation sites and Bhimgoda barrage of Ganga River. Detailed environment monitoring plan for the proposed ropeway is given in **Table 6.1.**

Table 6.1: Environment Monitoring Program

Environment Component/ Issues	Mitigation Measures	Parameter	Monitoring period	Location	Duration / Frequency	Standards
Ambient Air Quality	Ambient Air Quality with respect to RPM, SO_2, NOx shall be monitored	PM_{10}, $PM_{2.5}$, SO_2,CO, and $NO_{x,}$	During construction and 1 year after construction	1 location at LTP and 1 location at UTP	Once in a month for three Seasons in a year i.e. Pre-Monsoon, Post-Monsoon and Winter	National Ambient Air and Noise Quality Standards
Working zone Air Quality			During construction	At loading/unloading point near quarry & main haul road		
Noise Quality	Periodic measurement	Noise level in dB(A)	During construction and 1 year after construction	1 location at LTP and 1 location at UTP		
Working zone Noise Quality			During construction/ operation	At loading and unloading point of construction material /ropeway & main haul road.		
Ground water Quality / Drinking water	Changes in ground water quality will be monitored through water quality analysis.	Analyse 22 Drinking water parameters	During Construction	Har ki Paudi and UTP	Twice in a year (Pre and Post monsoon)	Drinking water standards (IS 10500)
			During Operation	Supply water after treatment at LTP and UTP		

Environment Component/ Issues	Mitigation Measures	Parameter	Monitoring period	Location	Duration / Frequency	Standards
Surface Water Quality	Water analysis for change in water quality	25 parameter covers general, Nutrient, demand parameters, major ions, microbiological, inorganic. Colour, odour, temperature, pH, EC, DO, NO_2 + NO_3 , BOD, total Coliform and Faecal coliform	During construction/ operation	Ganga River Near Dakshin Kali Mandir, Ganga River Near LTP and Near Tower-5 (Spring Water)	Four times in a year (Pre monsoon Once in a year for 25 parameters, Post monsoon 3 times for 10 Parameter)	Designated Best Use Classification of Surface water by CPCB.
Soil Quality	Soil contamination checking by analysis of samples	pH, Texture, Total Organic Matter, Nitrogen, Phosphate, Sodium, Potassium, Calcium, Chloride, Magnesium, and Electrical Conductivity	During Construction	LTP, Labour Camp, Tower 5 and UTP	Twice in a year (Pre and Post monsoon)	------
Ecology and Biodiversity	Monitoring	avifauna and mammals	During Construction	Rajaji National Park, plantation sites and Bhimgoda barrage of Ganga River	3 times in a year during entire construction period	------
			During Operation	Rajaji National Park, plantation sites and Bhimgoda barrage of Ganga River	Once in a season, Three seasons in a year during operation phase.	------

6.7 ESTABLISHMENT OF ENVIRONMENTAL CELL

The project authority shall establish an Environmental cell in the initial stage of the project. The division shall have one Environmental Engineer/Officer. The task of the environmental Engineer/Officer shall be to supervise and co-ordinate environmental concerns, monitoring and implementation of mitigation measures. The officer will monitor the environmental works in co-ordination with the Project Head. Cost of such a division has been estimated as **Rs.37.07 lakh** as per the details given in **Table 6.2.**

Table 6.2: Cost Of Environmental Cell

S. No	ITEM	COST (Rs)
A	**Capital Cost**	
	Office Furnishings (Computer, Audio visual aid and furniture)	2,50,000
B	**Recurring Cost**	
	Man Power Cost (For 36 months)	
	Environmental Engineer/Officer @ Rs. 50,000/month with annual increment of 8%	19,50,000
	Office Maintenance and consumables @ Rs. 30,000/month with annual increment of 8%	11,70,000
C	**Sub Total (A+B)**	**33,70,000**
	Miscellaneous and unforeseen expenses, LS (10 % of C)	3,37,000
	Total cost for establishment of cell	**37,07,000**

The Environmental Engineering will have minimum qualification of bachelor's in engineering preferably in Civil or Environment or MSc in Environmental Science with minimum experience of 5 years in the field of environmental engineering. Environmental experience for construction work will be preferred.

6.7.1 Record Keeping/ Inspection

- Periodic inspections will be performed by walking the entire perimeter of the site for documenting any damage due to weather, local traffic, ground movement etc. Damage observed will be noted down so that action can be taken immediately after approval of concerned authority.
- The monitoring shall be carried out through MoEFCC/NABL approved laboratory.
- Reports containing the environmental compliance monitoring and sampling information required, and any additional monitoring data gathered during the reporting period, will be compiled and submitted to the USPCB. All results shall be maintained at the project site.
- In addition to all environmental compliance monitoring data, reporting to USPCB
    - summary of any incidents of Emergency Response implementation;
    - non-conformances to any conditions of approval;
    - reports of any spillage or leakage of a regulated substance;
    - incidents of suspected or actual exceedance of discharge criteria; and,

- any written or verbal complaints of an environmental incident from the public related to the Project

Typical parameters to be recorded are summarized in **Table 6.3**.

Table 6.3: Record Keepings & Recordings

Parameters	Particulars
Water Uses & Disposal	• Monthly water consumption • Monthly chemical used in Treatment • Shut down period of STP • Sludge Production • BOD, COD, TSS and other monitoring parameters of the treatment system • Water quality testing
Waste Handling & Disposal	• Solid Waste Collection • DG sets maintenance routines, used oil production • HDPE drums, etc. (Form-2, Form-3) • Hazardous waste handling and disposal records • Public Awareness through Information, Education and Communication (IEC)
Regulatory License	• Consent to Operate • Half Yearly Compliance (1st June & 1st December)
Monitoring & Survey	• Records of environmental monitoring carried out during operation & post closure phase
Accident Reporting	• Date, Time & Place of accident • Affected people, equipment etc. • Measures taken
Others	• Log book of compliance • Employee environmental, health and safety records • Equipment inspection and calibration records, where applicable • Vehicle maintenance and inspection records

6.7.2 Reporting Schedules

The environment management cell shall be responsible for timely conduct of the monitoring activities. The results of the analysis shall be intimated to the project head. Any anomaly in test results shall be investigated into and proper corrective actions shall be undertaken. A complaint register shall also be maintained to note any complaints from the staff and visitors in the project or any other stakeholder. Corrective actions taken against the complaints shall also be noted.

6.7.3 Emergency

Alarming levels of pollutants in any of the monitored component may raise alarm in the mitigation measures followed. In these conditions the mitigation measures will be reviewed

and reconsult by the Environment management cells on necessary steps to be taken on an immediate and long term basis to tide over the problem.

6.8 ENVIRONMENTAL MONITORING COST

Environment Monitoring Cost for the construction and operation phase will be 66.47 Lakhs including Environment Management Cell.

Table 6.4: Environmental Monitoring Cost

S. No	ITEM	QUANTITY	ESTIMATED UNIT RATE (Rs.)	TOTAL COST (Rs. In Lakh)
A. ENVIRONMENTAL MONITORING COST				
I	**Water Quality Monitoring**			
	Monitoring during Construction Stage and after Construction	48 samples	10000	4.8
II	**Air**			
	Monitoring during construction and after Construction	51 samples	10000	5.1
III	**Noise Quality Monitoring**			
	Monitoring during construction and after Construction	63 Samples	5000	3.15
IV	**Soil Quality Monitoring**			
	Monitoring during construction and after Construction	12 samples	5000	0.6
V	Ecology And Biodiversity	Rajaji National Park, plantation sites and Bhimgoda barrage of Ganga River	----	15.75
VI	**Environmental Cell Cost**			
	Establishment of Environmental Cell	Refer Section 6.6	Refer Table 6.2	37.07
Environmental Monitoring Cost (A) = Sub Total (I) + (II) + (III) + (IV)+ (V)+(VI)				**66.47**

Chapter 7

Additional Studies

CHAPTER 7 ADDITIONAL STUDIES

7.1 PUBLIC CONSULTATION

Public consultation is a continuous process throughout the project period, during project preparation, implementation, and monitoring stage. At project planning stage the consultative process adopted ensures that the people of nearby locality and other stakeholders are informed, consulted, and allowed to participate actively in the process and decisions of people will be incorporated in project preparation. The consultations, though in brief, were carried out with the local people during social survey. It involved information dissemination i.e. informing the people about the details of the project. The consultant invited participants to give their suggestion and comments on the proposal of development of aerial ropeway Project.

The project level consultation process involved various groups such as shop keepers, devotees, pilgrims, tourists, drivers, hotel owners, monks and other stakeholders. Four public consultations were conducted in Deen Dayal Upaddhyay parking, Hari Ki Pauri, Chandi Devi temple and in existing ropeway parking area. Prior to the consultation, the participants were informed about the project. The issues like awareness about project, increase in tourists and devotees, traffic issue, increase in income and shop keeping business, better integrated transportation, employment opportunity, loss of income of auto drivers, saving of time and money, crowd management, mobility, disaster management measures, development of tourism, affordable travel fare, protection of wild animal, engagement of local labour etc were discussed. The presence of about 64 participants was ensured during focus group discussion and public consultation at project level. The photographs of public consultations is shown in **Figure 7.1**.

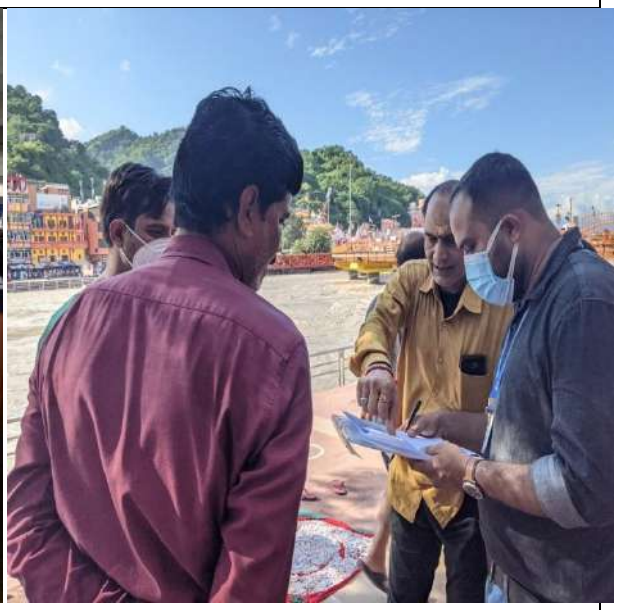
7.1.1 Objectives Of The Consultation

The main objective of the consultation process is to inform the people about the anticipated benefits, negative impacts and mitigation measures of the project. The objectives of public consultation as part of this proposed ropeway project are:

- Disseminate information to the people about the project in terms of its activities and scope of work; and understand the views and perceptions of the people and communities.
- Identify contentious local issues which might jeopardize the implementation of the project.
- Identify and assess major economic and social information and characteristics of the project area to enable effective project implementation plan.
- Establish transparent procedures for carrying out proposed works.
- Create accountability and sense of local ownership during project implementation;

- Establish an understanding for identification of overall developmental goals and benefits of the project.

Figure 7.1: Photographs of Public Consultation



7.1.2 Major Findings of Public Consultation

The major findings of public consultation are as follows:

- Majorly, the participants were unaware of the proposed ropeway project. However, after informing them about the project, they appreciated and supported the intervention of the government with respect to transportation and tourism development.
- The devotees and tourists would always prefer to use ropeway facility directly from Deendayal Upaddhyay parking to Chandi Devi temple.
- The LTP (Lower Terminal Point) of the ropeway project is proposed near to Deendayal Upaddhyay parking area whereas UTP (Upper Terminal Point) is proposed near to the existing washroom of Chandi Devi Temple. However, considering the proposed LTP station the participants reported that, it would be convenient for the devotees and tourists to visit Chandi Devi Temple straight from the parking point.
- Presently, the devotees and tourists travel about 4 kms to access the existing ropeway facility (USHA BRECO LIMITED) to visit Chandi Devi Temple which consumes their time and travel cost while taking the auto ride. However, the proposed ropeway will offer a way more convenient and integrated transport facility directly from Deen Dayal parking area to Chandi Devi temple while saving time, money and energy of the devotees which could be used in a more productive way. This may lead to loss of income to the auto drivers.
- The ropeway project is proposed in government land. Therefore, no private land acquisition and no loss of private structure are reported.
- The shop keepers at parking area near proposed LTP station reported that the construction of ropeway will result in increase of devotees and tourists which in turn will affect in their income. It will boost their shop keeping business.
- In order to address the traffic congestion in Har ki Pauri and surrounding area during festive seasons, the ropeway project may be helpful considering the proposed LTP station.
- Presently, the tourists and devotees are paying Rs. 200/ per person for using current ropeway facility to visit Chandi Devi Temple which is not affordable to everyone. The devotees as well as tourists belonging to the poor class of the society are not able to use the ropeway service. They have only option left to take the foot path which consumes time and energy. However, it is requested that the ropeway fare/ticket price shall be affordable to the masses.
- Presently, there is no much space available for construction of proposed UTP location due the presence of existing foot path, other temple structures and forest area. During festive seasons, large number of devotees and tourists visit the temple using the foot path and ropeway facility and long ques are observed. Therefore, the crowd management measures shall be taken into consideration during planning, construction and operation of the project.

- The existing shops located near proposed UTP location shall not be displaced for the construction and development of proposed UTP location due to lack of physical space.
- The proposed ropeway facility will increase the mobility of devotees and tourists towards Chandi Devi Temple.
- Employment opportunities are anticipated during construction and operation of the project.
- The proposed LTP and UTP locations shall be developed along with other necessary facilities for the passengers and devotees visiting the temple.
- The proposed project is going to be a good initiative by the government to introduce such project.
- The devotees and tourists would be happy to use the faster mode of integrated transportation right from the parking area to Chandi Devi Temple.
- In 2013, Haridwar as well as Uttarakhand experienced devastating floods which caused loss of so many human lives. The river was all flooded during that time. However, during planning, construction and operation of the ropeway project, the disaster prevention and safety measure shall be taken care of since the ropeway is going to cross over the Ganges River and touch the hill.

7.2 RISK ASSESSMENT

Risk assessment estimates the severity and likelihood of harm to any human life and the environment. Risk assessment is the use of the factual base to define health effects of exposure of individual or population to hazard material and situations.

Aerial ropeway is one such exclusive and simple mechanical system, which facilitates transport of man and material over difficult and abnormal terrain bringing about comparative ease and economy vis-à-vis other means of transport.

7.2.1 Hazards Identification Construction/Operation Phase Of Ropeway And Control Measures

During the construction phase, construction equipment like dozer, trucks, scrappers, concrete mixers, cranes, generators, pumps, etc. will be used. However, it shall be temporary and mostly confined to the site. PPE and PPA such as Helmet, safety shoes, Earmuffs etc will be provided to the construction worker. Hence, insignificant impacts due to construction machinery are envisaged. Hazard identification cable Ropeway construction & operation and Mitigation / control measures stated in **Table 7.1**.

Table7.1 Hazard Identification and Suggested Control Measures

Hazard Identification Ropeway Construction & Operation	**Mitigation / Control Measures**
Terminal /Tower foundation construction Ground collapse-Accidents Physical Hazards Occupational hazards Ropeway one tower construction in Ganga River – Drowning accident as Dredging is required in Ganga River	The use of benching or the installation of ground support (e.g. shoring) during Tower foundation • Use of PPE/PPA Dust inhalation, Eye injury, body part injury • Life jacket, Communication system at piling site, provision of speed boats during emergency situation
Flood /Water inrush As 13 nos Tower construction and leveling of ROW may be a change in the topography and drainage pattern along with top soil erosion, contamination Soil due to project activities Loss of productive soil.	• Dewatering pump systems to remove water and prevent build-up. • Maintained by preparing sodden waterways or installing culverts. • Reduction of the area of earth cuts on fills below. • Provide physical support for exposed soil or rock faces.
Falls form height	Working on height for tower /cable/ Roller fixing
Mechanical hazard –Tools handling Hazardous Manual task tower cable alignment	Nipping /accidents/leg hand injury during use of ladder, tower crane, Lifting tackles or other appropriate access
Chemical Hazard -exposure Airborne 1. Contaminants/welding cutting emission. Solvent & paint fumes 2. During washing of cable cars lubricants oil & greases may contaminate water environment impact on flora & fauna 3. DG set Fuel Low Sulphur Diesel and lubricating oil Used oil and Waste Lubricants will be the Hazardous waste in the project which will be disposed of as per Hazardous Waste (Management, Handling & Transboundary) Movement Rules, 2008 and its amendments.	Work as per standard operating procedure using work permit, Use of PPE /PPA, Training workman of Rotating tasks between workers for minimum exposure Provision of oil trap to lower & upper Terminal /car parking /Restaurant wastewater outlet Handling as per The Manufacture, Storage and Import of Hazardous (Amendment) Rules, 1994.
Electrical Hazards-Work related to HV electricity supply & repairs and services	Provision of Earthling Use of PPE/PPA ref to Indian electrical act.

	Standard operating procedure
Noise and vibration hazards Construction Phase; Noise due to Material handling vehicle, JCB work excavation, piling or even blasting operation and operation of DG sets	Encapsulation of DC motors/use of acoustic material Lubrication. Use of PPE/PPA/safe work practices
Biological Hazards food waste from Ropeway lower & upper terminal restaurant Bacteria, Food Fungi Epidemic and Pandemic Hazards	Provision of STP to labour camp during construction Provision of Toilet /dust bins / STP at Lower & upper ropeway terminal Follow epidemic/pandemic prevention appropriate life style
Road accidents Construction material transportation to upper terminal via present nearby narrow roads, Road accidents cannot be rule out.	Traffic signals/Traffic wardens/ provision of flood light near material storage area/ PPE provisions to truck /JCB Workers
Manmade Hazards- Terrorist attack, Stamped	

Vulnerability Analysis:

Area near Right of Way (RoW) is vulnerable areas during construction phase are mainly the immediate areas under below cable tower construction. Accident may cause during assemble /fabrication of towers at height. Scaffolding failure/ fall from height/ falling materials on workman will leads to serious accident. The vulnerability analysis during operation phase is given for natural as well as Operational hazards are shown in **Tables 7.2 and Table 7.3** respectively.

Table7.2 Vulnerability Analysis of Natural Hazards During Operation Phase

Natural Hazard	**Vulnerability**
Earthquake	Damage to Towers, Terminal Stations, Cable Cars
Landslides	Damage to Towers if slope stability is not maintained.
Flooding	Cable Tower foundation may damage if high flood
Lightning strike on ropeway cabin/ Haulage rope/Terminal buildings	Cable car in transit may affected by Thundershower and lightening
Wind & cyclone	Ropeway will design for 150 km/hr cyclone speed. Hence, moderate chances of wind & cyclone cause damage to cable car.

Cloud Burst	Cloud burst can cause soil erosion, landslides and flooding in river. It can cause damage at towers and lower/upper Terminal Station.

Table7.3 Vulnerability Analysis of Operational Hazards During Operation Phase

Hazard	Vulnerable Locations
Fire	Cable car, Car parking near Terminal Stations, Control Room Diesel stock, Restaurant
Electrical	Cable Car, Transformer, Control room
Mechanical /Instrumental Failures	Cable car, Ropes, Terminal Stations, Ropeway Towers
Technical failures	Ropeway, Cable car, Terminal Stations
Slip/skit/Hit; Accident to passenger staff & workman	Cable car, Ropeway Towers, upper & lower terminal stations while boarding/De boarding
Sabotage / Terrorist activities	Terminal Stations, Parking
Noise	Main drive motor, Cabin conveyor system Cabin door auto open & close operation Decoupling of cabins turning Zone at upper and lower terminals
Bio Hazards	From Food shops/dhaba/ Road small fast food waste accumulation near Terminal gates
Ergonomically hazards	old passenger /children/ Physically Handicapped during quick movement for boarding /De boarding

Hazard Identification Of Haridwar Cable Ropeway System During Operation Phase

Haridwar ropeway project's Lower terminal is located at Har Ki Pauri surrounded by shops and parking area. Ropeway operates with one or more sets of vehicles lined up one after another. As the sets pass through the stations, the rope speed slows or the system may even stop. The Hazard Identification -Operation Phase is shown in **Table 7.4**.

Table 7.4: Hazard Identification- Operation Phase

Reasons	Prevention	Action required to be taken
Socking failure	Proper material used, design of socket and periodic inspection	Maintenance guidelines to be followed regularly
Splicing failure	Periodic inspection	Training manpower, tools and tackles
Fall/ slippage of cabin (Grip failure, Hanger failure, failure of joints, overloading)	Components to be replaced as per life cycles	Replacement at proper time intervals to be done
Cabin door opening (collisions, jerking, component failure)	Simple precaution like locking before leaving cabin follow rules	Seat fasteners for seats to prevent falling of passengers

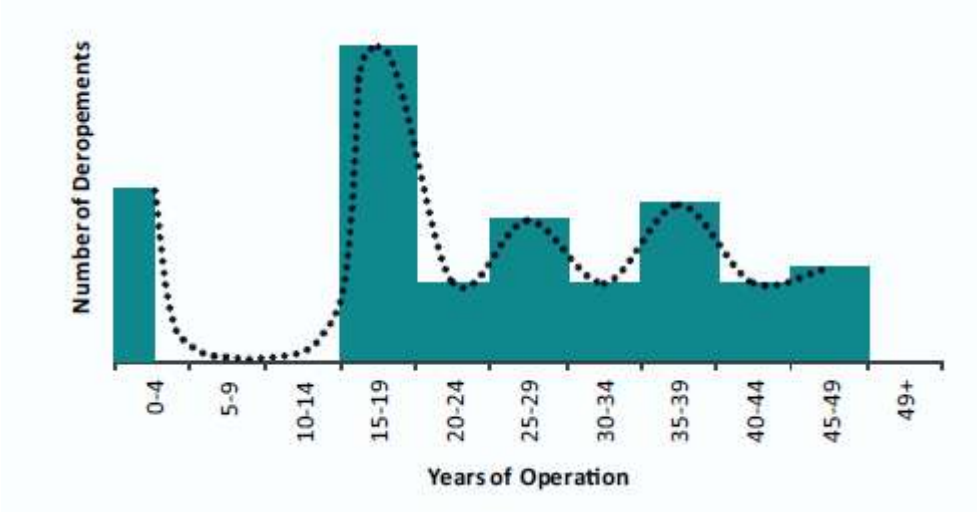
Mount assembly parts failure, tower failure (rusting, over-usage, ascertained deterioration, natural calamity)	Continuous monitoring, life cycle of components to be	Life cycle monitoring
To check for fatigue or corrosion of the anchor bolts on a sample tower	Whether a continuous uphill load imposed by the subtended angle of the haul rope on any vertical tower	Prevent water retention and resultant corrosion
Hitting of cabin (Improper demarcation of area, improper passenger management)	Proper signage, proper demarcation and cordoning of cabin, training of operators	Training of operators, proper maintenance
Electrocution (Lighting)	Proper rope earthing	Periodic monitoring
Entanglement of cabin (High wind, breakage of catenary wire)	Install and monitor Wind speed,	Periodic inspection of catenary wire, monitoring condition of wires
Natural causes like earthquakes, landslides, wind storm, hailstorm, flood, jungle fire	Earthquake resistant constructions, proper retention of landslide prone areas, early warning systems	Early warning systems

Deropements and Equipment Age

Reliability engineering widely uses a concept called the bathtub curve to describe typical failure rates over the life-cycle of a product. At the beginning of a product's life, increased failure rates may be experienced as a result of manufacturing quality errors or installation errors or the lack of familiarity of an operator with the product. Following this phase is a period where a lower failure rate is experienced, often a constant rate that is attributed to random issues. As the product ages and components begin to wear, an increased failure rate can be expected.

Elements of bathtub curve from **Figure 7.2** it can be observed when examining the instances of deropement relative to the age of the equipment in the above figures. There is an evident deropement rate that is experienced within the first two years of service. There are no deropements reported to have occurred on equipment between three and 15 years of age. Equipment installations and operations that are more than 15 years in age experience an increased deropement rate that remains as that equipment continues to age until retired from service

Figure 7.2: Deropements and Equipment Age



Unrestrained aerial deropements are much less frequent, they are more likely to result in injuries and those injuries are likely to be more severe. The Summary of Factors Contributing to Deropement Incidents is shown in **Table 7.5**.

Table7.5 Hazard Identification -Operation Phase

Cause	Contributing factor	Description
Sideways forces or sudden forces applied to the cable	Passenger usage	Passenger skiing or snowboarding out of the tow path
		Passenger loading or unloading error
		Passenger fell on tow path
		Passenger swerved
	Excessive carrier swing	Swinging carried during operation
		Irregular or uncontrolled carrier retraction
		Swinging carrier contacted tower/sheave
		Excessive swing on ropeway start-up
		Operator contacted carrier when removing snow
	Wind	High and/or strong winds
Cable obstructed	Weather	Ice accumulation
	Entangled equipment	Carrier (T-seat) over the haul rope
		Carrier and winch line tangled
Equipment	Alignment	Poor sheave assembly alignment
	Component failure	Sheave assembly component failed
	Installation	Spring box installed backwards after servicing
Operational error	Lack of experience	Lack of operational experience at the installation location. No other ropeway operating in the same area.

The most frequent contributing factor to deropement incidents relates to how directly passengers interact with the equipment either along the surface lift tow path or at the loading and unloading area.

The second most common contributing factor relates to carriers swinging during operation. These two factors (passenger interaction with equipment and swinging passenger carriers) combine to have influenced almost 79% of all deropements.

7.2.2 Risk Assessment

Risk assessment is an essential part of risk management and is the overall process of risk identification, risk analysis and risk evaluation (ISO 31000: 2009). Risk is inherently negative, implying the possibility of adverse impacts. It is assessed by describing the potential Impact if the risk were to materialise. Also describe the Causal Factors that could result in the risk materialising. Ensure that the Context of the risk is clear, e.g. is the risk 'target' well defined (e.g. Passenger, Staff, public, Ropeway station, etc.) and is the 'nature' of the risk should be clear such as (e.g. financial, safety, physical loss, perception, etc).

Passenger ropeways are some of the safest forms of transportation. Safety and confidence in these systems has been achieved by combining technical advancements in design with a strong safety culture within the industry. Put simply, safety is achieved when passengers remain on their carriers, carriers remain gripped to the cables and the cables remain on the sheaves.

Cable ropeways operate in both the summer and winter seasons and because of their limited transport capacity are suitable for short ropeways. On pulsed or reversible gondolas with fixed grip, the cabins are fixed to the rope in groups. As soon as a group of cabins reaches the station, the ropeway stops. This system makes it easy for passengers to enter and exit.

The cabins are attached to a single continuous haul rope that circulates between the two end terminals. The cabins are attached to the haul rope with fixed grips, however instead of being equally spaced along the line, the cabins are grouped in clusters and then the clusters are spaced at equal intervals along the line.

As a cluster of cabins enters either of the terminals, the haul rope speed slows to 0.3 metre per second to facilitate loading and unloading. Once the last gondola in the cluster departs the station, the rope speed automatically increases to a maximum speed of 3.0 meter per second. The rope speed slows down again as the next cluster enters either of the terminals. It is this speeding up and slowing down of the haul rope that the term "pulse" refers to. The Pulsed gondola system at Haridwar ropeway shall have of 90 cabins (6 passenger per carrier).

Specifications & Guidelines:

The civil works will essentially consist of station building, structural and equipment foundation. The design, material and workmanship for civil, structural, sanitary, water supply fittings shall conform to latest Indian Standards, Central Public Works Department Specifications.

The main activities regarding civil works to be done are detailed below:

Detailed field survey and fixing of specific alignment. Final location of stations, towers and approaches by actual setting out on the ground.

- Requisite geo-technical and soil investigation as per IS codes at tension tower and
- Terminal locations to determine design parameters for the foundations against superimposed loads.

Detailed designs and drawings for system, foundations and structures, towers including

- Architectural drawings of buildings, approaches etc. Civil works in foundation for towers and stations along with equipment including any
- Special precautionary measures required for slope protection in ropeway structures and buildings. Fabrication and erection of towers and structures as per relevant specification etc. is to be used.
- Works for completion of Terminals building and other structures, including of roofing and side cladding of stations.

Operation and Maintenance of Ropeway System:

Detailed operation and maintenance instruction manuals covering all aspects of maintenance of the Ropeway System would form an integral part of system documentation. The essential aspects of maintenance are, however, briefly listed below:

- cabins, hangers and grips etc shall be done.
- Periodic lubrication at the Stations shall be done.
- Routine lubrication at the Stations.
- Regular cleaning at stations to ensure a clean and dust-free atmosphere.
- Periodic Inspection, checking and replacement of hauling rope especially the
- spliced zones.
- Inspection, checking, lubrication and replacement if and when required of line
- components such as line sheaves.
- Tightening of all station tower bolts periodically.
- Checking of prime mover such as motors, gearbox, couplings etc

Purpose of Slope Stability Analysis

- Understand the development and form of natural slopes and the processes responsible for different natural features.
- Assess the stability of slopes under short-term (often during construction) and long-term conditions.

- Evaluate the possibility of landslides involving natural or existing engineered slopes.
- Analyze landslides and understand failure mechanisms and influence of environmental factors.
- To redesign failed slopes and plan for the design of preventive and remedial measures, where necessary.
- Study the effect of seismic loading on slopes and embankments.

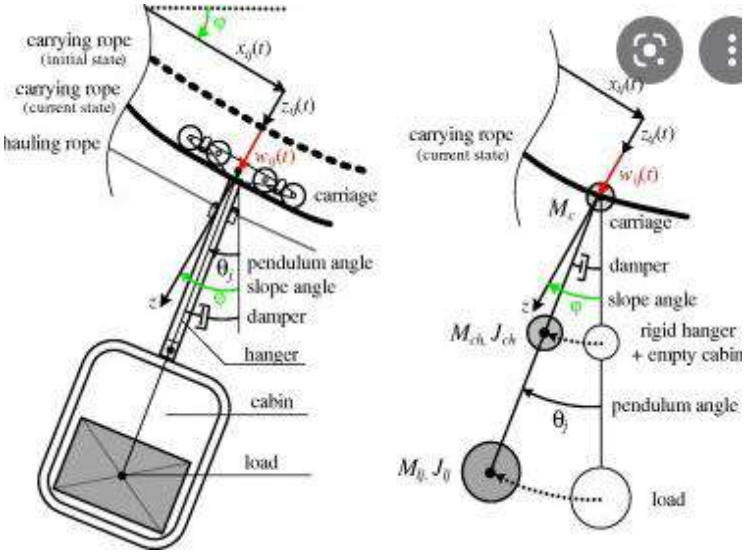
Identified contributing risk factors as under

- Improper set up of counterweight and carriage monitoring circuits
- Exposure of the counterweight to contamination
- Poor understanding relating to the elements of the tensioning system and haul rope dynamics
- Shape and design of the rope catching device
- Distance between towers #1 and #2 to dampen normal passenger-loading dynamics

Mathematical Modelling

Mathematical modeling of Haridwar Ropeway, wind impact also studied during design stage for sturdy and stable tower with reference to tower erection. The Mathematical modeling of Haridwar Ropeway is shown in **Figure 7.3**

Figure 7.3: Mathematical modeling of Haridwar Ropeway



Quantitative Risk Assessment of Haridwar Ropeway

Quantitative Risk Assessment Risk Matrix calculation based on 5X5 Matrix indicating Risk score from accidents/mishap caused by natural hazards and during construction and operation of Haridwar Cable ropeway is shown in **Table 7.6**.

Table7.6 Quantitative Risk Assessments Risk Score

Natural Hazard/Activities	Severity (1-5)	likelihood (1-5)	Severity x likelihood (1-25) (Hazards scoring 1-12 are less serious hazards & 13-25 are very serious hazards need prior attention
Earthquake	5	2	10
Landslides	5	4	20
Flood	5	1	5
Lightening on cable car	5	3	15
Wind & cyclone	2	2	4
Cloud Burst	5	1	5
Fuel Fire & explosion CNG/LPG Car explosion	5	2	10
Electrical accidents	3	5	15
accidents during Mechanical works	4	4	16
Technical failure	4	5	20
Security lapses	3	1	3
Fall from height/Tower during construction	4	5	20
Electrical Fire in terminals	3	4	12

Risk analysis–Natural Hazards

Risk analysis means, developing an understanding of the risks identified. In subjecting a risk to analysis, it is essential that account is taken of the existing control measures.

Seismicity: Project area falls in Seismic Zone IV as per Indian Standard IS 1893(part 1) – 2002 (Fifth revision). Proposed project management is providing more attention on structural stability of towers and terminals to cope up with zone IV Earthquake threat in design stage.

Wind & Cyclone: The yearly distribution of tropical cyclones in the north Indian Ocean indicates large year to-year variations in the frequency of cyclonic disturbances and tropical cyclones, but no distinct periodicity. However, the trend indicates a slight decrease with time. The Cyclone hazard map of India gives the vulnerability map of hazard due to cyclone. As per this map, the project area falls under a zone where moderate wind & cyclone is seen.

During storm or cyclone passengers inside cable cars will experience horizontal movement of the connection between the track cable and the carrier. This situation may cause injuries to passengers.

Each of the two track cable sections serves for just one direction, and these are linked together in the upper and lower stations by the overhead monorails. In making this assumption, numerical studies can be reduced to one span (**Figure 7.4 & 7.5**) of the track. In normal operation, the cabins move along the span with constant velocity. The trajectory along the span follows the elastic line of the track cable. The horizontal tension force and the dead

weight of the cable and the cabins influence this line. For this simulation, it can be assumed that the elastic line of the track cable is constant and fixed in a vertical direction.

This means that there are neither vertical oscillation effects nor swinging of the cabins in the x – z plane. Every gondola is modeled as a mechanical system with two degrees of freedom (DOFs)—rotation angle, j, and horizontal movement of the connection between the track cable and the gondola, y

Figure 7.4: Scheme Of A Span Of Cable Ropeway

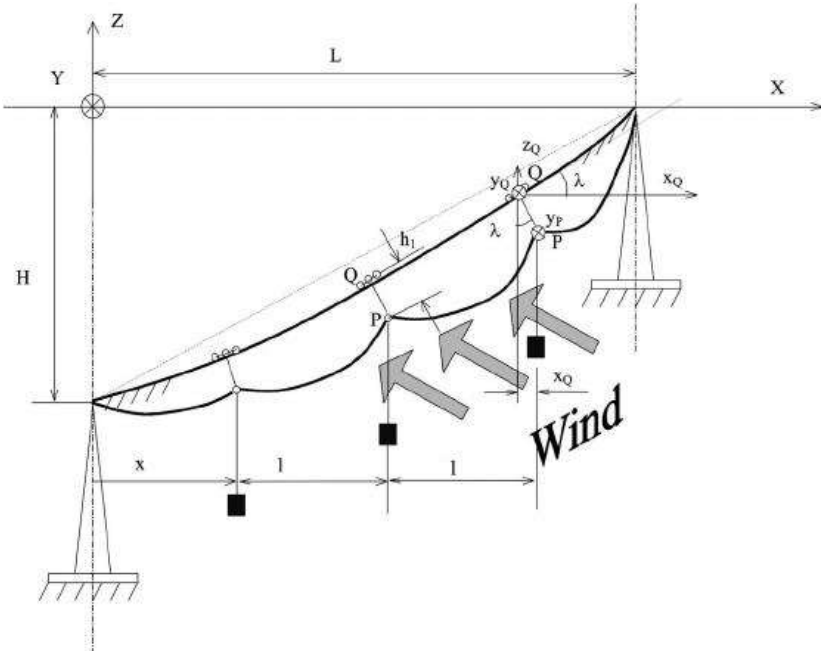
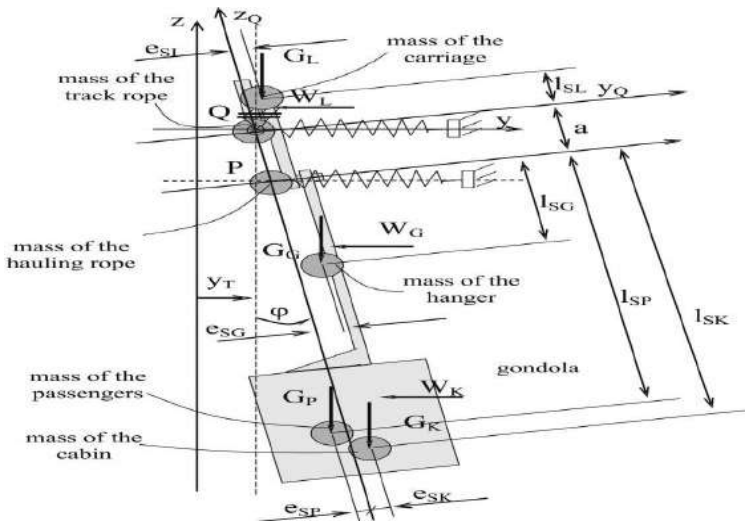


Figure 7.5: Horizontal Movement Of The Connection Between The Track Cable And The Gondola



Cloud Burst: It is not a regular phenomenon, cloudbursts lead to exceptionally heavy rainfall and sudden flash floods in the mountainous streams and rivers, leading to breaching of banks and overflowing of dams. However, chances of cloud burst impact will be moderate in this region.

Fire & Explosion: Likely Threat of fire and explosion Lower and upper terminal being busy area and car parking and POL storage activities. However, in a ropeway project, fire can mainly cause due to electric spark in electrical room, fire in the surrounding forest area, fire in fuel storage places, etc. The Fire & explosion can cause suffocation due to harmful gases generation & panic in the minds of people that will lead to stamped at lower & upper terminal

Electrical: The ropeway will run on electricity & hence, electrical current can pass through cable cars & wires due to inadequate insulation or accidently.

Mechanical: As the ropeway consists of cable cars, ropes & big & heavy machineries, mechanical hazards can cause risks to people working in the area during construction phase & people who will travel through the ropeway in operation phase. Mechanical hazards are like drive / return sheave shaft failure / tension system failure, mount assembly parts failure, rollback, slippage / fall of cabin, entanglement of cabin, swinging of cabin resulting in fall of passengers outside cabin, cabin derailment at station etc.

Technical faults: As Ropeway is a technology-based transportation method, technical faults like rope with broken wires in service, over speeding of ropeway, brake failure may occur.

Accidents: Consequences of the discussed hazards may result into accident during construction and operation phase

Security Threat: Terrorist's attack or Improvise Explosive Devices (IED) can cause panic among tourist, public and staff in lower & upper Haridwar Ropeway Terminal.

7.2.3 Risk Treatment - Mitigation Measures

Construction Phase Activity

- Dust and air emission particularly due to the excavation, construction, movement of vehicles, concrete mixing machinery, & DG set resulting in air pollution.
- Provision of spraying water to reduce dust emission.
- The amount of exposed ground and stockpiles will be minimized so that re-suspension due to wind and subsequent dust fall is prevented. Heights of stockpiles should control dust fall in nearby areas.
- Ensuring all vehicles, generators and compressors are well maintained and regularly serviced.
- The connection will be taken from State Electricity Board during the construction phase, & DG set would be kept as stand by

Topography, Drainage

- Undertake excavation and filling work as per sop /work permit
- Construction at the site would be planned in such a way that natural drainage pattern would not get affected.
- The stock of topsoil
- Arrangement of the soil will be such that runoff does not carry away topsoil but reaches the water bodies with which it is linked.

Workforce & Arrangement

- Workers numbering 100 will be working at the site.
- Local workers will be employed, as far as possible.
- Water will be arranged as per local rules.

Soil and Groundwater Contamination

- Contamination of soil due to leakage of oil from vehicles & equipment.
- Spillage of the concrete mixture containing additives and plasticizers.
- Spillage of construction material containing heavy metals, paints, coating, liners etc.
- Spillage of oil from construction vehicles and equipment will be avoided. These should be inspected by the supervisor for any leakage of oil.
- The contamination of soil will be avoided by suitable soil conservation measures.
- Care will be taken to compact the soil after refilling so that, soil erosion and consequent soil import is avoided
- Special care will be taken during deliveries of construction materials.
- Ensure that workers know what to do in the event of a spillage. It will be ensured that all deliveries are supervised by a responsible person. Activities Proposed Management / Mitigation Measures

Noise generation- Construction noise

- Mainly due to excavation, plying of vehicles, operations of construction machinery, operation of DG sets etc. The vehicles used will be with the standard limiting.
- Noise output.
- Earmarked as a high noise level area requiring the use of ear protection gadget Regular monitoring should be done.
- Appropriate measures can be taken DG set would be provided with acoustic enclosures.

Storage and Handling of Concrete Storage of all potentially polluting substances

- Will be located on impermeable surfaces with controlled drainage and Storage areas will be fenced off and, when not in use.
- Use locked to prevent theft and vandalism.
- Cement powder will be stored under cover and
- Kept dry to prevent wastage.

Excavated earth

- Concrete debris Waste oil from DG set Recyclables will be sold to authorized Vendors/ recyclers Inert material will be used as much as possible for the internal road construction and leftover will be sold to the road contractor Waste oil will be stored in HDPE drums and will be sold to authorized recyclers
- Socio-economic environment Workers
- 100 will be working temporarily at the site during construction of ropeway.
- Direct & indirect temporary employment opportunity.

Risk Treatment: Following Preventive Measures proposed for Haridwar cable Ropeway project

Earthquake: The project will be situated near Seismic Zone IV as per Indian Standard IS 1893. Special attention shall be given to the structural design of foundation, elements of masonry, timber, plain concrete, reinforced concrete, pre-stressed concrete, and structural steel. All applicable guidelines will also be followed in this regard to ensure safety of the building.

Landslides: The area where ropeway is proposed is having minimum prone to landslides. However, Structural stability & safety is must to prevent ropeway damage due to landslides. Slope stability in the area shall be maintained at 45^0.

Flooding: Flood Zone being Ganga River basin. Proper designing of drainage system shall be done. Structures shall be built in such a way that no harm occurs to the people & structures due to flooding due to natural calamities.

Fire and Life Safety Precautions: To deal with any fire related accident, firefighting system shall be provided as per IS: 1648. Firefighting hydrant system with fire/ smoke Detectors, Public address system, Fire hydrant network with Fire tanks and Fire pumps to be provided at Lower and Upper terminal. However, fire tank of suitable firefighting water tank to be provided at UTP. Dedicated water pipeline/lift pumps from nearby pond or from Ganga River to be provided upto UTP for Fire safety against Grass fire. ROW grass fire to be tackle by providing water supply arrangement at isolated locations.

- Smoking prohibited in Ropeway terminals and in cable cars
- Electrical equipment will be explosion-proof to meet national electrical code requirements.
- Dry chemical extinguishers should be accessible for small fires. An adequate supply of handheld and wheeled types should be available.
- Hydrants should be strategically placed with adequate hoses near Terminals
- Provision of sand earth, **or other non-combustible absorbent material, and the area then flushed with water.**

Electrical safety

Safety features in electrical system various safety features provided in electrical system are listed below.

- Under / Over Voltage protection

- Overload / Over current
- Tension System interlock with system safety
- Cabin swing at tower
- Cabin entry sensing automatically
- Hydraulic pump healthiness check
- Rope earthling
- Lightening Protection
- Over Wind Speed
- Regenerative power control
- Phase sequence monitoring
- Transformer temperature monitoring
- Motor temperature monitoring
- Speed regulation of Over Speed

Preventive measures for Technical & Mechanical Faults

Ropeway Design requirements:

1. Materials for aerial ropeways shall be in accordance with the appropriate Bureau of Indian Standard, noting that for load-bearing parts, including towers, and drive and return terminal structures, the materials are to comply with the low temperature impact properties for the minimum operating ambient site temperature.
2. The design, details, materials and construction features shall provide safety factors at least equivalent to those specified of Indian Standard.
3. The ropes used shall conform to the relevant Indian Standards. (IS 7649) As far as possible, all wire ropes shall be in single piece and of non-rotating construction.
4. Welded joints in the rope shall be spaced at least 6 times the pitch of the wire and their number in 500 m length shall not exceed the number of wires in the wire rope.
5. The cabins will be designed to be closed type with proper ventilation facility.
6. Each station will have a first-aid medical facility and the upper station at
7. Upper Terminal of Haridwar cable Ropeway would also be equipped with oxygen cylinders in case of any emergency situations.
8. The automatic lock system will be such that it cannot be opened by the passengers.
9. Cabin shall be provided with dual fixed grip per cabin wherein each grip will be capable of taking the entire laden weight of the cabin with passengers.
10. The ropeway system will be provided with minimum of two braking system; Emergency Brake and Service Brake. Both brakes should be capable of functioning automatically as per operational and program logic of control system OR manually, in case the need arises.
11. The ropeway system machine configuration shall comply to following minimum requirement:
12. In event of main power supply failure, the system should have full rated Diesel Generator to carry on the commercial operation. The Diesel Generator should be de-

rated by 30% or as recommended by the manufacturer to meet full load requirement of location altitude.

13. In the event of main motor/ main gearbox failure, the emergency drive should be capable of bringing the stranded cabins on the line to Ropeway Terminals. The emergency drive can be in the form of gasoline/diesel engine or Hydraulic motor or Electric Motor. In case of Hydraulic or Electric Motor as emergency drive, the ropeway company is to ensure fitment of an additional Diesel Generator; over and above the Main Diesel Generator.
14. Standard electrical safety and indicating devices shall be provided on ropeway. Special emphasis shall be paid to line de-ropement switches with independent control circuit to pin point the defect shall be used.
15. As the ropeway terrain is difficult, each tower and sensitive location will be provided with pan/tilt/zoom type wired cameras to monitor the line status before starting the plant each day
16. Rope catcher will be provided on mount beams on line trestle, P.F. and Stations to arrest/ support the hauling rope in case of de-ropement. Both drive and return bull wheel shall be provided with catcher device as well bull wheel arrestor device.
17. Emergency push buttons will be provided at stations to stop the ropeway, if required. The ropeway shall also be provided with 50% station speed switches to reduce the speed of cabins in case of continuously circulating system.
18. The project shall be provided with anemometers to monitor the wind speed. The anemometers shall be integrated with control panel to reduce operation speed to 50% in case wind velocity exceeds 50 km/h and stop the plant if the wind velocity exceeds 65-70 km/h.
19. Lightening arrestors shall be provided at all towers and stations to protect the plant and associated electronics. Adequate number of coal plus salt or chemical earth pits shall be provided at both stations and tower foundations.

All safety devices will be as per relevant Indian standard for passenger ropeway.

Securing System of Ropeway

Manual Checks: At all terminals the visitors shall be manually checked and asked for ID's.

CCTV: At all important location with a remote viewing facility and record back up. With highest resolution and picture quality. DVR being the back bone, its recording and replaying capabilities must be considered.

X-Ray Scanners: This may be installed and the bell desk may ensure that all the baggage's while being shifted out or in goes through the machines. One scanner shall be installed at terminal stations entry.

RFID based access control and smart card applications can also control the movements of guest as well as staff.

Rescue Arrangement:

The Ropeway system would be provided with a rescue arrangement to enable the passengers being evacuated in case of an extreme emergency where cabin are stopped on line.

Ladder rescue can generally be adopted for cabins which are stranded close to the ground. Here a light but strong aluminum ladder with a hook at the top is placed in position next to the cabin. An attendant stabilizes the ladder from below while another attendant goes up to open the door and help the passengers to come down.

Rope Rescue System involves a winch and lowering rope. A small hand winch is clamped to the nearest tower, uphill from the stranded cabin. One attendant climbs the tower and then he "rolls" down to the cabin by means of a carriage which is restrained by a rope attached to the hand winch. Once the attendant reaches the cabin he views the restraining rope through a set of rollers pre-fitted to the cabin. A safety harness is now attached to the end of the rope and individual passengers are lowered to the ground by means of the harness, rope and winch.

Diesel engine with independent drivel, so that the ropeway system can be operated at reduced speed to bring stranded cabins to the terminal stations in case of failure of electrical power supply or main motor. A full capacity DG set to continue normal operation in case of main power supply disruption. As mentioned elsewhere the *Auxiliary Drive* with diesel engine enables the passengers to be evacuated in the event of power failure.

Remote Surveillance of Towers and Stations

As the entire ropeway is set in difficult terrain with steep slope and high altitude Therefore, it is very essential that wire based video surveillance system must be incorporated along with ropeway system. Minimum of 2 cameras should be installed on each tower to see the line sheaves and position of the rope.

Similarly minimum of 3 cameras should be located at each station to check the condition of critical machines, such as hydraulic tension cylinder position and pressure, station clearance, start up of critical machines as drive lorry and so on. This will ensure very safe start-up of the system under controlled condition which can then be followed by physical verification, daily maintenance routine as greasing, etc. with the help of maintenance cabin, before commencement of commercial operation.

Communication: Both an audible signal system and a two-way voice communication system shall be maintained between the drive station and all loading and unloading stations.

If only one system fails to operate, the ropeway may continue to run, provided the remote attendant stop system is fully operational. In the event of the failure of both communication systems, the ropeway shall not be operated. In the latter event, provided that adequate special precautions are taken, the ropeway may be run for the purpose of evacuation only.

It is recommended that. no ropeway shall be operated without a functioning dedicated communication system.

Periodic maintenance: Periodic inspections of wire rope or strand will be organized by skilled staff. Inspection of third party or in-house expert staff will provide inspection and maintenance for conveyor belt, drums and rollers, conveyor belt tensioning system, braking systems, electrical control systems, communication systems and structures.

7.3 DISASTER MANAGEMENT PLAN

It is attempt to plan and implement Emergency Response plan vied related SOP's during Aerial Ropeway transfer accidents /mishaps/disasters during ropeway construction and operation phase. However, it is not always possible to totally eliminate such eventualities and random mechanical failures of Ropeway system /equipment or human errors. An essential part of major hazard control has therefore, to be concerned with mitigating the effects of such emergency and restoration of normalcy at the earliest.

The overall objective of an Haridwar cable Passenger Ropeway, On –site Disaster Management Plan (DMP) is to make use of the combined resources at the site and District Haridwar city civil administration whose repetitive services to achieve the following:

1. To localize the emergency and if possible, eliminate it.

2. To minimize the effects of the accident on people and property.

3. Effective rescue and medical treatment of casualties.

5. Evacuate passengers stuck-up in cabin at high Altitude from Haridwar cable ropeway to safe place

6. Informing and collaborating with statutory authorities for additional help

9. Investigating and taking steps to prevent reoccurrence mishap in future.

The Action plan is therefore related to identification of sources from which hazards can arise and the maximum credible loss scenario that can take place in the concerned area such as;

I. Prolonged time Mechanical failure of Ropeway, Collapse of tower or cabin, Passenger Cabin stuck-up in very high wind and vertical evacuation during cross wind direction threat in Haridwar cable ropeway section.

II. Fire in diesel storage areas (DG sets), Fire and explosion in car parking areas and LPG leakage in LTP/UTP Terminals food plaza/Hotels.

<u>What is disaster management?</u>

Disaster is a serious emergency that arises by natural calamities or by Manmade sabotage incident, mostly without prior warning and cause widespread loss of life, inflicts injuries, damage property, destroy materials, and in addition inflict negative impacts on the environment.

Disaster Management is the discipline of dealing with and avoiding risks. It is a discipline that involves preparing, supporting and rebuilding when

natural or human made disasters occur. The actions (efforts to avoid or ameliorate the impact) taken depends in part on the perceptions of the risk. In any event, an effective emergency management system will respond based on emergency action plans and practices conducted during mock drills.

Figure 7.6: Basic Structure of DMP

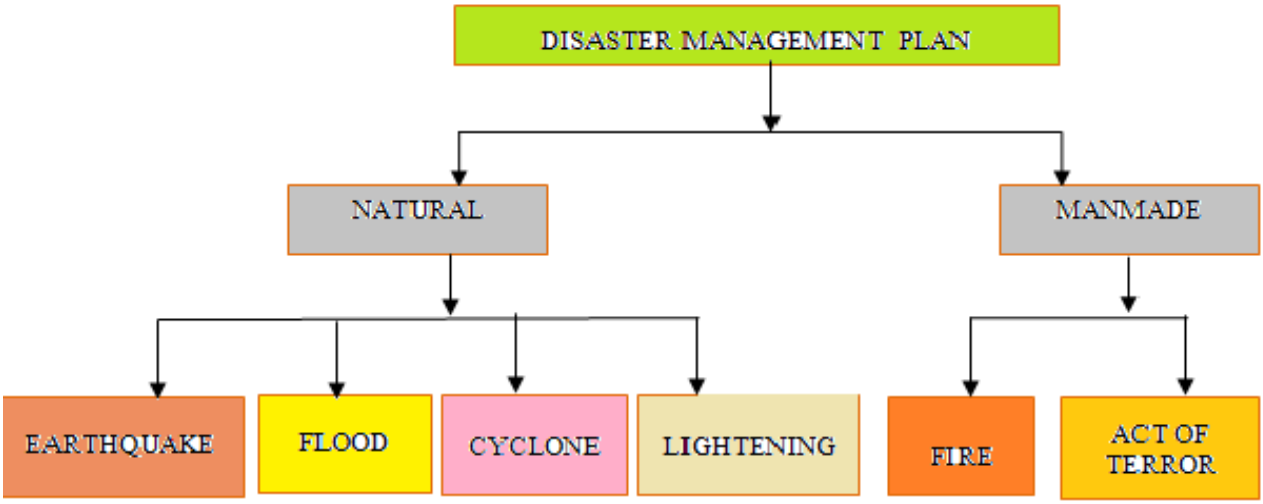
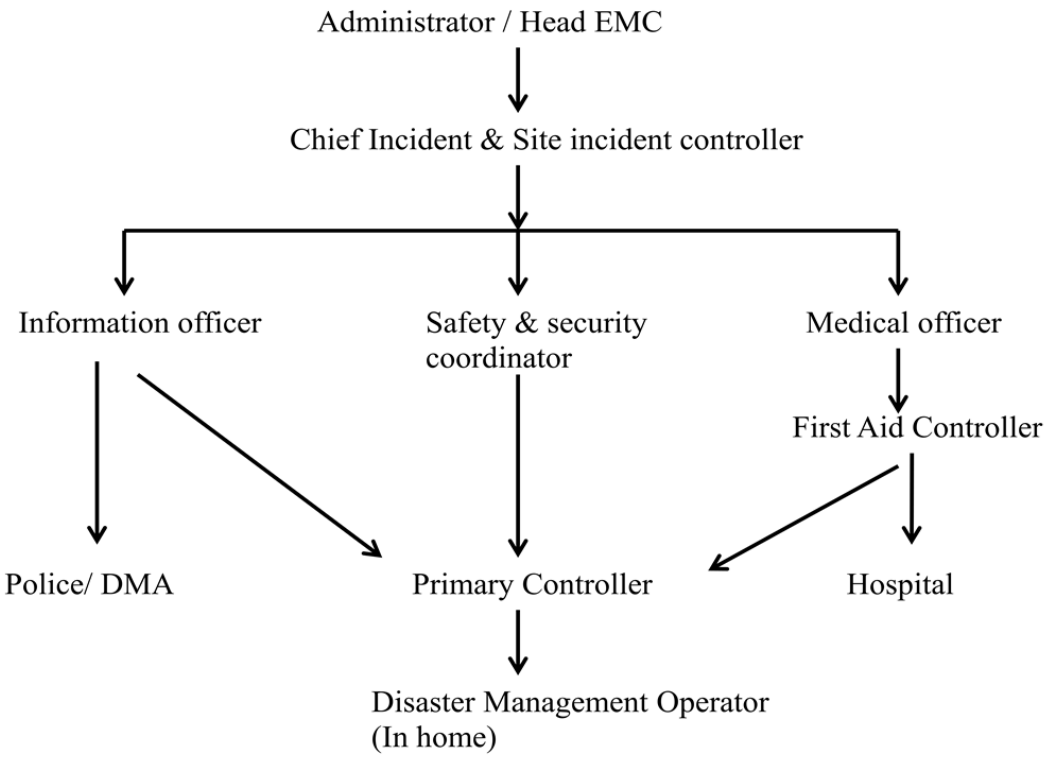


Figure 7.7: DMP Organization Chart of Haridwar Cable Ropeway –Operation Phase



7.3.1 Roles & Responsibilities Of Incident Emergency Response Team

Chief Incident Controller- Haridwar cable ropeway

He will be responsible:

1. To assess the situation and analyze the possible impacts on account of the emergency;
2. To declare emergency within project premises and specified danger zones;
3. To inform Govt. agencies like District Collector, Police, Fire Brigade, hospitals etc.;
4. To assess the magnitude, monitor/ review events in consultation with other controllers and take decision like as to whether and when people need to be evacuated from the danger zone; and
5. To ensure that all events/ decisions taken/ directives given by outside agencies are recorded for future analysis.

Site Incident Controller

1. On hearing the alarm, he will rush to the spot and take overall charge and report to Chief Incident controller;
2. Direct all operation within the affected area with priorities for safety of human life, minimum damage to the plant, properties and environment;
3. Coordinate with Information Officer for outside help if required and report/review the situation with site controller;
4. To evacuate non-essential staff to assembly points for utilization, if necessary by other coordinators;
5. To take all possible measures to protect evidences of further investigation.

Safety & Security Coordinator

The safety & Security Manager/officer will be responsible for fighting the emergency. His role will be:

1) On hearing the alarm, advice the Chief & Site Incident Controller about the nature of emergency
2) Organize manpower and other resources and give instructions to the plant staff to fight emergency;
3) Review the situation periodically and update the Chief and Site Incident Controller and seek for help if necessary, from outside agencies like Fire Brigade, Police, hospital etc.

Information Officer

His role & responsibility will be:

1) On hearing the emergency alarm, in consultation with Chief/Site Incident Controller,

2) Advice outside agencies like police, Fire Services, Hospital about the emergency;
3) To control traffics movements into & from the Ropeway Terminals and ensures that alternate transport is available as and when need arises; and

4) Liaison with Chief Controller/ Site Incident Controller/Medical officer call for ambulance/medical help, if necessary.

First-Aid Coordinator

His role will be to:

1) Ensure that causalities get adequate attention, arrange for additional help, if required and
1) inform relatives;
2) Arrange for relief of personal and organize refreshment/catering facilities, If emergency is
3) prolonged
4) Arrange the stretcher and the First Aid Box at the assembly point and with the available
5) Facilities, organize a Make Shift Hospital in the Haridwar cable ropeway Lower Terminal station;
6) Keep MHRW offices's vehicle ready for any emergency shifting of causalities to hospital.
7) Apprise the Chief/Site Controller about the status of injured personnel and the arrangements.

Medical Officer

On hearing the emergency siren/alarm or phone message, the medical officer along with first aid team will report to the Chief/site Incident Controller. His responsibility will be:

1. To ensure that ambulance will be made available at the Emergency Control Center (ECC);
2. If the ambulance leaves the ECC, it should be informed to Incident Controller;
3. If the ambulance leaves with patient, the name and other particulars, hospital, destination etc. should be informed to the Incident Controller;
4. To inform the Chief at the hospital about the causality reaching hospital for treatment**;**
5. To keep necessary first aid medicines and artificial respiration equipment ready; and
6. To inform doctors at other places to be ready, for attending serious injury and burns cases, if required.

Roll Call

Record should also be maintained of the arrival and departure of visitors/Passengers of all section Ropeway Terminals. Attendance will be verified with at assembly point near security gate of Ropeway at lower and upper Terminal at the time of emergency,

Total no of Ropeway Cabin Boarded and de-boarded Passengers will clarify no of Missing passengers in case of emergency

In case of Fire, Explosion and ropeway accident the Chief/Site Incident Controller should arrange for a search to be made for any casualty by fire brigade. Nominated work personnel should record the names and other details of casualties taken to respective reception areas and the location, e.g. hospital.

All Clear Siren / Alarm/Announcement to Ropeway Passenger

If the indication of the emergency is over and on hearing all clear signal, all passengers stranded in LTP/UTP will report back to Entry Gate/Ropeway Reception Hall for necessary instructions. The Chief Incident Controller is responsible for giving all clear signals after assessing the entire ropeway working conditions.

Standard operating procedure; Cabin Evacuation

1. The Ropeway system would be provided with a rescue arrangement to enable the passengers being evacuated in case of an extreme emergency. However, during high wind and heavy snow height in ROW, Vertical Evacuation to be avoided

2. Ambulance Cabin to be send to Terminal with life saving medicines, Paramedical staff and doctors to assist victim if accident happened near UPT.

3. Ladder rescue can generally be adopted for cabins which are stranded close to the ground. Here a light but strong aluminum ladder with a hook at the top is placed in position next to the cabin.

4. An attendant stabilizes the ladder from below while another attendant goes up to open the door and help the passengers to come down.

5. Rope Rescue System involves a winch and lowering rope. A small hand winch is clamped to the nearest tower, uphill from the stranded cabin. One attendant climbs the tower and then he “rolls “down to the cabin by means of a carriage which is restrained by a rope attached to the hand winch. Once the attendant reaches the cabin he views the restraining rope through a set of rollers pre-fitted to the cabin. A safety harness is now attached to the end of the rope and individual

6. Passengers are lowered to the ground by means of the harness, rope and winch.

7. Diesel engine with independent drivel, so that the ropeway system can be operated at reduced speed to bring stranded cabins to the terminal stations in case of failure of electrical power supply or main motor.

8. A full capacity DG set to continue normal operation in case of main power supply disruption.

9. As mentioned elsewhere the Auxiliary Drive with diesel engine enables the passengers to be evacuated in the event of power failure.

10. Remote Surveillance of Towers and Stations; it is very essential that wire based video surveillance system must be incorporated along with ropeway system. Minimum of 2 cameras should be installed on each tower to see the line sheaves and position of the rope.

11. In case of major mechanical failure, Passenger’s strand in Haridwar cable ropeway UPT should be evacuated tol lower terminal.

12. After evacuation from Cabin, Victim Passengers should shift on stretcher to Medical Inspection Room at Lower Terminal for First Aid Treatment.

13. Medically fit Passenger only should allow using Ropeway for descending toward Haridwar cable ropeway lower Terminal.

Emergency Contact Numbers: The format for important telephone numbers is given in **Table 7.7**.

Table 7.7: Important Telephone - Haridwar Ropeway Lower Terminal Office

S. No	Designation	Name	Office No	Mobile no
1.	CEO/Haridwar Ropeway Management			
2.	Chief Resident Manager			
3.	Chief Medical Officer			
4.	Chief Admin Officer			
5.	Chief Security Officer			
6.	Hospitals at Haridwar			
7.	Chief fire officer Haridwar District			
8.	Police Station			
9.	Civil Defense Haridwar District			
10.	List of Doctors Haridwar city			
11.	Ambulances suppliers/NGO Haridwar District			
12.	Medical shops Haridwar District			
13.	State Transport Haridwar District			

Figure 7.8: Incident Command System Haridwar District DMP Organization Chart

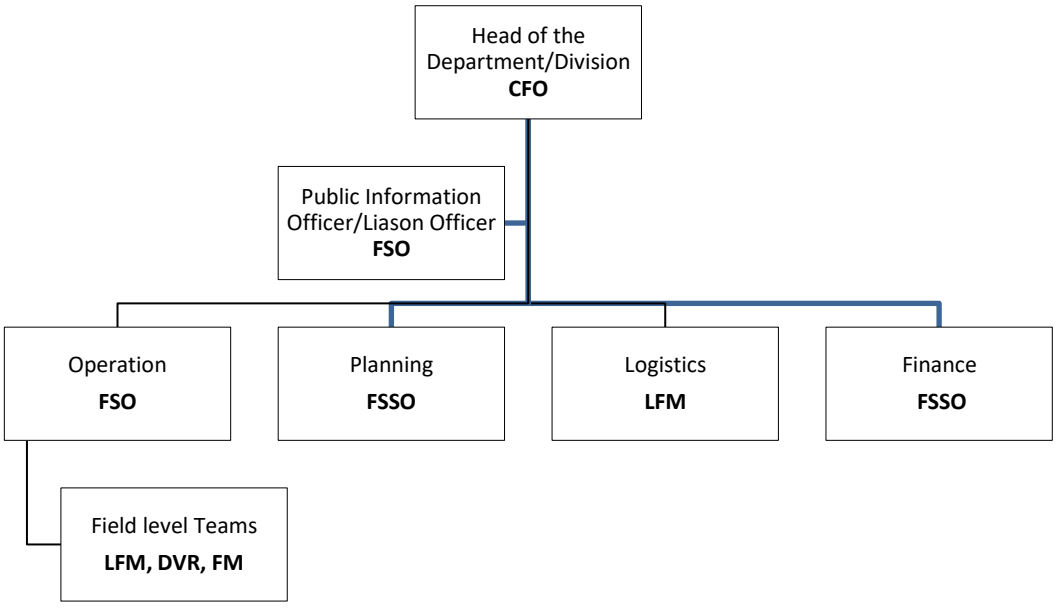


Table 7.8: Help line – Haridwar District Disaster Management cells

इंसीडेंट कमांड सिस्टम (आई। सी. एस.) INCIDENT COMMAND SYSTEM (ICS); जन सूचना अधिकारी / संपर्क अधिकारी:

क्र०सं०	जन सूचना अधिकारी/संपर्क अधिकारी	अधिकारी का पदनाम
1	श्री हरिश चन्द सिंह राणा (हरिद्वार कार्यालय)	अधिशासी अभियन्ता
2	श्री विजय कुमार माथुर (ऋषिकेश ऑफिस)	सहायक अभियन्ता
3	श्री गिरीश चन्द भट्ट (रुड़की शाखा)	सहायक अभियन्ता

अधिकारीगण –

क्र०सं०	जन सूचना अधिकारी/संपर्क अधिकारी	अधिकारी का पदनाम	फोन न०
1	उपाध्यक्ष	श्री दीपक रावत	9458977777 01334-2657702
2	सचिव	अरविंद कुमार पाण्डे	9411111389
3	मुख्य वित्त अधिकारी	डा० तंजीम अली	9456713426 01334-221558

Name of Tehsil /Block	Name of Sub-office/Centre/Sub-unit with Telephone no	Name of the Villages/area /was covered by the office/Centre /Sub-unit	Name of the Head with Telephone no	Resource Available		
				Equipment's	Vehicles	Staff No
हरिद्वार	मुख्य अग्निसमन	जनपद – हरिद्वार	CFO श्री राजेन्द्र खाती	-	**बूलोरो UK08GA- 0257**	CFO - 01

	अधिकारी		7409444451 CUG No. 9456597199			
	फायर स्टेशन मायापुर 01334 – 265600,101	नगर क्षेत्र, ज्वालापुर कनखल,भूपत वाला, रानीपुर, श्यामपुर, पथरी	FSO श्री दानीराम 9411356664 CUG No. 9456597198 FSSO श्री शिशुपाल नेगी 9557132045	रोपलैडर, सर्चलाइट, रस्से, ब्रीदिगओपर टेस, ड्रैगनलाइट, जनरेटरपम्प , न्यूमेट्रिकए यर, प्रेशर, वुडन कटर, जनरेटर सेट , लाइफ बॉय, लाइफ जैकेट	वॉटर टैंडर UA08J-3800 फोम टैंडर UA07G-5446 वॉटर टैंडर UP10C-0319 वॉटर टैंडर 80003 (NEW) पम्प कैरिंग UP07G-7614 मिनी वॉटर टैंडर UK07GA-1012 टाटा जीनोन UK08GA -0360 UK08GA -0361 बैक पैक सेट UK07GA -0553 UK07GA 1575 UK07GA -1578 UK07GA -1593 एम्बुलैंस UA08GA -4854	FSO – 01 FSSO – 01 LFM-01 DVR – 02 FM - 35
	फायर स्टेशन सिडकुल 01334-239888, 101	औघोगिक क्षेत्र सिडकुल	FSO श्री ठाकुर सिंह भण्डारी 9412978552 CUG No. 9456597197 FSSO श्री अनिल	ब्रीदिगओपर टेस ड्रैगनलाइट, पम्प, लाइफ बॉय लाइफ जैकेट	डीसीपी टैंडर UK08GA -0005 फोम टैंडर UK08GA -0006 वॉटर टैंडर UK08GA -0010 टाटा जीनोन UK08GA -0318 मिनी वॉटर टैंडर UK08GA -0360	FSO – 01 FSSO – 01 DVR – 02 FM - 25

			त्यागी 9412070359		बैक पैक सेट UK07GA - 1581 एम्बुलेंस UK08GA -0002 पम्प कैरिंग UK08GA -0034	

क्र०सं०	नाम फायर स्टेशन	टेलीफ़ोन न०	क्र०सं०	नाम फायर स्टेशन	टेलीफ़ोन न०
1	फायर स्टेशन देहारादून	0135-2716242	4	फायर स्टेशन अम्बाला रोड सहारनपुर	0132-2646100
2	फायर स्टेशन ऋषिकेश	0135-2430101	5	फायर स्टेशन बेहट रोड सहारनपुर	0132-2640419
3	फायर स्टेशन देवबन्द (सहारनपुर) उ०प्र०	0133-2644202	6	फायर स्टेशन मुजफरनगर उ०प्र०	0131-2623800

7.4 SOCIAL IMPACT ASSESSMENT

Social impact assessment due to the proposed project is briefly described in the Chapter-4 this report.

7.5 R &R ACTION PLAN

The project area lies in the forest and irrigation department land. Hence, there is no resettlement and rehabilitation is taking place for the development of proposed project.

*****

ANNEXURE 7.1

MINUTES OF PUBLIC CONSULTATION

(1)

Deendayal upaddhyay Parking.

EIA Study for Passenger Ropeway facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City- Public Consultation

Location:	Deendayal upaddhyay parking	Date:		20/07/2021
Sr. No	Perception about the Project	Yes	No	Remarks
1.	Do you think it is necessary to construct project?	✓		
2.	What impacts, both positive and negative of the project do you foresee			

S. No	Positive Impact	Yes-1 No-2	S. No	Negative Impact	Yes-1 No-2
I.	Increase in income	1	I.	Loss of livelihood	2
II.	Increase in Customers	1	II.	Loss in income	2
III.	Increase accessibility to facilities	1	III.	Structural loss	1
IV.	Decrease in accidents	1	IV.	Loss of customers and supplies	1
V.	Increase in employment	1	V.	Disruption of social/cultural/economic	1
VI.	Decrease in migration	2	VI.	Religious/sites and networks	2
VII.	Increase in property value	2	VII.	Decrease in value of properties	2
VIII.	Industrial Development and Networking	1	VIII.	Increase in accidents	2
IX.	Improvement in transportation system	1	IX.	Increase in crime rates	2
X.	Increase in Education level	2	X.	Increase in Migration	2
XI.	Others Specify		XI.	Others Specify	

Discussion

S. No	Issues raised/ Discussed	Participant Suggestions/ comments	Remarks
1	Save of money and time.	Presently in order to go to the present Ropeway Station Chandi Devi Temple, people pay Rs. 200 on an auto fare to and Fro. After the construction of new Ropeway, with from Parking Area straight will save money and time of the devotees and tourists.	
2.	Impact of Project.	The Ropeway project is proposed in Govt. land. However, no such negative impact of project is anticipated.	
3.		Sometimes, the auto drivers charge double price to the devotees and tourists to take them to ropeway Station. particularly, the new comers face this issue who come from outside	
4.	Awareness about the Project.	The respondents were unaware about the proposed ropeway. However, they were informed about the project.	

EIA Study for Passenger Ropeway facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City- Public Consultation

S. No	Issues raised/ Discussed	Participant Suggestions/ comments	Remarks
5.	Traffic issue	In order to address traffic issue in Haridwar particularly in Hari ki pauri and surrounding area, the proposed project would be helpful.	
6.	Boost in shopkeeping business	There would be a boost in shopkeeping business.	
7.	Increase in income	The ropeway project will lead to increase in income for the shopkeepers and other stakeholders.	
8.	Increase in business.	The proposed project will lead to increase in current business.	
9.	Convenience in Travelling	Already lot of tourists visiting to Haridwar. It would be convenient for them to go Chandi Devi temple directly from the parking area rather than taking auto and going to the ~~exi~~ availing the existing repeway service.	
10.	Employment opportunity	The Ropeway project will create the scope of employment opportunity for the local people during operation.	
11.	Presence of officer during operation of project. construction	The respondents desired presence of govt. officials during construction of project.	
12.	Loss of income of auto drivers.	The income of auto drivers will get affected once the tourists start using the proposed ropeway directly from the parking area. Because people will not take auto to avail the existing ropeway service which is little bit far from Hari ki pauri and also time consuming. The auto drivers usually charge Rs. 200 to the tourists for only 1 K.m to the existing Ropeway Service.	

EIA Study for Passenger Ropeway facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City- Public Consultation

List of Participants

S. No	Name of Participants	Sex	Age	Occupation	Signature	
1.	Lalit Bhardwaj	m		पुरोहित	पुरोहित	
2.	Sonu Bhardwaj	M		पुरोहित	पुरोहित	
3.	Pandit Amit Sharma.	m		पुरोहित	पुरोहित	96272 10447
4.	Jagdev Saini	m				
5.	Satish kumar	m				
6.	Deepu Saini	m	m	Shop		
7.	Manishi	M	25	Shop	Manishi	
8	Sunil Kumar	M		Foods		
9.	Abhishek	M				
10.	Kamal Bisht	M	50	Shopkeeper centre No 3		96348451 77.
11.	Raghunath Thakur	M	60	Shopkeeper	2 Feb 21	
12.	Amit Rastogi	M	32	Shopkeeper		730273-1394
13.	Vinod Saini	M	32	Shopkeeper	Vinod Saini	9759602753
14	Pratap Singh Kumar	M	33	Parking Employee		9058145890

(2) Tourist Group at Har ki pauri

EIA Study for Passenger Ropeway facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City- Public Consultation

Location:	Har ki pauri		Date:	21/07/2021
Sr. No	Perception about the Project	Yes	No	Remarks
1.	Do you think it is necessary to construct project?	✓		
2.	What impacts, both positive and negative of the project do you foresee			

S. No	Positive Impact	Yes-1 No-2	S. No	Negative Impact	Yes-1 No-2
I.	Increase in income	1	I.	Loss of livelihood	2
II.	Increase in Customers	1	II.	Loss in income	2
III.	Increase accessibility to facilities	1	III.	Structural loss	1
IV.	Decrease in accidents	1	IV.	Loss of customers and supplies	1
V.	Increase in employment	1	V.	Disruption of social/cultural/economic	1
VI.	Decrease in migration	2	VI.	Religious/sites and networks	2
VII.	Increase in property value	2	VII.	Decrease in value of properties	2
VIII.	Industrial Development and Networking	1	VIII.	Increase in accidents	2
IX.	Improvement in transportation system	1	IX.	Increase in crime rates	2
X.	Increase in Education level	2	X.	Increase in Migration	2
XI.	Others Specify		XI.	Others Specify	

Discussion

S. No	Issues raised/ Discussed	Participant Suggestions/ comments	Remarks
1.	Increase in tourists and devotees.	The project would lead increase in number of devotees and tourists	
2.	Loss of income of Auto drivers.	After the during operation of the proposed project people will use it rather than using the current Ropeway which will result in loss of income of the auto drivers.	
3.	Requirement of Ropeway project	Considering the present issues with the current Ropeway facility from Parking Area to Chandi Devi Temple.	
4.	Disaster management	In 2013, Haridwar experienced a great disaster. However, the disaster management measures should be considered before civil work	
5.	Opinion about project.	The respondents reported that the proposed Ropeway project would be very helpful for the devotees.	
6.	Save of time and Money.	From parking area, to the devotees get ropeway facility, they will be able to save money and time.	

EIA Study for Passenger Ropeway facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City- Public Consultation

S. No	Issues raised/ Discussed	Participant Suggestions/ comments	Remarks
7.	Affordable travel fare	The fare for the prepared Ropeway facility shall be affordable to people. Presently people are spending Rs 200 to go to the temple to and fro.	
8.	Demolition of Shops	The existing shops shall not be displaced for the development of UTP location considering limited space.	
9.	Situation of Stamped.	Lot of people visit the temple by using the footpath. If the footpath gets block due to the development of UTP location, there would be possibility of stamped of devotees.	
10.	Lack of space	During Peak/seasonal time, the rue of devotees goes up to the current ropeway gate/trolley gate. Lack of space is anticipated considering the development of	
11.	Crowd management of devotees.	proposed UTP location. The crowd management during construction of the project shall be taken care of.	
12.	Development of Tourism	The prepared Ropeway facility will boost the current tourist flow.	
13.	Cleanliness	The devotees litter very much in the temple premises. However, the temple cleanliness measure shall be considered.	
14.	Protection of wild Animals.	During construction and operation of the project, the wild animals shall not be harmed.	
15.	Availability of local labours,	During construction and operation of the project, the local labors and technical experts shall be hired considering the qualification.	

EIA Study for Passenger Ropeway facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City- Public Consultation

List of Participants

S. No	Name of Participants	Sex	Age	Occupation	Signature	
1	Rahul Kashyap	m	34	P. Job	Rahul	Tourist
2	Rama Kant	m	29	P. Job		Tourist
3	Vijay Kumar	m	26	P. Job		Tourist.
4	[illegible]	M	36			
5.	Durgesh., Badyun.	M	29	Farmer		
6.	Alok, Do	M	18	Student		
7.	Deepa, Do.	F	23	housewife	Deepa	
8.	Rahul Kumar	M	35	Cameraman	Rahul	
9.	Anil kumar	M	25	cameraman		
10.	Akash	M	19	Ayurveda employee		
11.	Laxmikant, Rajastha..	M	49	Tourist / media		9672981
12.	Abhinash "	M	32	P. Job.		Same.
13.	Shiv Shankar.	M	57	Media		7230030 - 85
14.	Rameshwari.	F	51	Tourist.		Same
15.	Mahima	F	20	Student / Tourist		Same/D.

(3) Chandi Devi Ropeway Area. and Hotel owners.

EIA Study for Passenger Ropeway facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City- Public Consultation

Location:	Hari ki pauldi		Date:	22/07/2021
Sr. No	Perception about the Project		Yes / No	Remarks
1.	Do you think it is necessary to construct project?		✓	
2.	What impacts, both positive and negative of the project do you foresee			

S. No	Positive Impact	Yes-1 No-2	S. No	Negative Impact	Yes-1 No-2
I.	Increase in income	1✓	I.	Loss of livelihood	2
II.	Increase in Customers	1	II.	Loss in income	2
III.	Increase accessibility to facilities	1	III.	Structural loss	12
IV.	Decrease in accidents	1	IV.	Loss of customers and supplies	1
V.	Increase in employment	1	V.	Disruption of social/cultural/economic	1
VI.	Decrease in migration	2	VI.	Religious/sites and networks	2
VII.	Increase in property value	2	VII.	Decrease in value of properties	2
VIII.	Industrial Development and Networking	1	VIII.	Increase in accidents	2
IX.	Improvement in transportation system	1	IX.	Increase in crime rates	2
X.	Increase in Education level	2	X.	Increase in Migration	2
XI.	Others Specify		XI.	Others Specify	

Discussion

S. No	Issues raised/ Discussed	Participant Suggestions/ comments	Remarks
1.	Opinion about project	The project would be very much effective for the tourists and devotees.	
2.	challenge to the devotees and tourists	It is observed that, sometimes the devotees and tourists does not use the ropeway facility at present as it is located 2 k.m away from Hari Ki pauri. They prefer not to spend money and time to use the ropeway facility	
3.	Benefit of the Ropeway project. and increase in income and customer.	The project will lead to increase in number of tourists and devotees which will in turn also be at the increased number of devotees and income as well.	
4.	Government Initiative	It is going to be a good initiative by the government to introduce such project.	

EIA Study for Passenger Ropeway facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City- Public Consultation

S. No	Issues raised/ Discussed	Participant Suggestions/ comments	Remarks
5.	Preference of Mobility.	Sometimes most of the guests prefer to visit Manse Devi rather than Chandi Devi temple in order to save money and time as the temple is located little bit from the hotel.	
6.	Future of the project.	The tourists and devotees would happy to use the proposed Ropeway project.	
7.	convenience of the project.	The tourists and devotees would like to use a Ropeway directly from the parking area to Chandi Devi temple.	
8.	Usefullness of Parking Area at Pandit Deendayal Upadhyay.	We would not have to be accountable for the tourists vehicle during their stay in the hotel.	
9.	Save of money	The proposed project will let the devotees to save money etc they use it rather than using the existing ropeway "USHA BRECO LIMITED".	
10.	Increase in Mobility	The proposed project will/ may increase the mobility of the devotees and tourists,	

EIA Study for Passenger Ropeway facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City- Public Consultation

List of Participants

S. No	Name of Participants	Sex	Age	Occupation	Signature
1.	Datta	M	35	Govt employee	[signature]
2.	~~Bha~~ Bhatu	M	35	DO.	[signature]
3.	Rushpandu	M	50	[illegible]	
4.	Kulbhushan	M	19	Student	[signature]
5	. Sachin	M	28	Govt-sm vent	[signature]
6.	Sachin	M			
7.	Gayatri Devi	M			[signature]
8.	Divya	M			[signature]
9.	Rajeev Kumar	M		Shopkeeper	[signature] 7417230897
10.	Ganesh	M		Shopkeeper	[signature]
11.	Nitin	M		Shop employee	Nitin
12.	[signature] Hotel Teerth Subhash Ghat, Hardwar	M	40	Management	[signature] 9258404204
13.	Ramesh Chand Dhaddy	M	54	Shoe Keeper	[signature] 9458127215
14.	Sanjay Kumar Sarvaiya	M	52	Waiter	[signature] 9219202882
15.	Lalit Prasad Rawat	M	53	Waiter	[signature] 9837464056

(4) Shopkeepers.

EIA Study for Passenger Ropeway facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City- Public Consultation

Location:	Chandi Devi Temple		Date:	21/07/2021
Sr. No	Perception about the Project	Yes	No	Remarks
1.	Do you think it is necessary to construct project?	✓		
2.	What impacts, both positive and negative of the project do you foresee			

S. No	Positive Impact	Yes-1 No-2	S. No	Negative Impact	Yes-1 No-2
I.	Increase in income	1	I.	Loss of livelihood	2
II.	Increase in Customers	1	II.	Loss in income	2
III.	Increase accessibility to facilities	1	III.	Structural loss	1
IV.	Decrease in accidents	1	IV.	Loss of customers and supplies	1
V.	Increase in employment	1	V.	Disruption of social/cultural/economic	1
VI.	Decrease in migration	2	VI.	Religious/sites and networks	2
VII.	Increase in property value	2	VII.	Decrease in value of properties	2
VIII.	Industrial Development and Networking	1	VIII.	Increase in accidents	2
IX.	Improvement in transportation system	1	IX.	Increase in crime rates	2
X.	Increase in Education level	2	X.	Increase in Migration	2
XI.	Others Specify		XI.	Others Specify	

Discussion

S. No	Issues raised/ Discussed	Participant Suggestions/ comments	Remarks
1.	Increase in income	After the construction of the project, there would be increase in income for the shopkeepers both in UTP and UTP location.	
2.	Increase in number of tourists.	Already lot of tourists and devotees are visiting Haridwar but after the construction of the project, the number may increase.	
3.	Employment opportunity.	The employment opportunity will be enhanced after during construction and operation of the project.	
4.	No loss of structure and land.	The project is entirely proposed in Govt. land. However, no losses structures and private land is anticipated.	
5.	Crowd management during seasonal time	During festive seasons, the crowd management measures shall be taken care of.	
6.	The crowd of tourist shall be planned through proper corridor/path.	The presently there is not much space available in the UTP (proposed) location. Therefore, during peak time bigger the crowd is observed. However, during construction of proposed ropeway, all these measures shall be taken into consideration.	

EIA Study for Passenger Ropeway facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City- Public Consultation

S. No	Issues raised/ Discussed	Participant Suggestions/ comments	Remarks
1.	Increase number of tourists / devotees	The project would be beneficial and helpful for the devotees and tourists as well.	
2.	Affordable ticket Price.	The ropeway fare should be affordable to the devotees and tourists. Then only they will be able to save some money from their budget which can be spent in	
3.	Save pay time and money	The devotees will be able to save time and money after construction of the ropeway project. Presently they are investing time and money for travel to use the current ropeway	
4.	cost of tempo fare will be saved.	Presently the devotees are spending a lot of money to reach to ropeway facility from Hari ki pauri. After the new project comes the money will be saved.	
5.	Employment opportunity construction and operation.	The ropeway project will lead to employment opportunity during	
12.	Tourist crowd management during peak time and space shall be managed well.	Due to lack of space at the proposed UTP location, lot of crowd would be there after the project (operation). The crowd	
13.	Area of stations development.	The proposed LTP and UTP locations shall be developed well along with other necessary facilities.	
14.	Shop buying route shall of devotees and tourists		
15.	Convenience to go to Chandi Devi Temple from Hari ki pauri.	It would be convenient for the devotees and tourists to access Chandi Devi Temple in lesser time.	
16.	The	The Chandi Devi Temple staff will get the benefit out of the project. They will not have to bring their motorcycles to the temple at hilltop they can keep their vehicles at the parking near LTP and take the ropeway.	

EIA Study for Passenger Ropeway facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City- Public Consultation

List of Participants

S. No	Name of Participants	Sex	Age	Occupation	Signature	
1.	Mukesh Kumar	M		Shopkeeper	[signature]	9837880895.
2.	Mantu	M		Shopkeeper		
3.	Sanjay Sharma.	M		Shopkeeper	Sanjay	
4.	Pankaj Singh.	M		Shopkeeper	[signature]	
5.	[illegible]	M				
6.	अनुप यादव	M	22		[signature]	84332 1587
7.	Amit Kashyap	M			Amit	740987
8.	Arjun.	M	35	Shopkeeper	Arjun	2819
9	Mahesh	M	32	Shop employee.	Mahesh	8923938 27
10.	Jitender Singh.	M	35	Temple Shoe Stand	Jitender	7055672475
11.	Vicky	M	33	Shop employee.	Vicky	9720190 65
12	Dhiru Singh	M	25	DHIRU		
13.	Dhiraj Chopra. 7906295599	M	17	Student class XI	[signature]	
14.	Mukesh - 9837357159	M	45	Shopkeeper	[signature]	
15.	Chandan - 8650521697	M	24	Shopkeeper.	[signature]	
16.	Ashok Kumar.	M	61	Shop owner Condemned	[signature]	926711
17.	Dheeraj Rana	M	45.	Shopkeeper	[signature]	8006553505
18.	Alok Dhyani	M	41	Shopkeeper	Adhyani	889954536
19.	Jhanvesh Negu	M	40	Manager.	[signature]	9410763891
20.	[illegible] Arora	M	27	Business men	[signature]	706014-1418

MINUTES OF STAKEHOLDER CONSULTATION

Baba Udashin Ashram Machla Kund.

Stakeholder: _____ Name of village: Chandi Ghat

Panchayat: Haridwar Grameen Block and District: Haridwar.

Date & Time: 23/7/2021 - 12:10 P.M Baikna ~~Machla~~ kund Mathila

Issues Discussed	Suggestions by Stakeholder/s
Ownership of Land	• Right side of the existing road belongs to Forest division, Haridwar. • The tower 5 and Tower-6 is proposed in land belongs to irrigation department as reported.
Recording ~~[illegible]~~ of Wild Animals	Indian Elephant, Indian Leopard, Swamp Deer and Cobra (Indian). These information are given by the Mahant and his associates.

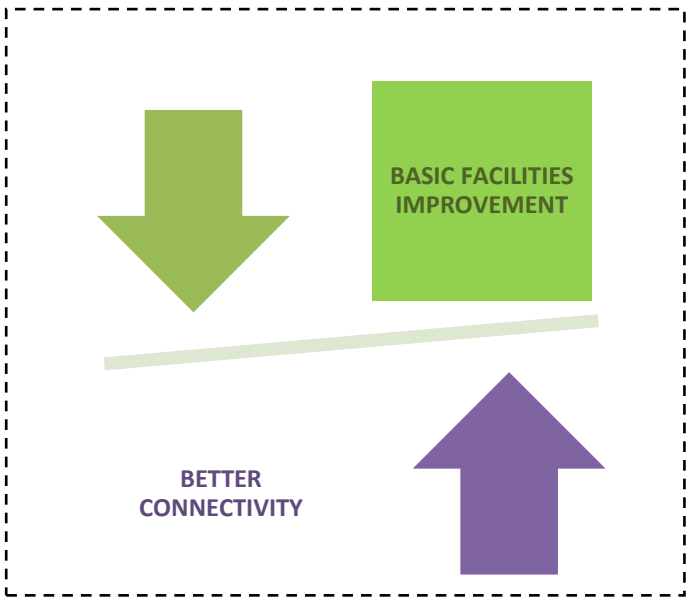
Name of Stakeholder	Occupation	Contact No.	Signature
1. Mehant Ganga Das ~~Baba [illegible]~~. Chandi Ghat.	Mehant	9897616192	गंगा दास

Chapter 8

Project Benefits

CHAPTER 8 : PROJECT BENEFITS

In order to understand the benefits of the proposed ropeway project, the social expert conducted public consultations with various groups at project level such as shop keepers, devotees, pilgrims, tourists, drivers, hotel owners, monks etc. However, considering the significance of the project it can be said that the ropeway will be very much helpful for the devotees, pilgrims and tourists largely. It will also indirectly improve the quality of socio-economic life of the shop keepers and other stakeholders. The benefits of the project are discussed as follows:



- Since the ropeway is proposed from Har Ki Pauri to Chandi Devi Mandir, it will connect more devotees, pilgrims and tourists to reach at Maa Chandi Devi temple directly from Har ki Pauri.
- It is observed that devotes and pilgrims are using proposed LTP station location for open defecation and laundry (using Ganges water) purposes by the locals. As a result, these activities are creating unhygienic condition and affecting the beauty of this holy place. The proposed LTP station development will lead to avoidance of open defecation and laundry at that place which will create hygienic environment for the devotees and tourists.
- This will reduce the time and effort of the people in reaching Maa Chandi Devi Temple.
- It will generate local employment opportunities during construction and operation of the said project.
- Due to Har Ki Pauri to Chandi Devi ropeway project, there will be increase in tourism in state of Uttarakhand due to better connectivity.
- The ropeway project will lead to reduction of vehicular traffic and traffic blockage.
- The ropeway project will help in reduction in pollution.
- The project will help in reduction in travel time and parking problems for the devotees and tourists.
- The project will help in enhancing the socio-economic condition of the shop keepers and other stakeholders.
- The ropeway is an eco friendly means of transportation.

- The ropeway will generate direct and indirect employment and livelihood opportunities.
- The ropeway installation is economic and easy to operate and maintain.
- During the construction of the ropeway project, the local labor may be hired which will create employment opportunity to them.
- It would be convenient for the elderly, women and children to commute from the lower part to the upper part of the hill.

8.1 EMPLOYMENT OPPORTUNITIES

The construction phase of the project is spread over a period of 24 months. During this period various categories of skilled, semi-skilled and unskilled manpower would be deployed for the project. About 100 persons would be working on the project during peak construction period. This would create good opportunities of direct employment during the construction period. In addition, indirect employment opportunities would be created in the support service sector. During the operation phase of the project 15 persons including staff and security will get the job opportunities on regular basis.

8.2 REVENUE GENERATION

Earnings would be generated by way of charges from tourist using the proposed ropeway. Tariff for the ropeway will be fixed in such a way that would be enough for operation and maintenance expenses of ropeway along with generation of funds for future development. The construction of ropeway will generate indirect revenues due to employment opportunity of the local people working in shops, transport, restaurant, hotel etc. The revenue to the government will arise.

8.3 BETTER MODE OF TRANSPORT/REDUCTION IN DISTANCE AND TRAVELLING TIME

The ropeway is the better mode of transportation in hilly terrain in terms of saving in time, operation cost and construction cost. The necessity of making cuttings of the slope for the construction of road and railway is avoided in case of ropeway. A cableway could be constructed and worked on hilly ground at a cost not greatly exceeding that which would be called for on a level country. Ropeways are generally less as expensive to operate when compared to cartage by mules, horses, and oxen. The ropeway provides direct connectivity between two points in hilly terrain and avoids the arduous journey. Reduced distance gives the benefits of saving in time.

8.4 BENEFITS OF CARBON CREDIT

Construction of ropeway will divert the traffic from roadways to ropeways which will create decongestion of road traffic, saving in time and saving in fuel. Reduction in use of fossil fuel will lead to reduction in pollution load in the environment providing benefit to carbon credits**.** Benefits to carbon credits make the system eco-friendly and conducive to the natural environment.

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Chapter 9

Cost Benefit Analysis

CHAPTER 9 COST BENEFIT ANALYSIS

9.1 INTRODUCTION

In this chapter cost-benefit analysis for the ropeway project has been prepared. Cost-benefit analysis is an economic evaluation technique that analyzes the generation of economic benefits and costs from a project or policy by comparing the discounted flows of benefits and costs over a prescribed time horizon.

9.2 PROJECT COST

The cost of the ropeway project is Approx. **Rs. 149.70 Cr.** This cost includes the following:

(i) Civil works,
(ii) Construction,
(iii) Equipment and its installation,
(iv) Consulting engineering design and supervision.

Besides that, during the construction and operation period, the monitoring process should be required in order to reduce the pollution which will harm the community and human beings. The cost for implementation of the Environmental measures is presented in Chapter - 6 and Chapter – 10 of the report.

9.3 PROJECT BENEFITS

Besides the tangible benefits, the project has got number of intangible benefits like increase in tourism potential, employment, better connectivity etc to the local people. The details of the same are given in Chapter – 8 of the report.

9.3.1 Incremental Return Rate

The project of development of passenger Ropeway at Chandi Devi Temple with an investment of Rs. 149.70 Crores appears to be a remunerative investment with IRR 28.6%. This is encouraging as being financially viable.

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Chapter 10

Environmental Management Plan

CHAPTER 10 : ENVIRONMENTAL MANAGEMENT PLAN

10.1 GENERAL

The Environmental Management Plan (EMP) describes the proposed remedial measures and monitoring plan for the impact during construction and operational period of the project. The EMP often contains a construction/management guideline that specifically addresses how the project proponent/contractors are to incorporate environmental considerations into their work. EMP considers compensatory measures if mitigation measures are not feasible or cost-effective. This chapter spells out the set of measures to be undertaken during project construction and operation to mitigate or reduce the adverse environmental impacts and bring them to acceptable levels based on the proposed Environmental Management Plans.

The most reliable way to ensure the implementation of EMP is that these plans are integrated into the overall project planning and implementation to make them as an integral component of the project. This ensures that it will receive funding and supervision along with other investment components. For optimal integration of EMP into the project, there should be links for:

- Funding,
- Management, training and
- Monitoring.

The purpose of the first link is to ensure that proposed actions are adequately financed. The second link helps in embedding training, technical assistance, staffing and other institutional strengthening in the mitigation measures to implement the overall management plan. The third link provides a critical path for implementation and enables sponsors and the funding agency to evaluate the success of mitigation measures, as part of project supervision, and as a means to improve future projects. For every impact discussed in **Chapter - 4**, the mitigation measures, implementing agency and budget have been presented as far as possible. All required funds would be channeled through the project authority. The Environmental Management Plans have been prepared and discussed in subsequent sections.

10.2 ENVIRONMENTAL MANAGEMENT PLAN

EMP contains a set of mitigation measures for negative environmental impacts through: a) changes in the design, construction practices, maintenance, and operation; and b) additional actions taken to protect the biophysical and social environment, as well as individuals who have been impacted adversely by a project. The extent and timing of mitigate actions are based on the significance of the predicted impacts. In the proposed project some aspects of impact mitigation are incorporated into project design which has

largely resolved the threat of impacts before construction commences. However, many mitigation measures require implementation during construction and operation phase to ensure that proposed actions are carried out at the correct times. Based on Project Description **(Chapter - 2)**, Description of the Environment **(Chapter - 3)** and Anticipated Environmental Impact & Mitigation Measures **(Chapter - 4)**, the environmental management plans to be adopted are presented below. **Table 10.1** summarizes Environmental Management Action Plan.

Table 10.1: Environment Management Plan

Environmental Attributes	Environmental Issue	Mitigation measures	Performance Indicator
Air	Fugitive dust emissions in atmosphere due to excavation loading, unloading of construction material. Dust emission from transportation of construction material. Dust and Gaseous emission from heavy machinery and vehicles Increased air pollution along nearby roads due to newly introduced vehicular traffic	**Construction Phase** • Vehicles delivering loose and fine materials like sand and fine aggregates shall be covered. • Loading and unloading of construction materials, stockpiling of the construction material, earthwork, unpaved haulage roads other dust prone areas and construction yard shall be provided with water spraying arrangement. • The excavated material shall be stored and covered properly so that it does not generate fugitive emissions. • Location of storage areas should be selected such that it is downwind of the habitation area and also there is no run off from the storage site during monsoon. • PUC certificate for all the vehicles used during construction, operation and inspection shall be made mandatory. • Batching plant will be located away from the site and from human settlement. • Mix concrete from batching plant will be used at site. • The Contractor should comply with all the statutory requirements Flyash shall be used in accordance with Flyash Utilisation Notification, 1999 and subsequent amendments. • All the machinery and equipment shall be regularly maintained. The Contractor shall keep routine maintenance records for inspection. • To avoid disruption of the existing traffic due to construction activities, comprehensive traffic management plan should be drawn up by the Contractor and get it approved for the same. • The Contractor shall procure material only from the approved	Photographic documentation PUC certificate Records of the vehicular movements (start time, end time, material of travel, travel route etc) machinery and equipment maintenance register Consent document received from UKMRCL regarding the procurement of the material from the licensed quarries Ambient air quality monitoring results Traffic management plan Compliance records of the traffic management Plan

Environmental Attributes	Environmental Issue	Mitigation measures	Performance Indicator
	Traffic congestion	quarry areas (approved by SPCB). • Air quality monitoring for the same parameters, which are monitored during the baseline studies, shall be implemented by the Contractor by hiring the services of the NABL accredited or MoEF&CC notified laboratory. National Ambient Air Quality standards 2009 shall be used for comparison of the ambient air quality during construction phase. Environment management cells will monitor that the AAQ monitoring program and air pollution control measures are scrupulously implemented.	
Air	Emissions from DG sets .	**Construction & Operation phase** • Use of ultra low Sulphur diesel. • Use of cleaner fuel if available. • Stacks will be provided of adequate height as per CPCB guideline.	Compliance report of DG sets as per CPCB. Sampling and fuel details of the DG sets.
Water	Ground and surface water depletion	**Construction Phase** • The contractor shall arrange the STP treated water. • As far as possible STP treated / Water collected in working pits to be used in sprinkling. **Operation Phase** • Water will be supplied by the Uttarakhand Jal Nigam. • Recycled water will be used for flushing.	Daily water consumption records. Site inspection report
Water	Impact on quality of ground and	**Construction Phase**	Compliance report of for discharge of water arising from

Environmental Attributes	Environmental Issue	Mitigation measures	Performance Indicator
	surface water	• To avoid the impact in River bed due to pile driving the construction will be carried out during the dry period. • Provision of perimeter drains to intercept storm-runoff from outside the works area. These shall be constructed in advance of site formation works and earthworks. Earth bunds or sand bag barriers should be provided on-site to direct storm water to silt removal facilities. • Sand/silt removal facilities such as sand/silt traps and sediment basins should be provided to remove sand/silt particles. • Exposed slope/soil surface should be covered by tarpaulin as soon as possible to reduce the potential of soil erosion. Arrangements should always be in place to ensure that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm. • Construction will not be carried out during the rainy period. However Cofferdam/ cassion/ silt curtain will be provided if during construction water will be found in the Dry river bed. • Oils and fuels should only be used and stored in designated areas which have pollution prevention facilities. To prevent spillage of fuels and solvents, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas. • All equipment operators, drivers, and warehouse personnel should be trained in immediate response for spill containment and eventual cleanup. Emergency response procedures and reporting shall be	dewatering Construction site management plan Photographic documentation Emergency response procedures Training report for immediate response for spill containment and Log books should be maintained.

Environmental Attributes	Environmental Issue	Mitigation measures	Performance Indicator
		made readily available by the Implementing Agency/Contractor in simple and local language. • All wastes arising from the construction should be disposed in an environmentally accepted manner so as not to block the flow of water in the channels. • Labour construction camps shall be avoided along the embankments and road alignments, and should be located away from habitation and river course. • The Contractor should provide adequate and safe water supply for the use of the workers in labour camp. • Install mobile toilets fitted with anaerobic treatment facility at construction sites. • Not to install mobile toilets in the natural drainage areas. • Labour camps should be provided with Mobile toilets. • The wastewater from the camps should not be allowed to be discharged into existing surface water bodies. • Water quality monitoring for the same parameters, which were monitored during the baseline studies, shall be implemented by the Contractor by hiring the services of the NABL accredited or MoEF&CC Notified laboratory. The Indian standards for drinking water IS 10500:2012 for ground water sample shall be used for analysis of the fresh water quality. Similarly, general standards for discharge of environmental pollutants mentioned in schedule VI of Environmental Protection Act, 1986 shall be used for analysis of Surface water quality.	

Environmental Attributes	Environmental Issue	Mitigation measures	Performance Indicator
		Operation Phase • Advanced Eco Reactor will be installed at station.	
Water	Water stagnation and creation of Temporary breeding habitats for mosquito/other vectors of disease	• Good housekeeping practice. • Source reduction by using the larvicide and anti mosquitoes and effective drainage are the main forms of mosquito control. • Periodic removal of aquatic weed. • Drainage system shall be developed on the site in the material storage areas to avoid the accumulation of stagnant water in monsoon season.	• Procurement and usage records of WHO approved larvicides or Anti mosquitoe pesticides • Photographic documentation and report for Good housekeeping practice • Records for removal of aquatic weed
Land	Soil erosion and flooding Loss of productive soil Soil contamination due to oil spills and other waste Handling of used Oil from D.G. sets	**Construction Phase** • Site preparation activities and excavation work would be undertaken during dry season after monsoon is over. • The top soil will be stripped from constructional areas and stockpiled for later reuse in landscaping. • Fuel and oil would be stored in cement lined storage yard and handled carefully to prevent soil contamination through leakage or spillage. • Used oil from DG Sets should be stored in HDPE drums in isolated covered facility and disposed off as per the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. • Waste from labour colony will be properly collected as per the Solid Waste Management Rule 2016 and its amendments. Solid waste bin should be provided at strategic location.	**Hazardous waste Management** • Maintain records of Hazardous waste (Form-3) • Ensure the maximum storing period will be 90 days • Maintain record of storing • Labeling of Hazardous and other waste as per Form -8 • Accidental reporting to SPCB (Form-11) Plastic waste Management: • Segregate plastic waste at

Environmental Attributes	Environmental Issue	Mitigation measures	Performance Indicator
	Soil contamination due to labour colony Disposal of construction debris Waste generated from the station	• Construction debris will be collected and suitably used on site as per Construction Waste Management Rules 2016 and its amendments. **Operation Phase** • Solid waste will be handled as per the SWM Rule 2016 and its amendment. Hazardous waste will be handled according to the Hazardous and Other Wastes (Management and Trans boundary Movement) Rules, 2016 and its amendments. • Plastic waste will be handled as per Plastic Waste Management Rule 2018 and its amendments.	source • Handover segregated waste to urban local body or agencies appointed by them or registered waste pickers', registered recyclers or waste collection agencies
Noise	Increase in noise level due to construction activity, machinery movement and operation DG sets	<u>Construction Phase</u> • Use of electric equipment instead of diesel power equipment. • Use of hydraulic tools instead of pneumatic tools. • All construction equipment and machinery shall be timely serviced and properly maintained to minimize its operational noise. • Stationary noise making equipments shall be placed along un-inhabited stretches. • Construction activity and timing shall be regulated to minimize the intensity of the noise impact. • Protection devices (earplugs or earmuffs) shall be provided to the workers. • Acoustic enclosure should be provided for individual noise generating construction equipment like DG sets. • Scheduling work to avoid simultaneous activities that generate high noise level.	• Maintenance schedule and records of the compliance for construction equipment and machinery • Construction site management plan • Construction activity Implementation • Compliance report of construction activity implementation Plan • Compliance report of DG sets as per CPCB • Records of the Sampling and fuel details of the DG sets

Environmental Attributes	Environmental Issue	Mitigation measures	Performance Indicator
		• Job rotation where feasible. • Use of Personal Protective Equipment (PPE) like earmuffs and earplug during construction activities. • Use of well-maintained equipment fitted with silencers. • Providing noise shields near the heavy construction operations.	
Noise	Diesel generator, machinery and Vehicular movement in the campus.	**Operation Phase** • Green Belt Development • Providing acoustic enclosures on D.G sets • housing all mechanical equipment inside a concrete building or using suitable material, discourage noisy vehicles.	Monitored noise level as per monitoring plan Check the Noise level with NAAQS.
Vibration	Vibration due to construction machinery	Construction Phase • Avoid night time activities. • Avoid impact pile-driving where possible in vibration-sensitive areas instead use drilled piles or sonic or vibratory pile drive. • Avoid vibratory rollers and packers near sensitive areas.	Monitored vibration level as per monitoring plan
Forest	Loss of forest	Mitigating measures to compensate the loss of forest cover by 10 times plantation & maintenance for 8 years.	Raising and maintaining the compensatory plantation will be monitored after 1st year to 8th year
Flora	Impact on Trees	Compensatory plantation of all 310numbers of tree species in forest area and 70 trees in open area is proposed.	Survival rate will be monitored after 1st year of transplantation up to 8th year. The amount for plantation of Rs 93100 will be

Environmental Attributes	Environmental Issue	Mitigation measures	Performance Indicator
			deposited for plantation of non forest trees and Rs 832500 will be deposited for plantation + Maintenance of forest trees
Fauna	Impact on Mammals, reptiles	Wildlife clearance is awaited for the Conservation of Schedule –I Species & Schedule –II Species	These species will be protected as per the Wildlife conservation plan. NPV is about (Rs 1.81 Lakh) of the forest is deposited to the forest department for the conservation of wildlife.
Avifauna	Impacts on Birds	Only peacock present in Schedule –I of WPA 1972	These species are protected as per the Wildlife conservation plan.
Occupational Health And safety	Health impacts on the workers due to emission from heavy equipment	• All equipment and machinery to be used shall comply with the design safety and industrial standards. • Premedical check-up of the worker • Periodical medical check-up for the workers • PPE will be provided to the construction labour • Regular SHE audit shall be conducted by the contractor.	Compliance report for detailed Safety, Health and Environment Management Plan
Occupational Health	Impact on safety workers	• The building and other construction workers' (regulation of employment and conditions of service) act, 1996 requirements shall be followed.	Compliance report for detailed Safety , Health And Environment

Environmental Attributes	Environmental Issue	Mitigation measures	Performance Indicator
And safety		• All hazardous chemicals and materials shall be stored and covered. Signboard and labeling should be done along with material safety data sheet (MSDS). • At every workplace, the Implementing Agency/Contactor in collaboration with local health authorities will ensure that a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances is made available. Access to the ambulatory services should be provided to approach the nearest hospital in case of an emergency. • The use of corrugated roofing sheets containing asbestos fibres shall not be permitted. • Preventive maintenance and servicing of equipment and machinery should be done to avoid any incident and breakdown. All exhaust should be provided stacks to release of gaseous emission at safe height. • All machinery and equipment should be covered with acoustic materials. • The labour camp should be adequately drained to avoid the accumulation of stagnant water. • The contractor will ensure good health and hygiene of all workers to prevent sickness and epidemics. • Measures shall be taken to prevent breeding at site by the contractor. • The workers should all be screened for the health problems before being considered for employment. Regular health check-up and immunization camps should all also be organized for the workers and nearby population.	Management Plan • Records for the procurement and utilization of first aid kit and ambulatory services • Maintenance schedule and records of the equipments • Traffic Management and Material Movement Plan • Compliance report for implementation of Traffic Management and Material Movement Plan • Compliance report for implementation of Labour Camp Management Plan • Records of the accidents and dangerous occurrences at construction site • Emergency Response Plan approved by civic authority. • Compliance report for implementation of approved Emergency Response Plan

Environmental Attributes	Environmental Issue	Mitigation measures	Performance Indicator
		• After completion of the construction; the contractor shall ensure the complete removal of the labour camps. • The Contractor shall deploy a team for Safety, Health and Environment management on the construction site as specified in SHE manual prepared by. • All accidents and dangerous occurrences shall immediately be informed verbally to the EMC, followed by a written communication giving brief about incident of accident, date/ time of occurrence. This will enable the EMC to reach to the scene of accident dangerous occurrences to monitor/ assist any rescue work and/ or start conducting the investigation process so that the evidences are not lost. • The Contractor shall prepare as required under the relevant rules of State Building and Other Construction Workers' Rules, an Emergency Response Plan for all work sites as part of the Contractor SHE Plan. • The Contractor shall develop a Work Permit system, which is a formal written system used to control certain types of work that are potentially hazardous. A work permit is a document, which specifies the work to be done, and the precautions to be taken. Work Permits form is an essential part of safe systems of work for many construction activities.	• Work Permit System
Occupational Health & Safety	• Exposure of workers & passersby to hazardous materials like	• Efforts shall be made to avoid the storage of hazardous chemicals near any residential area. Hazardous chemicals shall be labeled and stored in locked facility under authorized person. • Contractors shall be required to adopt and maintain safe working practices.	• Compliance report for detailed Safety, Health and Environment Management Plan • Photographic

Environmental Attributes	Environmental Issue	Mitigation measures	Performance Indicator
	asbestos use	• Use of appropriate signage in local language at the construction sites should be displayed generously and visibly to make the people aware of the ongoing work. Adequate lighting and fluorescent signage shall be provided at the construction sites. All equipment and machinery to be used shall comply with the design safety and industrial standards. • Each and every machine and tools should be inspected by the operator and supervisor before start of work. • Regular inspection and maintenance of the rail lines and facilities shall be carried out to ensure track stability and integrity in accordance with national and international track-safety standards. • The workers shall be trained for usage of all type of equipment and machinery. • Work area should be barricaded and provided with measures to prevent trespassing. To further ensure public safety, the right-of way close to habitation shall be fenced.	• documentation • Compliance report for equipment and machinery as per design safety and industrial standards. • Inspection and maintenance schedule of machines, tools, rail lines and other facilities • Photographic documentation • Compliance report for implementation of detailed Safety, Health and Environment management plan
Occupational health & Safety	• Visual Impacts due to reflective materials/ signages	• The signages should comply with industrial standard. • Use of reflective jackets and other safety PPE should be as per requirements.	• Procurement and distribution records of PPE s

10.3 ENVIRONMNET MANAGEMENT MEASURES

10.3.1 Ecology And Biodiversity

a) Compensatory Afforestation

As per the Supreme Court guidelines 10 times plantation is important for each tree removed. About 7 number of trees found in irrigation land. Therefore, 70 trees will be planted for compensation. The amount estimated for compensatory plantation and maintenance of revenue trees are Rs**.** 93,100.

b) Compensatory Plantation forest trees

The detailed scheme of Compensatory plantation to be carried out for 0.29 Ha of forest area, to be diverted for the construction of proposed ropeway. 100 trees are planted in vacant land with Rs 1,33,100/- **Annexure-10.1.** As per Supreme Court guidelines 10 times plantation is important for each tree removed. About 31 trees have been removed from project site and 310 trees will be planted. The amount for the plantation and maintenance is Rs 8,32,500/- for plantation of 310 trees will be transfer to forest department at the time of Stage –I forest clearance. The technical specifications of compensatory Plantation are given in **Annexure-10.2**. The amount is inclusive of the maintenance of the plantation for Eight years.

c) Net present value

The net present value of the 0.29 Ha of forest land diverted for the Shyampur reserve forest. The document name (Revision of rates of NPV applicable for different class/category of forests- November 2014) was referred for calculating the NPV. The rate of NPV as per the decision of the supreme court of India, dated 23/03/2008. The amount NPV value of 0.29 Ha of forest land diverted is calculated by forest department Haridwar is Rs 181540/ **Annexure-10.3.**

The objective of the Forest management should be to develop natural areas in which ecological functions could be maintained on sustainable basis. The Department of Forests is responsible for the conservation, maintenance and management of trees/forests/wildlife in the project area for which a total amount will be transferred to Forest Fund for forest land diversion from Forest as per the details described in **Table 10.2.**

Cutting cost: There are 31 trees impacted for the proposed development activity. The amount will be deposited for the value of trees are Rs. 1,24,369/ given in **Annexure-10.4.**

Table 10.2: Diversion Of Land From Forest Department

S. No.	Particulars	Cost In Rs	Remarks
1.	Raising and maintaining the compensatory plantation on 0.29 Ha of degraded Forest Land	8,32,500	Agreed with forest department
2.	Plantation of trees in vacant land @ Rs. 1330/tree	1,33,100	Agreed with forest department
3.	Estimated from the Guidelines of NPV (***Revision of rates of NPV applicable for different class/category of forests-November 2014***)	1,81,540	The rate of NPV, as per the decision of the supreme court of India, dated 23/03/2008.
4.	Tree cutting cost	1,24,369	-----
Total		**12,71,509**	

Wildlife Conservation Plan: A wildlife conservation plan for the Schedule –I & Schedule –II is prepared based on the baseline study conducted for the proposed ropeway. The baseline data includes both primary and secondary data. The primary data was collected consultation with forest and wildlife officials during field survey. The secondary data was collected from working plan of Haridwar division. An amount of Rs 20 Lakhs is estimated for conservation of wildlife.

Introduction: Biodiversity is part of our daily lives and livelihood, and resources upon which families, communities, nations and future generations will depend upon. The fragmentation, degradation and loss of habitats pose serious threat to biological diversity. These losses are irreversible and pose a threat to our well-being, considering dependence on food crop, medicines and other biological resources.

Main objective of the conservation plan is to ensure sustainable use of natural resources which involves scientific management of natural wealth vis-à-vis developmental activities likely to affect these resources. However, conservation management plan has been formulated for the conservation and management of wildlife.

The preparation of conservation plan for a developmental project is one of the steps towards the environment conservation. Human activities like agricultural expansion, urbanization and developmental activities are supposed to be major threats to biodiversity and wildlife.

The fauna in core zone and Buffer zone: The core zone is defined in a range of 0m to 500 m from the project site. The fauna in core zone is reported based on the primary data in consultation with forest officials and elderly villagers. The fauna reported in core zone are Indian Elephant, Indian Leopard, Spotted deer and Peacock fall under Schedule –I. A total of 8 mammals, 8 Birds and 02 Reptiles in core zone are reported.

The buffer zone starts beyond 500m to 15000m from the project site. The fauna in buffer zone is reported based on the secondary data. The secondary data was collected from working plan of Haridwar forest division. The Schedule-I Mammals reported in buffer zone are Indian Tiger, Indian Leopard, Leopard Cat, Hog Deer, Sloth Bear, Wolf, Blackbuck, Fishing cat, Indian Pangolin, Indian Elephant, Swamp Deer. Schedule –I Birds are Indian Peacock and Oriental pied Hornbill. Schedule –I Reptiles are Python, The Common Indian Monitor Lizard and Marsh Crocodile. Apart from that Monkey, Langur, Common Mongoose, two species of Otter, Wildcat, Indian red fox and Jackal are also reported which fall under Schedule –II. A total of 32 mammals, 07 Reptiles and 68 birds are reported in buffer zone.

Indian elephant (*Elephus Maximus*)

Habitat: Elephant is a flagship species in Rajaji national park. Elephants live in a matriarchal society, where the oldest female usually leads the group. In contrast, bull elephants prefer to lead a solitary life, especially after attaining the pubertal stage. Male elephants are known to use wide range of habitats, and travel more distances compared to the family groups. They are known to enter agricultural fields to feed on cultivated crops and return to the forest unharmed.

Behavior: The behavior of elephants in RNP, recorded that the bull elephants arrive and assemble in the forest adjacent to the agricultural fields in the afternoon and stay there till dusk; they enter the fields by forming groups and return to the forest before dawn. The timings of their movements entirely depend on the distances which have to be covered. However, sometimes they also get trapped in the villages when they stay in the fields for longer duration up to dawn or when they travel long distances during night and are not able to return from the fields. In such situations, bull elephants stay in any of the small forest patches (islands) located in the River Ganges and sometimes in the agricultural fields.

Food Habit: A number of villages situated along the eastern boundary of the Rajaji national Park grow various cash crops like paddy, wheat, maize, etc. elephants prefer to move across higher ridges during monsoon, as all the natural water sources located across the hilly terrain are filled with rainwater during monsoon, and several species of grasses like *Neyraudia arundinacea (Madagascar grass), Desmostachya bipinnata (sacrificial grass) and Dendrocalamus strictus (bamboo)* grow in abundance in the high ridges of the Rajaji national Park. Electric fences have been considered as one of the effective barriers to restrict elephants from entering crop fields.In Shyampur and Chiriapur forests of Haridwar Forest Division, Uttarakhand that some of the bull elephants were familiar with these fences.

Conservation Measures: It has also been suggested that the disturbance level by the road traffic should also be controlled by reducing the speed of the vehicles and prohibiting the blowing of horns. Sound dampners may be erected/placed by the side of the road/structure to reduce the intensity of sound of vehicular traffic using the road.

Monitoring of the passages regarding the movement of elephants by some biologists may also be carried out to know the performance of various proposals so that they can be adapted at similar places. Co-operation of the local people living in the areas shall also be required in restoration process and shall have to be protected from human and other settlements so that the animals do not have any hindrance in the area.

Indian Leopard: (*Panthra Padrus*)

The Indian Leopard is top most carnivores reported from both core& buffer zone of the study area. Therefore, conservation of topmost carnivore is most important to balance the food chain and food web.

Habitat: Leopards inhibit in variety of terrain. It is the most populous in woodland, grassland savannas and forests. They also occupy mountains, scrub and desert habitats. They prefer trees throughout their entire geographic distribution.

Behavior: Leopards are solitary, nocturnal carnivorous. They hunt during overcast days. They are less diurnal in areas close to humans in comparison to un-inhabitated areas. They usually mark their territory with urine, feces and claw marks and communicate by growling, roaring and spitting when aggravated.

Food Habit: Leopards are ambush predators, pouncing on their prey before it chance to react. They approach potential prey by crouching low to the ground. Once the prey item is captured, they immediately break the prey's neck which causes paralysis. After breaking the prey's neck, Leopards asphyxiate them and carry the carcass to a schedule feeding location, typically in the nearby tree. They may cover prey carcass in leaves and soil. Their tremendous strength allows them to tackle prey up to 10 times their own weight.

Conservation Status: Leopards are declining in parts of their geographic range due to habitat loss and fragmentation and hunting for trade and pest control. Leopards are vulnerable as per IUCN (International Union for Conservation of Nature) category and Schedule –I as per IWPA (Indian Wild Life Protection Act), 1972. Leopards appear to show some resistance to minor habitat disturbances and are relatively tolerant to humans.

Conservation Measures: Leopards are tolerant of habitat conversion, may persist close to large human populations provided they have suitable cover and prey.

- **Awareness generation camp among local communities, officials of various departments and other stakeholders to be organized by the forest department using local media and other platforms.**
- **Establishment of trained teams at two levels by the forest department. The team will comprise of primary response team and emergency response team.**
- **Use of latest technology and scientific measures to improve efficacy of capture, handling care and translocation of animal.**

The Schedule-I Mammals reported in buffer zone are Indian Tiger, Indian Leopard, Hog Deer, Sloth Bear, Wolf, Blackbuck, Fishing cat, Indian Pangolin, Indian Elephant, Swamp Deer. Schedule –I Birds are Indian Peacock and Oriental pied Hornbill. Schedule –I Reptiles are Python, The Common Indian Monitor Lizard and Marsh Crocodile. Apart from that Monkey, Langur, Common Mongoose, two species of Otter, Wildcat, Indian red fox and Jackal are also reported which fall under Schedule –II shall be protected like the leopards.

Some of the common conservation measures are

- Facilitating placement of some hording for awareness for the protection and conservation of Indian Elephant, Indian Leopard, Spotted deer, Sambar deer and Peacock in the project site as well as schools and major cross roads and other important locations.
- The construction shall be done in a manner (quick, with minimum disturbance) and with adequate design and technology to minimize long term impacts. Pre-fabricated and special methods to reduce the time taken in the erection /construction of the intrusion shall be adopted.
- Work during the nights totally be avoided at project site as the movement of many species, especially large mammals and carnivorous mostly during the nights.
- The camping of people/ workers shall also be avoided at project site. No domestic animals to be allowed to enter into the project site.
- Waste must be carried away from site and not dumped on site.
- Fuel- wood collection and use from the site should not be permitted. Fuel will be provided to the construction workers at the time of construction. (**Annexure-10.5)**
- Ropeway construction, installation and use of RoW shall be restricted to the diverted forest land /National park area only and not beyond the diverted land
- Before Ropeway construction /Installation the land to be diverted should be well demarcated with boundary pillars by user agency in coordination with the range office of forest.
- The construction and installation work and related operations should normally be carried out between sunrise and sunset.
- No barrier /Hindrance should be constructed in between the ropeway towers so, that wildlife movement their under is not obstructed.
- For the use of electric power cables /wires only insulated wires should be used.
- It shall be ensured by the Ropeway operator authority and their management agencies that wastes/polluting substances /materials including plastic polythene containers or carry bags etc are not thrown /disposed /tipped in the ropeway area or the adjoining the forest /sanctuary areas. Towards this end appropriate strict regulations formulated and enforced and necessary waste collection and disposal arrangement shall be put in place by the concerned authority /agency.
- The use of public address system should also provide such technology solutions that the sound level is maintained at such low disturbance to the severity are minimum.

Note: The above mentioned conservation plan is generic in nature. Actual conservation plan will be implemented as per the condition mentioned in NOC from NBWL.

Tentative budget allocation: Tentative budget allocation for wildlife conservation and management is given in **Table 10.3.**

Table 10.3: Budget for Wildlife Conservation and Management

S. No	Activities	Budget
1.	Wildlife conservation awareness program	Rs 10.0 Lakh
2.	Banner, Hoardings & Replica for protection and management of wild animals in the project site, school, major cross roads and other important locations	Rs 5.0 Lakh
3.	Rajaji National Park foundation fund	Rs 5.0 Lakh
Total		**Rs 20.0 Lakh**

Cost for Ecology Measures: Ecology is very important and pivotal component of the proposed development activity. It will be impacted and to mitigate the impacts adequate mitigation measures and management plan is mentioned in the report. The Ecology measures cost are estimated to be **Rs 49.39 Lakhs**. Cost of the Ecology Measures is give in **Table 10.4.**

Table 10.4: Cost of Ecology Measures

S. No	Components	Cost in Rs
1.	Compensatory plantation of trees in irrigation land	93100
2.	100 trees need to be planted in vacant land	133100
3.	10 times trees to be planted and maintain for 8 years	832500
4.	NPV Cost	181540
5.	Tree cutting cost	124369
6.	Ecological monitoring cost during construction & operation phase	1575000
7.	Wildlife conservation cost	2000000
Total cost		**49,39,609**

10.3.2 Wastewater Management and Water Conservation

The waste generated during construction and operation is 5.6 KLD and 52.4 KLD respectively. This waste water will be treated through the mobile toilets during the construction phase and during operation phase by the Advanced Eco reactor.

Advanced Eco reactor:

Advanced Eco-Reactor (AER) system uses specially formulated organic and inert/inorganic media to create a living ecosystem with a unique combination of microbes, enzymes and earthworms to treat the waste water in a naturally aerobic environment.

It is a viable green alternative to conventional wastewater treatment and does not require skilled manpower for operation and has significantly lower power consumption as compared to conventional STPs. It is an environment friendly and sustainable option which delivers reusable treated water without any daily/weekly/monthly sludge handling.

Pre Treatment: Bar screen chamber is provided to intercept inorganics (plastic, glass, cloth etc.) from entering into the STP. An oil & grease chamber is provided to prevent free

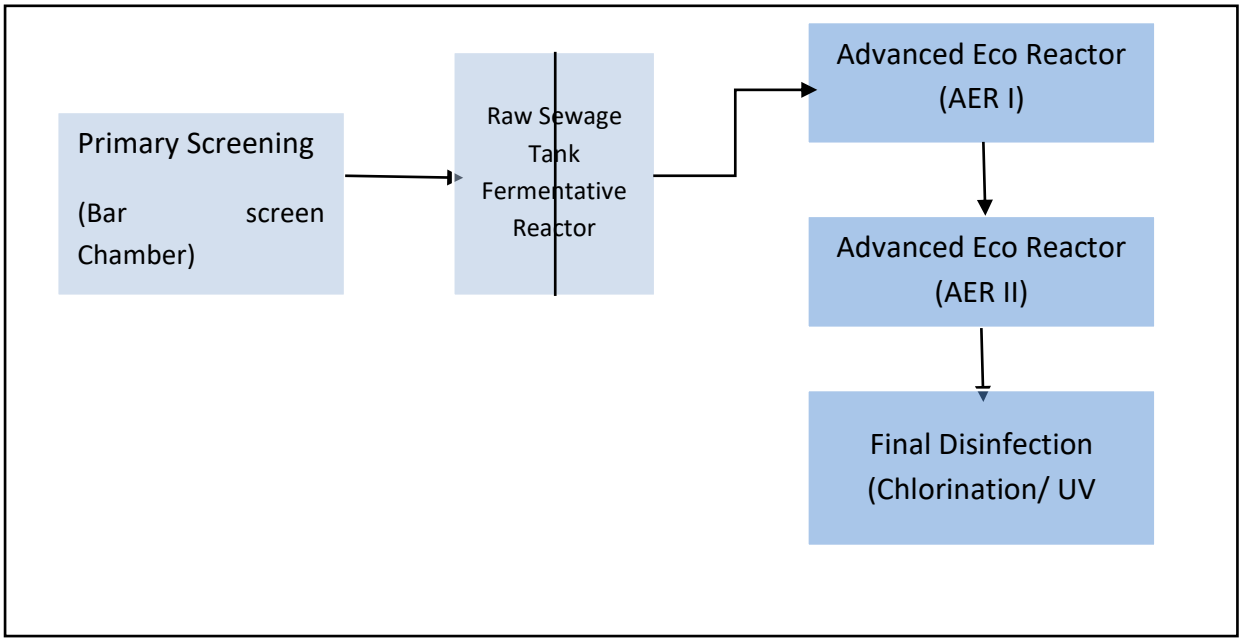
floating oil & grease from entering the STP. The waste water then enters the Equalization cum fermentative reactor.

Equalization cum Fermentative Reactor: The equalization tank allows the process to buffer the expected peak flows and allow the rest of the system operate an average flow rate. Special probiotic culture is inoculated in the system for suitable biofilm formation. In the first treatment phase, the biological processes are used to digest and remove the organic matter. Biomass of heterotrophic bacteria digests the macro suspended solids during their metabolism. Baffle walls directs the waste water stream between the chambers in a sinusoidal fashion.

Advanced Eco reactor: Effluent from the Fermentative reactor is pumped into the Advanced Eco-Reactor which is an engineered eco-system which consists of cultured organic and inorganic media which houses a healthy flora of beneficial microbes, enzymes and earthworms which degrade the organic matter as the water trickles/passes through the various layers of the reactor. Worms break down solids trapped in the AER media and excrete smaller particles and a consortium of microbes. These microbes form a biofilm on the attached growth surface. The filter media increases the contact of the bio-films with the effluent stream and is extremely efficient in retaining and digesting the left over pollutants. Advanced-Eco Reactor utilizes both physical and biological processes to provide high quality treatment. The number of AERs is dependent on the level of treatment required.[1]

Disinfection: Treated water can be used for non potable uses after the disinfection module.

Figure 10.1: Technology For Wastewater Treatment (Advanced Eco Reactor)

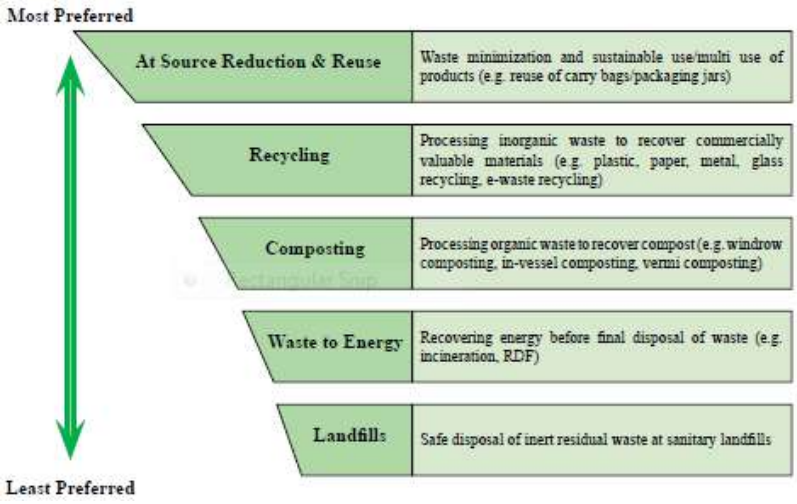


[1] CSE Case study of Organic solutions

10.3.3 Solid Waste Management Plan

After implementation of the recommended mitigation measures for the construction phase of the proposed project, there is no residual impacts will be expected from the project. Environmental monitoring will be necessary to ensure the implementation of correct disposal requirements for the various wastes generated from construction works.

During operation phase of the project the waste hierarchy followed for the project will be presents waste management stages commencing with the most preferable option to the least preferable option. Waste prevention is the most preferred option, followed by reuse, recycling, recovery and as the last option is safe disposal.



Solid Waste Management has remained the responsibility of the Urban Local Bodies. The Solid Waste Management Rules, 2016 have set responsibilities for ULBs, Gram Panchayat, State governments and Central & State pollution control boards for different aspects of SW management. These rules make ULBs, Gram Panchayat responsible for their implementation and for any other infrastructure development pertaining to collection, storage, segregation, transportation, processing and disposal of solid waste. They are also entrusted to aware the waste generators with the responsibility to avoid littering and promote segregation.

At present, waste is mostly collected through community bins/containers and road sweeping. Haridwar Nagar Palika Parishad (HNPP) sweepers and sanitary workers engaged by the Mohalla Swachhata Samities (MSS) sweep the streets. They accumulated the collected waste into small heaps and subsequently loaded manually or mechanically onto the community containers/bins or directly loaded onto the solid waste transportation vehicles for onward transportation to the disposal site. Haridwar Nagar Palika Parishad [HNPP] presently utilizes the Tractor trolley, Container carrier tractor, Tipper truck, Mechanical loader, Dumper placer, Refuse compactor, Vikram three wheeler vehicles and equipment for transportation of solid waste. There are two waste dumping sites at Chandi Ghat and Sarai Jawalpur. Chandi ghat site is uncontrolled dumping site near the River.

For the proposed ropeway the existing solid waste collection system will be followed for the safe disposal and treatment of the solid waste generation due to the proposed project. The proposed SWM system is broadly based on the 4R Environmental Protection Rules (Reduce, Recycle, Reuse, and Recover) and is in accordance with the SWM Rules, 2016 and its amendments. The primary aspects of the proposed plan include the following:

- Compliance with Solid Waste (Management & Handling) Rules, 2016
- Compulsory segregation at the source.
- Waste to be covered at all stages of handling.
- 100% collection and transportation of the generated waste
- Maximum recovery of resources by segregating recyclables and biodegradable
- Advocate 4R's i.e. reduce, recycle, reuse, and recover materials in SW management
- Promote Information, Education and Communication (IEC) across the stakeholders to ensure system efficiency and sustainability
- Adequate health and safety provisions for workers at all stages of waste handling
- Regular environmental monitoring
- Have robust complaint-handling system in place

The proposed Solid waste management system is given below in Figure 10.2.

Figure 10.2: Proposed Solid Waste Management System

Primary Storage System: The proposed infrastructure for primary waste collection will enforce segregation of waste at all the waste generation sources followed by separate collection and transportation system. The proposed system is outlined for infrastructure requirement at all the levels of collection and transportation value chain. Based on the waste quantification, the proposed infrastructure has been proposed.

- The segregation of waste into biodegradable and non-biodegradable waste (wet and dry waste) is proposed to be promoted at the source by providing separate bins for storage of segregated waste.
- Use of green plastic or metal containers with lid is advised for the storage of bio-degradable waste and a similar size bin of blue color may be used for storage of non-biodegradable waste.
- Total 64 Bins will be provided in the proposed project at different locations.

Table 10.5: Solid waste Collection System

S. No.	Description	Numbers of Bins	Capacities
1.	Lower Terminal Ground level	8 Bins, at entry exit within the premises	20 Liter
2.	Lower Terminal First	12 Bins, at entry, exit within	20 Liter

	Floor level	the premises.	
3.	Lower Terminal Boarding Level	4 Bins, Entry and exit	20 Liter
4.	Parking to the approach road to the Lower terminals.	30 Bins (After 20 m)	20 Liter
5.	Upper Terminals	6 Bins Entry, Exit and within premises	20 Liter
6.	Upper Terminals to temple	4 Bins system at upper Temple	20 Liter

Collection & Segregation: For effective management of the waste, The UKMRCL will hire the rag-pickers for the segregation of the waste and pick recyclables like polythene; plastics etc. These rag pickers will also be involved for the collection & transportation of waste from Upper terminal. UKMRCL will provide monthly remuneration to the rag pickers for the effective collection.

Secondary Collection: Near the Lower terminal a designated place will be identify by the UKMRCL. All waste coming from the LTP, UTP etc will be collected here in four separate 240 Litter Bins of Green and Blue. Recyclable waste will be picked by the rag pickers from the blue bins.

Transportation: Segregated waste near the project site will be given to Municipal Corporation for treatment and disposal. The requested amount for transportation and treatment will be paid to the Corporation by UKMRCL for the treatment of the waste. Dumping site at Sarai Jawalpur will be used for the solid waste disposal.

Public awareness through information, education & communication: Solid Waste Management is also an area where citizens, pilgrism need to be made aware of their role in achieving clean and healthy surroundings. Design of IEC material for SWM aims to reach out to different stakeholders including children, youth, housewives, offices, institutions, commercial groups, pilgrism etc.

With the existing technology, the management of solid waste by trained engineers will only solve the technical aspects; however, to keep the environment clean, it requires not only the technical solution but also ***public acceptance, co-operation and active people's participation***. After all every individual contributes one's own mite to the generation of solid waste. Therefore, it is necessary that individuals should be disciplined so as to decrease further pollution of the environment. IEC techniques the stakeholders and local community could be educated and aware about the issues and advantages of existing and implementing system of the solid waste management. The basic approach of IEC plan is to create effectiveness of the Solid Waste Management System. Its operational efficiency can be improved through Information, Education and Communication (IEC) techniques.

Table 10.6: Action Plan for Target Groups

S. No.	Target Groups	Target Group Details	Action Plan
1	Waste Generator	• Temple Community • Pilgrism • Residential Area • Commercial Areas (Shopping areas, Vegetable markets, Offices,) • Institutional Areas (Jr. High Schools, Colleges)	• Holding locality-wise meetings, seminars, targeted community meetings with self-help groups, through street plays, technical and pictorial presentation along with aware them about health hazards and remedial measures and sanitation improvement. • Informing and suggesting them about the segregated waste management and their important role.
2	Waste Collector	• Rag pickers • Waste Loader • Truck drivers	• They all should be involved and sensitize about the need of segregated waste collection and sanitation improvement. • The waste collection, transportation and disposal of the waste in proper timing so that waste could not be overflow. • The waste collector should be trained about the collection of segregated waste.
3	Waste Managers	• Environment Management Cells Of Ropeway	• Presenting them about the Rules and Regulation and updating them about the ongoing activities and techniques for SW management. • Training programmes for the technical staffs
4.	Leaders	• Political Leaders (Local MLA, MP) • Religious Leaders • Community Leaders	These leaders can be motivated to participate actively in promotional efforts of community involvement in segregated solid waste management.
5.	School Teachers and Students	• Primary Schools • Jr. High Schools • Public Schools	• School teachers can be informed and involved in the segregated solid waste management scheme and can be motivated to educate the children for the sanitary improvement. • The students can be educated and trained for the segregated waste management system and they can be great awareness creators for the

			societies.

Development of an IEC Plan

Once the target groups have been identified, the responsibility lies in developing the approach for informing, educating and communicating with these groups. The target groups will be informed by the Environment Management Cells about the waste segregation and its disposal practices. In information plan following activities can be undertaken:

- **i.** Site visits by administrative officers – This will be attracting attention of citizens on subject matter.
- **ii.** Meeting of mandir parishar Committee- meeting with committee for effective segregation of waste.
- **iii.** A brief introduction by safai mitra- workers or safai mitra can give a brief talk on waste collection and transportation to the people of the region. This way people can get engaged in segregation of waste at source level.
- **iv.** Display of data and information through pictures/hoardings- the information on SW can be shared with various target groups using methods like putting up pictures and boards at public places. These pictures can tell about the hazards of unscientific treatment of solid waste and need to handle the issue with better technologies for sustainable growth and development.

Likewise education plan will also be put in place where various channels of making people aware on waste management will be used. This can include the following:

- **i.** Participation of schools and colleges- Schools are important stakeholders of public welfare projects. Environmental awareness is part of curriculum at school and university level. This opportunity can be utilized to educate not only students but their family members too on waste and management and its social, economic and environmental benefits.
- **ii.** Public meetings – Public platform can be used to educate the people. They must know why this activity has been undertaken and what good it will do to them once gets operationalized.
- **iii.** Dissemination of written material – the pamphlets, booklets and other small informative brochures can be given to the stakeholders who in turn will take the responsibility to spread the word at local and community level on solid waste management.

The communication plan is last but not the least component of the IEC strategy. It is the most exhaustive of all and requires great efforts to reach to the massed. In this, the communication material should be developed and must be utilized in public awareness program through the tools of publicity. The use of various publicity tools as public address meetings, workshops, School Activities, Street Plays, Distribution of handbills, pamphlets etc. can be used. However, these activities overlap with the activities of Information and education plan but their scope and coverage is much vaster than the other two.

10.3.4 Hazardous Waste Management

It shall be the responsibility of the contractor to ensure that hazardous wastes are labeled, recorded, stored in impermeable containment and for periods not exceeding mandated periods and in a manner suitable for handling storage and transport. The contractor shall maintain a record of sale, transfer, storage of such waste and make these records available for inspection. The contractor shall approach only Authorized Recyclers for treatment and disposal of Hazardous Waste, under intimation to the Project Authority.

10.3.5 Construction and Demolition Waste Management

Construction and Demolition (C&D) waste is part of solid waste that results from land clearing, excavation, construction, demolition, remodelling and repair of structures, roads and utilities. C&D waste has the potential to save natural resources (stone, river sand, soil etc.) and energy, reduce transportation over long distances for dumping, and reduce space occupied at landfill sites. C&D waste generated from construction has potential use after processing, grading solid waste and recycling.

- Segregation and temporary storage of reusable and recyclable materials at identified locations. Transport recyclable materials to construction sites.
- Sale of metal scrap and other saleable waste.
- Identification of intended transport means and route.
- Concrete material shall be broken into coarse size and reutilised in filling.

10.3.6 Traffic Diversion/Management

The contractor shall develop, assess, and implement appropriate management measures for traffic management wherever the construction activity will affect or likely impact the efficiency and safety of road and related transport networks (including traffic flow, access, parking and user safety). Traffic management plan shall be prepared in consultation with the relevant road authority, transport operator, and emergency services, as relevant. As the Road capacity is sufficient to accommodate construction vehicle traffic volumes and that disruptions are minimize. However some of the measures will be used during the construction phase for the management of the traffic.

- Appropriate warning and information signs are installed to provide advance warning of changed traffic conditions.
- Barricades for pedestrians, public transport passengers, motorists, cyclists etc.
- Work activities are planned and undertaken to minimize any adverse impacts and to ensure that the traffic normalcy is resumed in shortest possible time.
- Suitably trained staff perform daily inspections on implemented Traffic Management Plans
- All construction workers should be provided with high visibility jackets
- Necessary permissions shall be obtained from traffic department of urban/rural local bodies and Road Authorities such as Commissioner of traffic.
- All vehicles involved in the excavation and/or demolition process and departing the property with demolition materials, spoil or loose matter must have their loads fully covered before entering the public roadway. Prior to the commencement of work,

suitable measures are to be implemented to ensure that sediment and other materials are not tracked onto the roadway by vehicles leaving the site.

- Provide safe and clearly marked lanes, buffer and work zones for guiding road users.

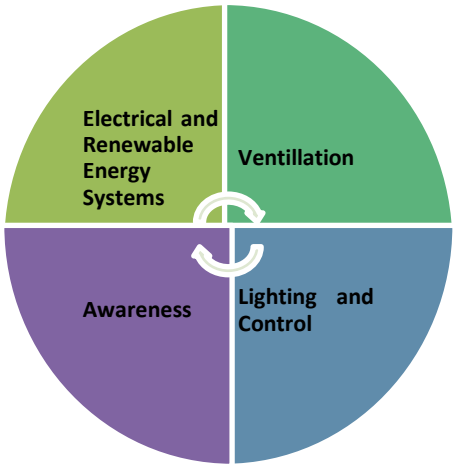
Various construction technologies can be employed to ensure that traffic impedance is minimized. Capital and operating cost are included in engineering cost and therefore is not included in EMP.

10.3.7 Traffic Circulation during Operation

Pt. Deen Dayal Upadhyay parking has two levels of parking floor which will be extended to 4 levels in due course, increasing the current parking capacity of 1,000 to around 2,000 cars. Traffic will be coming to Pt. Deen Dayal Upadhyay Marg from national highway and from interior roads of Haridwar which will be easy to manage due to huge parking lot at Har Ki Pauri.

10.3.8 Energy Conservation Measures

The some of the ECBC measures has been adopted in the proposed project to conserve the energy.



1. Electrical and Renewable Energy Systems

- Use of Energy efficient motors.
- BEE star rated DG sets shall be used in all compliant buildings (minimum 3-5 stars rating).
- All buildings shall have provisions for installation of renewable energy systems in the future on rooftops or the site.
- Project area gets the sufficient sunlight during whole of the year. To reduce the power load at each station roof top Solar PV of 15 Kw of system has been proposed. This will generate 47,882 Kwh annually. Cost of the Solar roof Top PV will be Approx. 18 Lakh. Ropeway will not be operated by solar. Other than the ropeway demand will be meeting by the Solar Roof PV.

2. Natural Ventilation

- Naturally ventilated buildings.
- Have minimum BEE 3-star rated ceiling fans.
- Have exhaust fans complying with minimum efficiency requirements of fans
- The high-efficiency spectacular reflectors or high-efficiency luminaries. Localized switching -installing localized switches near work stations to control local lighting.

3. **Lighting and Control**
    - Lighting design - (a) design lighting systems that maximize the use of daylight and (b) introducing local task lights (e.g. desks lights), allowing a reduction in general overhead lighting.
    - Automatic control systems - installation of (a) timer circuits that switch lamps off during room vacancy times, (b) photoelectric sensors that sense the amount of daylight in the room and either switch lamps on or off or adjust the lamp brightness accordingly and (c) occupancy sensors that switch lamps off when work stations are unoccupied.
    - Localized switching - installing localized switches near work stations to control local lighting.
    - Maintenance schedule - setting up a maintenance schedule to clean and replace lamps on a regular basis.
4. **Awareness**
    - Promoting employees awareness on energy conservation.
    - Training staff on methods of energy conservation and to be vigilant to such opportunities.

10.3.9 Sustainable building materials

To use BIS recommended wastes (such as fly ash, blast furnace slag etc.), having properties like conventional construction materials for building construction. These being low embodied energy materials as well as waste products, reduce the need for virgin materials in the building structure and help divert waste from landfills. If economical it shall be implemented.

10.3.10 Construction Material Management

Procedures for storage, handling and transport of construction material shall be prescribed in SH&E method statement approved for construction. Housekeeping is to keep the working environment cleared of all unnecessary waste, thereby providing a first-line of defense against accidents and injuries. It is the responsibility of contractor and all site personnel. Some of the measures are listed below:

- Full height fence, barriers, barricades etc. shall be erected around the site in order to prevent the surrounding area from excavated soil, rubbish etc, which may cause inconvenience to and endanger the public.
- All stairways, passageways shall be maintained without any blockages or obstructions. All emergency exits passageways, exits fire doors, break-glass alarm points, fire-fighting equipment, first aid stations, and other emergency stations shall be kept clean, unobstructed and in good working order.
- All surplus earth and debris shall be removed/disposed off from the working areas to officially designated dumpsites. Trucks carrying sand, earth and any pulverized materials etc. shall be covered while moving.
- Unused/surplus cables, steel items and steel scrap within the working areas shall be removed to identify locations.

- All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from work place to identified locations.
- Empty cement bags and other packaging material shall be properly stacked and removed.
- Proper and safe stacking of material is of paramount importance at yards, stores and such locations for future use. The storage area shall be well laid out with easy access and material stored / stacked in an orderly and safe manner.
- Flammable chemicals/compressed gas cylinders shall be safely stored.

10.3.11 Borrow Area Management

No borrow land will be required for the project site development. The cut and fill activities will fulfill the purpose while preparing the site. Hence no extra borrow area will be required.

Following measures should be taken during cutting and filling:

- The borrowed earth should be utilized only within the project area.
- After filling, the loose soil will be well compacted to avoid the soil erosion.
- Horticulture or natural grass turfing will be done at the borrowed patches wherever necessary.

10.3.12 Air Pollution & Dust Control measures

During construction period the impacts on air quality are mainly due to the material movement and the construction activities. Due to loading/unloading and stocking of construction material, the air quality in the immediate influence area will be affected and the pollution levels in ambient air would be increased, though, not in significant levels. The emissions from DG sets, construction equipment and vehicles may deteriorate the air quality in the area. In order to reduce the dust emissions due to material transport and construction activities following measures need to be taken:

- Provisions will be made for sprinkling of water where earth filling and excavation is being carried out. It will be ensured that the construction debris is removed daily.
- Idling of delivery trucks or other equipment wherever useful will not be permitted during periods of unloading or when they are not in active use.
- Vehicles carrying construction material shall be covered to avoid spilling
- Low emission construction equipment will be used wherever possible and all the machineries/equipment used will adhere to the standard emission norms.
- Water sprinkling at the construction site as per requirement
- The work schedule and the operation time for construction machinery shall be suitably modified and have limited construction activity to exercise a control on ambient air quality standards.
- All stationary machines / DG sets emitting the pollutants shall be inspected frequently for maintenance and should be fitted with exhaust pollution control devices.
- In no case, loose earth will be allowed to pile up along the approach roads.
- As soon as the construction activity is over the surplus earth should be utilized to fill up the low-lying areas, if any.

10.3.13 Noise Control Measures

1. Design consideration and project layout

- Construct noise barriers, such as temporary walls or piles of excavated materials between noisy activities and noise-sensitive receivers.
- Re-route truck traffic away from residential streets, if possible. Select streets with fewer homes, if no alternatives are available.
- Site equipment on the construction plot as far away from noise-sensitive sites as possible.
- Construct walled enclosures around especially noisy activities or clusters of noisy equipments.

2. *Sequence of operations*

- Combine noisy operations to occur in the same time period. The total noise level produced will not be significantly greater than the level produced if the operations were performed separately.
- Avoid nighttime activities. Sensitivity to noise increase during the nighttime hours in residential neighborhoods.

3. *Alternative construction methods*

- Avoid impact pile driving where possible in noise-sensitive areas. Drilled piles or use of a sonic or vibratory pile driver are quieter alternatives where geological conditions permit their use.
- Use specially quieted equipment, such as quieted and enclosed air compressor, mufflers on engines. .

10.3.14 Oil Spill control/Management

During construction and operation of the project, vehicles and equipments generate oil waste, which are likely to spoil the natural environment. These oil spills may enter in the runoff, which ultimately contaminate the soil and natural drains. To control the oil spill during construction stage of the project following measures should be taken:

- Good housekeeping
- Routine checkup of construction machineries and equipments
- Temporary cement/metal platform will be provided below the construction machineries at maintenance site to capture the spill.
- These platforms should be at sufficient height to avoid the littering
- Conducting routine inspections to ensure proper functioning of machineries/ equipments.

10.3.15 Labour Welfare

All the facilities should be provided as per Building and Other Construction Workers Act, 1996(BOCWA). Some of the measures are detailed below:

Shelter at Workplace: At every workplace, shelter will be provided free of cost, separately for use of men and women labourers. The height of shelter will not be less than 3m from

floor level to lowest part of the roof. Sheds will be kept clean and the space provided shall be on the basis of at least 0.5m^2 per head.

First aid facilities: Health problems of the workers should be taken care of by providing basic health care facilities. All necessary first aid and medical facilities will be provided to the workers. The provision and maintenance of suitably equipped first aid facility throughout the extent of the works has to be borne by the contractor who shall be responsible for welfare arrangements and requirements to the satisfaction of the Supervision Consultant and Site Engineer. At every workplace, a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances will be provided. Suitable transport will be provided to facilitate taking injured and ill persons to the nearest hospital.

10.3.16 Training

The training programmes need to be conducted for officers of project developer and contractors. These programmes should also be extended for the workers for their active participation in the project implementation. Apart from training, such programmes will include guidelines for safety, measures of disaster prevention, action required in case of emergency, fire protection, environmental risk etc. The cost involved for such a programme is presented in **Table 10.7.**

Table 10.7: Cost Of Environmental Training Programmes

S. No.	ITEM	COST (Rs)
1	15 days training during construction period	1,90,000
2	Demonstration/presentation aids	30,000
3	Transportation and Miscellaneous	30,000
	TOTAL	**2,50,000**

10.3.17 Soil Erosion Control

The cutting and filling operations may lead to erosion due to loosening of topsoil. The excavation of construction materials may alter the topography and may also lead to soil erosion. Temporary erosion/sedimentation and pollution control measures will be used to control the phenomenon of erosion, sedimentation and pollution that may develop during normal construction practices. The soil erosion at construction site can be minimized by following measures:

- Construction will not be carried out during monsoon.
- Erosion control measures such as ramming of topsoil immediately after the excavation and provision of silt control measures to minimize soil erosion.
- Ensure that no soil is left unconsolidated before completion of work at the site.
- Construction material shall be procured from the licensed material supplier.
- The excavated earth debris will be transported immediately to the disposal site and no accumulation shall be allowed at construction site.
- Soil erosion can also be controlled by efficient storm water management.

10.4 ENVIRONMENT MONITORING & MANAGEMENT COST

Most of the items described in the environmental management plan form part of the project cost which will be included in the project civil cost. Certain items like health care and medical facility to workers make part of the contractual obligations of the construction contractor. The environmental costs towards implementation of environmental management plan and mitigation measures during pre-construction, construction and operation of the proposed project are estimated of **Rs 152.01 lakhs** and described in **Table 10.8.**

Table 10.8: EMP Cost (Lakh)

S. No.	Item	Cost (In Rs. Lakhs)
1.	Environmental monitoring (Air, Water, Soil, EB, Noise)	29.4
2.	Establishment of Environmental Cell	37.07
3.	Sewage Treatment Plant	30
4.	Solid waste Management	1.4
5.	Training	2.50
6.	Solar Power Plant	18.00
7.	Ecology Measures (WC, Compensatory Plantation)	33.64
	Total Cost	152.01

10.5 EPILOGUE

After incorporation of environmental management plans, the environmental sustainability will be further improved. In a nutshell, it could be concluded that the project is environmentally sustainable and eco-friendly. The most of the mitigation measures for the construction phase impacts will form the part of tender documents. The responsibility for their compliance thus would be binding for the prospective contractor as per the contract condition. The overall responsibility for implementation and monitoring of mitigation measures will, however, rest with the UKMRCL. Risk Analysis and Disaster Management Plan for safe operation of Ropeway will be suggested in the relevant chapter.

Annexure –10.1

COST OF THE TREES PLANTATION IN VACANT LAND

परियोजना का नामः– उत्तराखण्ड मेट्रो रेल, शहरी अवस्थापना एवं भवन निर्माण निगम लिमिटेड द्वारा जनपद हरिद्वार में हर की पौड़ी से चण्डी देवी मन्दिर तक रोपवे प्रणाली के विकास हेतु आरक्षित वन भूमि 0.29 हैक्टेयर का हस्तान्तरण प्रस्ताव।

रिक्तपड़े स्थान पर उचित वृक्षारोपण योजना का प्रमाण–पत्र

प्रमाणित किया जाता है कि प्रस्तावित मोटर मार्ग के आस–पास रिक्त पड़े स्थानों पर उचित वृक्षारोपण हेतु वांछित धनराशि वन विभाग को उपलब्ध करायी जायेगी। योजना संलग्न है। (पृष्ठ सं0)

(Ajay Bir Singh Negi)
Assistant Manager (Civil)
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Raghvendra Prakash Dubey (रघवेन्द्र प्रकाश दुबे)
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रिक्त स्थानों में 100 पौंध रोपण पर व्यय (1330.00 प्रति पौंध)

क्र0सं0	कार्य का विवरण	सं0	दर	धनराशि	विभागीय शेड्यूल रेट मद
1	गड्डों हेतु संरेखन करना	100 गड्डे	29.00 प्रति सैकड़ा	2900.00	भाग–1 (2)
2	गड्डों का खुदान करना (60x60x60cm)	100 गड्डे	33.00 प्रति गड्डा	3300.00	भाग–7 (3)
3	गड्डों हेतु सड़ी गोवर की खाद की आपूर्ति करना	100 गड्डे	35.00 प्रति गड्डा	3500.00	भाग–7 (2)
4	6 से 7 फिट ऊँचाई के पौधों की आपूर्ति करना	100 पौंध	185.00 प्रति पौंध	18500.00	भाग–7 (4)
5	पौंधों का रोपण करना सरबोझ तथा थावलाबन्दी सहित।	100 पौंध	44.00 प्रति पौंध	4400.00	भाग–7 (5)
6	श्रमिकों को रखकर सालभर पौंधों की निराई–गुड़ाई व रख–रखाव कार्य	100 पौंध	376.00 प्रति पौंध	37600.00	भाग–7 (6)
7	स्थानीय झाड़ी से पौंधों की सुरक्षा हेतु ट्री सुरक्षा गार्ड बनाना मय गाढ़ना सहित	100 पौंध	100.00 प्रति पौंध	10000.00	स्थानीय
8	पौंधों की सिंचाई करना 9 माह x 3 बार	100 पौंध	61.00 प्रति पौंध	6100.00	भाग–7 (8)
9	पौंधों का रोपण अनुरक्षण रोपण वर्ष के 9 वर्षों हेतु	108 माह	330.00 प्रति माह	35640.00	स्थानीय
10	साईन बोर्ड बनाना मय कीमत बनवाई व लिखाई सहित	1 बोर्ड	6609.00 प्रति बोर्ड	6609.00	भाग–7 (ii)
11	अन्य व्यय	–	ल0स0	4551.00	
			योग	**133100.00**	

उप वन संरक्षक
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Annexure –10.2

COST OF THE COMPENSATORY PLANTATION AND ITS SPECIFICATION

परियोजना का नामः– उत्तराखण्ड मेट्रो रेल, शहरी अवस्थापना एवं भवन निर्माण निगम लिमिटेड द्वारा जनपद हरिद्वार में हर की पौड़ी से चण्डी देवी मन्दिर तक रोपवे प्रणाली के विकास हेतु आरक्षित वन भूमि 0.29 हैक्टेयर का हस्तान्तरण प्रस्ताव।

प्रभावित वृक्षों की दस गुनी संख्या में वृक्षारोपण करने सम्बन्धी प्रमाण–पत्र

प्रमाणित किया जाता है कि उक्त परियोजना 1 हैक्टेयर से कम क्षेत्रफल हैं। दस गुनी संख्या में वृक्षारोपण की योजना संलग्न है।

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प्रयोक्ता एजेन्सी

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जनपद हरिद्वार में हर की पौड़ी से चण्डी देवी मन्दिर तक रोपवे निर्माण में बाधित 31 वृक्षों के सापेक्ष 10 गुना वृक्षारोपण का प्राक्कलन

क0 सं0	कार्य का विवरण	इकाई	परिमाप	दर	धनराशि
1	2	3	7	8	9
1	क्षेत्र का सर्वेक्षण	ha	1 ha.	168.00	168.00
2	लैण्टाना झाड़ी कटान कर बाहर फेंकना व फुकान करना 50 प्रतिशत	ha	1 ha.	14347.00	14347.00
3	गढढों का संरेखण करना (0.60x0.60x0.60)	No.	310 Nos.	32/- Hundred	99.20
4	गढढा खुदान कार्य	No.	310 Nos.	27/-	8370.00
5	पौंधो हेतु ट्री गार्ड क्रय करना मय जी0एस0टी0 सहित	No.	310 Nos.	1416.00	438960.00
6	ट्री गार्ड का ढुलान करना	No.	310 Nos.	125/-	38750.00
7	ट्री गार्ड पर रेड आक्साईड व ग्रीड पेंट करना	No.	310 Nos.	213.40	66154.00
8	पौंधो को क्रय करना बाजार से	No.	341 Nos	203.50	69393.50
9	पौंधों का ढुलान करना	No.	341 Nos	L.S.	3000.00
10	गढढों का भरान करना कीटनाशक खाद मिलाकर	No.	310 Nos.	4.40	1364.00
11	पौंधों का रोपण करना मय थावलाबन्दी सहित	No.	310 Nos.	4.22	1308.20
12	ट्री गार्ड को फीट करना सीमेंट कंक्रीट सहित	No.	310 Nos.	211.00	65410.00
13	पौंधों का दो बार निराई–गुड़ाई करना	No.	310 Nos.	3.87	1199.17
14	पौंध रोपण पश्चात झाड़ी कटान	ha	1 ha.	2851.00	2851.00
15	पौंध रोपण पश्चात पौंधो की देख–रेख व सिंचाई पर व्यय (8 माह)	ha.	1 ha.	905.5/- ha.	7244.00
16	8 वर्षों तक पौंधों की देख–रेख पर व्यय	96 Month	96 Month	1000/- per month	96000.00
17	वृक्षारोपण क्षेत्र में साईन बोर्ड बनाना व फीट करना	-	-	L.S.	15000.00
18	अन्य आकस्मिक व्यय	ha.	1 ha.	2970.00	2970.00
				Total	**832588.07**
				Say	**832500.00**

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हरिद्वार वन प्रभाग, हरिद्वार

Annexure –10.3

NPV for Forest land

परियोजना का नामः– उत्तराखण्ड मेट्रो रेल, शहरी अवस्थापना एवं भवन निर्माण निगम लिमिटेड द्वारा जनपद हरिद्वार में हर की पौड़ी से चण्डी देवी मन्दिर तक रोपवे प्रणाली के विकास हेतु आरक्षित वन भूमि 0.29 हैक्टेयर का हस्तान्तरण प्रस्ताव।

एन0पी0वी0 जमा कराये जाने का प्रमाण–पत्र

प्रमाणित किया जाता है कि उक्त प्रकरण में एन0पी0वी की देय धनराशि 181540-00 द्वारा वन विभाग के पक्ष में जमा करायी जायेगी। इसके अतिरिक्त यदि मा0 उच्चतम न्यायालय द्वारा एन0पी0वी0 की धनराशि में कोई बढ़ोतरी की जाती है तो एन0पी0वी0 की अतिरिक्त धनराशि भी.....द्वारा जमा करा दी जायेगी।

प्रमाणित वनभूमि 0.29 X 626000 = 181540.00
हरियाली घनत्व 0.3
है का वर्गीकरण III

उप वन संरक्षक
हरिद्वार
प्रयोक्ता एजेन्सी

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Annexure – 10.4

VALUES OF TREES AND CUTTING COST

परियोजना का नामः– उत्तराखण्ड मेट्रो रेल, शहरी अवस्थापना एवं भवन निर्माण निगम लिमिटेड द्वारा जनपद हरिद्वार में हर की पौड़ी से चण्डी देवी मन्दिर तक रोपवे प्रणाली के विकास हेतु आरक्षित वन भूमि 0.29 हैक्टेयर का हस्तान्तरण प्रस्ताव।

परियोजना से प्रभावित होने वाले वृक्षों की मूल्य सूची

प्रमाणित किया जाता है कि विषयगत परियोजना के अन्तर्गत काटे जाने वाले पेड़ों का कुल मूल्य रूपये 1,24,369.00 (एक लाख चौबीस हजार तीन सौ उनहत्तर) आंकलित किया जाता है।

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प्रभारी वनाधिकारी

वन क्षेत्राधिकारी
श्यामपुर रेंज
हरिद्वार वन प्रभाग

उप वन संरक्षक
हरिद्वार वन प्रभाग, हरिद्वार

परियोजना का नामः– उत्तराखण्ड मेट्रो रेल, शहरी अवस्थापना एवं भवन निर्माण निगम लिमिटेड द्वारा जनपद हरिद्वार में हर की पौड़ी से चण्डी देवी मन्दिर तक रोपवे प्रणाली के विकास हेतु आरक्षित वन भूमि 0.29 हैक्टेयर का हस्तान्तरण प्रस्ताव।

परियोजना से प्रभावित होने वाले वृक्षों की मूल्य सूची

क्र0 सं0	प्रजाति	व्यास वर्ग	वृक्षों की संख्या	दर	कीमत
1	साल	2–3	02	4683.00	9366.00
		3–4	01	11886.00	11886.00
		5–6	01	38636.00	38636.00
2	सांदन	5–6	01	6843.00	6843.00
3	बाकली	1–2	01	150.00	150.00
		2–3	03	1125.00	3375.00
		3–4	04	3375.00	13500.00
4	खैर	2–3	01	3871.00	3871.00
5	बेल	1–2	01	90.00	90.00
		2–3	03	825.0	2475.00
6	रोहणी	1–2	01	90.00	90.00
7	सागौन	1–2	01	490.00	490.00
		2–3	02	1571.00	3142.00
		3–4	05	5872.00	29360.00
8	कोकाट	1–2	03	90.00	270.00
		2–3	01	825.00	825.00
योग			31		124369.00

उप वन संरक्षक
हरिद्वार

वन क्षेत्राधिकारी
श्यामपुर रेंज

Annexure – 10.5

परियोजना का नामः– उत्तराखण्ड मेट्रो रेल, शहरी अवस्थापना एवं भवन निर्माण निगम लिमिटेड द्वारा जनपद हरिद्वार में हर की पौड़ी से चण्डी देवी मन्दिर तक रोपवे प्रणाली के विकास हेतु आरक्षित वन भूमि 0.29 हैक्टेयर का हस्तान्तरण प्रस्ताव।

परियोजना के क्रियान्वयन के समय ईधन हेतु वृक्षों का अवैध पातन न किये जाने का प्रमाण पत्र

प्रमाणित किया जाता है कि परियोजना के क्रियान्वयन के समय परियोजनान्तर्गत कार्यरत कर्मियों/मजदूरों द्वारा ईधन हेतु निकटवर्ती वनों/वृक्षों का अवैध पातन नहीं किया जायेगा। परियोजना के क्रियान्वयन के समय ठेकेदार द्वारा परियोजनान्तर्गत कार्यरत कर्मियों/मजदूरों को ईंधन उपलब्ध कराया जायेगा ताकि वृक्षों का अवैध पातन को रोका जा सके।

प्रभागीय वनाधिकारी

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Chapter 11

Summary and Conclusion

CHAPTER 11 : CONCLUSION

11.1 CONCLUSION

Haridwar city is a main pilgrimage place of Uttarakhand. Every year lakhs of pilgrims visit here and important events like Maha Kumbh and Ardh Kumbh are organized in this city and every year lakhs of devotees also visit Haridwar city in Kanwar fair. Most of the pilgrims coming to Haridwar also visit Chandi Devi and Mansa Devi after taking Har ki Pauri bath. At present, ropeway facility is available on Najibabad Road where the devotees reach after traveling a long distance by road to visit Chandi Devi Temple. There is also not enough space available for parking of vehicles at that place, due to which pilgrims have to face a lot of difficulties in going to visit Chandi Devi temple and it also takes a lot of time. Due to these difficulties many pilgrims are unable to visit Chandi Devi Temple.

In the meeting held on 08.07.2019 under the chairmanship of Hon'ble Chief Minister, Uttarakhand Government, it is decided that provide the ropeway facility from Har ki Pauri to Chandi Devi.

The Environmental Impact of the proposed ropeway is assessed in this report (both positive and negative) due to Project location, possible accident, Construction and Operation. For the negative impact, various mitigation measures have been proposed. Environment health and safety management plan has been presented and cost of the same has been worked out. The major negative impacts include:

- Impact on Ecology and Biodiversity.
- Impacted tree- 38 Nos.
- Diversion of 0.29 ha forest land
- The fact that the alignment is passing through the Buffer zone of Rajaji Tiger Reserve.
- There will be temporary negative impact during construction on Air quality, Noise levels, Traffic and on Soil quality.

This project will facilitate the surrounding environment and pilgrism with notable features of:

- Since the ropeway is proposed from Har Ki Pauri to Chandi Devi Mandir, it will connect more devotees, pilgrims and tourists to reach at Maa Chandi Devi temple directly from Har ki Pauri.
- Due to Har Ki Pauri to Chandi Devi ropeway project, there will be increase in tourism in state of Uttarakhand due to better connectivity.
- The ropeway project will lead to reduction of vehicular traffic and traffic blockage. Which may reduce use of fossil fuel will lead to reduction in pollution load in the environment.
- The project will help in enhancing the socio-economic condition of the shop keepers and other stakeholders.
- The ropeway is an eco friendly means of transportation.
- The ropeway will generate direct and indirect employment and livelihood opportunities.
- Enhanced solid waste management facility,

- Drinking water arrangement for pilgrims
- Enhanced Public toilets facility
- Scientific and modern wastewater management,
- This will reduce the time and effort of the people in reaching Maa Chandi Devi Temple.
- Employment Opportunity: During construction and Operation as approximately 100 workers during peak construction and 15 staff will be engaged for the operation.

Cost of all the mitigation measures have been worked out which comes out to **Rs. 152.01 Lakh.** The proposed project has certain temporary negative impact which can be mitigated through deploying proposed measures during construction. Permanent negative impact like loss of trees has been compensated by various mitigation measures like compensatory afforestation.

Chapter 12

Disclosure of Consultant

CHAPTER 12 DISCLOSURE OF CONSULTANT

12.1 EIA CONSULTANT

Name of Project	EC/FAE	Name of Expert	Name of Firm
EIA Studies for Ropeway facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City	Environmental Co-ordinator (EC)	Mr. Deepak Kumar Jain	RITES Ltd. Gurgaon
	AP	Dr. Manoj Kumar Mishra	
	SHW	Mr. S. Harinag	
	WP	Ms. Amita Jain	
	NV	Dr. Manoj Kumar Mishra	
	HG	Mr. S Kunnar	
	GEO	Mr. S Kunnar	
	SE	Dr. Sanjay Pradhan	
	LU	Mr. Sanjay Raut	
	RH	Dr. Ravindra Kode	
	AQ	Dr. Manoj Kumar Mishra	
	SC	Mr. Manoj Kumar Dwivedi	
	EB	Mr. Manish Indurkar	

12.2 OTHER ORGANIZATION/LABORATORIES ENGAGED

Monitoring: Monitoring was carried out by the NABL accredited Lab – Arihant Analytical Laboratory Pvt. Ltd. *Certificate No. (TC-5826*)

Declaration by Experts contributing to the "EIA Studies for Ropeway facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City"

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA.

EIA coordinator:

Name: Deepak Kumar Jain
Signature and Date:

Period of involvement:
Contact information: UT Division, RITES Ltd
Plot No: 1, Sector - 29, Gurgaon - 122001
Ph: +91 124 2818743
E-mail: ue.rites@gmail.com,

Functional Area Experts:

S. No	Functional Area	Name of the Expert	Expert Task
1.	AP	Dr. Manoj Kumar Mishra	Selection of Monitoring Stations, Source Identification, Control Measures etc.
2.	AQ	Dr. Manoj Kumar Mishra	Identification of Pollution Sources, Emission Estimation, Impact and Mitigation Measures
3.	NV	Dr. Manoj Kumar Mishra	Selection of Monitoring Stations, Source Identification, Impact Assessment and Mitigation Measures
4.	RH	Dr. Ravindra Kode	Risk Assessment and Mitigation / Control Measures and Disaster Management Plan
5.	SHW	Mr. S. Harinag	Solid and Hazardous Waste Estimation and Management For Ropeway.
6.	WP	Ms. Amita Jain	Identification of water sources, Impact Assessment and Mitigation Measures etc. associated in preparation of EIA Report
7.	SE	Dr. Sanjay Pradhan	Socio-Economic Profile of the study area
8.	LU	Mr. Sanjay Raut	Land Use Classification, Analysis of Water data, Impact Assessment and Mitigation Measures and assistance to PC
9.	EB	Mr. Manish Indurkar	Identification of Flora and Fauna in the project area, List of Trees to be removed, Compensatory Plantation, Identification of Species for Plantation
10.	SC	Mr. Manoj Kumar Dwivedi	Identification of Sampling Locations and analysis of Soil Test Results, Impact and mitigation measures.
11.	GEO	Mr. S Kunar	Geological study, impact and mitigation
12.	HG	Mr. S Kunar	Hydrogeological study, impact and mitigation

Declaration by the Head of the accredited consultant organization/ authorized person

I, Sujata Savant, hereby, confirm that the above mentioned experts prepared the EIA Studies for Ropeway facility from Har-Ki-Pauri to Chandi Devi Temple in Haridwar City. I also confirm that the consultant organization shall be fully accountable for any mis-leading information mentioned in this statement.

Name:	Sujata Savant
Designation:	General Manager
Name of the EIA consultant organization:	RITES Ltd

RITES Ltd has been accredited as EIA consultant Organisation in the Sector "Ropeways" as Category "A" as per the 112th minutes of Accreditation Committee Meeting for Initial Assessment dated 8th October, 2013 and accreditation renewed subsequently through SA1 120th MOM dated 27th May 2015, RA1 125th MOM dated 17th March 2017, SA2 242th MOM dated 8th February, 2019 and RA-251th AC meeting Dated Jan 08, 2021.

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