

# **ENVIRONMENTAL IMPACT ASSESSMENT**

**PROJECT REPORT ON  
CONSTRUCTION OF RAILWAY LINE  
IN MOUNTAINEOUS REGION**

# Agenda

- INTRODUCTION
- PROJECT DESCRIPTION
- DESCRIPTION OF ENVIRONMENT
- ENVIRONMENTAL IMPACTS
- MITIGATION MEASURES
- LAWS AND LEGISLATION
- ENVIRONMENT MANAGEMENT PLAN
- SUMMARY AND CONCLUSION

# INTRODUCTION

Environmental Impact Assessment (EIA) is a process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals. It helps the project proponent, impact assessment authorities, regulatory agencies, and other stakeholders understand the project, environmental impacts, mitigation measures, and establish emission requirements and other measures early in the project cycle. This report describes the baseline environmental scenario, potential environmental impacts, and proposed measures for effective environment management during the project cycle.

# BACKGROUND

- Northeast Frontier Railway (NFR) has begun construction of the North Bengal–Sikkim Railway Link, a 52.7km stretch of track that will connect Sivok, North Bengal, to Rangpo, Sikkim.
- Once operational, it will be for the first time that Sikkim will be connected to the main Indian rail network, and it is expected to boost local tourism and the region's economy.
- The line will be broad gauge (5ft 6in) and has a proposed 100km/hr speed limit.
- The rail link will pass through the steep terrain of the Kanchenjunga mountain range foothills and the Tiesta river valley; in addition 85% of the route will pass through tunnels.

# PROJECT AREA

- The proposed project railway line passes through the foothills of Kanchenjunga ranges of Himalayas running close to river Teesta.
- It passes approximately 100 to 600 m away from the National Highway NH-31A connecting from Rangpo to Gangtok via Kalijhora – Durbin Dara, through the reserve forest areas in the Darjeeling District of West Bengal and East Sikkim District of Sikkim.
- The topography is hilly and falls in seismic zone – IV.
- The locality receives heavy to very heavy rainfall; the average rainfall is in the order of 2500 mm per year and monsoon period extend from May to October.

# ENVIRONMENTAL IMPACT ASSESSMENT

- The purpose of the assessment is to ensure that decision makers consider the environmental impacts while deciding whether or not to proceed with a project.
- EIA thus ensures that the potential problems are foreseen and addressed at an early stage in project planning and design.
- Such environmental assessment provides a rational approach to sustainable development.
- It also enables us in carrying out environmental cost-benefit analysis of projects at an initial stage.

# ENVIRONMENTAL IMPACTS

- Creating new paths to access the tunnel face, destroy the landscape and existing environmental conditions.
- Construction of rail access is an inevitable intervention in the environment that causes significant impacts by removal of trees, earth excavation and embankment.
- One of the most significant undesirable impacts on the environment is disposing of excavated materials during the tunnel excavation.
- Disposal of waste materials in the construction of the tunnel is a type of effects that can create detrimental effects on environment such as water pollution, soil contamination and pollution of natural ecosystems.

# NOISE AND VIBRATION

- Noise levels can arise during the phase of construction causing environmental hazards, because a high noise level is often generated.
- The major sources of noise in the tunnel during construction include:
  - Noise from blasting for excavation tunnels
  - Noise from drilling machines, instruments, loading, etc.
  - Noise from traffic and transportation around the tunnel
  - Noise from loading and haulage
  - Noise from fans for tunnel ventilation

# SURFACE WATER QUALITY

- The surface water quality gets affected during the life cycle of an infrastructure such as a tunnel.
- Detailed investigation of surface and subsurface hydrology should take place before and during construction.
- The least damaging route and structural elements should be chosen to get minimum interruption and alteration of hydrology patterns and processes.
- Pollutants on construction sites can also soak into the groundwater, a source of human drinking water.
- Once contaminated, groundwater is much more difficult to treat than surface water.

# SURFACE WATER QUALITY

- Water quality is of prime concern not only for drinking and irrigation purposes but also for maintenance of ecology, aquatic life, other consumption, aesthetic uses and sustainability.
- Surface water run-off also carries other pollutants from the site, such as diesel and oil, toxic chemicals, and building materials like cement.
- When these substances get into waterways they poison water life and any animal that drinks from them.
- The baseline quality of the river water will be assessed by measuring the following parameters:
- temp, pH, conductivity, turbidity, total dissolved solids, total suspended solids, hardness, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, chloride, sulphates.

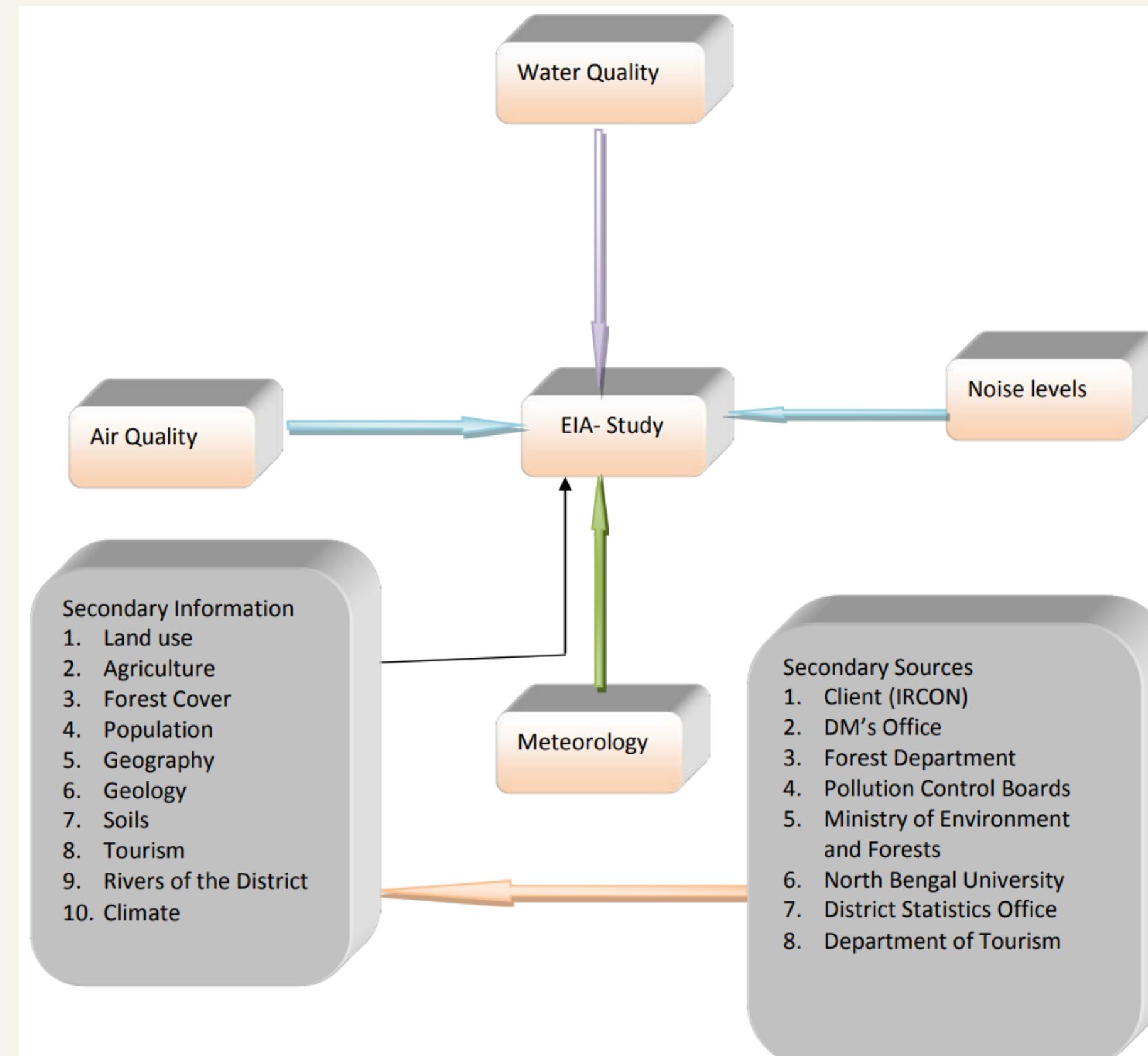
# AIR QUALITY

- Construction activities that contribute to air pollution include: land clearing, operation of diesel engines, demolition, burning, and working with toxic materials.
- All construction sites generate high levels of dust (typically from concrete, cement, wood, stone, silica) and this can carry for large distances over a long period of time.
- Major air pollutants emitted are the suspended particulate matter, carbon dioxide, oxides of nitrogen, sulphur dioxide and respirable particulate matter.
- The objective of air quality monitoring is to assess the air quality levels before, during and after construction and conclude how the project affected the local air quality and suggest and implement the mitigation measures to curtail the air pollution levels.

# MUCK GENERATION

- Muck is a type of organic sediment that can accumulate in lakes and ponds, often consisting of decomposing plant material, algae, and other organic matter.
- Muck is generated in large quantities in a tunneling project
- Thus generated muck should be properly disposed not to contaminate adjacent water bodies and not to contaminate ground water.
- Precautionary measures will be suggested for proper handling of Muck

# ENVIRONMENTAL DATA COLLECTION



# **LAWS AND LEGISLATION**

# LAWS AND LEGISLATIONS

- Extensive network on environmental legislation has grown in this country since 1970. The Environmental Legislation helps to plug in gaps and protect environment while developing various projects associated with the development of the country
- There is legislation which must be considered before the execution of the project, in terms of getting clearances from the statutory bodies for the implementation of the project.
- There are also laws to be followed at the time of implementation of the project.

Further in this section, we will be explaining about the laws and legislations taken under account for this project in brief.

<b>Laws</b>	<b>Purpose of the Law</b>	<b>Legal Procedures applicable at various levels of the project.</b>
<b>Environmental Protection Act 1986</b>	<b>To protect and improve overall environment</b>	The Railway Project does not require any environmental clearance
<b>Environmental Impact Assessment Notification 14th Sep-2006 and its amendment till 2009</b>	<b>To provide environmental clearance to new development activities following environmental impact assessment</b>	No Environmental Clearance is required
<b>Air (Prevention and Control of Pollution) Act, 1981</b>	<b>To control air pollution</b>	This would be applicable at the time of the execution of the project

Laws	Purpose of the Law	Legal Procedures applicable at various levels of the project.
<b>Water Prevention and Control of Pollution) ACT 1974</b>	<b>To control water pollution by controlling discharge of pollutants as per the prescribed standards</b>	This would be applicable at the time of the execution of the project
<b>Noise Pollution (Regulation and Control Act) 1990</b>	<b>The standards for noise for day and night have been promulgated by the Ministry of Environment, Forests and Climate Change, for various land uses</b>	This would be applicable at the time of the execution of the project
<b>The Forest (Conservation) Act 1927</b> <b>The Forest (Conservation) Act. 1980</b> <b>The Forest (Conversion) Rules 1981</b>	<b>To check deforestation by restricting conversion of forested areas into non- forested areas</b>	The clearance should be obtained at the time of design stage. At present the client is working on the Forest clearance

Laws	Purpose of the Law	Legal Procedures applicable at various levels of the project.
<b>Wild Life Protection Act 1972 and Amendment in 1991</b>	<b>To protect wildlife through certain of National Parks and Sanctuaries</b>	The clearance should be obtained at the time of design stage. At present the Client is perusing the clearance.
<b>Explosive Act 1984</b>	<b>Safe transportation, storage and use of explosive</b>	The clearance should be obtained at the time of design
<b>Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules1989</b>	<b>To check vehicular air and noise pollution.</b>	This would be applicable at the time of the execution of the project

Laws	Purpose of the Law	Legal Procedures applicable at various levels of the project.
<b>The Land Acquisition Act 1894, 1989</b>	<b>Set out rule for acquisition of land by Government.</b>	The clearance should be obtained at the time of design stage
<b>Biological Diversity Act 2000</b>	<b>disclosure of species survey or collection activities to the</b>	The clearance should be obtained at the time of design
<b>Ancient Monuments and Archaeological sites &amp; Remains Act 1958</b>	<b>Conservation of Cultural and Historical remains found in India</b>	This would be applicable at the time of the execution of the project

Laws	Purpose of the Law	Legal Procedures applicable at various levels of the project.
<b>Public liability insurance Act 1991</b>	<b>Assessment of hazardous materials and accident hazards</b>	This would be applicable at the time of the design stage of the project

# **STATE SPECIFIC LAWS:**

**THERE ARE A TOTAL OF 2 STATE SPECIFIC LAWS APPLICABLE FOR THIS PROJECT:**

## **Bengal Trees (Protection and Conservation in Non-Forest Areas) Act, 2006:**

- To regulate indiscriminate felling of trees in non-forest areas;
- To provide for undertaking plantation of trees obligatory in lieu of felling of each tree; and
- To protect and conserve trees, particularly those looked upon as sacred groves or identified as belonging to an endangered species or given the status of heritage.

# **STATE SPECIFIC LAWS:**

## **West Bengal Ground Water Resources (Management, Control and Regulation) Act 2005**

- In 2005, West Bengal enacted the Ground Water Resources Act to regulate groundwater use.
- The act aims to manage and oversee the sustainable utilization of groundwater resources within the state.
- The legislation is designed to prevent the uncontrolled and unsustainable use of groundwater, ensuring its judicious and responsible utilization.

# INTERNATIONAL AGREEMENTS

- Convention on International Trade in Endangered Species (CITES)  
1973
- Montreal Protocol on Substances that deplete the Ozone Layer  
1987
- Basel Convention on Trans boundary Movement of Hazardous Wastes, 1989
- UN Framework Convention on Climate Change (UNFCCC), 1992
- Convention on Biological Diversity, 1992
- UN Convention on Desertification, 1994
- International Tropical Timber Agreement 1983, 1994
- Permissions/Approvals/Clearances

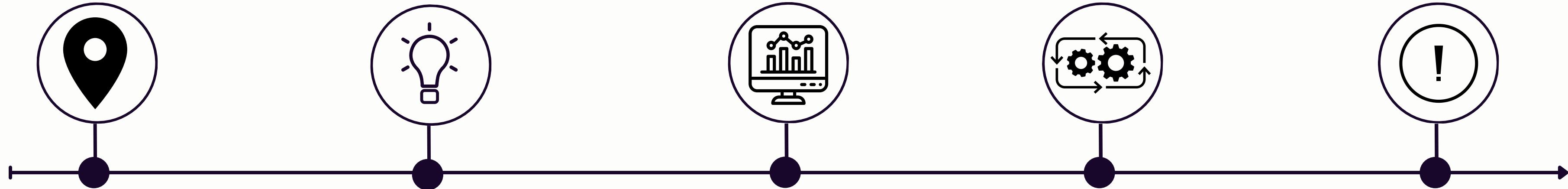
# **BASELINE ENVIRONMENTAL QUALITY**

**THE PRESENT CHAPTER MAJOR EMPHASIS IS ON THE ENVIRONMENTAL QUALITY, VARIOUS FACTORS FOR THE PROPOSED TUNNELING WORK AND BRIDGE CONSTRUCTION IN MAHANANDA WILDLIFE CONSTRUCTION AND FORESTS**

MAHANANDA WILDLIFE SANCTUARY LOCATED AT THE FOOTHILLS OF EASTERN HIMALAYAS, THE MAJORITY OF THE WEST BENGAL STATES NETWORK OF THE PROTECTED AREAS LOCATED IN A NARROW STRIP EXTENDING BETWEEN NEPAL AND BHUTAN. THESE FORESTS HARBOR A RICH DIVERSITY OF PLANT AND ANIMAL SPECIES, INCLUDING SEVERAL ENDEMIC AND THREATENED SPECIES. THE MAHANANDA WILDLIFE SANCTUARY IS LOCATED IN THE SOUTHERN PART OF THE DARJEELING DISTRICT OF THE WEST BENGAL.

THE FORESTS IN AND AROUND DARJEELING HAVE DELIGHTFUL FLORA AND FAUNA. IT IS A PLANT LOVER'S PARADISE. FOUR THOUSAND SPECIES OF FLOWERING PLANTS, THREE HUNDRED VARIETIES OF FERNS, INCLUDING TREE FERN AND COUNTLESS TYPES OF FLOWERLESS PLANTS, MOSSES, ALGAE, FUNGI, BIRCHES, AND OF COURSE, THE PRIZE ORCHIDS, WILD AND CULTIVATED. THERE ARE OAKS, CHESTNUTS, CHERRY, MAPLE, BIRCH, ALDER-ALL FINE AND LARGE TREES OF EXCELLENT GROWTH. IN THE UPPER HILLS AREAS AND THE ALPINE ZONE ARE THE MAGNOLIAS, BUCK-LANDIAS, PYRUS AND CONIFERS SUCH AS WEBB, HIMALAYAN FIRS, ENGLISH YEWS, SIKKIM SPRUCES, LARCH, WHICH IS THE ONLY DECIDUOUS CONIFER, WEEPING TSUGA BRUNONIANA AND JUNIPERS IVY IS COMMON.

# AIR QUALITY MONITORING



## Locations:

Sivok Town  
Muck Disposal Area  
Sivok Kali Mandir Area  
Kalijhora

## Parameters:

Suspended Particulate Matter (SPM)  
Respirable Particulate Matter (RPM)  
Oxides of Nitrogen (NOx)  
Sulphur Dioxide (SO<sub>2</sub>)

## Monitoring Techniques:

High Volume Sampler for air quality.  
Respirable Dust Sampler for RPM.  
Gravimetric & Calorimetric Analysis for accurate results.

## Process:

Collection using suitable media.  
Gravimetric analysis for particulates.  
Calorimetric analysis for gaseous pollutants.

## Importance:

Ensure environmental and public health safety.  
Preliminary findings to be analyzed.

# RESULTS OF AIR QUALITY MONITORING

THE RESULTS CLEARLY INDICATE THAT THE AIR QUALITY PARAMETERS ARE VERY MUCH IN THE PRESCRIBED LIMITS SUGGESTED BY THE CENTRAL POLLUTION CONTROL BOARD. THE MONITORING METHODOLOGY ADOPTED IS GIVEN IN THE TABULAR FORM GIVEN BELOW:

<b>Ambient Air Monitoring Parameter</b>		
<b>Particular</b>	<b>Testing Method to be Followed</b>	
A	SPM Suspended Particulate Matter	Respirable Dust Sampler method (IS : 5182 P 23 - 1994)
B	RSPM Respirable Particulate Matter	Fine Particulate Sampler method (IS : 5182 P 23 - 2006)
C	SO <sub>2</sub> (Sulphur Dioxide)	IS 5182 (Part – II) 2001, with Improved West & Geake Method
D	NO <sub>2</sub> (Nitrogen Dioxide)	Modified Jacobs – Hochheiser Method/ Arsenite Method

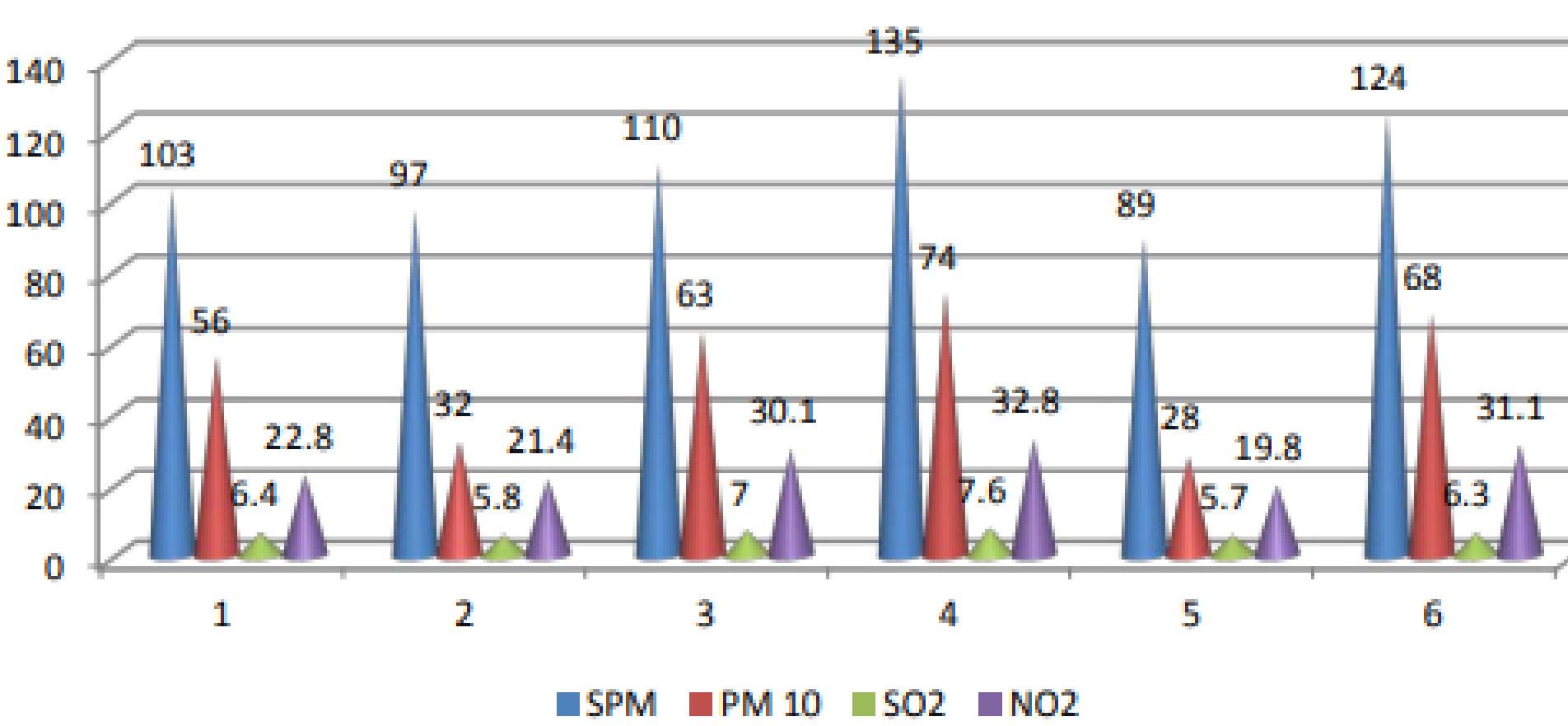


Figure 2 Air Quality Results at Sivok

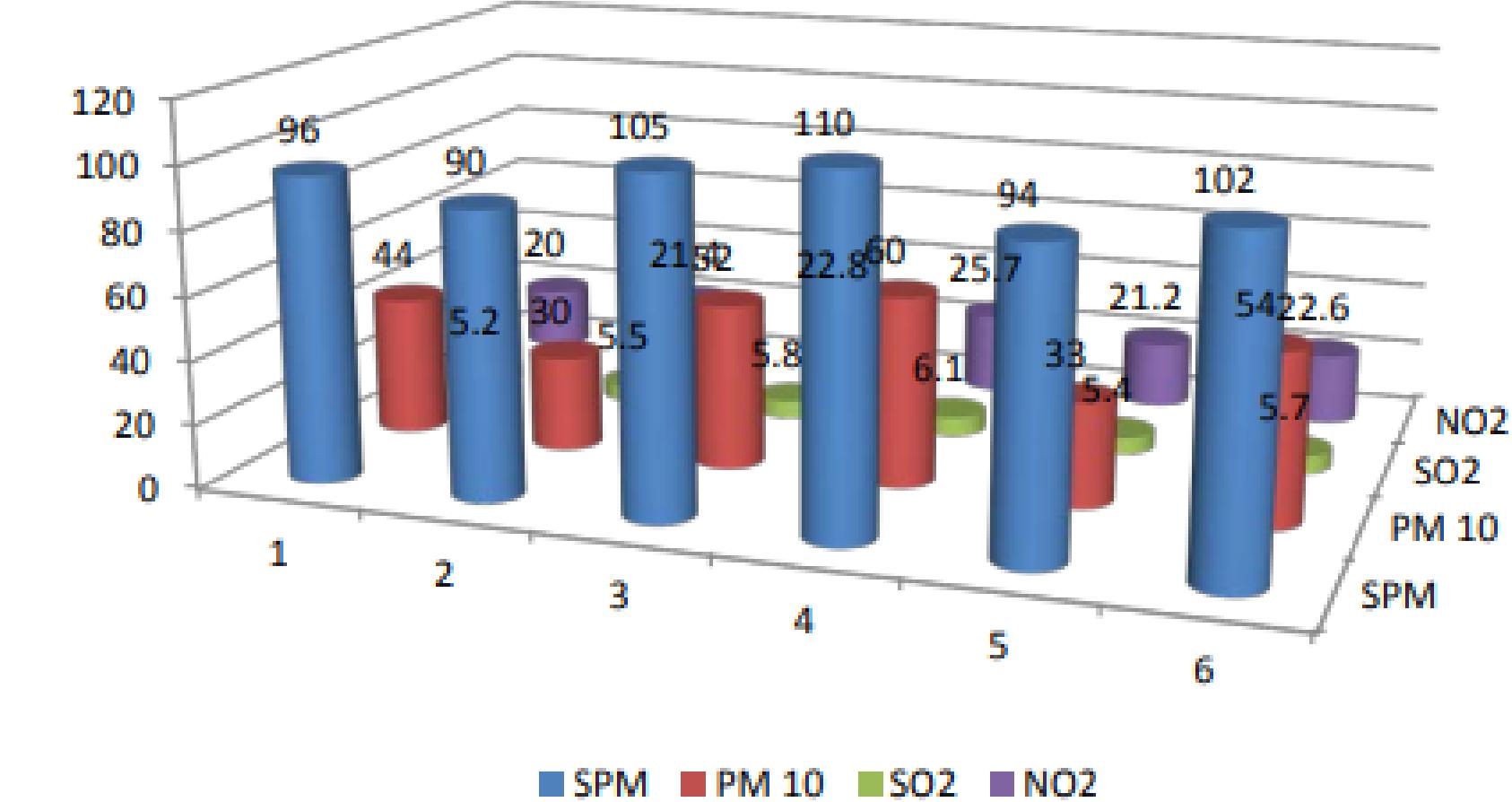


Figure 3 Air Quality Results at Muck Disposal Area

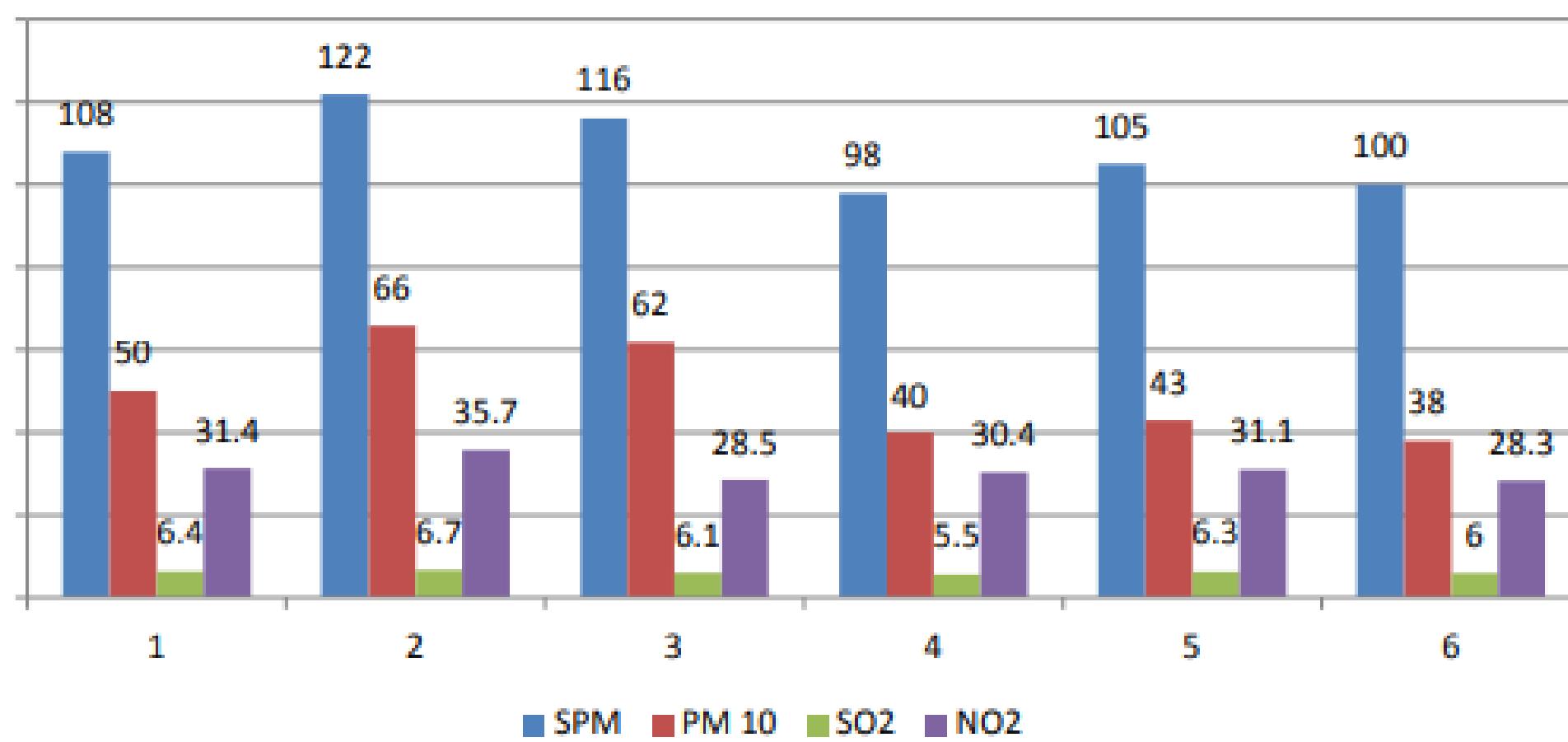


Figure 4 Air Quality data from the Kali Mandir

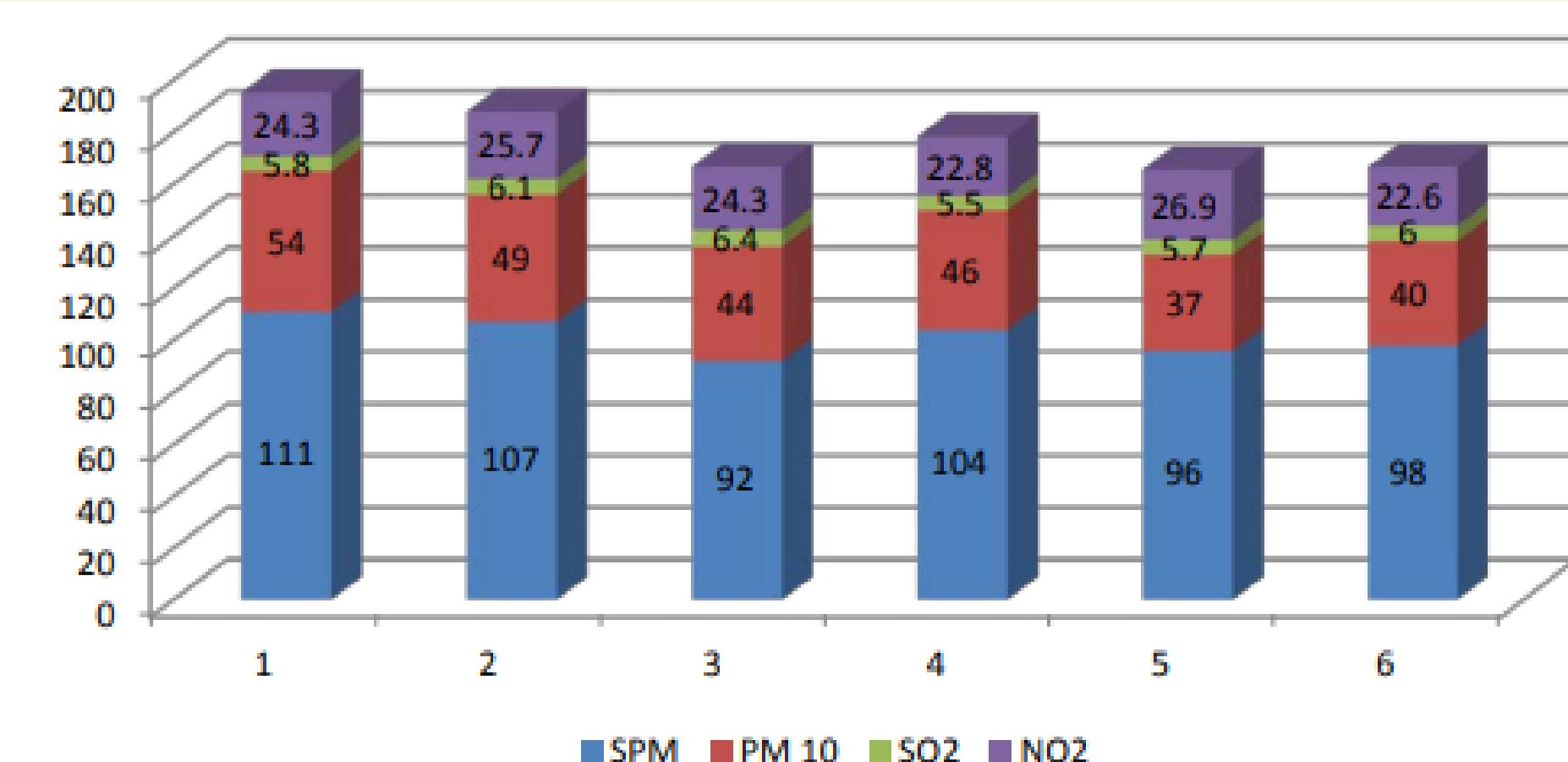
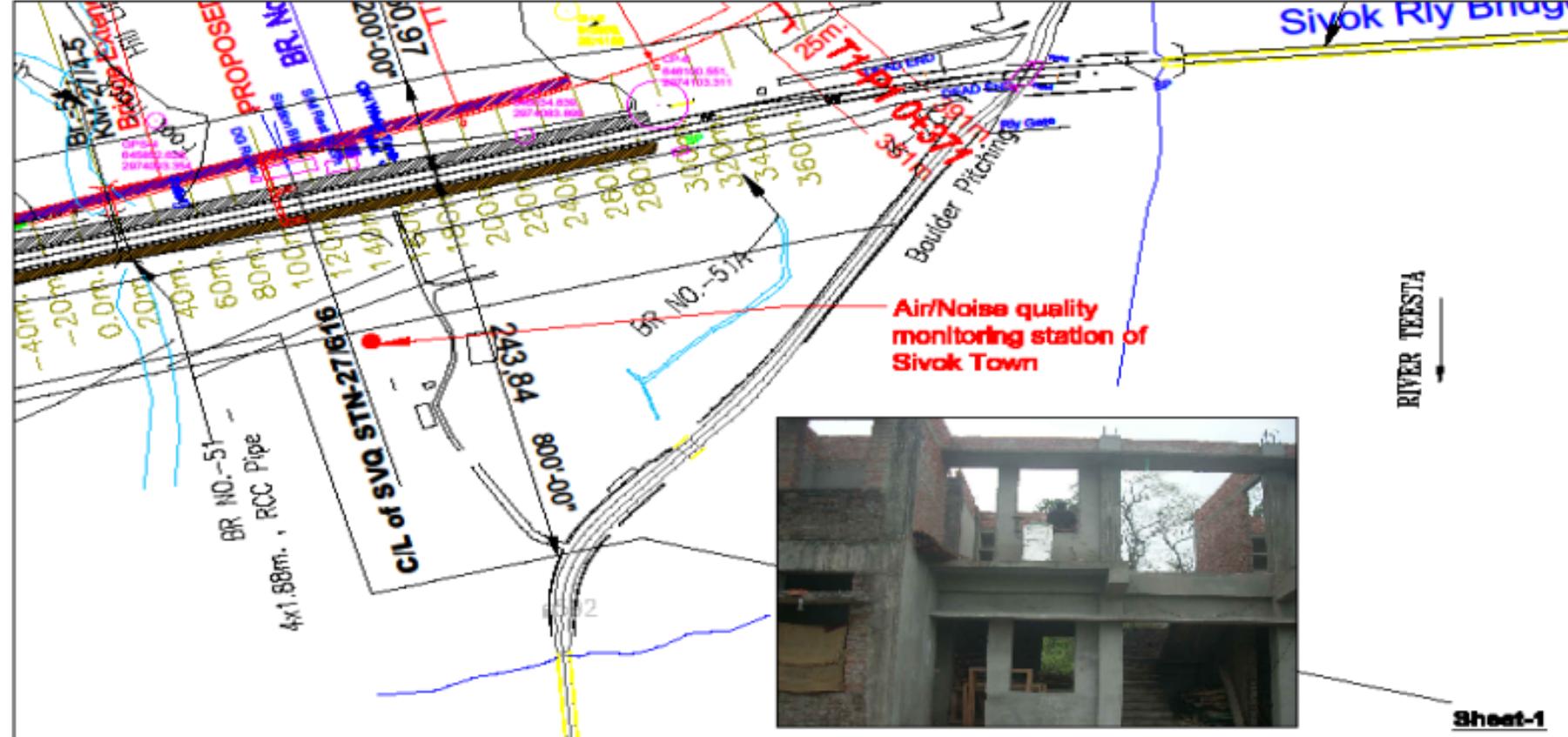
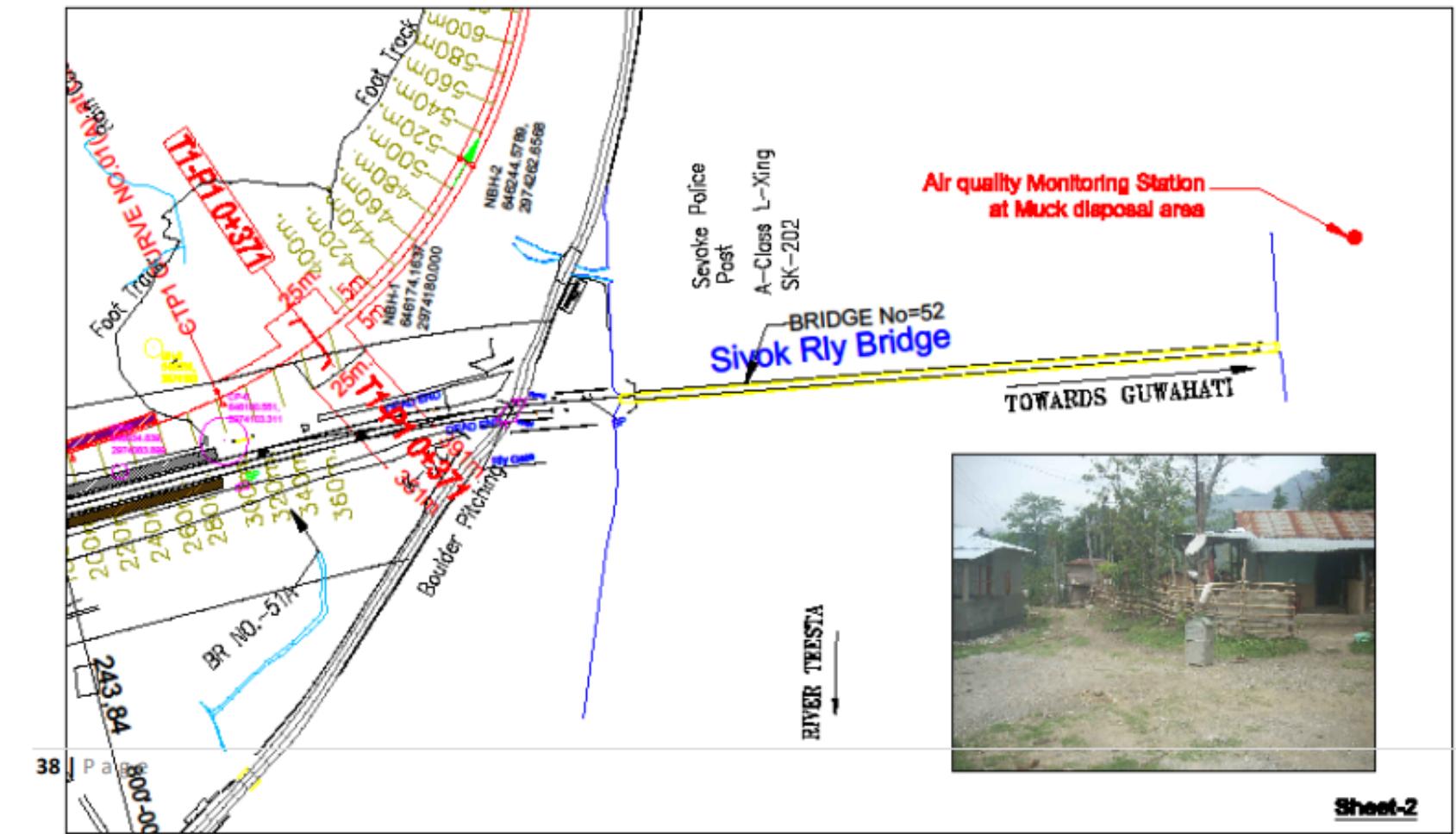


Figure 5 Air Quality data from Kali Khola

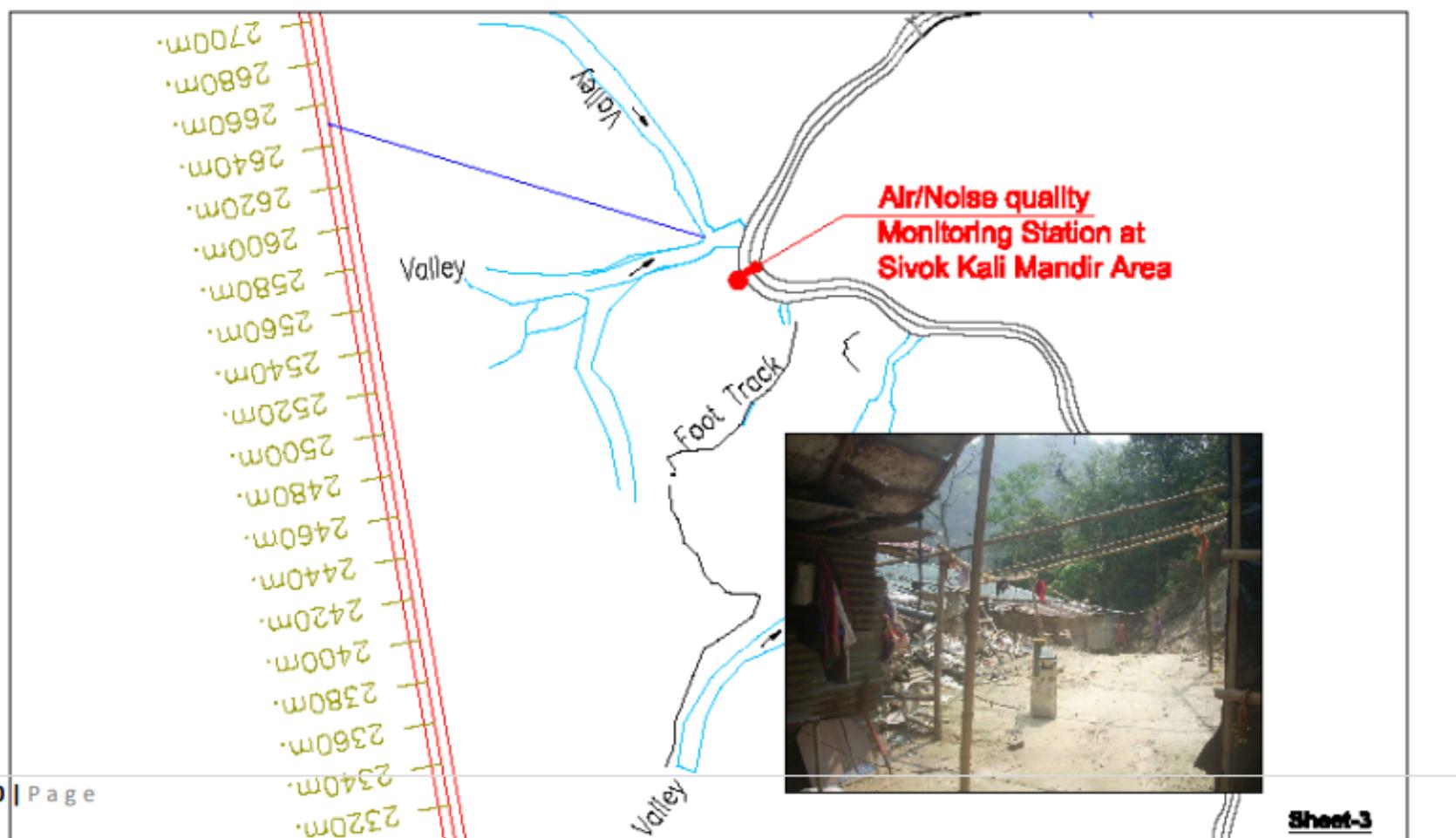
## **Environmental Monitoring Location for Tunnel T-1, T-2**



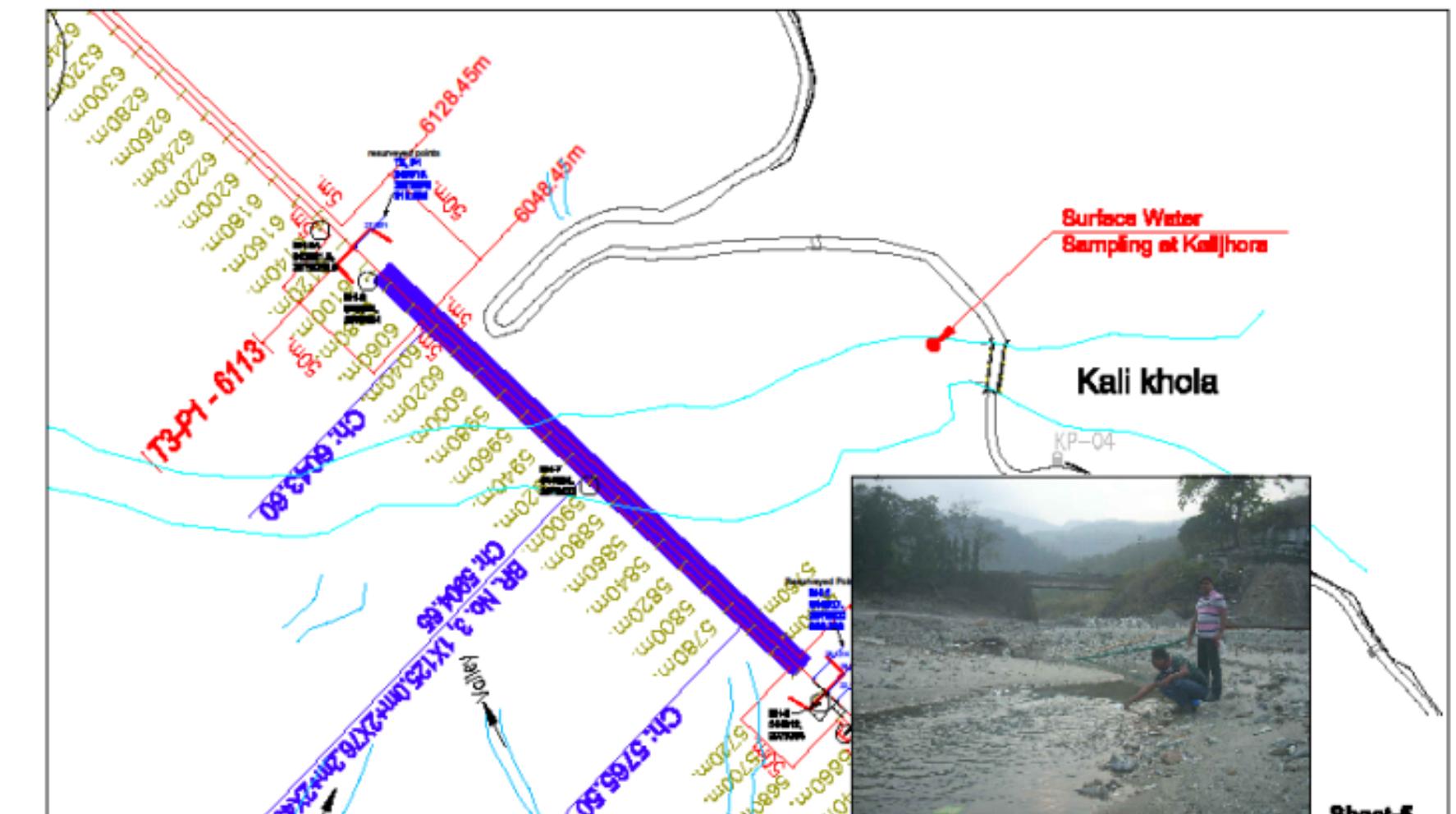
## **Environmental Monitoring Location for Tunnel T-1, T-2**



## **Environmental Monitoring Location for Tunnel T-1, T-2**



#### **Water Sampling Location for Tunnel T-1, T-2**



# NOISE LEVEL MONITORING

LOCATION	Date of monitoring 12.04.2016 (Leq in dBA)	
	Day Time	Night Time
Sivok Town	63.2	54.5
Sivok Kali Temple	60.4	53.6
NHPC, Kalijhora	63.1	48.3

■ Day Time ■ Night Time



INSTANT SOUND LEVEL METER IS USED FOR THE COLLECTION OF DATA RELATED TO NOISE AT AN INTERVAL OF ONE HOUR PER READING. NOISE LEVEL FOR 24 HOURS WAS CONDUCTED. THE DETAILS OF THE INSTRUMENT USED FOR THE SAMPLING IS MENTIONED IN THE SEPARATE ANNEXURE UNDER THE HEADING OF DETAILS OF INSTRUMENTS & APPARATUS. THE INSTRUMENT DETAILS ARE GIVEN BELOW.

Instrument	Make	Model No.	Instrument Identification	Detection limit
Integrated Sound Level Measurement Instrument Standard Accessories	HTC	SL-1352	SME/SUD/VL/DS LM25/2012 08.06.2012	Lo 30-80dB Hi 80-130dB

# **WATER QUALITY MONITORING:**

**SAMPLING LOCATIONS:**

**NANDI KHOLA**

**ANDHERI JHORA**

**KALI JHORA**

**RIVER TISTA**

**UPSTREAM AT NHPC RESERVOIR**

**SIVOK RAILWAY BRIDGE**

**ADDITIONAL SAMPLES:**

**RIVULET BETWEEN T-9 AND T-10**

**IN BETWEEN T-10 AND T-11**

**TWO SAMPLES FROM TIESTA RIVER**

**FOR MUCK DISPOSAL**

**PARAMETERS ANALYZED:**

**PHYSICAL**

**CHEMICAL**

**BIOLOGICAL**

**ANALYSIS:**

**PHYSICAL, CHEMICAL, AND  
BIOLOGICAL PARAMETERS**

**EXAMINED FOR ALL**

**SAMPLES.**

# WATER QUALITY ANALYSIS

Table 4.7 Water Quality Analysis

Sl. No.	Parameters	Specification, Standard Methods	Nandi Khola	River Teesta	River Teesta at Kalijhora	Andheri Jhora.	Kalijhora
1	Colour, Hazen Units	APHA 22 <sup>nd</sup> Edition, 2120 B.	< 5	< 5	< 5	< 5	< 5
2	Turbidity, NTU, Max	APHA 22 <sup>nd</sup> Edition, 2130 B.	< 1	< 1	< 1	< 1	< 1
3	pH (at 25°C)	APHA 22 <sup>nd</sup> Edition, 4500-H B	7.00	6.96	6.98	8.02	9.95
4	Conductivity (μmho/cm )	APHA 22 <sup>nd</sup> Edition, 2510-B	185.4	130.8	179.1	160.5	151.8
5	Total Hardness (as CaCO <sub>3</sub> )mg/l	APHA 22 <sup>nd</sup> Edition, 2340 C	116.6	64.3	87.5	60.3	67.4
6	Iron (as Fe), mg/l	APHA 22 <sup>nd</sup> Edition, 3500 Fe B	0.13	0.27	0.43	0.21	0.10
7	Chloride (as Cl), mg/l	APHA 22 <sup>nd</sup> Edition, 4500 Cl-B	2.71	< 2.0	2.46	3.2	2.22
8	Residual free chlorine, mg/l	APHA 22 <sup>nd</sup> Edition, 4500-Cl-B	< 0.1	< 0.1	< 1	< 1	< 1
9	Fluoride, (as F), mg/l	APHA 22 <sup>nd</sup> Edition, 4500 F- B	<0.5	<0.5	<0.5	<0.5	<0.5
10	Total Dissolved Solid , mg/l	APHA 22 <sup>nd</sup> Edition, 2540 C	168.0	119.5	162	145.0	138.0
11	Calcium (as Ca) ,mg/l	APHA 22 <sup>nd</sup> Edition, 3500 Ca B	41.5	21.8	29.8	18.1	19.4
12	Magnesium (as Mg) , mg/l	APHA 22 <sup>nd</sup> Edition, 3500-Mg-B	3.12	2.4	3.14	3.62	4.58
13	Sulphates (as SO <sub>4</sub> ) ,mg/l	APHA 22 <sup>nd</sup> Edition, 4500-SO <sub>4</sub> - E	11.1	15.9	13.7	12.2	10.8
14	Nitrate (as NO <sub>3</sub> ) , mg/l	APHA 22 <sup>nd</sup> Edition, 4500 NO <sub>3</sub> E	1.64	2.45	2.67	1.84	1.45

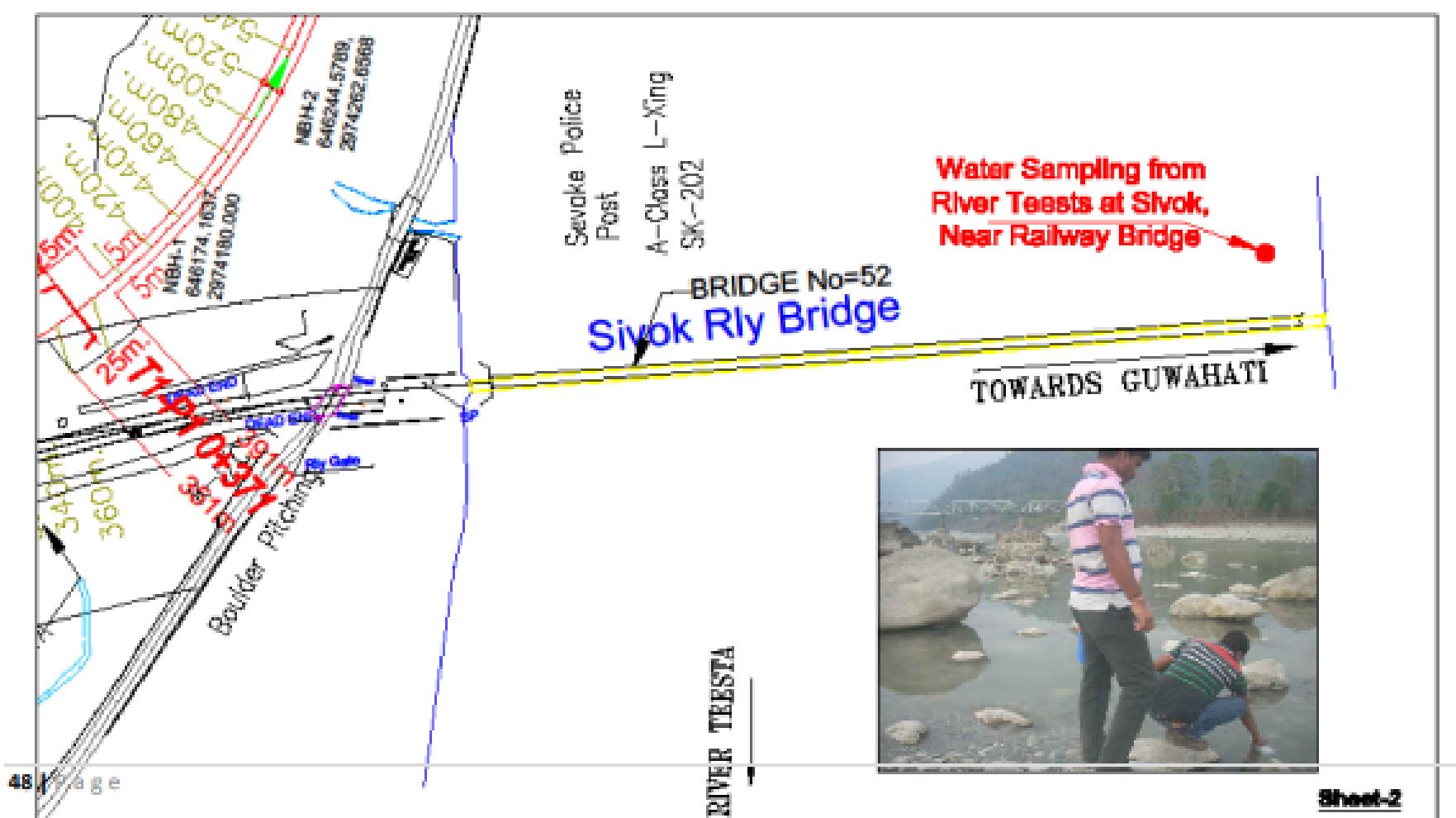
Table 4.7 Water Quality Analysis

Sl. No.	Parameters	Specification, Standard Methods	Nandi Khola	River Teesta	River Teesta at Kalijhora	Andheri Jhora.	Kalijhora
15	Alkalinity (as CaCO <sub>3</sub> ), mg/l	APHA 22 <sup>nd</sup> Edition, 2320 B	116.4	52.7	81.6	64.7	67.7
16	Phenolic Compounds mg/l,	APHA 22 <sup>nd</sup> Edition, 5530-henols-D	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
17	Arsenic (as As) mg/l,	APHA 22 <sup>nd</sup> Edition, 3500As-B	<0.01	<0.01	<0.01	<0.01	<0.01
18	Sodium(as Na) mg/l,	APHA 22 <sup>nd</sup> Edition, 3500 Na-B	32.6	9.05	20.5	14.5	15.1
19	Potassium(as K) mg/l,	APHA 22 <sup>nd</sup> Edition, 3500 K-B	2.67	0.53	4.11	2.82	1.96
20	Chromium as Cr +6 mg/l,	APHA 22 <sup>nd</sup> Edition, 3500 Cr-B	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
21	Total Suspended Solids (mg/l)	APHA 22 <sup>nd</sup> Edition, 2540D	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
22	Biological Oxygen Demand 3 days at 27°C (mg/l)	IS:3025,Part-44,2003	2.8	2.3	2.2	2.9	2.3
23	Chemical Oxygen Demand (mg/l)	APHA 22 <sup>nd</sup> Edition, 5220B	19.7	9.8	8.4	10.3	9.8
24	Dissolved Oxygen	APHA 22 <sup>nd</sup> Edition-4500-O-C	6.2	7.6	8.0	5.8	7.8
25	Total Kjeldahl Nitrogen as TKN (mg/l)	APHA 22 <sup>nd</sup> Edition, 4500-Norg-B	2.6	<1.0	< 1	1.4	<1.0
26	Phosphate as PO <sub>4</sub> (mg/l )	APHA 22 <sup>nd</sup> Edition, 4500-P-D	< 0.15	< 0.15	< 0.15	< 0.15	< 0.15
27	Manganese as Mn (mg/l )	APHA 22 <sup>nd</sup> Edition, 3500, Mn-D	<0.1	<0.1	<0.1	<0.1	<0.1
28	Silica as SiO <sub>2</sub> (mg/l)	APHA 22 <sup>nd</sup> Edition, 4500, -----	1.14	1.83	1.04	1.16	<1

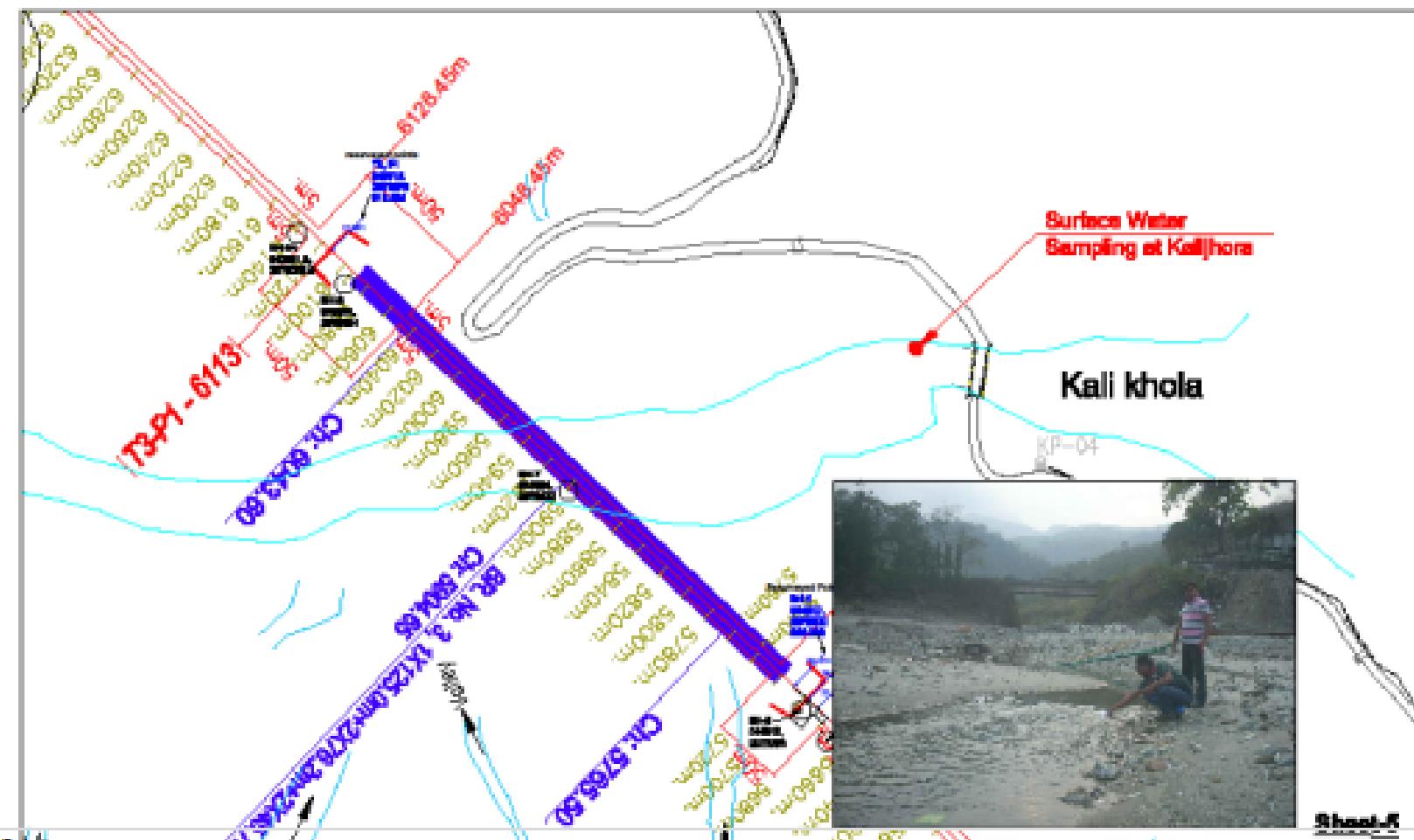
Table 4.7 Water Quality Analysis

Sl. No.	Parameters	Specification, Standard Methods	Nandi Khola	River Teesta	River Teesta at Kalijhora	Andheri Jhora.	Kalijhora
29	Zinc as Zn	APHA 22 <sup>nd</sup> Edition, 3500-Zn-B	<0.25	<0.25	<0.25	<0.25	<0.25
30	Aluminum as Al (mg/l)	APHA 22 <sup>nd</sup> Edition, 3500-Al-B	<0.03	<0.03	<0.03	<0.03	<0.03
31	Boron as B (mg/l)	APHA 22 <sup>nd</sup> Edition, 4500-B-C	<0.5	<0.5	<0.5	<0.5	<0.5
32	Oil & Grease (mg/l)	APHA 22 <sup>nd</sup> Edition, 5520-B	<2	<2	<2	<2	<2
33	Copper as Cu (mg/l)	APHA 22 <sup>nd</sup> Edition, 3500-Cu-B	<0.05	<0.05	<0.05	<0.05	<0.05
34	Total Coliform Count, MPN/100ml	IS: 1622-1981	345	79	70	278	63

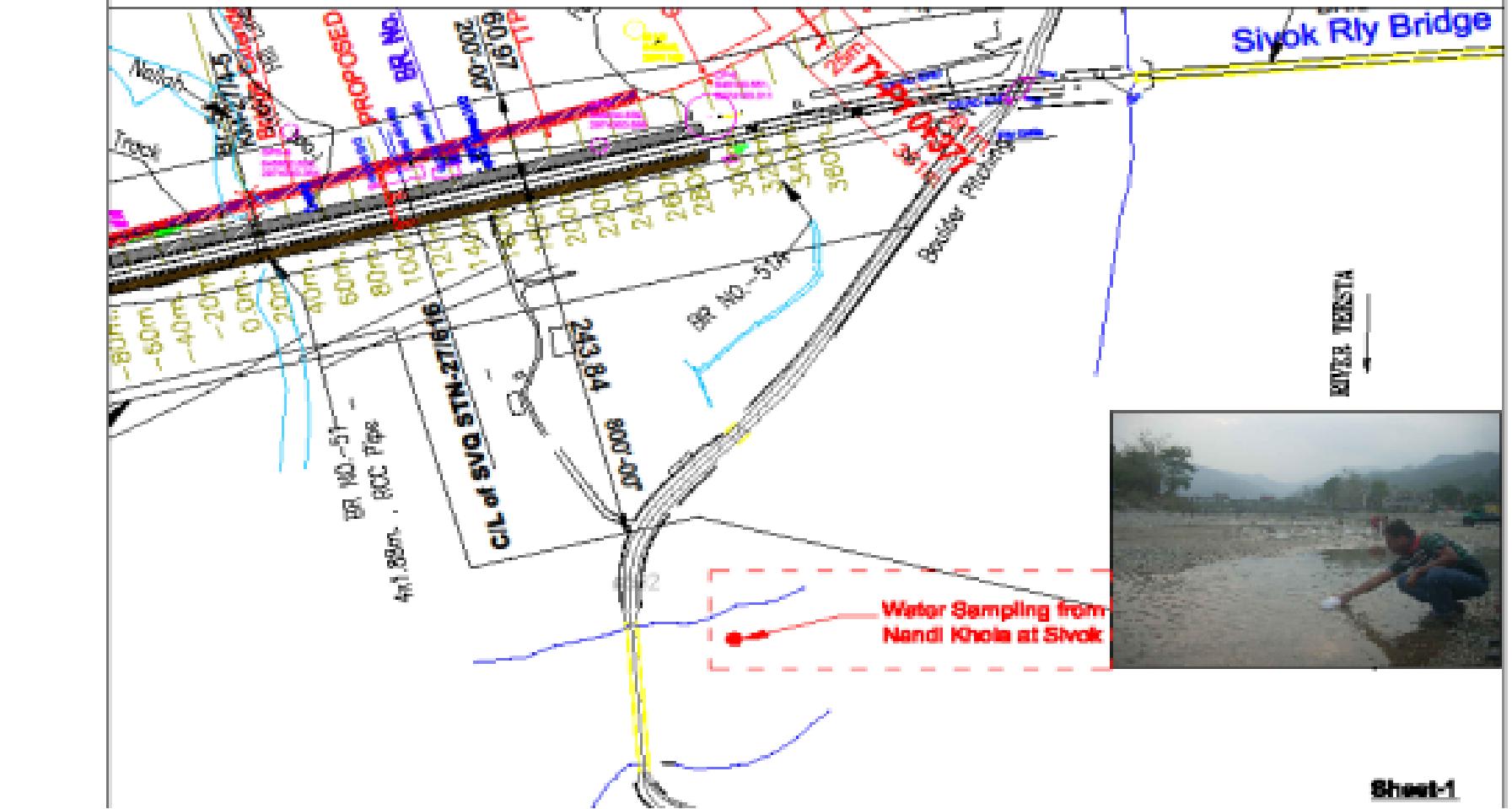
### Water Sampling Location for Tunnel T-1, T-2



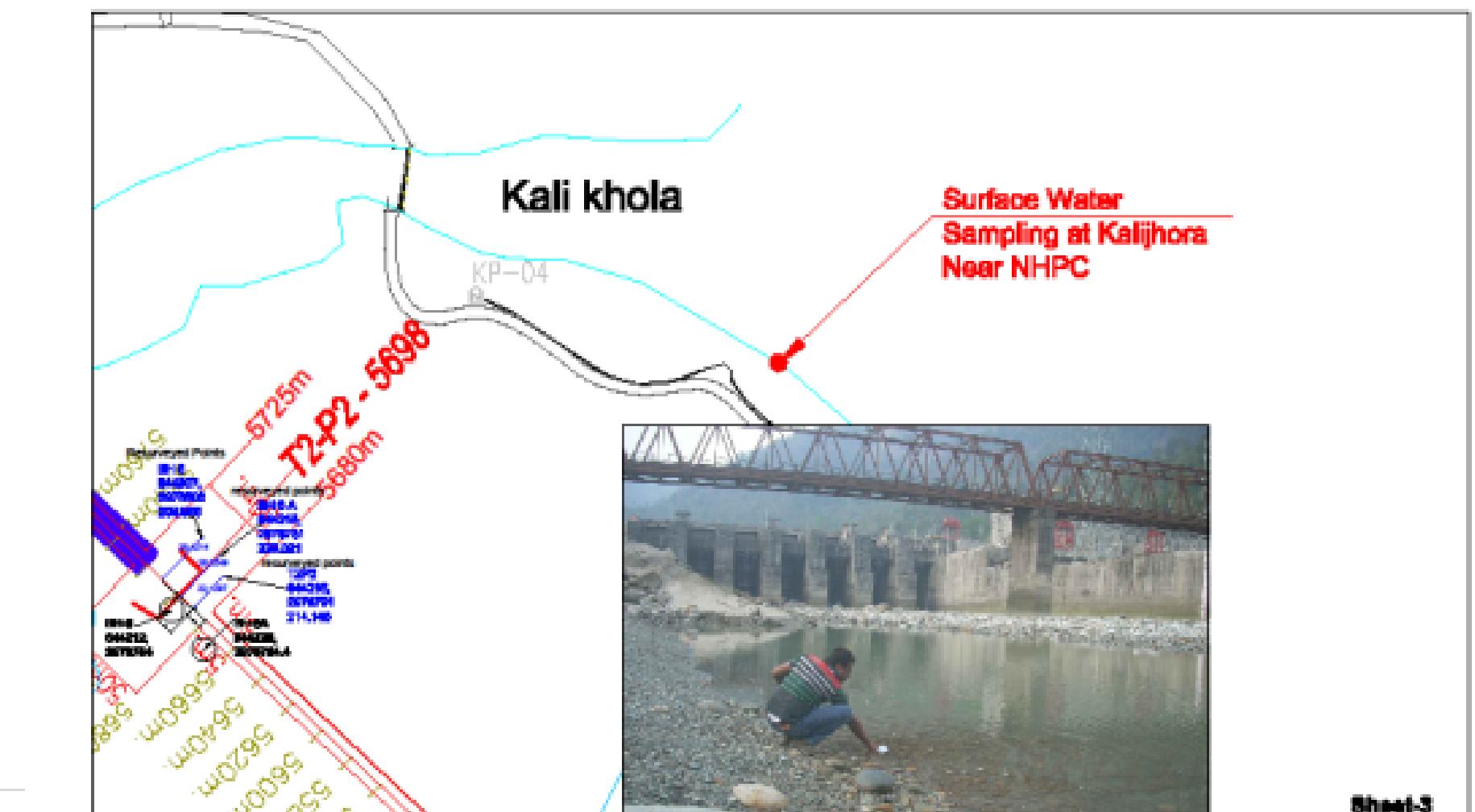
### Water Sampling Location for Tunnel T-1, T-2



### Water Sampling Location for Tunnel T-1, T-2



### Environmental Monitoring Location for Tunnel T-1, T-2



**Distance between Tunnel alignment and Environmental Monitoring/Water sampling Locations of T-1 and T-2**

**Surface Water Sampling:-**

<b>Location</b>	<b>Distance From Tunnel alignment</b>
Nandi Khola at Sivok	350 m
River Teesta at Sivok, Near Railway Bridge	500m
River Teesta at Kalijhora, Near NHPC	290 m
Andheri Jhora	225 m
Kalijhora	210 m

**Air Quality Monitoring station Locations:-**

Sivok Town	140 m
Muck Disposal Area	550 m
Sivok Kali Mandir Area	180 m
Kalijhora, NHPC	280 m

**Noise Level Data Monitoring Stations:-**

Sivok Town	140 m
Sivok Kali Mandir Area	180 m
Kalijhora, NHPC	280 m

# GEOLOGY

THE ROCKS OF DARJEELING DISTRICT WERE SUB-DIVIDED INTO FIVE GROUPS, VIZ, GNEISS, THE DALING SERIES GONDWANA AND THE TERTIARY SYSTEM  
FOUR ROCK FORMATIONS PRESENT: RECENT TO SUB-RECENT AND PLEISTOCENE, MIOCENE (SHIVALIK), PERMIAN (DALING SERIES, AND DARJEELING GNEISS)  
THE SHIVALIK ROCK FORMATIONS COMPRISING OF MICACEOUS AND ARKOSIC SAND STONE, BLUISH AND GREYISH SILTSTONE, CONGLOMERATION AND PEBBLE BEDS ARE PREVALENT IN THE PROJECT AREA.

# MINERALS

THE METAMORPHIC ROCKS OF DARJEELING AND DALING SERIES CONTAIN DEPOSITS OF COPPER, NICKEL, IRON AND PRECIOUS STONES. LYING SOUTH OF THE METAMORPHIC OCCUR THE GONDWANA BELT PASSING THROUGH TINDHARIA.

# SOILS

THE SANCTUARY'S SOIL DIVERSITY IS EVIDENT, WITH UPLAND SOIL BEING RED AND GRITTY, AND PLAINS SOIL DARK AND FERTILE. RED AND YELLOW SOILS, ORIGINATING FROM GNEISSES AND SCHISTS, DOMINATE HIGHER SLOPES, DERIVED THROUGH ROCK WEATHERING. THE SANDY, POORLY DEVELOPED SOILS VARY FROM COARSE AND PALE YELLOW IN SAND ROCK AREAS TO FINE AND RED IN SANDSTONE AREAS. NOTABLY, THESE SOILS FOSTER THE GREGARIOUS GROWTH OF SAL, SHAPING THE SANCTUARY'S BIODIVERSITY.

Major Soils in the District	Column1
Soils	Area ('000 ha)-Percentage
Medium deep to very deep fine loamy soils (hill-brown forest soils)	110.48 (35%)
Sandy loam soils (medium lands to foot hills)	109.31 (34.7%)
Shallow to medium deep loamy soils (Plains)	30 (30%)

# PEOPLE OF DARJEELING DISTRICT

THE ORIGINAL INHABITANTS OF DARJEELING AND SIKKIM, THE LEPCHAS, ARE NOW A MINORITY IN DARJEELING. NEPALI GURKHAS, FROM DIVERSE CASTES LIKE GURUNG, MANGAR, LIMBU, TAMANG, NEWAR, RAI, SHERPA, AND THAMI, CONSTITUTE THE MAJORITY. THE TIBETAN COMMUNITY, FORMED BY REFUGEES AFTER CHINA CAPTURED TIBET IN 1950, IS A RECENT ADDITION. DARJEELING'S POPULATION ALSO INCLUDES BENGALIS, BIHARIS, MARWARIS, AND OTHERS FROM THE PLAINS OF INDIA

POPULATION PRESSURES HAVE RISEN IN DARJEELING, NOTABLY IN THE SILIGURI URBAN AGGLOMERATION. THIS AREA, CLOSEST TO MAHANANDA, HAS EXPERIENCED SIGNIFICANT GROWTH DUE TO MIGRATION FROM NORTHEASTERN INDIAN STATES AND NEIGHBORING COUNTRIES. DESPITE EFFORTS TO CURB ILLEGAL TIMBER HARVESTING WITH PATROLS AND ELECTRIC FENCES, THE PRACTICE PERSISTS. THERE ARE 11 VILLAGES WITHIN AND AROUND THE PROTECTED AREA, WITH THE LOCAL POPULATION RELYING ON AGRICULTURE, TEA PLANTATIONS, AND TIMBER CUTTING.

Darjeeling District		
Total Area	3,149 Sq. KM	
Population Statistics	2001	2011
Total Population	16,09,172	18,42,034
Male Population	8,30,644	9,34,796
Female Population	7,78,528	9,07,238
Decennial Growth Rate %	23.79	14.47
Population Density Per Sq. KM	511	585
Sex Ratio No of Females per 1000 Males	937	971
Total 0-6 Population	-	1,80,170
Male 0-6 Population	-	92,728
Female 0-6 Population	-	87,442
0-6 Population % Compared to Total Population	12.72	9.78
Literacy Statistics	2001	2011
Total Literacy Rate (excluding 0-6 population)	71.79	79.92
Male Literacy Rate (excluding 0-6 population)	80.05	85.94
Female Literacy Rate (excluding 0-6 population)	62.94	73.74
Literacy Rate in Urban Areas	83.34	87.48
Male Literacy Rate in Urban Areas	87.66	91.23
Female Literacy Rate in Urban Areas	78.52	83.65
Literacy Rate in Rural Areas	66	74.97
Male Literacy Rate in Rural Areas	76.12	82.5
Female Literacy Rate in Rural Areas	55.39	67.2

# LAND USE

WEST BENGAL'S LAND USE PATTERN IS PRIMARILY DICTATED BY PHYSIOGRAPHIC CONDITIONS. THE STATE'S GEOGRAPHICAL AREA IS DIVIDED INTO ARABLE LAND (66.8%), ENCOMPASSING NET SOWN AND FALLOW AREAS, AND NON-ARABLE LAND (33%), INCLUDING FORESTS AND UNCULTIVABLE AREAS. AGRICULTURAL ACTIVITIES ARE CONCENTRATED IN THE FERTILE GANGETIC PLAINS, WHILE HIGHER FOREST COVER, NOTABLY 44.68%, IS FOUND IN DISTRICTS WITH HILLS, MOUNTAINS, AND COASTAL AREAS. DARJEELING DISTRICT BOASTS THE MAXIMUM FOREST AREA.

Land use Pattern of Darjeeling District	
Area	Area ('000 Ha)
Geographical Area	325.46
Cultivable Area	160.14
Forest Area	124.5
Land under Agriculture use	37.2
Permanent Pastures	1
Cultivable wasteland	1.8
Land under Misc. trees crops and groves	2
Barren and un-cultivable land	2.49
Current fallows	13.34
Other Fallows	3.8

## GEOGRAPHY

DARJEELING DISTRICT, SPANNING 3149 SQ.KMS, FORMS AN IRREGULAR TRIANGLE. THE NORTHERN BOUNDARY STARTS AT PHALUT PEAK (3657.6 METERS) AT THE NEPAL-SIKKIM JUNCTION, RUNNING EAST ALONG THE RAMAM RIVER, JOINING THE RANGIT, AND REACHING THE TISTA. MOVING EAST, IT FOLLOWS THE TISTA TO ITS JUNCTION WITH RANGPOCHU, PROCEEDING UPSTREAM UNTIL REACHING THE KHUMANI FOREST IN JALPAIGURI DISTRICT.

TO THE WEST, IT'S BORDERED BY NEPAL, FOLLOWING THE SOUTHWARD RIDGE TO THE MECHI RIVER. THE SOUTHERN BOUNDARY INTERCEPTS PURNEA AND WEST DINAJPUR, SEPARATED BY THE MAHANANDA RIVER. TO THE EAST, IT'S BOUNDED BY BANGLADESH AND JALPAIGURI DISTRICT.

THE DISTRICT INCLUDES THE TARAI, AT 91 METERS ABOVE SEA LEVEL, AND HILL AREAS REACHING 3657.6 METERS. HILLS ARE A LABYRINTH OF RIDGES AND VALLEYS, MOSTLY FOREST-CLAD, WITH LOWER SLOPES HOSTING TEA PLANTATIONS AND CROP CULTIVATION.

# CLIMATE

GENERAL CLIMATE:

VARIES FROM SUB-HUMID TO PER-HUMID.

UNIFORM TEMPERATURES DUE TO GEOGRAPHICAL FEATURES.

RAINFALL PATTERN:

HEAVY RAINFALL IN NORTHERN REGIONS (>3000 MM).

GRADUAL DECREASE TOWARDS THE SOUTH, FORMING A MODERATE RAINFALL ZONE.

ANNUAL RAINFALL AVERAGES 1,900 MM, WITH 1,600 MM DURING MONSOON.

TEMPERATURE ZONES:

NORTHERN HIMALAYAN REGION EXPERIENCES FREEZING POINT TO 10°C IN WINTER.

PLAINS HAVE WINTER TEMPERATURES AROUND 12°C TO 18°C.

DARJEELING SEES OCCASIONAL SNOWFALL WITH WINTER TEMPERATURES OF 5.8°C TO 17.0°C.

SUMMER TEMPERATURES REACH ABOUT 20°C IN DARJEELING.

MAHANANDA WILDLIFE SANCTUARY:

THREE SEASONS: SUMMER (10°C TO 30°C), WINTER (BELOW 3°C), AND RAINY SEASON (MAY TO OCTOBER).

AVERAGE ANNUAL RAINFALL IS 300 CM

Rainfall in Darjeeling District		
Monsoon	Normal Rainfall (mm)	Normal Rainy days
South west monsoon (June- September)	1220	32
Northeast monsoon (October-December)	100	15
Winter (January-February)	130	2
Summer (March- May)	225	
Annual	1675	49

# DRAINAGE

TISTA TRIBUTARIES RISING ON ITS NORTHERN FACE TO FLOW NORTHWARDS AND OTHERS FLOW EAST OR WEST BEFORE JOINING THE MAIN RIVER. THE RIVERS OF THE DISTRICT ARE, TISTA WHICH RISES IN GLACIER, IN NORTH SIKKIM, 21000FT ABOVE SEA LEVEL, GREAT RANGIT, JALDHAKA, MAHANADI, BALASON AND MECHI.

# ECONOMY, TOURISM, AND ATTRACTIONS IN DARJEELING

DARJEELING'S VIBRANT ECONOMY IS FUELED BY TWO MAJOR CONTRIBUTORS: TOURISM AND THE ICONIC TEA INDUSTRY. RENOWNED GLOBALLY, DARJEELING TEA FACES COMPETITION BUT REMAINS A KEY PLAYER. THE TEA SECTOR IS EVOLVING, WITH COOPERATIVE MODELS AND POTENTIAL TRANSFORMATIONS INTO TOURIST RESORTS.

TEA ESTATE WORKERS, PREDOMINANTLY WOMEN, RECEIVE COMPENSATION IN CASH AND BENEFITS, WHILE POPULATION GROWTH STRAINS NATURAL RESOURCES. AGRICULTURE FOCUSES ON CASH CROPS, SUPPORTING RURAL LIVELIHOODS, AND TOURISM, A MAJOR ECONOMIC DRIVER, PEAKS IN SUMMER AND SPRING, FUELING EMPLOYMENT IN HOSPITALITY.

BEYOND ITS ECONOMIC PROWESS, DARJEELING IS CELEBRATED FOR ITS HILL STATIONS, RENOWNED TEA, AND YEAR-ROUND APPEAL AS A HOLIDAY DESTINATION. NOTABLE ATTRACTIONS INCLUDE THE GHoom MONASTERY, MUSEUM OF NATURAL HISTORY, LLYOD BOTANICAL GARDEN, PADMAJA NAIDU HIMALAYAN ZOOLOGICAL PARK, AND TREKKING ROUTES ACROSS THE SINGALILA RANGE. MIRIK OFFERS TRANQUILITY AROUND THE ENCHANTING SUMENDU LAKE, AND THE MAHANANDA WILDLIFE SANCTUARY, A GAME RESERVE, SPANS VARYING ELEVATIONS, ATTRACTING TOURISTS NATIONWIDE. DARJEELING'S RICH CULTURAL HERITAGE IS EVIDENT IN TIBETAN CRAFTS AND TRADITIONAL ARTS, CONTRIBUTING TO THE LOCAL ECONOMY.

IN SUMMARY, DARJEELING SEAMLESSLY BLENDS ECONOMIC VIBRANCY, CULTURAL RICHNESS, AND NATURAL BEAUTY, MAKING IT A HOLISTIC DESTINATION FOR TOURISTS WORLDWIDE.

# IMPACT ASSESSMENT

Every developmental activity for construction and construction work would lead for some adverse impacts during the project execution. Even though the impacts are not permanent, it leaves a scar on the environment. The implementation of the timely mitigation measures would reduce the impacts to certain extent.

Development is not possible without disturbing the environment. The players who are involved in the execution of the project should have concern to protect our pristine environment while executing the project.

# IMPACT ON AIR QUALITY

Vehicles and stationary equipment will impact air quality at the construction site through emissions from the engines and equipment, fugitive emissions due to material handling, etc. Additionally quarry site activities including operation of crushers, concrete batch plants, construction work and movement of vehicles along unpaved road will generate dust & gaseous emission and impact air quality. The burning of waste will also affect air quality. In absence of proper fuel, construction workers at the project site may use wood for fuel burning.

# MITIGATION MEASURES

- Scheduling construction activities to avoid disturbances to bird populations during feeding and reproduction periods;
- Keeping an inventory of all large trees to be removed in order to identify bird eggs and nests and minimize impacts;
- The contractors to establish environmental units and implement public awareness programs during construction regarding the impacts caused by the construction activity.
- No construction yard will be established at the forest area.
- No disposal of construction waste in the forest premises
- No earthen material or water from the springs present in the forest area will be used for the construction activity.
- Hunting will be strictly prohibited for the workers

# IMPACTS ON THE WILDLIFE

The wildlife population often decline due to the cumulative impacts of the linear projects. The impacts are quite substantial are severe and more detrimental. The major impacts are listed below, Wildlife mortality, Habitat loss and degradation, Causes habitat fragmentation, Landslides and soil erosion, Effect on arboreal animals, Impact on the flora and fauna, Impacts on aquatic ecosystem, Change in animal behavior and Pollution from construction activity and due to construction equipment

# MITIGATION MEASURES

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## **IMPACTS DUE TO OPERATION OF CONSTRUCTION PLANT AND EQUIPMENT**

During the construction phase, various types of equipment will be brought to the site and construction plants and repair workshops will be set up. The sitting of this construction equipment's would require significant amount of space.

During construction phase, there will be increased vehicular movement for transportation of various construction materials to the project site. Large quantity of dust is likely to be generated due to movement of trucks and other heavy vehicles on unpaved road.

Therefore, sufficient mitigation measures would be required to be implemented to minimize the impact on health of the people living in the vicinity and labourers working in the project area.

# MITIGATION MEASURES

- Placing of dust arresters surrounding the crusher and the construction yards will prevent the dispersion of the dust to a great extent.
- Spray water on the stones while unloading from the truck/dumper.
- Spray water at the primary crusher feeder chute.
- Set and enforce speed limits, especially near schools and populated areas.
- Install appropriate signs warning drivers to slow down in settlement areas.
- Arrange flagmen to control the traffic at the muck disposal areas.
- Proper training imparted to the workers involved in the construction activity

# IMPACTS DUE TO APPROACH ROAD CONSTRUCTION

The topography of the project area has steep slopes, which descend rapidly into valleys. The conditions can give rise to erosion hazards due to downhill movement of soil aggregates. The project construction would entail significant vehicular movement for transportation of construction material and heavy construction equipment. Most of the approach roads to the Mille yard in the project area would require a new road proposed to be constructed for this project.

# MITIGATION MEASURES

- Avoid accidental spills through good practice.
- Install and maintain mufflers on equipment and vehicles.
- Provide drainage to reduce risk of flooding.
- Provision of drains to reduce stagnation of water.
- Installation of culverts, bridges, etc. as needed according to the hydrological surveys conducted.
- Adequate development of green belt to composite the tree cutting

# IMPACTS DUE TO GROUND VIBRATIONS

The explosive energy generated during blasting sets up a seismic wave within the surface, which may affect the structures and cause discomfort to human population. When an explosive charge is fired in a hole, stress waves traverse in various directions, causing the rock particles to oscillate. Blasting also generates ground vibrations and instantaneous noise. Noise in and around the construction site will likely affect the wildlife and residents in the nearby areas. Wildlife in the area will likely move away from the noise and eventually return to the area when construction is complete. Take necessary precautionary measures during the construction.

# MITIGATION MEASURES

- The vibrations can be reduced considerably by ensuring and keeping correct track geometry by advanced measurement.
- Effective maintenance programs are essential for controlling ground borne vibrations.
- Controlling noise vibrations at the source.
- Proper maintenance of tunnel excavation equipment's

# **IMPACTS DUE TO MUCK DISPOSAL**

Waste will be generated due to construction of tunnel and Mille yard and approach roads to the yard. Waste generated by excavation and by the tunnelling activity can be used for construction purpose.

The unused muck which is left behind is proposed to be dumped at pre-identified locations nearer to the River Teesta. There are several measures suggested to prevent polluting the Teesta River waters.

# MITIGATION MEASURES

- The waste material generated during the excavation of rock will be reused during the site development to some extent. The material will be used after testing its quality.
- Construction debris will be disposed of in suitable pre identified dumping location, suggested by the Pollution Control Board. A prior approval from the statutory agencies will be required before disposal of muck.
- Construction labour camp should be more organized with adequate facilities and should be away from the muck disposal yard.
- Required a regular inspection for the debris disposal site

# IMPACTS ON WATER QUALITY

The major sources of water pollution during project construction phase are as follows:

- Sewage from Construction work camps/colonies
- Effluent from Construction Plants and Workshops
- Disposal of solid waste

# MITIGATION MEASURES

- The sewage will be treated appropriately.
- The effluents will be suitably treated before letting out
- No disposal of cut spoils into gullies or watercourses.
- A waste disposal site should be away from human settlement, because of incidence of health hazards. Generally barren lands are preferable for this purpose.
- A disposal site should be away from water streams and river Teesta.

# **ENVIRONMENTAL MANAGEMENT PLAN**

# ENVIRONMENTAL MANAGEMENT PLAN

- The developed EMP addresses the environmental and social impacts during the **design, construction and operational phases** of the project.
- EMP outlines the key environmental management and safeguards that the project proponent will initiate to **manage the project's key environmental and social concerns**.
- **Environmental Management Plan (EMP)** is the mechanism to ensure that environmental considerations are integrated into the project survey and design, contract documents and project supervision and monitoring. These are tools for **mitigating or offsetting the potential adverse environmental and social impacts** resulting from various activities of the project.

# DESIGN PHASE

Activities	Environmental impacts	Mitigation Measures
Design	<b>Erosion and instability of cut faces and pits</b>	<ul style="list-style-type: none"><li>• Design cut slope to minimize instability</li><li>• Use structural stabilization measures such as retaining walls and gabions in the design.</li><li>• Use adequate design, sitting, and sizes of drainage structures</li></ul>
	<b>Erosion of Lands</b>	<ul style="list-style-type: none"><li>• Site drainage structures so as to avoid a cascade effect and to ensure that runoff is conveyed into natural drainage lines with controlled velocities</li><li>• Line the receiving areas with stones or concrete to protect soils at outflow areas</li><li>• Incorporate sufficient number of drainage outlets such that flow from any individual outlet is not excessive.</li></ul>
	<b>Impacts on wildlife through interruption of migratory routes and other habitat disturbances</b>	Tunnel Project will be sited and designed with utmost care so as not to disturb the forest vegetation or will not affect any forest migratory routes will not be affected.

Activities	Environmental impacts	Mitigation Measures
Design	<b>Encroachment on water supply systems</b>	<ul style="list-style-type: none"> <li>• Surveys carried out as part of the project will identify water supply systems</li> <li>• Culverts will be incorporated into Tunnel Project design where water systems are planned.</li> <li>• Detailed design will include plans for avoidance of damage to water systems and replacement/repair of water systems where avoidance is not possible.</li> <li>• Coordination with the Water Supply department is necessary.</li> </ul>
	<b>Encroachment on Sacred and old Trees</b>	Design of the tunnel alignment to avoid Sacred Trees or old trees. The relocation of the trees is also possible. Local populations may consider some of the trees to be auspicious

# CONSTRUCTION PHASE

Activities	Environmental impacts	Mitigation Measures
<b>Mobilization of equipment's and workforces</b>	<b>Accident risks from mobilizing construction equipment</b>	<ul style="list-style-type: none"><li>• To the extent possible, avoid the mobilization of heavy equipment's at night.</li><li>• Over-width and over-length vehicles should display adequate warnings such as flashing lights, signs, and flags on extending parts of equipment as it is a hilly terrain.</li></ul>
<b>Construction Equipment</b>	<b>Diesel Emissions</b>	<ul style="list-style-type: none"><li>• Proper maintenance and tuning of engines</li><li>• Correct fuel specification</li><li>• Limiting idling time</li><li>• Avoiding overloading</li></ul>
	<b>Earth moving equipment and excavation</b>	Water sprays and dust suppression surfactants
	<b>Unpaved access roads and pathways, and the clearing of access roads</b>	<ul style="list-style-type: none"><li>• Water sprays and dust suppression surfactants</li><li>• Revegetation</li></ul>
	<b>Masonry activities (preparation of concrete, cement and mortar mixes; cutting stone, bricks or pavers)</b>	<ul style="list-style-type: none"><li>• Avoiding cement dust emissions</li><li>• Managing stockpiles (sand, gravel) by using water sprays(when emptying cement bags into mixer).</li><li>• Wet cutting and drilling techniques.</li></ul>

Activities	Environmental impacts	Mitigation Measures
<b>Construction Equipment</b>	<b>Crushing or screening aggregate materials, stockpiled material.</b>	<ul style="list-style-type: none"> <li>• Suitable extraction procedure</li> <li>• Limiting size of stockpiles</li> <li>• Vertical barriers (or covering the pile if it is small)</li> </ul>
<b>Impact on health and Social Wellbeing of Local population.</b>	<b>Negative impact on the health and social well-being of local population due to the introduction of workforce from other places</b>	<ul style="list-style-type: none"> <li>• Conduct special briefing or on-site training on environmental, occupational safety and health requirements of the project workers.</li> <li>• Strictly supervise workers not to interfere with local affairs or quarrel with local people.</li> <li>• In case of complaints from local people on the issues caused by workers and complains will be solved as soon as possible, under collaboration of Environmental Consultant of the Project Management Consultant and Supervision Consultant.</li> </ul>
	<b>Impacts on Local Wildlife by Workforce</b>	<ul style="list-style-type: none"> <li>• Carry out awareness-raising campaigns on wildlife value for workers</li> <li>• Worker conduct haunting or buy wildlife from local people, will be dismissed from job</li> <li>• Supply workers with sufficient foods from outside the Project area</li> </ul>
	<b>Accident risk from mobilizing</b>	<ul style="list-style-type: none"> <li>• Establishment of all relevant safety measures required by law and good engineering practices.</li> <li>• Provision of first aid facilities at the construction sites.</li> </ul>
	<b>Outbreak of disease</b>	<ul style="list-style-type: none"> <li>• The Contractor will have all his workers undergo a regular medical check on their arrival on Site.</li> <li>• Make medical treatment available for workers. Provide workers mosquito nets and malaria-prevention medication.</li> </ul>

Activities	Environmental impacts	Mitigation Measures
<b>Impact on health and Social Wellbeing of Local population.</b>	<b>Depletion of natural resources through demand for building materials, fuel, and food for workers</b>	<ul style="list-style-type: none"> <li>Do not harvest wood resources within project area.</li> <li>Where local materials must be used, make agreements with local communities about the areas or the volume that can be harvested without significant impact</li> <li>Upon completion of construction, consideration will be given for transferring camp structures to local people for community or government use.</li> </ul>
	<b>Erosion and instability of cut faces and borrow pits</b>	<ul style="list-style-type: none"> <li>No contour will be permitted in areas with steep slopes</li> <li>At the end of the construction phase, grow vegetation in cut slopes where ever it is feasible</li> <li>Install settlement basins, which allow silt, pollutants and rubbish to settle out of runoff water before it flows into downstream water courses.</li> </ul>
<b>Earthworks and operating of quarries and borrow pits</b>	<b>Erosion from disposal of cut spoil.</b>	<ul style="list-style-type: none"> <li>Where spoil disposal in vegetated sites cannot be avoided, select areas with scrub, bamboo, or herbaceous growth over areas of healthy forest.</li> <li>No disposal in or adjacent to cultivated areas (unless such areas lie within the Tunnel Project reserved width, in which case owners will be compensated under the Resettlement Plan).</li> </ul>
	<b>Loss of vegetation due to haulage routes and detours</b>	<ul style="list-style-type: none"> <li>Remove and store the top soil of any important detours and it should be used for rehabilitation and revegetation of the area after Tunnel Project construction</li> </ul>

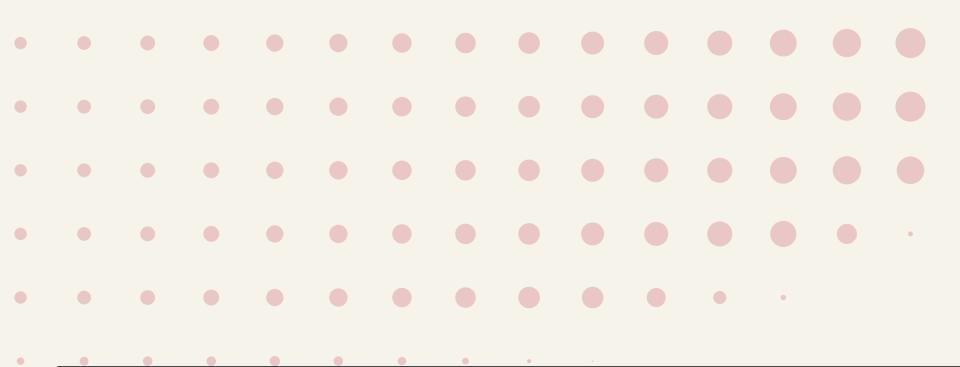
Activities	Environmental impacts	Mitigation Measures
<b>Earthworks and operating of quarries and borrow pits</b>	<b>Improper disposal of solid waste</b>	<ul style="list-style-type: none"> <li>Segregation of wastes shall be observed.</li> <li>Residual and hazardous wastes shall be disposed of in disposal sites approved by local authorities</li> </ul>
	<b>Pollution due to use and storage of hazardous substance</b>	<ul style="list-style-type: none"> <li>Hydrocarbon, toxic material and (explosives --- if blasting will be involved) will be stored in adequately protected sites to prevent soil and water contamination while vehicle maintenance and re-fueling will be confined to areas in construction sites designed to contain spilled lubricants and fuels.</li> <li>All areas intended for storage of hazardous materials will be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation</li> </ul>
	<b>Occupational health and safety</b>	<ul style="list-style-type: none"> <li>Workers shall be provided with appropriate personal protective equipment (PPE) such as safety shoes, hard hats, safety glasses, ear plugs, gloves, etc.</li> <li>Monitoring and control of the working environment and planning of safety and health precautions should be performed as prescribed by national laws (Government of India) and regulations.</li> </ul>
	<b>Public health and safety risks</b>	<ul style="list-style-type: none"> <li>The general public/local residents shall not be allowed in high-risk areas, e.g., excavation sites and areas where heavy equipment is in operation.</li> <li>Speed restrictions shall be imposed on Project vehicles and equipment when traversing areas with sensitive receptors (residential, schools, temples, etc.).</li> </ul>

Activities	Environmental impacts	Mitigation Measures
<b>Earthworks and operating of quarries and borrow pits</b>	<b>Loss of vegetation and habitat at the quarries and borrow pits</b>	<ul style="list-style-type: none"> <li>• Utmost care will be observed to avoid unnecessary damage to vegetation</li> <li>• In case of new quarries operation, the quarries will be approved by the Environmental monitoring Authorities</li> </ul>
	<b>Impacts on wildlife through interruption of migratory routes and other habitat disturbances</b>	<ul style="list-style-type: none"> <li>• Strict monitoring in this area will be used to prevent tree cutting and hunting</li> </ul>
	<b>Encroachment on water supply systems</b>	<ul style="list-style-type: none"> <li>• Contractors will pay a fee to villagers for damage to water systems, perhaps based on number of days without water until the system is re fixed.</li> </ul>
	<b>Dust/air pollution</b>	<ul style="list-style-type: none"> <li>• Maintain all construction vehicles to minimize toxic vehicle emission.</li> <li>• Concrete batching plant and rock crushers shall be located at least 500 m from settlements, schools, and other sensitive receptors.</li> </ul>
	<b>Creation of stagnant water bodies in borrow pits, quarries</b>	<ul style="list-style-type: none"> <li>• Incorporate adequate drainage and fill in borrow pits and quarries. Before doing this activity the local concern should be considered. The village authorities should also be consulted.</li> </ul>

Activities	Environmental impacts	Mitigation Measures
<b>Earthworks and operating of quarries and borrow pits</b>	<b>Noise and vibration</b>	<ul style="list-style-type: none"> <li>• All construction vehicles will have working mufflers and they will be properly maintained.</li> <li>• Activities that will generate high noise levels will be scheduled to coincide with period when people are least likely to be affected. Construction activities will be strictly prohibited between 10 P.M. and 6 A.M. in the residential areas</li> </ul>
	<b>Traffic disruption during construction</b>	<ul style="list-style-type: none"> <li>• Employ “flag men” to regulate the traffic flow at every construction area mainly at the passage for the local population</li> </ul>
	<b>Traffic movement at the construction site</b>	<ul style="list-style-type: none"> <li>• For controlling dust from traffic movements, suppression using water-based surfactants is more effective than suppression using water alone.</li> </ul>
	<b>Visual impact of spoil disposal, borrow pits, and quarries</b>	<ul style="list-style-type: none"> <li>• Where feasible, quarries will be sited away from the Tunnel Project. Blasting and construction of crushing plants will be done away from the Tunnel Project. The plants will not be placed very near to the human settlement.</li> <li>• In sites where quarries must be close to the Tunnel Project, trees and other vegetation will be left between the quarry/crushing plant sites and the Tunnel Project</li> </ul>
	<b>Ground and water contamination by oil, grease, fuel, etc.</b>	<ul style="list-style-type: none"> <li>• Collect, store and dispose of POL materials in accordance with local law or standard acceptable practice.</li> </ul>

Activities	Environmental impacts	Mitigation Measures
<b>Earthworks and operating of quarries and borrow pits</b>	<b>Construction/traffic related dust and noise impacts in villages areas</b>	<ul style="list-style-type: none"> <li>• Limit construction works between 6 am and 10.p.m in or near villages</li> <li>• Avoid use of vehicles with excessive exhaust or noise emission, install and maintain equipment silencers</li> </ul>
	<b>Environmental and Social disruption from construction Camp</b>	<ul style="list-style-type: none"> <li>• Site construction camp should minimize adverse impacts by better management practices.</li> <li>• Implement malaria control, HIV/AIDS education</li> <li>• Plan and carry out post construction site clean-up</li> </ul>
	<b>Water quality impacts</b>	<ul style="list-style-type: none"> <li>• Work in rivers will be scheduled during dry season and work duration shall be as short as possible during the monsoon months</li> <li>• Stockpile areas and storage areas for hazardous substances shall be located away from water bodies.</li> </ul>
<b>Operation of construction camps</b>	<b>Solid waste from the construction camps</b>	<ul style="list-style-type: none"> <li>• Provide garbage tanks and sanitary facilities for workers. Waste in the specific tanks should be cleared regularly so that vector borne infections can be prevented</li> <li>• Special attention will be paid to the sanitary condition of camps</li> </ul>
	<b>Impact from extraction of construction materials</b>	<ul style="list-style-type: none"> <li>• Re-contour walls of borrow pits, reduce depth or fill in if required, spread with topsoil and re-vegetate with native species or return it to productive use, alternatively pits may be reshaped and left flooded for water storage or fishponds. Conversion borrow pits to fish ponds should be done in concurrence with the local population.</li> </ul>

Activities	Environmental impacts	Mitigation Measures
<b>Increased vehicular traffic</b>	<b>Accidental risk of toxic materials spills from increased vehicular traffic</b>	<ul style="list-style-type: none"> <li>• Incorporate plans for safe storage of all toxic and potentially toxic material into traffic planning.</li> <li>• Regulate transport of toxic materials.</li> </ul>
	<b>Accidental Risk of Injury or Loss of Life to People and Livestock from Increased Traffic Volume and Speed from the construction vehicles</b>	<ul style="list-style-type: none"> <li>• Install appropriate signs warning drivers to slow down in settled and livestock areas</li> </ul>
<b>Tunnel Project</b>	<b>The excavation and the digging activity for the proposed tunnel would generate a lot of dust and muck generation, wastewater, solid waste and noise and vibration</b>	<ul style="list-style-type: none"> <li>• Proper maintenance of the construction equipment and material transportation trucks.</li> <li>• Proper dust and noise barriers at the construction yard and at construction camp.</li> <li>• Advance notice of construction activities to neighbors. - Provision of enough distance between construction yards and residential areas.</li> <li>• Development of a green belt. - Provision of noise barriers at sensitive areas, if necessary.</li> </ul>



# OPERATION PHASE

Activities	Environmental impacts	Mitigation Measures
Operation Stage	<b>The operation of Tunnel Project have positive impacts on the environment</b>	<ul style="list-style-type: none"><li>• The environmental pollution would come down considerable extent.</li><li>• The movement of goods would be much faster by the Tunnel Project.</li><li>• There will be job potential during construction stage for the local population by executing this project.</li><li>• There may be increase in employment chances for the local population at the time of the operation.</li><li>• There may be increased number of tourists and pilgrims.</li></ul>

# SUMMARY AND CONCLUSION

- The proposed railway corridor between Sivok to Rangpo will improve the **mobility of men and machine**. The loss of time due to the **frequent traffic jams and landslides on the NH-31 A**, can be avoided by the proposed rail corridor. There are temporary **negative impacts** like disturbance of air quality due to the construction works and **increased noise and vibration levels** due to the project execution which are **overshadowed by the positive impacts**.
- The existing stretch T1-T2 and the Sivok development would be a great help for the passenger movement from Siliguri, West Bengal to Sikkim. The train movement would **increase the tourist inflow** in the region. This rail link will become the life line of Sikkim and it will be the **shortest route connecting Sikkim to rest of India** and a scenic hill rail journey.

# SUMMARY AND CONCLUSION

- Moreover it is **strategically important to Army** deployed to China border in Sikkim for the Indian Army troops and equipment movement to the far flung area will be beneficial to some extent. The existing NH-31A is also very important from **tourism point of view and it links important tourist destinations** like Gangtok, Changu lake, Nathula Pass, Rumtek monastery etc. The tourist inflow would **give an economic boost** to the entire project area. The tunnels will also **cut the air emission** for considerable extent.
- The **informal consultation with the local population** at the Sivok area indicates that they are **eagerly waiting for the project** execution and they are **expecting an economic boost** for the area due to the inflow of the tourists. Freight through rail will ensure safe, voluminous of goods movement which will boost economic. Over the entire proposed project would give a **positive impact to the entire area** not limited to the two villages. The local environment will also improve and would give an **economic boost**.

# SUMMARY AND CONCLUSION

- The railway development projects serves as an **important employment generator** and provide huge direct and indirect employment opportunity during construction period and operation period. The transportation by road leads to consumption of fuel which ultimately leads to air pollution. The rail connectivity in the Siliguri and Rangpo region will **reduce the traffic load on roads, which will reduce the air pollution in the area.** The present proposed rail link will be environmental friendly option of transport

# CURRENT SCENARIO

- In 2009, a **Memorandum of Understanding (MoU)** for the project was signed between the West Bengal government and then Union Railway Minister Mamata Banerjee. On 30 October that year, Banerjee and India's then Vice-President Hamid Ansari laid the foundation stone of the project.
- Banerjee had assured that the **project would be completed in five years**. However, according to railway officials, **difficulty in obtaining land clearances from villagers** has been one of the main reasons for the delay. Railway officials made it clear that **another five years would be needed** after obtaining all the land needed.
- **Estimated to cost around Rs 1,339.48 crores** when it was sanctioned in 2008–2009, the **project touched Rs 4085.69 crores** in 2015 due to the delay.
- Around 38 kms of the entire project alignment is passing through tunnels and the railway has already completed **83 percent** of the tunneling work. The tunnel mining is expected to be **completed by January 31, 2024**.
- Presently, the railway has completed the final lining of tunnel T-14. The lining is also under progress at tunnels – T-02, T-05, T-09, T-10, T-11 and T-12. **A total of 5.34 km lining has been completed** so far and it is **expected to be completed by September, 2024**.

# STRUGGLE FOR FOREST RIGHTS ACT

- The struggle for the enactment of the Forest Rights Act, 2006, in the Darjeeling hills region has been going on for a long time. The majority of the population living in villages in these forest divisions have been **denied their rights as forest dwellers.**

*"Despite FRA, we have no rights to this land," Khati points out.*

*"As a result, NOCs [no-objection certificates] from gram sabhas were not obtained before starting the railway project, which is mandatory for any construction work inside forest lands."*



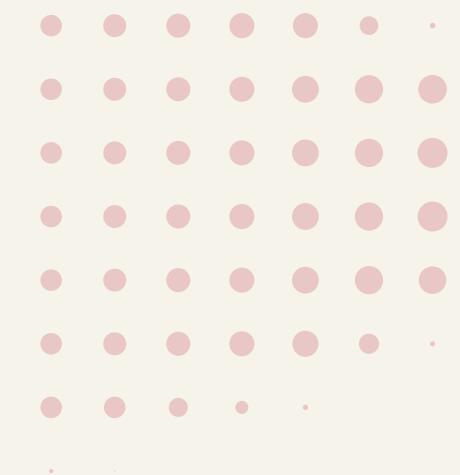
# STRUGGLE FOR FOREST RIGHTS ACT

- The process of granting settlement rights to forest dwellers here began only in 2020
- In a November 2017 letter to the West Bengal government, the Ministry of Environment, Forest and Climate Change gave “Stage-I approval” to the project after considering “the proposal of the State [West Bengal] government” and “on the basis of decisions” taken in a meeting of the Forest Advisory Committee and Regional Empowered Committee under the Forest (Conservation) Act (FCA), 1980.

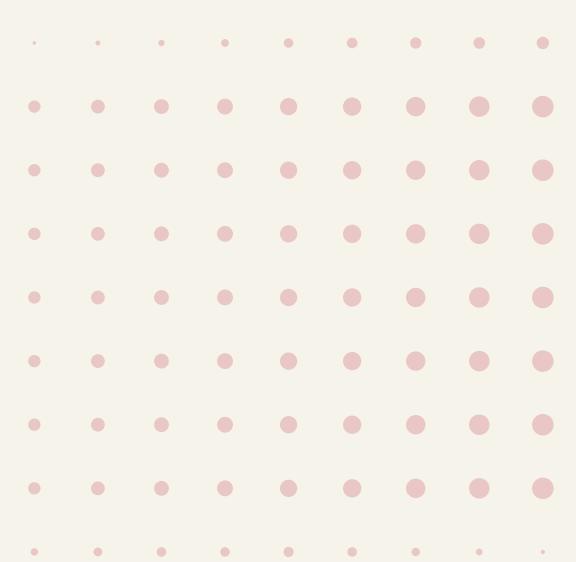


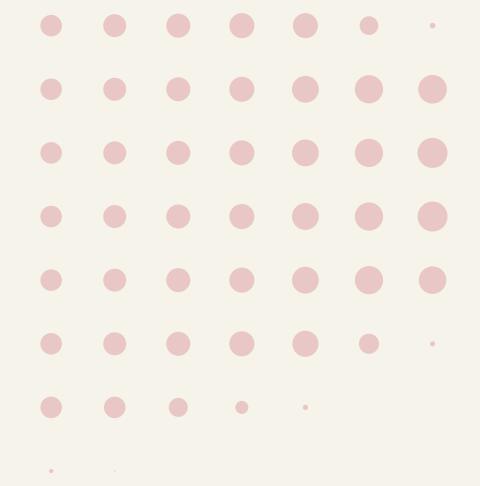
# STRUGGLE FOR FOREST RIGHTS ACT

*"Till then, IRCON maintained they had not received forest clearance, which was true," said Soumitra Ghosh, an environmental and forest rights activist in the region. "Nothing changed on the ground after that – and yet IRCON received Stage-I 'in-principle' clearance and went ahead with the project. Stage-II clearance has not yet been received, but 60% of construction work has already been completed by the railways, and this is a clear violation of the FRA."*

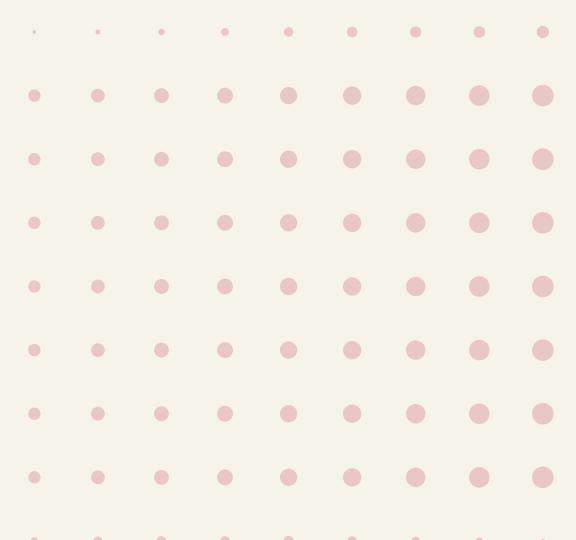


# VIOLATION?

- Several media reports have documented the **deliberate violations of the Forest Rights Act** by the state government and railways while obtaining no-objection certificates from locals.
  - For example, in June 2018, officials from railways and district administrations met only members of the 26 families from Melli, who were eventually rehabilitated, and refused to interact with gram sabha members as directed under the Forest Rights Act.
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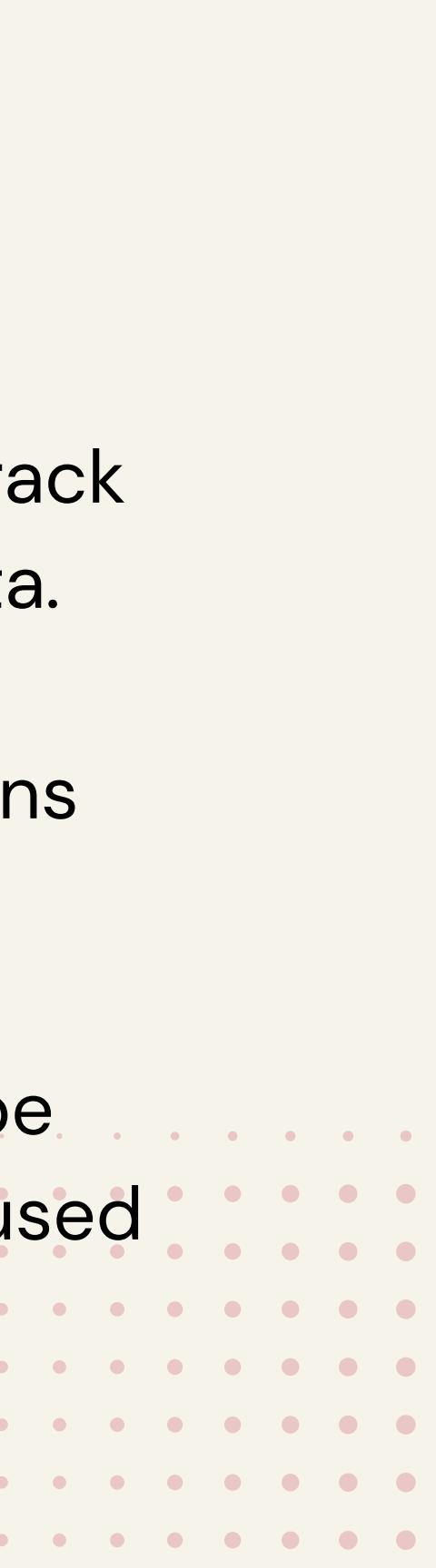
# VIOLATION?



- The Forest Rights Act, 2006, states that the “Gram Sabha is the authority to initiate the process for determining the nature and extent of individual or community forest rights.” A gram sabha is defined as a village assembly which shall consist of all adult members of a village, according to Section 2 (g) of the Forest Rights Act, 2006.



# OTHER ISSUES

- Threat of **landslides and floods** is particularly problematic along the 40 km of track that will pass through tunnels inside mountains that stand right next to the Teesta.
  - A section of geologists says that road constructions have already made mountains weak giving rise to the dangers of landslides and other **natural disasters**.
  - The **water** which comes out of mountain springs is **not drinkable** and it cannot be used for livestock as well, as it gets **mixed with concrete and other chemicals** used for construction works
  - The **deforestation** could also stop the natural underground recharge of water, increasing water woes in the region.
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# FINAL CONCLUSION

- Residents in the Sevoke-Rangpo region point out that they are **not opposed to trains running** – their only **interest lies in securing their rights to the land**, because absent that, they will not qualify for compensation in the event of any calamity triggered by the project.
- There are **multiple issues that are already addressed in the EIA** but it is **not possible to address all the issues** that might occur, and that is why monitoring throughout the project is very important
- It is usually the **local people that face the most issues** due to any project and often times even if there are laws to protect them, it is not enough.
- Majority of the **concerns that the local people voice are not being addressed properly** in real life even if it addressed in the report.
- This project is definitely a very **ambitious project** and will bring a **lot of good changes** but we **should care about the local people** and listen to their concerns as well.

# **THANK YOU**

**Presented By- (Group 7)**

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