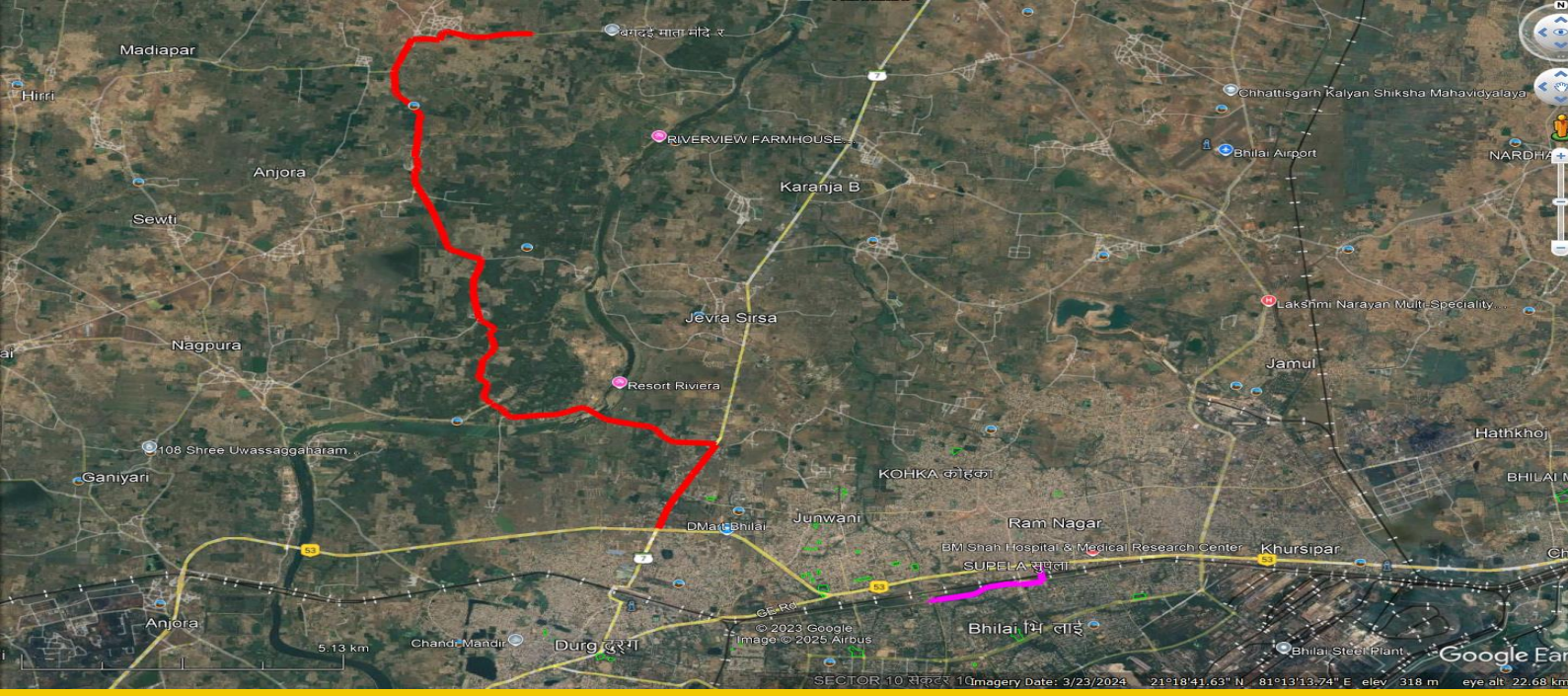

FINAL REPORT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY FOR CDG NATURAL GAS PIPELINE FOR GA 11.10 IN DURG, AT TEHSIL-DURG, DHAMDHA & BHILAI, DISTRICT-DURG, CHHATTISGARH, INDIA

SUBMITTED TO

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June 2025

REPORT NO.: 2025/ET-006495/AD/NA/NA/64190

Name of the Project	Natural Gas Pipeline in Durg & Bhilai, District- Durg, Chhattisgarh
Assignment	Environmental and Social Impact Assessment (ESIA) Study for Natural Gas Pipeline of Durg GA at Tehsil: Durg, Dhamdha & Bhilai Nagar, District- Durg, Chhattisgarh
Enquiry Number	ET-006495
Project Code	4153815353
Assignment to be submitted	ADANI TOTAL GAS LIMITED
Assignment/ report prepared by	TÜV SÜD SOUTH ASIA PRIVATE LIMITED

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ABBREVIATIONS

ATGL	Adani Total Gas Limited
AoI	Area of Influence
ASME	American Society of Mechanical Engineers
BCM	Billion Cubic Meters
CBM	Coal Bed Methane
CGD	City Gas Distribution
CGS	City Gate Station
CGWA	Central Ground Water Authority
CNG	Compressed Natural Gas
COP-26	26th UN Climate Change Conference of the Parties
CPCB	Central Pollution Control Board
DRS	District Regulatory Station
EHS	Environment, Health, and Safety
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESIA	Environmental and Social Impact Assessment
G.S.R	Gazette of India, Statutory Rules and Orders
GA	Geographical Area
GA	Geographical Area
GI	Galvanized Iron
GIS	Geographic Information System
H.T. Line	High Tension Line
HDD	Horizontal Directional Drilling
IFC	International Finance Corporation
ISO	International Organization for Standardization
JV	Joint Venture
MoEF&CC	Ministry of Environment, Forests and Climate Change
MSS	Manufacturers Standardization Society
MUT	Mechanized Ultrasonic Testing
NG	Natural Gas
NH	National Highway
NOCs	National Oil Companies
OISD	Oil Industry Safety Directorate
PCV	Pressure Control Valve
PESO	Petroleum & Explosive Safety Organization
PNGRB	Petroleum & Natural Gas Regulatory Board
RoU	Right of Use
RoW	Right of Way

ROW	Right of Way
SCADA	Supervisory Control and Data Acquisition
SDG	Sustainable Development Goal
SH	State Highway
UN	United Nations

NON-TECHNICAL SUMMARY

INTRODUCTION

Adani Total Gas Limited (hereinafter referred as **ATGL**) is in the process of developing City Gas Distribution (CGD) networks to deliver Piped Natural Gas (PNG) to industrial, commercial, and residential sectors, as well as Compressed Natural Gas (CNG) to the transportation sector. Natural gas is a reliable, convenient, and environmentally friendly fuel that provides consumers with enhanced safety, convenience, and economic efficiency.

The company has already set up city gas distribution networks in various locations in India. During the 11th round of CGD bidding, Adani Total Gas Limited has successfully bid for multiple Geographical Areas (GA) in Chhattisgarh, Madhya Pradesh, Maharashtra, Jharkhand and Odisha the list of all the 11 GA. To cater industrial, commercial and transportation demand of natural gas **ATGL** has planned to develop a total of "***20.17 km Natural Gas Pipeline Infrastructure***" in Durg District of Chhattisgarh India. The NG pipeline for CGD is proposed via two pipeline routes L01 of approximately 17.82 km from GAIL SV-32 U/C to Vardhaman Highway and L02 of approximately 2.35 km from SV-31 to BPCL Petrol Pump (Gill Goods Carrier) of natural gas in the Durg District of Chhattisgarh.

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA STUDY) & SCREENING

TÜV SÜD South Asia Private Limited (hereinafter referred as **"TÜV SÜD"**) has been entrusted by **ATGL** for providing consultancy services of Environmental and Social Impact Assessment Study (ESIA) for City Gas Distribution Project at Durg District, Chhattisgarh, India. The objective of the study is to assess potential Social and Ecological, Environmental Impacts from the project on the environment and social setting and address mitigation measures for the identified impacts. Environmental and Social management Plan (ESMP) has been designed in line with the impact identified and mitigation measures suggested in this report. In accordance with the screening criteria of IFC, and in accordance the observations of site reconnaissance survey, **TÜV SÜD** ESIA team has categorized Project as '**Category B'**.

AREA OF INFLUENCE (AOI) FOR ESIA STUDY

ESIA study to evaluate environment and social risks and impacts associated with the Project.

The overall area covered by the assessment includes the following constituent areas:

- The footprint of the project, hereafter referred to as the 'Project Site'.
- The area extending 500 m (either side) outward from the project site boundary (estimated to contain the potential receptors of any project related environment, social and ecological impacts), hereafter referred to as the 'Area of Influence' or 'AOI'; and
- Buffer zone is 5 km.

LEGAL FRAMEWORK

The Environmental and Social Impact Assessment study report has been prepared in accordance with major international and national regulatory frameworks. The major guidelines considered for the project are the *IFC's EHS Guidelines dated 30th April 2007.* The *IFC performance standard, 2012 and Equators principle "EP4" guideline* has also been considered during the study.

PROJECT DESCRIPTION

ATGL is responsible for laying (8 inches diameter), building, operating or expanding the CGD of natural gas pipeline network planned in approx. 20.17 km stretch divided in two routes (L-01, L-02) across the Durg Town and nearby villages within the Durg district of Chhattisgarh.

BASELINE ENVIRONMENTAL AND SOCIAL CONDITION

The baseline environmental, ecological, and social conditions of the project area have been assessed within 05 km radius of study area. Assessment of physical environmental parameters is currently under progress and ecological, and environmental survey was conducted during the site visit from **20th to 21st January 2025**.

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

As per impact assessment study conducted for the proposed CGD for the natural gas pipeline project, environmental and social parameters can be mitigated with prescribed measures. Permission will be required for SH and ODR from the relevant state departments for all the two pipeline routes,), permission from the irrigation department also be required since the pipeline route 1 (L-01) as it passes through the Shivnath River and Sonbarsa River, permission from Railways will be required for the pipeline route 2 (L-02. Therefore, during the Planning Phase, the impact of land procurement is initially moderate, but with proper mitigation and permissions, it reduces to low.

During construction Phase, various factors such as topography, drainage, water resources, and ambient air and noise quality have moderate impacts, which can be reduced to low with appropriate management. Ecology shows a low impact, which becomes insignificant post-mitigation. Socio-economic impacts are initially low but can turn moderate-beneficial because of community engagement and local employment. Occupational health and safety risks, which are moderate at first, are minimized to low with proper safety measures. In the Operational Phase, the water environment and health & safety impacts are low, and with effective measures, they reduce to insignificant. Summary of impacts has been provided below.

Table 1-1: Summary of Impacts

Category	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Planning Phase		
Impact due to Land Procurement	Moderate	Low
Construction Phase		
Topography and Drainage	Moderate	Low
Water resources and availability	Moderate	Low
Ambient air and noise quality	Moderate	Low

Category	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Ecology	Low	Insignificant
Socio-economic Impacts	Low	Moderate-beneficial
Occupational Health and Safety	Moderate	Low
Operational Phase		
Water Environment	Low	Insignificant
Environment Health & Safety	Low	Insignificant

**Source: Analysis by TUVSUD Team*

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

Environmental and Social Management Plan for the project has been designed in accordance with the impact identified during the project lifecycle (Construction and Operation phase). Adequate mitigation measures have been suggested against each identified impact during each of the above-mentioned phases.

Based on the ESIA Study conducted, it may be concluded that the project is eco-friendly and environmentally sustainable in the long run. The project will not only help in reducing the CO_2 emission responsible for global warming but also other gases and particulate emissions, which otherwise would be generated using conventional fossil fuel-based transportation vehicles and to cater energy demand for residential and commercial use. This Baseline ESIA study together with mitigation measures and follow up of recommendations on management actions will help **ATGL** in complying with the environmental & social standards/safeguard policy of MFIs & National regulations as well.

1 INTRODUCTION

1.1 BACKGROUNG

Energy has been crucial for human progress since the "Industrial Revolution," and it will remain a mainstay of India's economic development. India accounts for around 18 percent of the world's population. It currently consumes only around 6 percent of the world's primary energy resources. India's per capita energy consumption is roughly one-third of the global per capita average. But with the country's increasing growth and prosperity, its energy demand will also rise in the coming years. The priority for the government is to ensure access to sustainable and clean energy resources. Government of India is actively working to fulfil objectives of Sustainable Development Goal (SDG 7) i.e., "***Ensure access to affordable, reliable, sustainable and modern energy for all***" through strategic interventions. The government has taken various steps to achieve the five nectar elements (Panchamrit) of India's climate action as outlined during COP-26 by achieving the target of net-zero emissions by 2070 and reduction of the carbon intensity of the economy by 45 percent by 2030.

Natural gas plays a pivotal role in India's energy transition, serving as a bridge fuel between conventional fossil fuels and renewable energy. It is cleaner than coal and oil, offering a viable solution to reduce carbon emissions while ensuring energy security. The Indian government is promoting natural gas as a transition fuel and aims to increase its share in the primary energy mix from 6% to 15% by 2030. This shift aligns with India's broader vision of creating a gas-based economy that supports industrial growth, urbanization, and sustainable development.

India's energy demand is projected to grow at 2.7% annually until 2050, compared to the global average of 0.6%. Within this growth trajectory, natural gas is expected to play a crucial role, particularly in sectors such as power generation, industries, city gas distribution (CGD), fertilizers, and transportation. Currently, India contributes 2.2% to global natural gas demand, a figure that is likely to increase as consumption expands across various sectors.

India's domestic natural gas production stood at 34.44 billion cubic meters (BCM) in FY 2022-23. Out of this, 67% was produced by National Oil Companies (NOCs) under the nomination regime, while 33% came from private and joint venture (JV) companies, including 2% from Coal Bed Methane (CBM) sources. However, despite increasing production, India's import dependence on natural gas was 43.9% in 2022-23, highlighting the need for domestic exploration and infrastructure development [1].

[1] *Press Information Bureau (PIB), Government of India (2022), Press Information Bureau (PIB), Government of India (2021), Ministry of Petroleum & Natural Gas, Government of India (2024).*

Adani Total Gas Limited (ATGL) is one of the largest city gas distributions (CGD) companies, with its expanding network of CGD infrastructure promises to fuel the growing aspirations of the nation. To cater industrial, commercial and transportation demand of natural gas at Durg & Bhilai Nagar, **ATGL** has planned to develop "***20.17 kms Natural Gas Pipeline Infrastructure***".

1.2 PROJECT BRIEF

Adani Total Gas Limited (ATGL) is a joint venture between Adani Group and Total Energies. ATGL is one of India's largest city gas distribution companies. **ATGL** specializes in the development of city gas distribution (CGD) networks for the continuous supply of piped natural gas (PNG) and compressed natural gas (CNG).

With intent of catering demand of natural gas of several industrial and commercial service sectors in, ATGL has developed "**20.17 *kms Natural Gas Pipeline Infrastructure at Durg and Bhilai Nagar, District-Durg, Chhattisgarh***." At present, the natural gas (NG) pipeline for Route 1 has been installed up to Nawagaon village, while the remaining section is still under construction. In addition, Route 2 of the NG pipeline is currently in the planning stage. The GAIL Pooling Substation (PSS) is positioned directly opposite the entry point of the AGTL NG pipeline.

ATGL is responsible for designing and installation of optimal size of the infrastructure in terms of pipeline of various types including steel belting of the authorized area, allied equipment and facilities in the NG pipeline network depending upon the potential demand for natural gas. The infrastructure in the network will be adequate to maintain uninterrupted flow of natural gas in the pipelines.

The service for Environment Impact Assessment (hereinafter referred as "ESIA") has been aligned in accordance with the **International Finance Corporation (IFC's)** *Performance Standards (PS) on Environmental & Social Sustainability (2012)*. The pipeline being included within the regulatory framework of host country, attracts MoEF&CC ESIA Notification 2006 & its subsequent amendments. The proposed natural gas pipeline has been categorised under "***Item 6(a)*** *i.e., Oil & gas transportation pipeline (crude and refinery/ petrochemical products), passing through national parks /sanctuaries/coral reefs /ecologically sensitive areas including LNG Terminal*" of Schedule of ESIA Notification,2006 & its subsequent amendments.

1.3 PROJECT DEVELOPER

Adani Total Gas Limited (ATGL) is developing City Gas Distribution (CGD) Networks to supply the Piped Natural Gas (PNG) to the Industrial, Commercial, Domestic (residential) and Compressed Natural Gas (CNG) to the transport sector. The company has already set up and is operating the city gas distribution networks in multiple area including Ahmedabad and Vadodara in Gujarat, Faridabad in Haryana and Khurja in Uttar Pradesh. In 9th and 10th round of PNGRB bidding for developing CGD networks, ATGL received 15 GA authorizations to develop CGD network in Gujarat, Rajasthan, Haryana, Uttar Pradesh, Karnataka, Odisha, and Tamil Nadu state where CNG and PNG infrastructure has been setup to cater

industrial, commercial, domestic and CNG sector. All 9th and 10th round GAs have been gasified and are operational.

In addition, the development of Allahabad, Chandigarh, Ernakulam, Panipat, Daman, Dharwad, South Goa, Bulandshahr –Part and Udhamsingh Nagar gas distribution networks has been awarded to Indian Oil- Adani Gas Pvt. Ltd. (joint venture of Adani Total Gas Ltd and Indian Oil Corporation Ltd.). At present, Indian Oil Adani Gas Pvt. Ltd. (IOAGPL) has been operational in total 19 Geographical areas across country.

1.4 ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) CONSULTANT

TÜV SÜD South Asia Private Limited (hereinafter referred as "**TÜV SÜD**") has been entrusted by ATGL for providing consultancy services of Environmental and Social Impact Assessment Study (ESIA) for City Gas Distribution Project at Durg District, Chhattisgarh, India.

TÜV SÜD is one of the leading testing, certification, and technical advisory firm. TUV SUD was established in 1995 in India & is a 100% owned subsidiary of **TUV SUD AG**, Germany. It is the trusted advisor to some of the world's leading businesses and institutions. The organization provides products, services, and insights to private, public, and independent sector organizations throughout the capital value chain, drawn from nearly two decades of front-line experience.

Working for many years with evaluation and assessment of sustainability, environment, safety, and social management, supply chain management and performance of companies all over the world and working with Bi-lateral and Multilateral Financial Institutions (MFIs), **TÜV SÜD** has developed an eclectic understanding in Environment, Social, Safety management system and presenting our studies in a balanced and trustworthy manner. Assessment of projects impact on environmental and social aspects and reporting by **TÜV SÜD** will therefore add trust and confidence to the report and your communication with stakeholders.

1.5 SCREENING OF THE PROJECT RATIONAL

The purpose of this assignment is to evaluate the environmental and social impacts of the proposed project in line with the International Finance Corporation (IFC's) Performance Standards (PS) on Environmental & Social Sustainability (2012) and other national and international statutory regulations applicable to the project.

This project has been screened considering guidelines provided in IFC's Interpretation Note (IN) on Environmental and Social Categorization, 2012. Categories underlined in IFC Project screening methodology are as follows:

- Category A: Business activities with potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented.
- Category B: Business activities with potential limited adverse environmental or social risks and/or impacts that are few, generally site-specific, largely reversible, and readily addressed through mitigation measures.

- Category B+: The categorization of projects under B+ generally covers small to medium-scale projects which have localized impacts and can be managed through the implementation of specific mitigation measures. These projects might involve changes to land use, small-scale infrastructure development, or activities that don't significantly affect sensitive areas like forests, wetlands, or biodiversity hotspots.
- Category C: Business activities with minimal or no adverse environmental or social risks and/or impacts.
- Category FI: Business activities involving investments in financial institutions (FIs) or through delivery mechanisms involving financial intermediation.

In accordance with the screening criteria of IFC, and in accordance the observations of site reconnaissance survey, **TÜV SÜD** ESIA team has categorized Project as '**Category B**", which specifies that the project can have potential limited adverse social or environmental impacts largely reversible in nature. The project is categorized as such because the proposed line route passes through the Shivnath river, several villages which have the prominent settlement areas, canals, railway crossing and state highway and other major district road and hence might have the potential E&S impact which can be reversed through the proper mitigation measures.

1.6 LIMITATION OF THE STUDY

The Environmental and Social Impact Assessment (ESIA) report has been developed based on professional judgment, a walkthrough survey, and brief discussions with stakeholders to gather relevant information, leading to subjective interpretations. The professional assessments presented in this report are based on the available data within the defined scope of work, information provided by the client or their representatives, existing secondary data, budget constraints, and project timelines.

The walk-through survey along with a brief discussion with project stakeholders was undertaken during the site visit based on the present understanding of the project. This assessment may change in case of a change in the project location. The documents like SOPs, policy and procedures for EHS&S management were limited for review at the time of pre-project desktop review process. The Traffic Survey was not conducted by TUV team on site however, the team has prepared a generic Traffic Management Plan enclosed in **Section 9.13** of this report for highlighting the suggestions for the client to prepare a detailed Traffic Management Plan as per the site condition.

1.7 CONTENT OF THE ESIA REPORT

The report has been divided into the following chapters.

Table 1-1: Contents of ESIA Report

Chapter	Title	Description and Details
Chapter 1	Introduction	This chapter provides background information of the existing pipeline, brief description and objectives of the project, scope of the study.

Chapter	Title	Description and Details
Chapter 2	Project Description	This chapter provides the details of the proposed project with description of the resources required and emissions, waste and wastewater anticipated to be generated.
Chapter 3	Legal, Policy and Regulatory Framework	This chapter provides the details of the proposed project with description of the Legal, Policy and Regulatory Framework.
Chapter 4	Description of Environment	This chapter describes the existing baseline status of environment components collected in a pre-defined study area based on primary and secondary data collection.
Chapter 5	Anticipated environment impacts and mitigation measures	This chapter describes the potential impacts of the proposed project and evaluates their significance based on parameters such as Intensity, Spatial extension, Temporal duration, and Environmental Vulnerability. Impact avoidance and mitigation measures are delineated.
Chapter 6	Analysis of Alternatives	This Chapter accesses the alternative routes, and their feasibility for pipeline construction and also examine the reasons why certain routes may not be viable.
Chapter 7	Additional Studies	This chapter assesses the potential risks involved in the construction and operation of proposed facilities and presents a Disaster Management Plan (DMP).
Chapter 8	Project Benefits	This chapter presents the details of direct and indirect benefits due to proposed project.
Chapter 9	Environment Monitoring & Management Plan	This chapter describes the details of the monitoring schedule to be implemented for checking the effectiveness of mitigation measures. It covers the parameters, frequency, and location of monitoring. If existing monitoring schedule is sufficient to cover the proposed development, the same has been clearly mentioned. The chapter also describes the organizational structure and resources planned for implementing the mitigation measures and monitoring schedule.
Chapter 10	Summary & Conclusions	This chapter summarizes the potential positive and negative environmental impacts of the project.

1.8 NEED & SCOPE OF ESIA

The purpose of this ESIA is to assess the potential environmental impacts due to the proposed project in a study area of 05 km radius around and 500 m on both sides of the pipeline. The assessment covers both construction and operation phases of the project. The ESIA forecasts changes (positive and negative) that may occur because of key project activities to the baseline environmental conditions in the study area. Early identification of impacts and their mitigation reduces the risk of long-term adverse environmental effects.

2 PROJECT DESRIPTION

2.1 DESCRIPTION OF NATURAL GAS PIPELINE NETWORK

Adani Gas Limited has been granted authorization for laying, building, operating or expanding the City Gas Distribution CGD Network in GA 11.10 i.e., Mungeli, Bemetara, Durg, Balod and Dhamatri districts and the proposed CGD covers four charge areas in the state of Chhattisgarh. This report covers the Durg District GA where ATGL has planned to lay 8 inches diameter natural gas pipeline network in approx. 20.17 km stretch divided in two routes (L-01 and L-02) across the Durg Block, Dhamdha Block and Bihai Town that covers the Charge Area number 3 namely Dhamdha, Durg, Patan Charge area.

Adani Gas Limited is responsible for laying, building, operating or expanding the (CGD) network of optimal size of the infrastructure in terms of pipeline of various types including steel belting of the authorized area, allied equipment and facilities in the NG pipeline network depending upon the potential demand for natural gas. The infrastructure in the NG pipeline network will be adequate to maintain uninterrupted flow of natural gas**.** Error! Reference source not found. **Figure 2-2** provides the details of layout of the pipeline gas network.

*Source: ATGL and Google Earth

Figure 2-1: Route Map of Proposed Natural Gas Pipeline Network of Pipeline, Durg Route 1 (L-01)

Source: ATGL and Google Earth

Figure 2-2: Route Map of Proposed Natural Gas Pipeline Network of Pipeline, Durg Route 2 (L-02)

2.2 PROJECT IMPLEMENTATION SCHEDULE

A grant of authorization was signed on 16th February 2022 by Petroleum and Natural Gas Regulatory Board (PNGRB) vide a letter of authorization to AGL group. The letter schedule D of the letter stated the year wise work program within the 8-contract year period.

2.3 PIPELINE ROUTE & ACCESSIBILITY

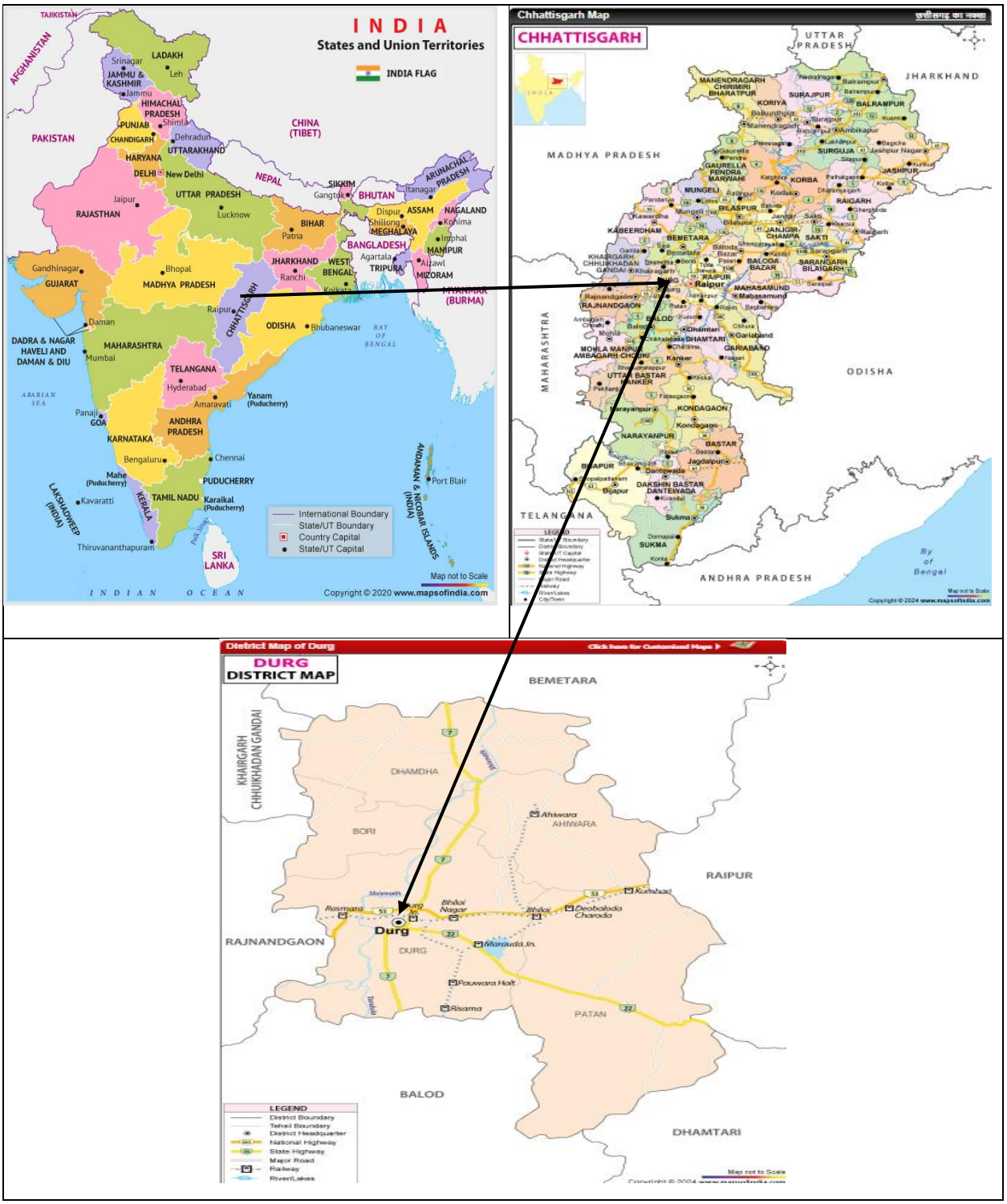
The pipeline for the CGD that run along ROW of the Durg GA is sub divided in the two pipeline route networks. The proposed Line GAIL SV-32 U/C to Vardhaman Highway takes off from Proposed GAIL SV-32 in Durg in Durg District in State of Chhattisgarh (81°16'28.37"E, 21°19'03.38"N) and terminates at Vardhaman Highway in Durg District of Chhattisgarh State (81°17'39.94"E, 21°12'52.16"N) and the proposed Line Proposed SV-31 to BPCL Petrol Pump (Gill Goods Carrier) takes off from Supela in Bhilai City in Durg District of Chhattisgarh (81°21'11.32"E E, 21°12'25.24"N) and terminates at Khandelwal CNG Station in Durg District of Chhattisgarh State (81°20'11.08"E, 21°11'57.44"N) the details of each route is given below in **Table 2-1**:

Table 2-1: Basic Details of the Pipeline

Sl. No.	Feature		Pipeline Route 1	Pipeline Route 2
1.	Name of the Pipeline		GAIL SV-32 U/C to Vardhaman Highway	Supela to Khandelwal CNG Station
2.	Length		17.826 Km	2.35 Km
3.	Start Point	Name	GAIL SV-32 U/C	Supela
4.		Location Co-ordinates	81°16'28.37"E, 21°19'03.38"N	21°12'25.24"N, 81°21'11.32"E
5.		Tehsil	Dhamdha	Bhilai Nagar (M Corp. + OG)
6.		District	Durg	Durg
7.	End Point	Name	Vardhaman Highway	BPCL Petrol Pump (Gill Goods Carrier)
8.		Location Co-ordinates	81°17'39.94"E, 21°12'52.16"N	81°20'11.08"E, 21°11'57.44"N
9.		Tehsil	Durg	Bhilai Nagar (M Corp. + OG)
10.		District	Durg	Durg
11.		State	Chhattisgarh	Chhattisgarh

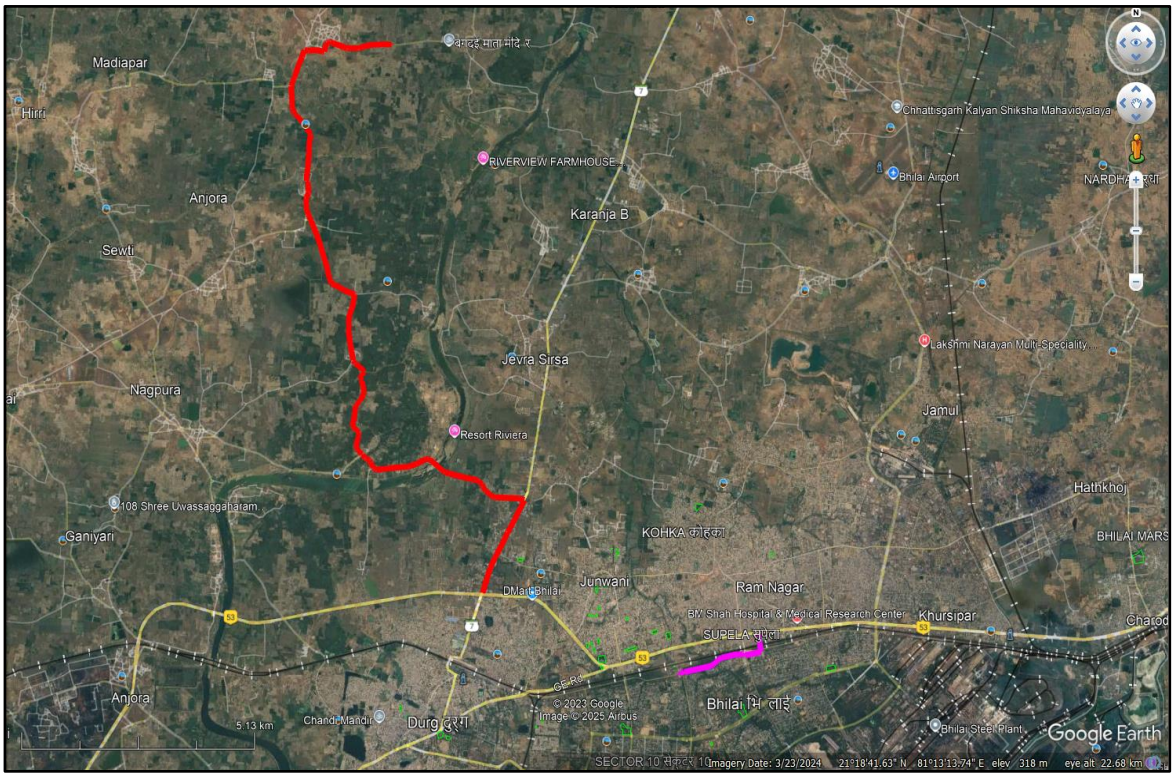
**Source: DPR, ATGL*

Figure 2-1 and Figure 2-2 depicts the combined route map of both the proposed pipeline route and the **Figure 2-5** to **Figure 2-14** provide the photographs of the site as per the primary survey conducted in the Bhilai Nagar by the TUV-SUD team.



Source: Maps of India

Figure 2-3: Location Map for Project Ara



**Source: Adani Total Gas Limited & Google Earth*

Figure 2-4: Route Map for NG Pipeline (on Google Earth)

Figure 2-5: Site for Proposed NG Network, Nawagaon Village, Durg

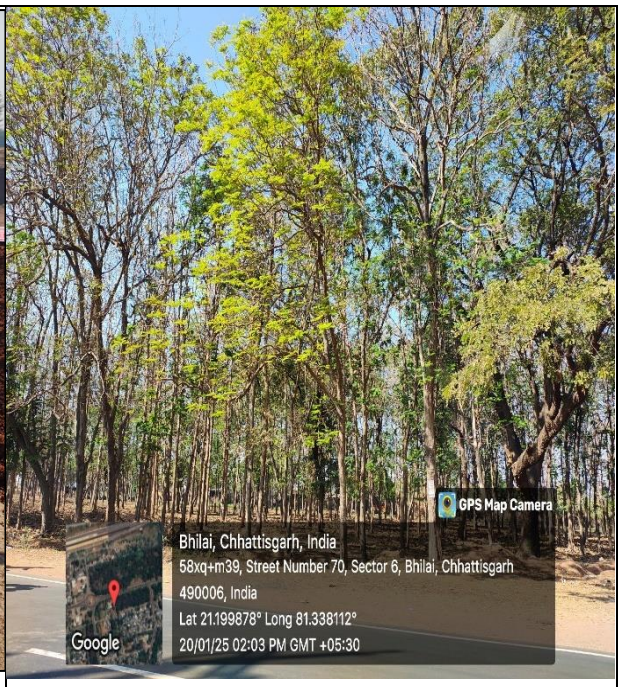


Figure 2-6: Site for Proposed NG Network, Bhilai

Figure 2-7: Zero Point of NG Pipeline Network (Route 1)

Figure 2-8: Crossing Point of NG Pipeline Network (Route 2)

Figure 2-9: Shivnath River Crossing of NG Pipeline Network Route 1

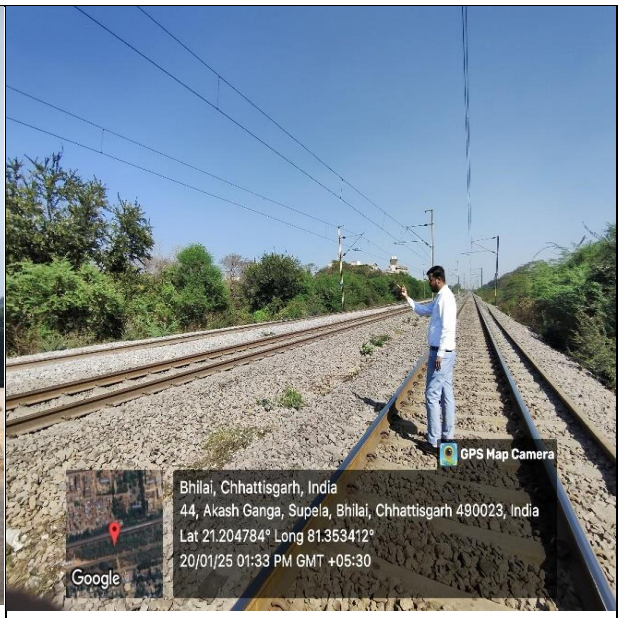


Figure 2-10: Railway line crossing of NG Pipeline Network Route 2

Figure 2-11: Stream (Sonbarsa River) Crossing in NG Pipeline Network at Dhaba, Durg (Route 1)

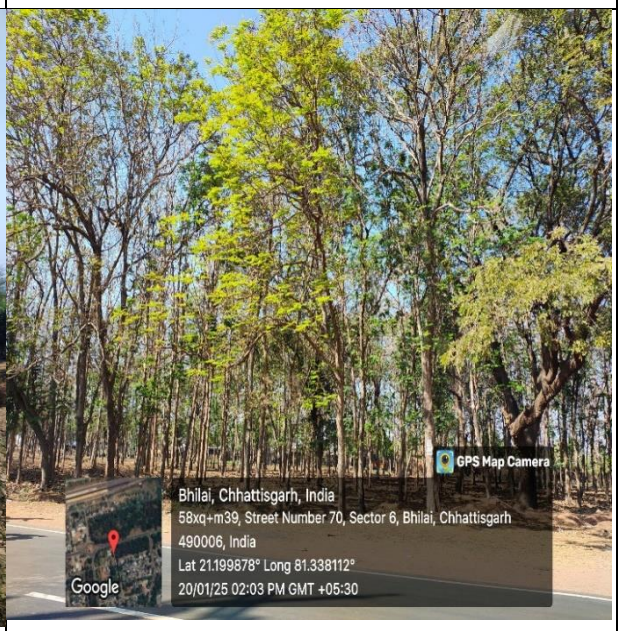


Figure 2-12: Avenue Plantation in NG Pipeline Network at Bhilai (Route 2)

Figure 2-13: Water Body nearby NG Pipeline Stretch at Nawagaon Village, Durg (Route 1)

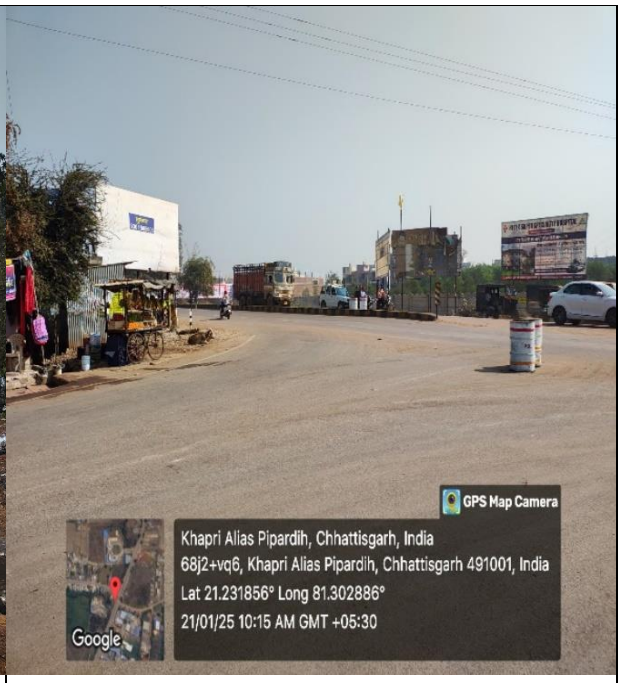


Figure 2-14: Major crossing of NG Pipeline Network at Durg- Dhamdha Highway (SH-7) (Route 1)

**Source: TUV-SUD Primary Survey*

List of the Crossings for all the two pipeline routes is given in Error! Reference source not found. and D etails of all the major crossing along with its chainage for all the two pipeline route has been provided below in **Table 2-3** Error! Reference source not found.

Table 2-2: List of Crossings for all the Two Pipeline Routes

Sl. No.	Detail of Crossing	Pipeline Route 1	Pipeline Route 2
1.	SH/NH	1	5
2.	Road	33	0
3.	River	2	0
4.	Canal	1	0
5.	Nala/Drain	7	2
6.	Cart/Track	4	0
7.	H.T/Powerline	76	6
8.	Pipeline	1	0
9.	Railway Track	0	1
Total		**125**	**14**

**Source: DPR, Adani Total Gas Limited*

Table 2-3: Details of Major Crossing within Proposed Pipeline Routes

Sl. No.	Description	Chainage (m)			Location
		Start	Centre	End	
Pipeline Route 1: GAIL SV-32 U/C to Vardhaman Highway					

Sl. No.	Description	Chainage (m)			Location
		Start	Centre	End	
ROAD CROSSINGS					
1	Asphalted Road (Nawagaon to PMGSY Road (Nawagaon-Bori))	1470.64	1464.12	1480.41	TP24-TP25
2	Murram Road (Nawagaon to PMGSY Road (Nawagaon-Bori))	1847.58	1840.69	1854.35	TP30-TP31
3	PMGSY Road (Bori to Parsadapar)	2132.33	2127.38	136.62	TP35-TP36
4	Asphalted Road (Parasda to PMGSY Road)	2939.70	2928.33	2949.61	TP41-TP42
5	Asphalted Road (Dhaba to PMGSY Road)	5076.81	5071.08	5082.48	TP82-TP83
6	RCC Road (Dhaba to PMGSY Road)	5287.38	5282.91	5291.23	TP91-TP92
7	RCC Road (Dhaba to PMGSY Road)	5465.44	5461.95	5470.17	TP98-TP99
8	RCC Road (Dhaba to PMGSY Road)	5744.07	5733.70	5753.21	TP104-TP105
9	RCC Road (Dhaba to PMGSY Road)	5966.30	5964.06	5968.28	TP110-TP111
10	RCC Road (Bhendsar to PMGSY Road)	8981.08	8979.04	8982.86	TP170-TP171
11	RCC Road (Bhendsar to PMGSY Road)	9060.13	9057.43	9063.12	TP171-TP172
12	RCC Road (Bhendsar to PMGSY Road)	9186.73	9184.04	9189.45	TP174-TP175
13	RCC Road (Bhendsar to PMGSY Road)	9259.90	9256.70	9262.93	TP174-TP175
14	PMGSY Road (Nagpura to Ganiyari)	345.81	9340.87	9352.32	TP177- TP178
15	Murram Road (Karuriadih to Balodi - Bhendsar Road (ASP))	10513.80	10508.29	10518.47	TP218- TP219
16	Balodi - Bhendsar RCC Road (Balodi to Bhendsar)	11643.06	11634.60	11656.69	TP251- TP252
17	RCC Road (Thelkadih -Durg Road to Balodi)	11666.51	11660.82	11672.28	TP252-TP253
18	RCC Road (Thelkadih -Durg Road to Balodi)	11895.16	11892.18	11898.09	TP261-TP262
19	Asphalted Road (Thelkadih - Durg Road to Balodi)	13279.21	13275.15	13283.73	TP276- TP277
20	RCC Road (Thelkadih -Durg Road to Chikhli)	14732.73	14720.68	14743.47	TP290-TP291
21	RCC Road (Thelkadih -Durg Road to Chikhli)	14929.98	14926.73	14933.70	TP296-TP297
22	RCC Road (Thelkadih -Durg Road to Chikhli)	15042.90	15040.18	15045.95	TP301-TP302
23	RCC Road (Thelkadih -Durg Road to Chikhli)	15169.41	15166.49	15171.84	TP303-TP304
24	RCC Road (Thelkadih -Durg Road to Chikhli)	15246.51	15244.22	15249.38	TP304-TP305
25	RCC Road (Thelkadih - Durg Road to Chikhli)	15269.93	15267.91	15271.79	TP305-TP306
26	RCC Road (Thelkadih -Durg Road to Chikhli)	15288.94	15286.81	15290.55	TP305-TP306
27	RCC Road (Thelkadih -Durg Road to Chikhli)	15309.17	15306.32	15311.40	TP305-TP306
28	RCC Road (Thelkadih -Durg Road to Chikhli)	15387.11	15384.64	15389.24	TP306-TP307
29	RCC Road (Thelkadih -Durg Road to Chikhli)	15404.93	15402.55	15407.55	TP306-TP307

Sl. No.	Description	Chainage (m)			Location
		Start	Centre	End	
30	RCC Road (Thelkadih -Durg Road to Chikhli)	15424.97	15423.04	15426.87	TP306-TP307
31	SH-7 (Durg to Dhamdha)	15688.87	15668.42	15699.30	TP311-TP312
32	RCC Road (SH-7 to Khapri)	15735.11	15728.33	15741.08	TP313-TP314
33	Murram Road (SH-7 to Plotting Area)	16083.36	16079.51	16087.41	TP316-TP317
34	Junwani Road (SH-7 to Junwani)	16942.94	16913.65	16974.60	TP323-TP324
WATER BODY CROSSINGS					
35	Nala	1616.72	1614.20	1619.24	TP27-TP28
36	Sonbarsa River	2824.00	2804.29	2843.71	TP39-TP40
37	Nala	4866.19	4830.50	4901.87	TP80-TP81
38	Lined Canal	6484.18	6478.18	6490.23	TP118- TP119
39	Nala	8563.96	8561.95	8565.98	TP161- TP162
40	Seonath River	13527.63	13381.40	13673.86	TP278- TP279
41	Nala	14605.83	14592.25	14619.73	TP288- TP289
42	Nala	15754.57	15752.18	15756.95	TP313- TP314
43	Nala	17033.79	17030.48	17037.09	TP324- TP325
PIPELINE CROSSING					
44	Ex. GAIL Gas Pipeline	3734.56	--	--	TP57-TP58
Pipeline Route 2: Supela to Khandelwal CNG Station					
ROAD CROSSINGS					
1	Circus Maiden Road (Dakshin Gangotri,Supela to Supela Road)	114.58	109.17	120.71	TP1-TP2
2	Railway Under Pass Road (U/C)	316.96	310.40	323.76	IP4/2-TP5
3	Asphalted Road (Priyadarshini Parisar East to Garage Road)	997.38	985.48	1010.96	TP9-TP10
4	Bhilai Nagar Station Road (Bhilai Nagar RS to Rail Chowk)	1786.94	1770.41	1803.09	TP16- TP17
5	Garage Road (Raipur Naka to Maharana Pratap Chowk)	1868.06	1857.89	1883.06	TP20- TP21
RAILWAY CROSSING					
6	Southeast Central Railway Main Line(electrified) (Bhilai Nagar RS to Powerhouse Bhilai RS)	270.00	244.47	296.96	IP4/1- IP4/2
WATER BODIES CROSSING					
7	Major Drain	326.29	324.80	327.77	IP4/2-TP5
8	Samoda Nala	1325.47	1313.06	1337.87	IP12/1- TP13

Table 2-4: Technical Specifications of Pipeline

Sl. No.	Description	Piping Details
1.	Pipeline internal Diameter (Inches)	8”
2.	Pipeline Wall Thickness (mm)	6.4 mm
3.	Pipeline Grade/Material Specifications	Steel API 5L Grade X65
4.	Type of Coating	3-layer Polyethylene (PE) Coating
5.	Normal Operating Pressure	28 Bar (g)
6.	Maximum Allowable Operating Pressure (Design Pressure)	49 Bar (g)
7.	Design Throughput (MMSCMD)	86,362 SCMH

Sl. No.	Description	Piping Details
8.	Pipeline Design Life	25 years
9.	Design Temperature (°C)	Varies with ground conditions
10.	Mainline Valve Stations	Installed as per standard practice

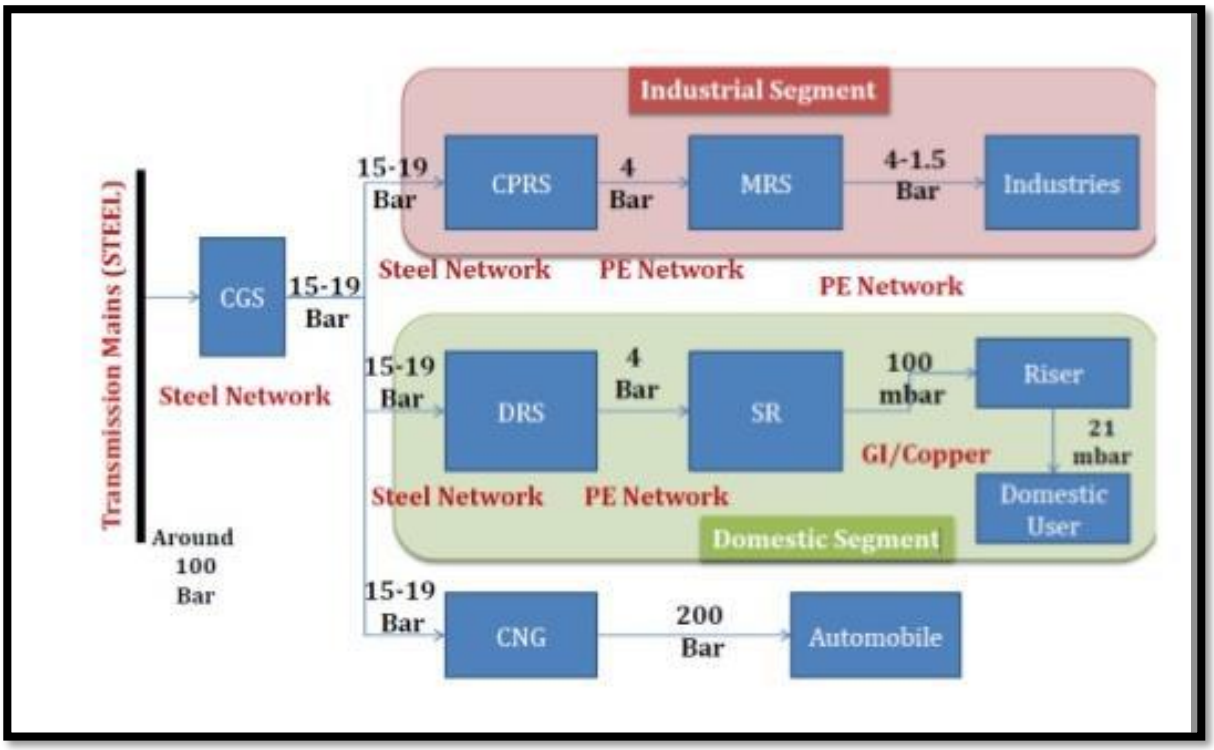
**Source: DPR, AGTL*

2.4 ASSOCIATED FACILITIES

2.4.1 CGD Network

A typical CGD network shall comprise of one or more or all the following:

- City Gate Station (CGS)
- Pipeline Network-Steel pipeline, Polyethylene pipeline etc.
- Regulating stations- District Regulating Stations (DRS), Service Regulators, Domestic / Commercial / Industrial Regulators.
- Metering Stations / Metering & Regulating Stations (MRS)
- CNG Stations



(Source: DPR, Adani Total Gas Limited)*

Figure 2-15: Network Diagram- Typical Arrangement Network of CGD

Project Company will take tap-off from nearest natural gas transmission pipeline of Gas Suppliers and further lay steel pipeline network, build City Gate Stations (CGS), Compressed Natural Gas (CNG) stations & District Regulating Stations (DRS), lay MDPE pipeline network etc in the various GAs for supplying piped natural gas to Domestic Households, Commercial & Industrial consumers and CNG to Automotive sector.

The steel pipeline route will be mainly along the National or State highways from CGS and will further spread inside city boundaries.

The Gas Distribution network will be designed and engineered primarily in accordance with the provisions of the PNGRB Regulations GSR 612(E), Aug' 2008 (T4S) and ASME Standards for Gas Transmissions and Piping Systems (ASME B31.8).

2.4.2 City Gate Station (CGS)

The gas from pipeline owner shall be available at a maximum pressure of 49 Bar(g) at the upstream of CGS. Pressure reduction skid is assumed to be installed by pipeline owner or CGD entity within its premise as per their normal business practice. Un-odourised gas is assumed to be made available from the downstream flange at the outlet of pressure reduction skid after metering at a maximum pressure of 45 Bar(g).

2.4.2.1 Steel Network

Steel pipeline sizes is generally restricted to 16" NB, 12" NB, 8" NB, 6" NB & 4" NB whereas, spur lines shall be of 4" NB. Steel pipeline is proposed to be installed at a minimum depth of 1.2 meters of soil cover, and in accordance with international standards for pipeline laying.

2.4.2.2 District Regulation Station

DRS are provided at various demand centres based on the requirement. DRS are located either in customer's premise or at a safe location on the roadsides. DRS capacity may be 5000 SCMH, 2500 SCMH, 1500 SCMH and 1000 SCMH or below is based on its availability and requirement in a particular area.

2.4.2.3 CNG Station (MOTHER/ONLINE/DAUGHTER/DAUGHTER BOOSTER STATION)

CNG Station

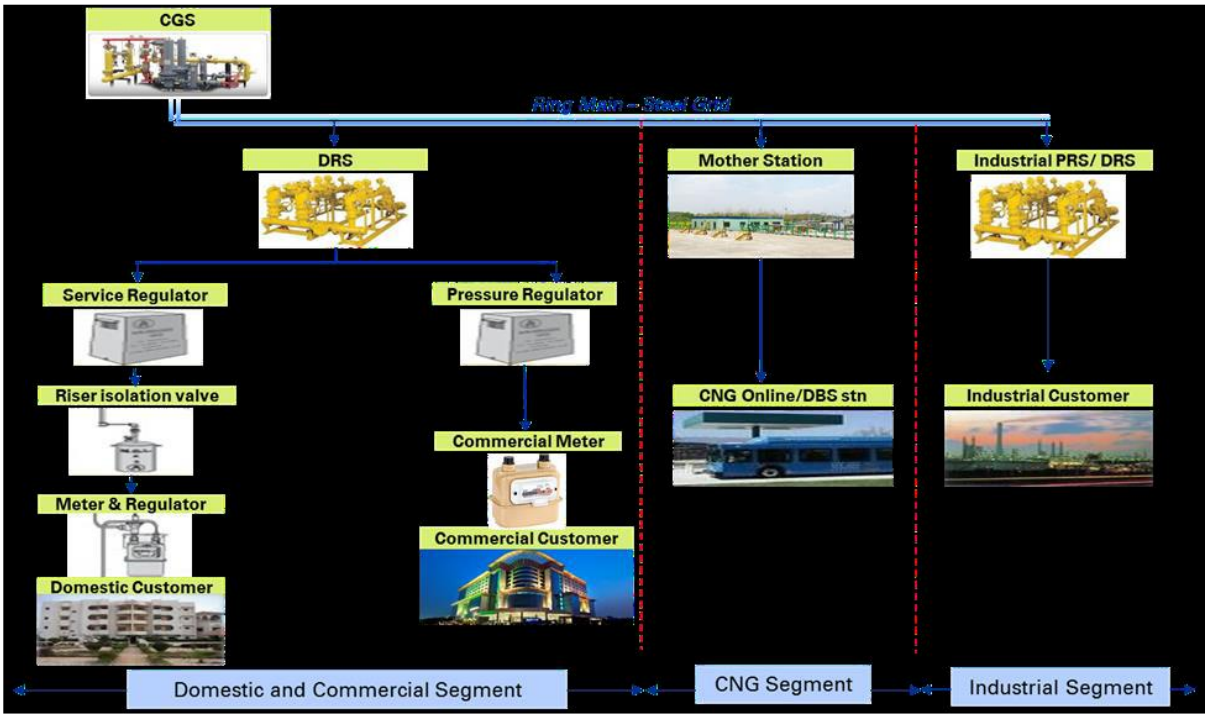
CNG station is a site consisting of interconnected equipment, which is designed to compress natural gas to a high pressure, store and dispense it directly to a natural gas vehicle. CNG stations are located at various locations in the city based on the demand and availability of land. CNG station can be either – On-line station (including mother stations) or daughter booster station.

Mother / Online Station

These are equipped with a compressor, which compresses low-pressure pipeline gas to the pressure of 255 bar for dispensing CNG to the vehicle cylinder at a pressure of 200 bar (g). Some of these stations also provide Cascade filling facility at 255 bar (g), used to fill gas in small cascades and transmitted to daughter booster stations. These kinds of stations are referred to as "Mother Stations". Online stations are the same as mother stations except that they do not have the cascade filling facility. The main components of an online CNG station are Compressors along with auxiliaries, Stationary cascades, Dispensers for cars and three-wheelers (autos), Dispenser for buses, Loading Facility for Mobile Cascades, Stainless steel tube connecting compressor, dispenser & cascades laid in U/G trenches, DG Set, UPS & Battery Bank, AVR, Electrical Control Panel, Instrument Air and Water Facilities and firefighting equipment.

Daughter Booster Station: Daughter station provided with the compressor (Known as booster) to compress the gas we are getting from the mother station are known as as daughter booster station.

Daughter station: Daughter stations are established in those areas where laying a pipeline is not possible. In that case gas is delivered from mother station to daughter station, via mobile cascade van. The gas from mother station is filled in mobile cascade by LCV filling point.



Source: DPR, Adani Total Gas Limited

Figure 2-16: Typical Arrangement Network of CNG Station

2.4.3 Design Basis/ Philosophy Considered for CGD Network Stimulation

The detailed market assessment of natural gas demand for all four segments that are Domestic, Commercial, Industrial and CNG Demand is conducted for 25 years. Based on 25th year natural gas demand, the major demand centres are mapped & identified and depicted below in Error! Reference s ource not found. in the geographical area of Mungeli, Bemetara, Durg, Balod, and Dhamatri districts under 10th round of CGD bidding. Network is planned in such a way that it caters all the major demand centres.

The details of the four segments in which natural gas use/ application is primarily segmented are as following:

- **Domestic segment (cooking/residential use**) – This segment includes Households and their usage for cooking and other house utilities such as geyser etc within the geographical area
- **Commercial segment**– This segment includes usage of gas in hotels, hospitals, bakeries, shops, hostels, food plazas, restaurants, sweet shops, malls and other commercial establishments for cooking/ heating purpose within the GA

- **Industrial segment (heating/ power generation use) –** This segment includes small/ medium scale industries (customers having requirement of natural gas up to 50,000 SCMD shall be supplied through the CGD network) located within GA for power generation, heating and other industrial applications.

CNG Segment (NGV applications) – This segment primarily caters to the transportation fuel demand of the various vehicles and potentially inter-city floating vehicles.

Table 2-5: Estimated Demand for all four segments for Mungeli, Bemetara, Durg, Balod and Dhamatri GA

Sl. No.	Segments	Domestic Demand	Commercial Demand	Industry Demand	CNG Demand	Total Demand
1	FY 2024	0	0	0	0	0
2	FY 2025	0	0	0	0	0
3	FY 2026	19459	2653	8583	22952	53648
4	FY2027	27799	5602	13906	76841	124148
5	FY2028	65328	8870	46705	146757	267660
6	FY2029	116756	12485	82812	223557	435611
7	FY2030	205713	16475	130113	307050	659352
8	FY2031	291890	17392	160591	433219	903093
9	FY2038	555981	28045	245667	949988	1196936
10	FY2043	555981	34157	285616	1196936	2072690

**Source: DPR, AGTL*

A detailed market assessment of geographical area is conducted for 25 years & peak demand in SCMH for the 25th Year is estimated on each sector based on the following hourly operations given in:

Table 2-6: Daily Operating Hours for Different Segments

Sl. No.	Segments	Hours Considered
1	Domestic	4
2	Industrial	16
3	Commercial	7
4	CNG	18

(Source: DPR, Adani Total Gas Limited)*

2.4.4 SCADA, Telecommunication & Leak Detection System

SCADA system shall be devised to monitor and operate the NG pipeline network. The Master Control Station shall be equipped with Supervisory Control and Data Acquisition (SCADA) software running under multi-programming, multitasking real time operating system environment. The SCADA software shall incorporate control & monitoring of all locations including Block valves. Leak Detection system shall be provided, and the Leak Detection Software shall run in a separate machine at Master Control Station. Regular check and control will be conducted to assure the safe continuity of the gas supply to consumers. For the network, patrolling will be conducted by the owner operators. This operation shall include but not

limited to the activities like, checking of local device such as levels of liquid, filter DP in filtration skid, regulator/ monitor/ SSV reliability etc. The gas quantity consumed by each end user will be totalized once a year. This package will enable the operator to take optimal control actions and thus ensure the safety and security of the pipeline network.

2.4.5 Filtration Skid & Liquid Catchers

The Equipment like regulators and meter are quite sensitive to dirt. Metering requires no particles above 5 microns. Whatever are the precautions taken during construction, no pipeline is perfectly clean and small quantities of residual dirt may always still exist. Residual dirt tends to move along with the gas depending on gas speed and pipeline geometry and clog the inlet filters to CGS. Special care by a maintenance team is required during the initial stages of operations. Small K-O drum and filter-separators (the Filters) are installed in front of the filtration skid.

2.4.6 Pressure Reduction Skid

The pressure control system shall be of High Integrity type (HIPPS) combining from upstream to downstream. Slam-shut valve is mechanically actuated designed to close quickly in the event of an abnormal pressure (whether excess or low) being detected at a selected point in a gas system; it needs local manual reset; Fail-safe position is to close. The pressure reduction system shall consist of the following:

- Monitor: A Pressure Control Valve (PCV) which shall take over control in case the active PCV fails to maintain downstream pressure below required maximum pressure; Fail-safe position is to open.
- Active Pressure Control Valve (PCV) that regulates the downstream pressure as required; Fail-safe position is to open.
- Pressure reduction skid comprising active and monitor combination with a minimum 50% redundancy with stream discrimination arrangement, including slam shut valve for over and under pressure protection and creep relief valves.

Such concept is called "Non-Venting Pressure Safety" and allows avoiding the "Safety Relief Valves" more common in industrial plants. Some suppliers may offer the combination of the above "Slam-shut" valve and "Monitor" in one single integrated device. This may be allowed for, if strict certification is produced. All piping and station components, that are located up-stream to first valve of the "Metering Facility" are designed to handle a pressure of 49 bar, including valves

2.4.7 Metering Skid

Metering shall be provided at the CGS. High accuracy metering is used typically; orifice/ultrasonic/turbine type flow metering is used along with associated flow computer, retrieving information on gas pressure, temperature and composition. Upstream dry gas filter(s) shall be installed when rotary or turbine meters are used. Accurate gas composition shall be derived from data from gas chromatographs to determine the consumption. While supplying gas to a domestic/CNG area, large swings in volume of gas should be expected. Considering that the gas flow / volume is to be reconciled with the transporter, the metering

philosophy adopted here is same as that of the transporter. Filters are installed ahead of meters wherever required.

2.4.8 Odorizer

Natural gas introduced into any system should have a distinctive odour strong enough to detect its presence down to a concentration (of CNG) in air not exceeding 20% of the lower limit of flammability. By its property, natural gas is odourless which makes detection of leaks impossible without special gas detection tool. Consumers connected to a Natural Gas Distribution System do not have adequate skills for gas handling; hence it is mandatory to add an odorant to the gas before it enters the medium pressure distribution system. Odorization is based on the injection of ethyl mercaptan on the medium pressure side. The flow signal is provided by a dedicated flow measurement system.

2.4.9 Fire Alarm & Fire Fighting System

As per the Petroleum and natural gas regulatory board notification 2008, Schedule 1 D, after construction activities relevant warning signs shall be displayed in the area. A proper Emergency Response Plan shall be in place and emergency contact numbers of relevant agencies should be visible. Firefighting equipment's should be available during commissioning.

As per the PNGRB notification, 2008, ATGL shall provide an Emergency Control Room, staffed round the clock, and equipped with effective communication system and emergency vehicles fitted with communication facilities, first aid equipment, fire extinguishers, gas detectors, repair kits and tools, maps, plans, material safety data sheets etc. at its disposal. The entity shall put in place an Emergency Response Plan, a Disaster Management Plan, and a Pandemic Plan. While preparing these plans the entity shall take into confidence the various local authorities (i.e., Fire authorities, Police authorities, Health authorities, local administration, Disaster Management authorities, Mutual aid, Factory inspectorate etc) and clearly elaborate on their role in case of an incident.

2.4.10 Corrosion Protection

Underground carbon steel section beyond transition fitting is below ground, it shall be protected against corrosion by minimum 400 micron thick 2 pack high build epoxy coating. Above ground service piping shall be Galvanized Iron or copper, or carbon steel protected by anti-corrosive coating. Conventional coating of pipelines by 3-layer polyethylene (PE) coating shall be used as "passive" protection. Complete corrosion protection cannot be achieved practically by coating, as it is impossible to fully avoid minor defects such as pores or cracks in the coating.

2.4.11 Check Valve (Non- Return Valve)

Consisting of the same functionality as like the "Fire Brigade" Inlet valve, a check valve ("non-return valve") is installed before the distribution header dispatching gas to the down-stream multiple departure. This allows guaranteeing no backflow from distribution network to a potential defect in the station and avoids the necessity of down-stream "Fire-brigade" valve outside the station. The "Check-valve" shall be either "fire-proofed" if installed above ground or better, buried together with the distribution header.

2.5 LAYING OF PIPELINE

2.5.1 Site Preparation & Laying Methodology

The project is for laying of natural gas pipeline with open trenching. However, for the Portion passing through, train tracks, Canals, Horizontal Directional Drilling Method (HDD) will do ponds bridges to reduce the environmental impacts to minimum.

The usual approach to pipeline installation is to dig an open trench, place the pipeline and then bury it. Proposed pipeline is passing through commercial, industrial residential, agricultural areas, water bodies, public spaces etc. shall be laid by:

1. Horizontal Directional Drilling (HDD) method for pipeline.
2. Open cut method for remaining portion of pipeline.

Horizontal Directional Drilling (HDD) is a Trench-less methodology that provides an installation alternative that can offer several benefits over traditional open-cut method.

- In a sensitive wetland environment such as a river/creek crossing, wildlife habitats would be destroyed, and extensive mitigation efforts would be required while pipe laying by open cut method. As a result, trenchless or "no-dig" technology has been used extensively worldwide.
- HDD can be implemented with little disruption to surface activities, requires less working space, and may be performed more quickly than open-cut methods.
- 8” Nominal bore & 4” Nominal bore pipelines Steel Pipelines laid together by HDD methodology and remaining length of CRZ portion by Open Cut Method.

Open Cut Method is a usual approach to pipeline installation is to dig an open trench, place the pipeline and then bury it.

Pressure shall be between 16-40 Bar, 3 layers of PE coated steel pipes for the transportation of gas to its delivery centres.

2.5.2 Pipeline Burial

As per the Petroleum and natural gas regulatory board notification 2008, all types of pipes (plastic and steel) and fittings shall be laid underground and shall not be exposed. The buried service lines are provided with a minimum cover of 1.2 m. Where it is impractical to provide 1.0 m cover due to physical constraints, additional protective measures such as concrete slabs or high impact resistance plastic sheets shall be installed at least 300 mm above the service line. In no case the depth of cover shall be less than 600mm. For transition from plastic pipe to GI pipe, transition fittings shall be used. Plastic part of transition fitting protruding above ground shall be protected by encasing it with concrete guard.

In case carbon steel section beyond transition fitting is below ground, it shall be protected against corrosion by minimum 400 micron thick 2 packs high build epoxy coating. Above ground service piping shall be Galvanized Iron or copper, or carbon steel protected by anti-corrosive coating.

In cases where HDD is used for pipeline burial, plastic or carbon steel, adequate depth of 2-2.5m shall be maintained under if the pipeline is going below from any of the listed features, i.e., River/ canal beds, highways, roads, houses, and industries.

Table 2-7: Minimum Depth of Cover for Buried

Sl. No.	Location	Minimum Cover (m)
1	Normal/ Rocky Terrain	1.0
2	Minor River/ unlined canal/ nala crossing/ tidal areas/ other water courses	1.5
3	Major River Crossings	2.5
4	Rivers with rocky bed	1.5
5	Lined canals/ drains/nalas	1.5
6	Drainage ditches at roadways and railways	1.0
7	Rocky Areas	1.0
8	Cased/ uncased road crossing	1.2
9	Cased railroad crossing	1.7

(Source: PNGRB Notification,2008)*

2.5.3 Testing, Cleaning & Drying

2.5.3.1 Filling for Nitrogen Gas-In

The nitrogen shall be injected in the pipeline before filling the pipeline with gas (gas-in) to prevent direct mixing of gas with air. Nitrogen needed for Energization of the pipeline shall be provided by the contractor. The maximum allowable Oxygen content inside the pipeline shall be less than 1% by volume. The pipeline will be evaluated, cleaned, and dried, section after section.

2.5.3.2 Cleaning of Pipeline

Before starting the pigging activity, initial weight of the pig shall be measured at the Launching Station and after receiving the pig at the Receiving Station, the final weight of the pig shall also be measured. The difference between the initial and final weights of the Pig shall not exceed more than 20% of the initial weight of the pig. Air cleaning must be done by oil free compressors only.

2.5.3.3 Testing

Pre-Hydrostatic test Pressure and Final Hydrostatic Test Pressure shall be done at 1.4 times of design pressure. It should be confirmed that the hoop stress should not increase by 95% of SMYS.

2.5.3.4 Thermal Stabilization

If the difference of minimum and maximum atmospheric temperature should cause thermal instability on the pipe section directly exposed to atmospheric condition, the temporary scraper traps and above ground pipeline shall be properly protected. The test medium shall be evaluated to confirm soft non-aggressive water. The water to be used shall be filtered, shall not be contaminated, and free from sand or silt. Before filling operation, air driven pigs will clean the pipeline to remove all mill scale rust/sand from the internal of pipe sections. The final change shall be executed with pigs provided with air jet holes or nozzles to keep the internal dust in turbulence ahead of the pigs. Thermal stabilization shall be

considered to have been achieved when a difference not higher than 1°C is attained between the average values of the last two readings.

2.5.3.5 Swabbing & Drying

Poly pigs followed by high and medium density foam pigs shall be propelled with compressed / Dry air for removal of residual water for swabbing operation. Drying shall be conducted round the clock, once started after the swabbing operation. If possible, the swabbing shall be preferably conducted using drying air to reduce the drying time. Mainline valves shall be kept fully open during operation and by passes shall be used only to check drying stage in between length and drying of valves.

After completion of swabbing and tie-in of valves, tap off etc. in each Hydrotest section, following operations shall be conducted for the drying. A sequence of three nos. of foam pigs, High, Medium & Low density (7 to 10-kg ranges) shall be launched with the super dry air at the interval of 30 minutes each. The discharge of drying unit shall be measured at every 06 hours using digital dew point meter and – 45°C at the outlet of dryer shall be maintained. The foam pigs when received at other end shall be removed and vents shall be kept open on receiving end to ensure min. backpressure. The dry air shall be allowed to flow continuously till – 8 to 10°C is achieved at the receiving end.

2.6 PROJECT REQUIREMENT

2.6.1 Land

The land required for the project is only for natural gas pipeline network measuring 20.17 kms. The pipeline network is planned to be established within the Geographical Area (GA), originating from the Tap-Off point at SV-32/33 (MNJPL) in Durg, where the gas will be extracted for distribution.

2.6.2 Manpower Resources

During the construction phase, local skilled and unskilled labour will get temporary employment based on required skill sets. However, as the development will be phase wise, the total number of locals employed at any one time may not be more than 35-50. **ATGL** has contracted out the construction works and management of labour to contractors, local skilled and unskilled workers and service providers are preferred to boost local employment generation. For operational phase is considered, guards will be employed to patrol the pipeline areas, which will be around 10-20 people for this stretch. Skilled workers will be employed for the operation and maintenance. All these will also be contracted out to the subcontractors.

2.6.3 Power Requirement

The power requirement will be met from DG sets during construction phase of the project. During operational phase, power will be only required for SCADA & associated facilities. The same shall be supplied via state grid.

2.6.4 Water Requirement

Water requirement will be minimal for the project associated only with domestic use by the workers during construction and office staff during constructions and operations period at the distribution centres.

The water requirement for construction phase will be contracted out to private tankers. There will be no water requirement during operation phase expect for domestic usage of staff and workers.

2.6.5 Emission and Discharges

Fugitive dust shall be the main air pollutant, from the small diesel engines used for the construction works & movement of vehicles for which dust suppression system will be used as relevant points. No effluent will be generated during operation of the proposed project.

3 LEGAL, POLICY AND REGULATORY FRAMEWORK

The emerging environmental scenario calls for attention on conservation and judicious use of natural resources. There is a need to integrate the environmental consequences of development activities and for planning suitable measures to ensure sustainable development of the region. The environmental and social considerations in any developmental process have become necessary for achieving sustainable development. To achieve such goals, the basic principles to be adopted are:

- To enhance the quality of environment in and around the project area by adopting proper measures for conservation of natural resources.
- Prevention of adverse environmental and social impact to maximum possible extent; and
- To mitigate the possible adverse environmental and socio-economic impact on the project-affected areas.

This section highlights the environmental and social regulations applicable to proposed City Gas Pipeline distribution network project. The section broadly focuses institutional framework, applicable environment, health and safety and social legislative, World Bank's guidelines and IFC's Performance Standards requirements relevant to the proposed project.

3.1 ENFORCEMENT AGENCIES

All the permissions and the approvals must be taken from concerned ministries, line departments and the local civic bodies for any upcoming project in India. The environmental and social governance approach in the country consists of:

1. Regulatory and implementing entities.
2. Legal framework including policies, acts, and laws; and
3. Permitting system.

With the aim to create a National Gas Grid (One Nation, One Gas Grid) and increase the availability of natural gas across the country, Petroleum and Natural Gas Regulatory Board (PNGRB) under Ministry of Petroleum and Natural Gas has authorized to lay Natural Gas Pipeline network across the country and the environmental aspects are governed by Ministry of Environment, Forests and Climate Change (MoEF&CC), Central Pollution Control Board (CPCB). The social governance aspects at the micro level are addressed by institutions like panchayats and municipal bodies.

A brief description of the relevant enforcement agencies with respect to the institutional framework is described in the following sub-sections:

3.1.1 Ministry Of Environment, Forests and Climate Change (MOEF&CC)

The Ministry of Environment, Forests and Climate Change (MoEF&CC) is the nodal agency in the administrative structure of the Central Government for the planning, promotion, co- ordination and overseeing the implementation of India's environmental and forestry policies and programs. The primary concerns of the ministry are implementation of policies and programs related to conservation of the country's natural resources including its lakes and rivers, its biodiversity, forests, and wildlife, ensuring

the welfare of animals, and the prevention and abatement of pollution. While implementing these policies and programs, the ministry is guided by the principle of sustainable development and enhancement of human well-being. The specific functions of MoEF&CC are as follows:

1. Environmental policy planning.
2. Effective implementation of legislation.
3. Monitoring and control of pollution.
4. Environmental Clearances for industrial and development projects covered under ESIA notification.
5. Promotion of environmental education, training, and awareness; and
6. Forest conservation, development, and wildlife protection.

3.1.2 Central Pollution Control Board (CPCB)

The Central Pollution Control Board (CPCB) was established in September 1974, for the purpose of implementing provisions of the Water (Prevention and Control of Pollution) Act, 1974. The executive responsibilities for the industrial pollution prevention and control are primarily executed by the CPCB at the Central level, which is a statutory body, attached to the MoEF&CC. CPCB works towards control of water, air and noise pollution, land degradation and hazardous substances and waste management. The specific functions of CPCB are as follows:

- Prevent pollution of streams and wells.
- Advise the Central Government on matters concerning prevention, control and abatement of water and air pollution.
- Co-ordinate the activities of SPCB's and provide them with technical and research assistance.
- Establish and keep under review quality standards for surface and groundwater and for air quality.
- Planning and execution of national program for the prevention, control, and abatement of pollution through the Water and Air Acts; and
- The CPCB is responsible for the overall implementation and monitoring of air and water pollution control under the Water Act, 1974, and the Air Act, 1981.

3.1.3 Chhattisgarh Environmental Conservation Board (CGECB)

Chhattisgarh Environment Conservation Board is constituted by Government of Chhattisgarh on 25th July 2001 and Notified in the Chhattisgarh Government's Official Gazette on 31st August 2001. For Prevention and Control of water pollution and maintaining or restoring of wholesomeness of water and prevention, control & abatement of air pollution environmental laws namely Water (Prevention and Control Pollution) Act, 1974 and Air (Prevention and Control of Pollution) Act, 1981 have been enacted. Central and State Pollution Control Boards came into existence to fulfill the purpose mentioned in the above Acts. With the constitution of Chhattisgarh State, a Board namely Chhattisgarh Environment Conservation Board came into existence.

To have uniform laws, all over the country for broad environmental issues endangering the health & safety of our people as well as of our flora and fauna and to check environmental degradation, the Parliament of India has enacted the following laws:

- The Water (Prevention & Control of Pollution) Act, 1974 as amended to date
- The Water (Prevention & Control of Pollution) Cess Act, 1977
- The Air (Prevention & Control of Pollution) Act, 1981 as amended to date

The aforesaid laws have been adopted by the Govt. of Chhattisgarh to control environmental pollution in the State. The Govt. of India, Ministry of Environment & Forests, has also framed the following rules for the management of Hazardous Waste, Bio Medical Waste, Municipal Solid Waste, Recycled Plastic, Used Batteries, Control of Noise Pollution and Protection of Ozone Layer under the provisions of the Environment (Protection) Act, 1986.

- The Hazardous Waste (Management & Handling) Rules, 1989 as amended to date
- The Manufacture, Use, Import, Export and Storage of Hazardous Micro Organisms Genetically
- Engineered Organisms or Cells Rules, 1989
- The Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 as amended to date
- The Public Liability Insurance Act, 1991
- The Bio-Medical Waste (Management & Handling) Rules, 1998
- The Recycled Plastics Manufacture, Sale & Usage Rules, 1998 as amended to date
- The Municipal Solid Waste (Management & Handling) Rules, 2000
- The Noise Pollution (Regulation & Control) Rules, 2000
- The Ozone Depleting Substances (Regulation) Rules, 2000
- The Batteries (Management & Handling) Rules, 2001
- E-waste (Management) Rules, 2016

The Board has been entrusted the task of implementation of environmental laws in the State of Chhattisgarh. The State has prepared its Environmental Policy within the basic framework of economic and social priorities with the objective of ensuring environmental conservation without impeding any development imperatives. It is aimed at:

- Ensuring sustainable development with an emphasis on social and intergenerational equity
- Enhancing environmental performance as a means of competitive advantage for the State
- Improving the quality of life of citizens.

3.1.4 Petroleum & Explosive Safety Organization (PESO)

The PESO is under the Department of Industrial Policy & Promotion, Ministry of Commerce and Industry, Government of India. The Chief Controller of Explosives is responsible to deal with provisions of

- The Petroleum Act 1934 and the Rules 2002.
- The Static and Mobile pressure vessels {Unfired} Rules, 1981 and amendment 2000, 2004.
- Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 and amendment 2000.

3.1.5 Ministry Of Petroleum & Natural Gas

The MoPNG is the nodal ministry of Government of India for all matters related to petroleum and Natural Gas. The ministry formulates policies for the exploration, production, refining, distribution, and marketing of petroleum and natural gas. The ministry, through the Petroleum and Natural Gas Regulatory Board (PNGRB), authorizes entities to develop City Gas Distribution networks. These networks supply piped natural gas (PNG) to households, industries, and commercial establishments, and compressed natural gas (CNG) for vehicles. MoPNG promotes the development of infrastructure for natural gas, including pipelines and import terminals, to enhance the availability and accessibility of natural gas across the country. The ministry issues guidelines for the allocation and pricing of natural gas to ensure its efficient and equitable distribution.

3.1.6 Central Ground Water Authority (CGWA)

Central Ground Water Authority (CGWA) was constituted under sub-section (3) of Section 3 of the Environment (Protection) Act, 1986 for the purposes of regulation and control of ground water development and management. The authority is entrusted with powers of:

- To resort the penal provisions contained in section 15 to 21 of the said act.
- To regulate and control, management and development of ground water in the country and to issue necessary regulatory directions for the purpose.
- Exercise of powers under section 4 of Environment (Protection) Act, 1986 for the appointment of Officers.

CGWA is regulating withdrawal of ground water by industries/ projects. CGWA has published guidelines/ criteria for evaluating proposals/ requests for ground water abstraction (with effect from 16/11/2015). As per the guidelines, for non-notified areas, NOC for ground water withdrawal will be considered for Industries as per the criteria given in the notification, presented in below **Table 3-1**.

Table 3-1: Criteria for granting NOC to Industries/ Infrastructure/ Mining in Non-Notified Areas

Category	Requirement of NOC			
	Safe	Semi-Critical	Critical	Overexploited
Domestic use (rural & urban)/Rural drinking water supply schemes/armed forces establishment/MSME	Not Required	Not Required	Not Required	Not Required

Category	Requirement of NOC			
	Safe	Semi-Critical	Critical	Overexploited
abstracting less than 10 cum/day				
Residential Apartments / Group Housing Societies / Govt. Water Supply Agency	Required (GW abstraction charges to be paid)	Required (GW abstraction charges to be paid)	Required (GW abstraction charges to be paid)	Required (GW abstraction charges to be paid)
Agriculture	Not Required	Not Required	Not Required	Not Required
Industrial Use	Required	Required	Required	Prohibited except MSME excluding new packaged water industries
Mining	Required (GW abstraction charges to be paid)	Required (GW abstraction charges to be paid)	Required (GW abstraction charges to be paid)	Required (GW restoration charges to be paid)
Infrastructure Projects	Required (GW abstraction charges to be paid)	Required (GW abstraction charges to be paid)	Required (GW abstraction charges to be paid)	Prohibited for Water Parks/Theme Parks/Amusement Parks. For construction allowed only if alternate option such as treated sewage water is not available within 05 km.

*Authorized water tankers will supply the water needed to clean the modules in areas where automated cleaning systems are not available. However, **AGTL** will adopt robotic cleaning technology and dry brush cleaning to conserve water.*

3.2 IFC EHS GUIDELINES

The IFC's EHS Guidelines dated 30th April 2007 shall be applicable for the project. **ATGL** should ensure using the Guidelines as guiding framework for addressing impacts on Environment, Occupational Health and Safety, Community Health and Safety during construction, operation as well as decommissioning phase of the project.

The IFC's EHS Guidelines provides industry specific management measures for addressing impacts on biodiversity, occupational health, and safety as well as community health and safety as early as possible in the project cycle, including the incorporation of EHS considerations into the site selection, to maximize the range of options available to avoid and minimize potential adverse impacts.

The EHS Guidelines for Electrical Power Transmission and Distribution dated 30th April 2007 should further be followed by **ATGL** for addressing EHS issues associated with electric power transmission and distribution that occur during the construction and operation phases of the project along with recommendations for their management.

3.3 IFC PERFORMANCE STANDARDS

The Performance Standards (PS) established stipulates that the project shall meet the following throughout the life of an investment by IFC or other relevant financial institution:

- **Performance Standard 1:** Assessment and Management of Environmental and Social Risks and Impacts.
- **Performance Standard 2:** Labour and Working Conditions.
- **Performance Standard 3:** Resource Efficiency and Pollution Prevention.
- **Performance Standard 4:** Community Health, Safety and Security.
- **Performance Standard 5**: Land Acquisition and Involuntary Resettlement.
- **Performance Standard 6:** Biodiversity Conservation and Sustainable Management of Living Natural Resources
- **Performance Standard 7:** Indigenous Peoples; and
- **Performance Standard 8:** Cultural Heritage.

These performance standards and guidelines provide ways and means to identify impacts and affected stakeholders and lay down processes for management and mitigation of adverse impacts. A brief on the requirements as laid down in the performance standards is described below **Table 3-2**.

Table 3-2: Applicable performance Standards

PS No.	Performance Standards	Applicability
PS-1	Assessment and Management of Environmental and Social Risks & Impacts	• Yes ○ No
PS-2	Labour and Working Conditions	• Yes ○ No
PS-3	Resource Efficiency and Pollution Prevention	• Yes ○ No
PS-4	Community Health, Safety, and Security	• Yes ○ No
PS-5	Land Acquisition and Involuntary Resettlement	○ Yes • No
PS-6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	• Yes ○ No
PS-7	Indigenous Peoples	○ Yes • No
PS-8	Cultural Heritage	○ Yes • No

The details of applicability of IFC Performance Standards for proposed solar power project are given below **Table 3-3:**

Table 3-3: Applicability of IFC Performance Standards for CGD Project

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
Assessment and Management of Environmental and Social Risks & Impacts (PS-1)	PS-1 establishes the importance of integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects; effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; the client's management of environmental and social performance throughout the life of the project.	The PS-1 is applicable to projects with environmental and/or social risks and/or impacts. The proposed project is a CGD of NGP Project and will have environmental and social impacts such as stress on existing water resources, generation of noise, air emission during construction activities and transportation, biodiversity impacts etc.	***Applicable*** ***Policy and Environment and Social Assessment and Management System*** **ATGL** in coordination with other responsible government agencies and third parties as appropriate, will conduct a process of environmental and social assessment. The client will also establish an overarching policy defining the environmental & social objectives and principles that guide the project to achieve sound environmental and social performance. Further, **ATGL** needs to adhere with respect to measures suggested in ESMP of this report to manage the risks associated with its operations like stakeholder engagement, emergency response plan, contractor management plan, grievance redressal etc. and decommissioning phase of the project. ***Requirements: Identification of Risks and Impacts and Management Programs.*** **ATGL** will establish and maintain a process for identifying the environmental & social risks and impacts of the project. Management Programs will be developed depending upon nature and scale of the project. Impacts identified during construction and operation phase of the project have been detailed in **Chapter** Error! Reference source n ot found. of this ESIA report. **Chapter 8** defines framework for environmental and social management plan for the proposed project. ***Requirements: Organizational Capacity and competency*** **ATGL** in collaboration with appropriate & relevant third parties, will establish, maintain, and strengthen as necessary an organizational structure that defines roles, responsibilities in association with the

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			project. Organization structure for implementation of environmental and social management plan has been detailed in **Section 9.3, ESMP** of the report. It reflects the role of corporate and site level EHS team in managing EHS aspects at site and outlines a clear responsibility of the EHS team in management of EHS with respect to ESMP. Some of the specific trainings that will be carried out on routine basis are as follows: • Occupational Health & Safety • Fire Safety & Prevention • Emergency Response Preparedness • Operational Training • HR Induction Training • PPE Training • Driver Safety The above-mentioned trainings are preliminary trainings which will be undertaken at inception stage once the employee/worker joins the company and/or project. Post that, monthly refresher training can be taken especially for the workers. **ATGL** will draw project specific HSE plan and other management plans like water management, waste management, labour management, site security etc ***Requirements: Emergency Preparedness and Response*** The **ATGL** will establish emergency preparedness and response system to respond to accidental and emergency situations associated with the project in a manner appropriate to prevent and mitigate any harm to people and/or the environment. The client is required to design emergency preparedness and response plans based on the risks to community health and safety identified during the risks and impacts identification process. The level of planning and

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			communication should be commensurate with the potential impacts. **ATGL** will establish procedures to monitor & measure effectiveness of management program, as well as compliance with any related legal and/or contractual obligations and regulatory requirements. This ESMP will have to be monitored on aregular basis, quarterly or half-yearly and all outcomes would need to be audited in accordance with existing EHS commitments. ***Requirements: Monitoring and Review*** The monitoring process will cover all stakeholders including contractors, labourers, suppliers, and local community impacted by project activities and associated facilities. Inspection and monitoring of environmental & social impacts of construction and operation phase activities will increase the effectiveness of suggested mitigations. Through the process of inspection, audit, and monitoring, **ATGL** will ensure that all contractors comply with the requirements of conditions for all applicable permits including suggested action plans. The inspections and audits will be done by **ATGL's** trained team & external agencies/experts. The entire process of inspections & audits will be documented. The inspection and audit findings will be implemented by contractors in their respective areas. ***Requirements: Stakeholder Engagement, Disclosure of Information and Consultations*** **ATGL** should identify the range of stakeholders that may be interested in their actions and consider how external communications might facilitate a dialogue with all stakeholders. **ATGL** will develop and implement a Stakeholder Engagement Plan that is scaled to the project risks & impacts. It will be tailored to characteristics and interests of the affected communities. **ATGL will**

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			provide affected communities with access to relevant information on: (i) Purpose, nature, and scale of the project. (ii) Duration of project activities (iii) Any risks to and potential impacts on such communities and Relevant mitigation measures. (iv) Envisaged stakeholder engagement process. (v) Grievance mechanism. When affected communities are subject to identified risks and adverse impacts from a project, the client will undertake a process of consultation in a manner that provides the affected communities with opportunities to express their views on project risks, impacts and mitigation measures. It will allow the client to consider & respond to them. **Chapter 8** of the report details the stakeholder identification and engagement related to the project. A stakeholder's engagement plan is also formulated as a part of ESIA report to correct any gaps and ensure adequate stakeholder engagement going forward.
Labour and Working Conditions (PS-2)	Performance Standard 2 recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of fundamental rights of workers. The objectives of PS 2 are: • To promote fair treatment, non-discrimination, and equal opportunity of workers. • To establish, maintain, and improve worker- management	The proposed project will involve employment of direct and contracted workers during construction and operation phase. The client will engage direct workers, workers engaged through third parties (contracted workers), as well as workers engaged by the client's primary suppliers (supply chain workers).	***Applicable*** ***Requirements: Working Conditions and Management of Worker Relationship*** The **ATGL** will provide workers with documented information that is clear and understandable, regarding their rights under national labour and employment law. The proponent shall ensure measures to: • Prevent child labour, forced labour, and discrimination. • Freedom of association and collective bargaining shall be provided. • Wages, work hours and other benefits shall be as per the national labour and employment laws.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
	relationship. • To promote compliance with national employment and labour laws. • To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain. • To promote safe and healthy working conditions, and health of workers. • To avoid use of forced labour.		**ATGL** will ensure that reasonable working conditions and terms of employment for both direct and contracted workers through contractor agreements are provided. Contractor engaged by **ATGL** for various activities should ensure that terms of employment include wages and benefits, wage deductions, hours of work, breaks, rest days, overtime arrangements, overtime compensation, medical insurance, pension, leave for illness, vacation, maternity, and holiday are communicated to workers clearly. Migrant workers, if employed shall also be providedsame working conditions equivalent to those of non-migrant workers performing the same type of work. It will be the responsibility of all the construction contractors engaged by **ATGL** for the project, to provide accommodation, transportation, and basic services including water, sanitation, & medical care to workers. ***Requirements: Non-Discrimination and Equal Opportunity*** **ATGL** will not discriminate with respect to any aspects of employment relationship, such as recruitment, hiring, compensation (including wages and benefits), working conditions, terms of employment, access to training, job assignment, promotion, termination of employment or retirement, and disciplinary practices. **ATGL** will take appropriate measures to prevent any discriminatory treatment of migrant workers. Measures to prevent any harassment, including sexual harassment or psychological mistreatment within the workplace will also be undertaken. ***Requirements: Retrenchment*** **ATGL** should ensure that all workers receive notice of dismissal and severance payments mandated by law and collective agreements in a timely manner.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			ATGL should ensure that proper consultations are undertaken with the workers before retrenchment, if any. Selection criteria for those to be laid off should be objective, fair, and transparent. The retrenchment should not be based on personal characteristics and unrelated to inherent job requirements. ***Requirements: Grievance Mechanism*** **ATGL** will provide a grievance mechanism for workers (and their organizations, where they exist) to raise workplace concerns. In providing a grievance mechanism through which workers may raise workplace concerns, **ATGL** should ensure that matters are brought to management's attention and addressed expeditiously. **ATGL** needs to document all grievances and follow up on any corrective actions. ***Requirements: Protecting the Work Force*** **ATGL** will not employ children in any manner that is economically exploitative or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. **ATGL** is required to ensure that no child labour (as defined in IFC PS 2), forced labour is employed by the contractor during construction and operation phase of the project. **ATGL** should also exercise diligence regarding key contractors and subcontractors so that they do not knowingly benefit from practices that lead to bonded or indentured status of workers. ***Requirements: Occupational Health and Safety (OHS)*** **ATGL** will provide a safe and healthy work environment, considering inherent risks in its sector and specific classes of hazards in the client's work areas, including physical, chemical, biological, and

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			radiological hazards, and specific threats to women. ATGL will extend a safe and healthy work environment to contracted workers and to any other workers who provide project-related work and services. ATGL should ensure that training is provided to all workers on relevant aspects of OHS associated with their daily work, including emergency arrangements and OHS briefing for visitors and other third parties accessing the premises. All occupational injuries, illnesses and fatalities are to be documented and should be clearly communicated to third parties, and if possible, to workers engaged by these third parties.
Resource Efficiency and Pollution Prevention (PS-3)	Performance Standard 3 recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. The objectives of PS 3 are: • To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities. • To promote more sustainable use of resources, including energy and water. • To reduce project related GHG emissions.	ATGL shall assess the impacts and risks associated with generation, use, storage, release, and/or disposal of pollutants during the ESIA, and implement them as per action plan. Also, pollution control measures shall be planned and implemented right from the project conception stage. Practices like minimal release of waste, handling of hazardous waste, safe disposal of waste, wastewater management etc. shall be considered prior to each phase. PS -3 is therefore applicable for the proposed project. The proposed project is a clean energy project and will not have major pollution sources associated with it. The construction works for development of project will entail generation of wastes like wastewater, waste oil and construction debris. The operation phase will result in generation of minor quantities of waste such as	***Applicable*** **Requirements: Resource Efficiency** ATGL will implement technically and financially feasible and cost-effective measures for improving efficiency in its consumption of energy, water, as well as other resources and material inputs, with a focus on areas that are considered core business activities. ***Requirements: Greenhouse Gases*** ATGL needs to work on the management, mitigation, and reduction of GHG emissions associated with the construction, operation, and decommissioning of the pipeline. These emissions primarily include methane (CH_4), which is a potent GHG associated with natural gas distribution, and other related carbon emissions. ***Requirements: Water Consumption*** During the construction phase, water will be primarily required for dust suppression on the site, hydrostatic testing, concrete mixing, and providing catering and sanitation for the workforce. Sustainable sourcing prevents over-extraction, proper wastewater management prevents contamination. Compliance with local regulations and monitoring are crucial for sustainable water use.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
		transformer oil and wastewater from cleaning of solar panels.	Continuous adjustment is essential to meet IFC Performance Standard 3 requirements and avoid the significant adverse impacts on others. ***Requirements: Pollution Prevention*** **ATGL** will avoid the release of pollutants or, when avoidance is not feasible, minimize and/or control the intensity and mass flow of their release. **ATGL** should monitor emissions to ensure that requirements of PS-3 are being met. Monitoring frequency of pollutant emissions should be appropriate to the nature, scale, and variability of potential impacts. ***Requirements: Waste and Hazardous Materials Management*** **ATGL** will avoid generation of hazardous and non-hazardous waste materials. Where waste generation cannot be avoided, they will reduce generation of waste, recover and reuse waste in a manner that is safe for human health and the environment. **ATGL should** investigate options for waste avoidance, waste recovery and/or waste disposal during the design and operational stage of the project. MSDS for all the hazardous chemicals to be used during construction and operation phase should be readily available. Also, arrangements for storage yard and scrap yard needs to be made for storage of construction material and disposal of scrap. The arrangements need to be made for segregation of biodegradable and non-biodegradable waste and a CPCB authorized vendor is required to be hired for waste handling and management.
Community Health, Safety, and Security (PS-4)	PS 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and	The proposed project will involve transportation of construction material and movement of construction machinery using existing village road which may pose safety	***Applicable*** ***Requirements: Community Health and Safety and Community Exposure to Disease***

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
	impacts. Its main stress is to ensure that safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the affected communities.	risks to the affected communities.	Community health and safety considerations should be addressed through a process of environmental & social risks and impact identification resulting in action plan for disclosure to project affected communities. **ATGL** is required to address community health and safety associated with the construction and operation phase of the project. A transport and traffic management plan should be developed to be implemented during different phases of the project. Since the project will be using existing roads for transportation of equipment and machinery, impacts due to transportation on the community could be mitigated through implementation of Traffic Management Plan. ***Requirements: Infrastructure and Equipment Design and Safety*** For the **ATGL** it is essential to minimize risks and protect the health and safety of both workers and the surrounding community, they should also build its internal capacity to monitor engineering design and managing the potential hazards associated with the distribution of natural gas, including leaks, explosions, fire risks, and other operational safety concerns. *During Construction Phase*: The safety-first approach in pipeline design involves integrating safety features like gas leak prevention measures, pressure relief systems, and venting systems. It also ensures easy emergency access and provides worker safety equipment to minimize risks associated with natural gas exposure. The project will pass through and will involve movement of vehicles through the NH, SH, MDR and other roads mainly for transportation of construction material. The traffic management plan needs to be properly implemented to avoid impacts on community safety and security. The speed limit should not exceed 20 km/hr in proximity of settlements and habitation in villages. Also, the village road should be continually repaired if damaged due to project activity.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			During Operation Phase: It is necessary for ATGL to ensure the Gas Distribution Safety systems such as automated shut-off valves, pressure regulation systems, and gas detection sensors to minimize the risk of leaks, fires, and explosions. Corrosion protection, Leak Detection Systems, Emergency Shut-Off Systems and worker's safety. ***Requirements: Hazardous Materials Management and Safety*** **ATGL** will avoid or minimize potential for community exposure to hazardous materials and substances that may be released by the project. The project will not use any hazardous chemicals. Limited number of hazardous substances such as diesel in DG sets, transformer oil etc., will be required. **ATGL** will either engage a contractor for handling used oil or will ensure proper handling and storage procedures will be followed to minimize any contamination due to accidental spills of such substances. ***Requirements: Ecosystem Services*** CGD of NGP project being linear project there will be no significant change to physical environment, such as natural vegetation cover, existing topography, and hydrologic regime due to the project. ***Requirements: Emergency Preparedness and Response*** **ATGL** will assist and collaborate with affected communities, local government agencies, and other relevant parties to respond effectively to emergency situations, especially when their participation and collaboration are necessary to respond to such emergency situations. **ATGL is** required to design emergency response plans based on risks to health and safety of the affected community and other

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			stakeholders. Emergency plans should be developed in close collaboration and consultation with potentially affected communities and other stakeholders. The plans should include detailed preparation to safeguard health and safety of workers and communities during emergency. ***Requirements: Security Personnel*** When the client retains direct or contracted workers to provide security to safeguard its personnel and property, it will assess risks posed by its security arrangements to those within and outside the project site. **ATGL** will make reasonable inquiries to ensure that those providing security are not implicated in past abuses; will train them adequately in use of force (and where applicable, firearms), and appropriate conduct toward workers and affected communities.
Land Acquisition and Involuntary Resettlement (PS-5)	PS 5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. The main aim is to anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by providing compensation for loss of assets at replacement cost and ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed	In this case, the project will be located entirely within the existing Right-of-Way (ROW) of an operational road, which means the pipeline will be constructed along land that has already been designated for road use. This pre-existing ROW likely already includes agreements or easements that allow for infrastructure development. No new land acquisition will occur for the pipeline, as the land needed for construction is already allocated for road use. Hence, there will be no involuntary resettlement, displacement of people, or loss of access to land or resources. The project avoids the need for additional land purchases or changes to land use, which are the primary	***Not Applicable*** ***Requirements: verification of ROW and Land Use*** **ATGL** shall ensure that the ROW is legally clear for pipeline construction and that no new land acquisition or involuntary displacement occurs. Monitoring for Potential Issues: Even though PS-5 is not applicable, it's prudent to monitor the social and environmental impacts during construction, particularly regarding temporary disruption or access issues that could affect communities near the pipeline route. ***Requirements: Community Engagement and Engagement with Relevant Authorities*** **ATGL** shall engage with affected communities, including host communities, through the process of stakeholder engagement. **ATGL** engaged community for disclosure of relevant information and

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
	participation of those affected.	triggers for PS-5. Compliance to PS-5: Given that the ROW is already dedicated to infrastructure (the road), no new displacement or land acquisition is involved. Therefore, PS-5 does not apply, as there is no involuntary resettlement or physical displacement anticipated.	participation of affected communities during planning & implementation stage of the project. A Stakeholder Engagement Plan was developed as a part of environment and social management plan. **ATGL** shall engage with local authorities and stakeholders to ensure that the project complies with any regulatory or land-use guidelines relevant to the ROW, as well as any applicable local laws that may govern infrastructure development within road corridors. ***Requirements: Grievance Mechanism*** **ATGL** shall establish a grievance mechanism consistent with Performance Standard 2 in the project development phase. **ATGL** shall ensure to resolve grievances at the community level. It is also to be ensured that a designated person will be trained and available to receive grievances and coordinate efforts to redress those grievances through the appropriate channels, taking into consideration of any customary and traditional methods of dispute resolution within the affected communities. Grievance Redressal Mechanism is already in place with **ATGL** and the same will be implemented at project level. During consultation with the land seller and Sarpanch under which all the project villages fall, it was confirmed that they have no objection or any other concern with projects plan or the acquisition of land. They expressed their satisfaction with rates from market rate compensation they got from land sale. ***Requirements: Economic Displacement*** Economically displaced persons who face loss of assets or loss of livelihood during the development of project or access to assets shall be compensated for such loss at full replacement cost.
Biodiversity Conservation and	PS 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably	Ground vegetation will be cleared for development of project. The project activities	***Applicable*** ***Requirements: Protection and Conservation of Biodiversity***

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
Sustainable Management (PS-6)	managing living natural resources are fundamental to sustainable development. This standard is aimed to promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.	are not likely to have any significant impact on the ecology.	For the protection and conservation of biodiversity, the mitigation hierarchy includes biodiversity offsets, that may be considered only after appropriate avoidance, minimization, and restoration measures. Baseline studies for ecological aspects have been described in "**Chapter 4**" of the report. The study has been collected through site survey, literature review and initial desktop analysis. The extent of the literature review will depend on sensitivity of biodiversity attributes associated with project's area of influence and ecosystem services that may be impacted. There is no critical habitat with high biodiversity value, including: i. habitat of significant importance to critically endangered and/or endangered species. ii. habitat of significant importance to endemic and/or restricted-range species. iii. habitat supporting globally significant concentrations of migratory species and/or congregatory species. iv. highly threatened and/or unique ecosystems; and/or v. areas associated with key evolutionary processes in the project area of influence (AoI) and its associated facilities and in buffer zone. **ATGL** should adopt mitigation measures to achieve no net loss of biodiversity wherever feasible. Appropriate actions include: • Avoiding impacts on biodiversity through the identification and protection of set asides. • Restoring habitats during operations and/or after operations; and • Avoiding intentionally introduces any new alien species. **ATGL** should take all precautionary measures during laying of the pipeline to avoid any impact during project construction activities. It

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
			is advised that the pipeline should adhere to the mitigation measures given in "**Chapter 5**" **of ESIA Report.** ***Requirements: Management of Ecosystem Services*** With respect to impacts on priority ecosystem services of relevance to affected communities and where the client has direct management control or significant influence over such ecosystem services, adverse impacts should be avoided. Being a cleaner source of energy, no significant degradation and loss of ecosystem services are associated with the project that can pose operational, financial, and reputational risks to project sustainability.
Indigenous Peoples (PS-7)	Performance Standard-7 recognizes that indigenous peoples, such as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development.	In the Durg district of Chhattisgarh, where the CGD project is proposed, Schedule Caste (SC) constitute of 13.49 % of the population, while Schedule Tribe (ST) people constitute nearly 12.06 %.	***Not Applicable*** Since, for the pipeline route project no land acquisition is required, hence it can be said that no land of ST population is getting affected. However, **ATGL** has policy of not buying any land from SC/ST or other vulnerable community members to the maximum extent possible.
Cultural Heritage (PS-8)	PS 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the convention concerning the Protection of the World Cultural and	No archaeological monument or place of importance is located within a 05 km radius from the project site.	***Not Applicable*** ***Requirements: Protection of Cultural Heritage in Project Design and Execution*** In addition to complying with applicable law on the protection of cultural heritage, World Cultural and including national law

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project(Compliance)	Actions Taken/Requirements
	Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage during their project activities. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity. For this Performance Standard, cultural heritage refers to tangible forms of cultural heritage, such as tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values.		implementing the host country's obligations under the Convention Concerning the Protection of the Natural Heritage, the client will identify and protect cultural heritage by ensuring that internationally recognized practices for the protection, field-based study, and documentation of cultural heritage are implemented. No clearance is required to be obtained from ASI as proposed development not identified within 200 meters of the protected site. However, project should be monitored during construction phase so that environmental pollution from the project would not impact the natural and cultural heritage sites around the project site. ***Requirements: Project's Use of Cultural Heritage*** Where a project proposes to use the cultural heritage, including knowledge, innovations, or practices of local communities for commercial purposes, the client will inform these communities of (i) their rights under national law; (ii) the scope and nature of the proposed commercial development; and (iii) the potential consequences of such development. The client will not proceed with such commercialization unless it (i) enters a process of ICP as described in Performance Standard 1 and which uses a good faith negotiation process that results in a documented outcome and (ii) provides for fair and equitable sharing of benefits from commercialization of such knowledge, innovation, or practice, consistent with their customs and traditions. The proposed project of gas pipeline, it **will not use cultural heritage** or the archaeological site for commercial purposes.

3.4 PROJECT SPECIFIC REGULATORY GUIDELINES

The Ministry of Environment, Forest, and Climate Change (MoEF&CC) has notified the Environmental Impact Assessment (ESIA) Notification, 2006 under the provisions of the Environment (Protection) Act, 1986, which regulates development and their expansion/modernization of 39 sectors/activities listed in the Schedule to the ESIA Notification, 2006. There are two categories of the projects in the notification namely Category 'A' and Category 'B' projects. Category 'A' projects are appraised at the level of MoEF&CC and Category 'B' projects are appraised by the respective State Environment Impact Assessment Authority (SESIAA) following the procedure prescribed under the ESIA Notification, 2006.

As per project/ activity 6 (a) of Schedule of ESIA Notification 2006, oil and gas transportation pipelines that pass through national parks, sanctuaries, coral reefs, or ecologically sensitive areas sites require Environmental Clearance (EC).

A recent notification by dated 7th November 2014 by MoEF&CC (Annexure-1) accorded general approval under the Forest (Conservation) Act, 1980 (FC Act) for underground laying of optical fibre cables, telephone lines, drinking water supply pipeline and CNG/ PNG pipelines along the petroleum pipelines within existing right of way not falling in National Parks and Wildlife Sanctuaries, without felling of trees, where the maximum size of the trench is not more than 2.00 meter depth and 1.00 meter width.

The present project does not fall under any notified area in the state of Chhattisgarh hence no clearance is required. However, the client needs to intimate the project detail to the respective State Environment Impact Assessment Authority (SESIAA) Chhattisgarh following the procedure prescribed under the ESIA Notification, 2006.

The pipeline passes along main other district roads, state hence it is required to obtain clearance from the Public Work Department and Chhattisgarh Road Development Corporation Limited (CGRDC). The proposed pipeline route also crosses railway lines hence will be requiring clearance from Indian Railways. The project also requires permission from irrigation department as the pipeline passes through rivers and canals.

Table 3-4: Applicability of all acts, laws & rules to Pipeline Project

Sl. No.	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable (Yes/No)
1.	Environmental (Protection) Act & Rules, 1986	To protect and improve overall environment	All environmental notifications, rules and schedules are issued under this act	MoEF&CC GoI, Forest, Ecology & Environment Department, CPCB, & Chhattisgarh Environment Conservation Board (CECB)	Yes
2.	The Irrigation Laws (Amendment) Act, 1964	To maintain the uninterrupted flow of natural water ways and canals	For using land under the right of way basis for laying the NG pipeline across either side of the	Water Resources Department	Yes Application to be made to the

Sl. No.	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable (Yes/No)
			flowing water course of all canals, branches, distributaries, major-minor channels etc.	Chhattisgarh (PWD)	Water Resources Department
3.	The Railways Act, 1989	To manage safety of railways	For using land under the right of way basis for laying the NG pipeline	Indian Railways (IR)	Yes. Permission/NOC is required from Railways Department as the NG pipeline crosses railway track at 1 location in Durg.
4.	The Control of National Highways (Land and Traffic) Act, 2002	To manage safety National Highway, State Highway	For using land along the highway on right of way basis for laying the NG pipeline	National Highway Authority of India (NHAI) & Road and Building Department	No.
5.	Environmental Impact Assessment (ESIA) Notification, 2006	To provide environmental clearance to new development activities following environmental impact assessment.	As per project/ activity 6 (a) of Schedule of ESIA Notification 2006, oil and gas transportation pipelines which pass through national parks, sanctuaries, coral reefs or ecologically sensitive areas sites require Environmental Clearance (EC).	MoEF&CC	No
6.	Forest (Conservation) Act, 1980 and amendments thereof	To check deforestation by restricting conversion of forested areas into non-forested areas.	Since the proposed pipeline route does not pass through any forest area	Forest Department Durg (Chhattisgarh)	No.
7.	National Forest Policy (Revised), 1988	To maintain ecological stability through preservation and restoration of biological diversity	No eco sensitive zone exists along the project corridor, from which the pipeline passes through.	Forest Department Durg (Chhattisgarh)	
8.	Wildlife Protection Act, 1972 & 2022 (Amended)	To protect wildlife sanctuaries and National Parks	Not Applicable.	NBWL, SBWL & Chief Wildlife Warden, MoEF&CC	No
9.	Water (Prevention and Control of Pollution) Act, 1974	To control water pollution by controlling emission & Water pollutants as per the prescribed standards	This act will be applicable during construction, for establishments of hot	Chhattisgarh Environment Conservation Board (CECB)	Yes

Sl. No.	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable (Yes/No)
	and amendments thereof		mix plant, construction camp, workers' camp, etc.		
10.	Air (Prevention and Control of Pollution) Act, 1981 and amendments thereof	To control air pollution by controlling emission and air pollutants according to prescribed standards	This act will be applicable during construction; for obtaining NOC for establishment of hot mix plant, workers' camp, stone crusher, construction camp, & other heavy machinery.	Chhattisgarh Environment Conservation Board (CECB)	Yes
11.	Noise Pollution (Regulation and Control) rules, 2000	Noise pollution regulation and controls	This act will be applicable as vehicular noise on project routes required to assess for future years and necessary protection measure need to be considered in design.	Chhattisgarh Environment Conservation Board (CECB)	Yes
12.	The Explosives Act (& Rules), 1884	An Act to regulate the manufacture, possession, use, sale, transport, import and export of Explosives	For transporting and storing diesel, bitumen etc.	Chhattisgarh Environment Conservation Board (CECB)	Yes
13.	Public Liability Insurance Act, 1991	Insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling any hazardous substance and for matters connected therewith or incidental thereto	Contractor needs to stock hazardous material like diesel, Bitumen, Emulsions etc. safely in designated locations within the construction camp	Chhattisgarh Environment Conservation Board (CECB)	Yes
14.	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 (Amended,2023)	Storage, handling, transportation, and disposal of hazardous waste	Storage and handling of hazardous waste during construction	Chhattisgarh Environment Conservation Board (CECB)	Yes
15.	Solid Waste Management Rules, 2016	Management and handling of solid waste	For disposal of solid waste generated during construction	Chhattisgarh Environment Conservation Board (CECB)	Yes
16.	Construction and Demolition Waste Management Rules, 2016	Management of construction and demolition waste	For disposal of solid waste generated due to construction and demolition	Chhattisgarh Environment Conservation Board (CECB)	Yes

Sl. No.	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable (Yes/No)
17.	Batteries (Management & Handling) Amendment Rules, 2023	Management and handling of used lead acid batteries	Safe disposal of used lead batteries through authorized e waste recyclers	Chhattisgarh Environment Conservation Board (CECB)	Yes
18.	E-Waste (Management) Amendment Rules, 2023	Effective mechanism to regulate generation, collection, storage, transport, import, export, recycling, treatment and disposal of e-wastes	Handling of e-waste	Chhattisgarh Environment Conservation Board (CECB)	Yes
19.	Central Motor Vehicles Act, 1988	To control vehicular air and noise pollution	This rule will be applicable to road users and construction machinery	Motor Vehicle Department	Yes
20.	The Petroleum Act 1934, as amended in August 1976 The Petroleum Rules 1976, as amended in March 2002.	Operation, Storage and transportation of Petroleum products	The rule is applicable as the transportation and distribution of compressed natural gas will take place	Ministry of Petroleum & Natural Gas	Yes
21.	Petroleum and Natural Gas Rules, 1959, amended 2009.	As states own the blocks found within their territory and are therefore, responsible for awarding the licenses for onshore blocks,	The rule is applicable as the distribution of natural gas will take place in Chhattisgarh	Ministry of Petroleum & Natural Gas	Yes
22.	The Petroleum and minerals pipeline (acquisition of right of user in land) act, 1962	Acquisition of right of user in land [for laying pipelines for the transport of petroleum and minerals and Provision of compensation in case of any damage, loss or injury is sustained by any person interested in the land under which the pipeline is proposed to be, or is being, or has been laid	The pipeline passes through industrial, residential and commercial areas.	Ministry of Petroleum & Natural Gas	Yes
23.	Petroleum and Natural Gas Regulatory Board Act, 2006	Regulation of refining, processing, storage, transportation, distribution, marketing and sale of petroleum, petroleum products and natural gas excluding production of crude oil and natural gas so as to protect the interests of	The project is proposed under this act and is bid out by PNGRB for uninterrupted and adequate supply of petroleum, petroleum products and natural gas in all parts of the country.	PNGRB	Yes

Sl. No.	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable (Yes/No)
		consumers and entities engaged in specified activities			
24.	NOC from Gram Panchayat	As per Chhattisgarh Panchayat Raj Adhiniyam, 1993	Chhattisgarh Panchayat Raj Adhiniyam, 1993	Village Sarpanch	Application to village Panchayat falling in the stretch is to be made

3.5 PIPELINE DESIGN AND CODE

According to the PNGRB Notification 2008, the design, materials and equipment, welding, fabrication, installation, testing, operation and maintenance, and corrosion control of the CGD network shall comply with the requirements of ASME B31.8, except where such requirements are specifically cancelled, replaced, or modified by the regulations specified in this notification.

It is intended to apply these regulations to all new and such aspects of already existing networks as design, fabrication, installation, testing at the time of construction and commissioning. However, if an Adani has laid, built, constructed, or expanded the CGD infrastructure based on some other standard or is not meeting the standards specified in these regulations, then it needs to carry out a detailed technical audit of its infrastructure through a Board authorized or approved third party agency by the Board. Adani thereafter shall submit the recommendations made by the third party along-with its time-based mitigation plan and implementation schedule to the Board for authorization within six months from the date of notification of these regulations.

Technical standards and specifications mentioned in PNGRB notification, 2008 including safety standards (hereinafter referred to as standards) for city or local natural gas distribution networks are as specified in Schedule–I which cover material and equipment (Schedule–1A), welding (Schedule–1B), piping system components and fabrication (Schedule– 1C), design, installation and testing (Schedule–1D), operating and maintenance procedures (Schedule–1E), corrosion control (Schedule–1F) and miscellaneous (Schedule–1G).

Table 3-5: Applicable Standards and Codes

Sl. No.	Code No.	Description
1.	ASME B31.8	Gas Transmission and Distribution Piping Systems
2.	ASME B16.5	Specification for Pipe flanges and flanged fittings
3.	ASME B16.9	Specification for Factory made Wrought Steel Butt welding fittings
4.	ASME B16.11	Specification for Forged Fittings, Socket – Welding and Threaded
5.	ASME B16.34	Pressure and temperature ratings for forgings, castings, plate, bar, and tubular products
6.	API 5L	Specification for Line Pipe
7.	API 6D	Specification for Pipeline Valve
8.	API RP 1102	Steel Pipelines Crossing Railroads & Highways
9.	API 1104	Welding of Pipelines and Related Facilities

Sl. No.	Code No.	Description
10.	API RP 2201	Procedures for Welding or Hot. Tapping on Equipment in Service
11.	ASTM A106	Specification for Seamless Carbon Steel Pipe for High- Temperature Service
12.	ASTM A234	Specification for Piping Fittings of Wrought Carbon steel and alloy steel for moderate and High Temp. service
13.	ANSI 16.20	Ring-joint Gaskets & Grooves for Steel Pipe Flanges
14.	T4S	Technical Standards and Specifications Including Safety Standards for City or Local Natural Gas Distribution Networks
15.	INFRA/IMP/CGD/1/2013	Integrity Management System for City or Local Natural Gas Distribution Network
16.	G.S.R. 478(E)	Determining capacity of Petroleum, Petroleum products and Natural Gas Pipeline
17.	Codes	Details
18.	G.S.R 720(E)	Code of Practice for Quality-of-Service City or Local Natural Gas Distribution Networks
19.	G.S.R 196(E)	Authorizing Entities to Lay, Build, Operate or Expand City or Local Natural Gas Distribution Networks
20.	OISD 141	Design and Construction Requirements for Cross- Country Hydrocarbon Pipeline
21.	DIN 30671	Thermoset Plastic Coating for Buried Steel Pipes
22.	DIN 30672	Tape and Shrinkable Materials for the Corrosion Protection of buried or Underwater Pipelines without Cathodic Protection for Use at Operating Temperatures Up to 500 ^{o}C
23.	DIN 30673	Bitumen Coatings and Linings for Steel Pipes, Fittings and Vessel
24.	DIN 30675-1	External Corrosion Protection of Buried Pipes & Range of Applications for Steel Pipes
25.	DIN 30677	Protection of Buried Valves Against Corrosion Coating (External) with Duro plastics
26.	DIN 30670	Polyethylene Coating on Steel Pipes and Fittings
27.	EN 12062	Non-Destructive Examinations of Welds-General Rules of Metallic Materials
28.	EN 10285	Steel tubes and fittings for on shore and offshore pipelines- external three-layer extruded polyethylene-based coating
29.	EN 12068	Cathodic Protection – External Organic Coatings for the Corrosion Protection of Buried or Immersed Steel Pipelines Used in Conjunction with Cathodic Protection of Steel Structures
30.	IS 8062	Code of Practice for Cathodic Protection of Steel Structures
31.	IS 12944-5	Paints and Varnishes – Corrosion Protection of Steel Structures by Protective Paint System
32.	ISO 8502-3	Preparation of Steel Substrates before Application of Paints and Related Products – Tests for the Assessment of Surface Cleanliness
33.	ISO 9305	Seamless Steel Tubes for Pressure Purpose Full Peripheral Ultrasonic Testing for the Detection of Transverse Imperfections
34.	ISO 10124	Seamless 7 Welded (Except Submerged Arc Welded) Steel Tubes for Pressure Purposes. Ultrasonic Testing for the Detection of Laminar Imperfections
35.	ISO 12094	Welded Steel Tubes for Pressure Purpose. Ultrasonic Testing for the Detection of Laminar Imperfections in Strips / Plates used in Manufacture of Welded Tubes
36.	ISO 15741	Paints and Varnishes – Friction-Reduction coatings for the interior of on-and offshore steel pipelines for non- corrosive gases
37.	ISO 15590-1	Petroleum and natural gas industries-induction bends, fittings and flanges for pipeline transportation system- part:1 induction bends
38.	ISO 21809-3	Petroleum and Natural gas industries-external coatings for buried or submerged pipelines used in pipeline transportation system

Sl. No.	Code No.	Description
39.	MSS-SP-44	Steel Pipeline Flanges
40.	MSS-SP-25	Standard Marking System for Valves
41.	MSS SP75	Specification for High Test, Wrought, Butt Welding Fittings
42.	G.S.R 198€	Exclusivity for City or Local Natural Gas Distribution Network
43.	OISD 105	Work Permit for Testing & Commissioning
44.	OISD 226	Natural Gas Transmission Pipeline & City gas Distribution
45.	OISD 179	Safety Requirements on Compression, Storage, Handling & Refueling of Natural Gas (CNG).

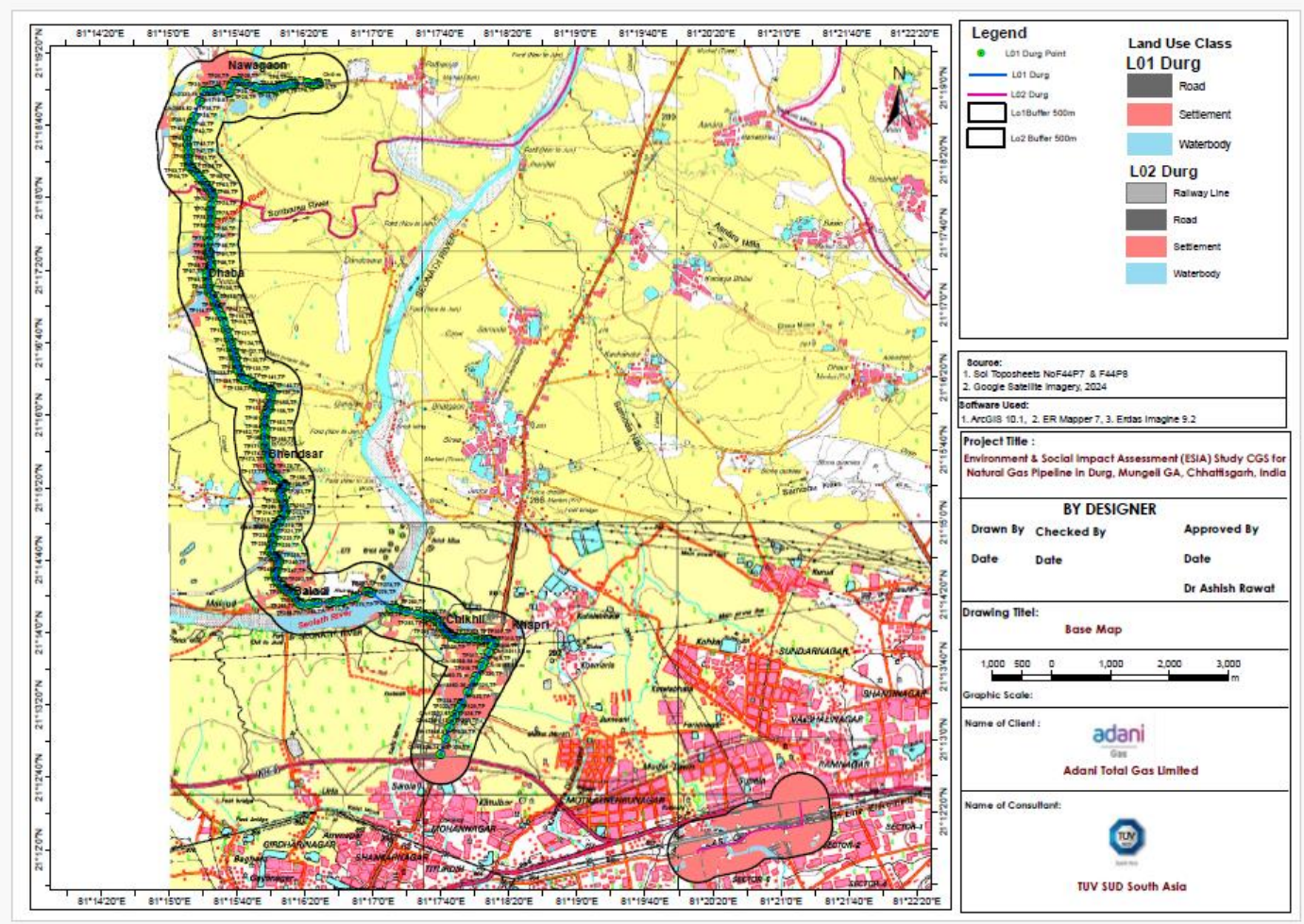
**Source: AGTL Due Diligence Report*

4 ENVIRONMENTAL DESCRIPTION

Baseline data generation forms an integral part of the ESIA study and helps to evaluate the predicted impacts on the various environmental and social attributes in the study area by using scientifically developed and widely accepted environmental and social impact assessment methodologies.

4.1 STUDY AREA

The study area comprises “Project Footprint Area” (area to be physically impacted by the project activities across all phases) and “Area of Influence (up to 500 m)” and the “buffer zone” (500 m-10.00 km). While the primary field investigations for the physical and biological and socio-economic environment have been collected from Project Footprint area and Area of influence. The Environmental baseline survey and study for the project has been carried out on **20th- 22nd January 2025**.



*(*Source: TUVSUD GIS Mapping)*

Figure 4-1 : Project Study Area superimposed on Toposheet

4.2 PROJECT FOOTPRINT AREA

The project footprint is the area that may reasonably be expected to be physically touched by Project activities across all phases. The pipeline for the CGD that run along ROW of the Durg GA is sub divided in the two pipeline route networks. The proposed Line GAIL SV-32 U/C to Vardhaman Highway takes off from Proposed GAIL SV-32 in Durg in Durg District in State of Chhattisgarh (81°16'28.37"E, 21°19'03.38"N) and terminates at Vardhaman Highway in Durg District of Chhattisgarh State (81°17'39.94"E, 21°12'52.16"N) and The proposed Line Proposed SV-31 to BPCL Petrol Pump (Gill Goods Carrier) takes off from Supela in Bhilai City in Durg District of Chhattisgarh (81°21'11.32"E E, 21°12'25.24"N) and terminates at Khandelwal CNG Station in Durg District of Chhattisgarh State (81°20'11.08"E, 21°11'57.44"N).

4.3 AREA OF INFLUENCE (AOI)

Baseline monitoring for Environmental Impact Assessment study has been designed with primary data collection followed by secondary data review for establishing and interrelating the baseline condition of the project area. To collect the data for baseline study, the 'Area of Influence' (AoI) has been defined as the area in which a direct or indirect impact on the physical, biological, social, or cultural environment might occur, and it has been considered up to 5 km surrounding of the project footprint area. For the detailed analysis of the current baseline of the project, the following areas of influence have been defined in **Table 4-1.**

Table 4-1: Detailed Area of Influence (AOI) considered for Different Attributes

Sl. No.	Environmental & Social issues	Area of Influence (AoI)	Justification
Physical Environment			
1.	Ambient Air Quality	Immediate vicinity of the project foot-print area	Dust Emissions, Fugitive dust etc. is typically observed within 100-200 meters from the Construction/operation areas. AoI minimum of 500m to maximum 1.00 km has been taken to capture all sources of emissions including vehicular movement in surrounding and across access road.
2.	Noise Pollution	500 m-1.00 km On either side of the pipeline route.	Primary Noise effect from a noisy source can often be detected up-to 400-500 m from any operation. However, keeping in view, an AoI of 500 m to maximum 1.00 km has been considered from noise pollution from all sources including vehicular movement.
3.	Surface Water	Within 2.00 km on the either side of pipeline route	The entire project area of influence has been considered for Surface Water Sampling. Surface water samples were collected from multiple surface water sources, which are coming within AoI (500-5km) aerial distance from project foot-print areas.
4.	Ground Water condition	2.00 Km on either side of the pipeline route.	Ground water quality of the project study area has been assessed in project influence area, close to the proposed construction activity sites and habitation areas.

Sl. No.	Environmental & Social issues	Area of Influence (AoI)	Justification
5.	Land Environment	500 m on either side of the pipeline route	An area of 500 m has been considered around the project footprint area and near to habitation areas to predict the indirect effects usually occur due to accidental release of hazardous waste, vehicular/heavy machinery movement and activities at allied sites.
Biology and Environment			
1.	Terrestrial Ecology	5.00 km on either side of the pipeline route	Area of Influence has been considered as 5.00 km around the project footprint area to identify the biodiversity of the area and its impacts due to the project.
Socio-economic Environment			
2.	Socio-economic conditions	5.00 km on either side of the pipeline route	An AoI of 5.00 Km radius is considered for the socio-economic consultations to determine perceived impacts due to the project including employment opportunity and increased anthropogenic/vehicular activities in remote areas.

4.4 METHODLOGY FOR ENVIRONMENTAL AND SOCIAL BASELINE SURVEY

Environmental & Social study includes the study of various baseline environmental aspects covering Physical, Biological and Socio-Economic parameters. Integration of these parameters gives an overall perception of positive and negative impacts due to construction of underground NG pipeline within the port area.

Initially after primary desktop assessment of the project, detailed project reports and site details were collected from Adani Total Gas Limited. A team comprising of Social, ecological, and environmental Experts from TÜV SÜD visited the site on **20th to 22nd January 2025** to collect the primary baseline data of drainage, land-use, topographic, ecological condition of the site and collect data on socio-economic scenario of the project study area. Baseline monitoring plan has been finalized and subsequently, in accordance with the baseline monitoring plan, environmental monitoring is currently under progress and will be completed in the February 2025 in accordance with the Terms of Reference and Guidelines of MoEF&CC & CPCB.

Apart from the baseline environmental monitoring for Ambient Air, Noise, Soil, Water (Groundwater & Surface water) various other attributes such as aquatic and terrestrial avifaunal habitat & biodiversity, socio-economic status, geology, hydrology, and land-use pattern etc. of the study area was also studied and data has been collected from primary and authenticated secondary sources.

Table 4-2: Secondary Data Sources for Baseline Study

Data	Source
Long term Climatological Data	India Meteorological Dept. (IMD), Govt. of India and data from other Remote climate monitoring stations
Toposheets	Survey of India (SOI), Dehradun
Soil Maps	NBCC Nagpur
Satellite Data	NRSA, Google Earth, etc.

Data	Source
Forest Characteristics, Forest Types & Resources	Forest Survey of India (FSI)
Details of Flora, Fauna & Wildlife Habitats	From various publicly available research papers, journals, and manuscripts
Land Record and Demography Status	State Revenue Dept., District Statistical Handbook & Census of India, etc.
Drainage Pattern	Water Resource Dept., NASA SRTM data
Hydro-geology Status	District Ground Water Report, Central Ground Water Board (CGWB)
Technical Data	Details provided by **ATGL**

Prior to the site visit, the following relevant and available documents related to the underground NG pipeline project at Durg District, Chhattisgarh have been collected from **ATGL**:

- Project Location Maps
- Project specifications and technical details of the project – DPR
- ESMS and EHS policy

Primary environment baseline monitoring and secondary data collection was undertaken as per process tabulated below in **Table 4-3 .**

Table 4-3: Environmental and Social Attributes studies

Sl. No.	Attributes	Parameters	Source & Frequency
1.	Ambient Air Quality	SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO	Twice for a week
2.	Ambient Noise quality	Noise level in dB(A)	Daytime and night-time sampling for single day for all locations
3.	Soil condition and its quality	Physical and chemical parameters	Composite sampling in all locations
4.	Ground water quality	Physical, chemical, biological parameters as per IS 10500:2012	Single sampling (mainly from Bore well/tube well)
5.	Surface water quality	Physical, chemical, biological parameters of different surface water stream/body within the project study area.	Single Sampling from surface water bodies.
6.	Socio-economic aspects	Socio-economic, demographic, livelihood characteristics	Secondary sources data like primary census abstracts of Census of India 2011.
7.	Hydrology & Drainage	Drainage area and pattern, nature of streams, aquifer characteristics,	Based on primary site visit and data collected from secondary sources.
8.	Ecology	Floral and faunal distribution, Terrestrial and water birds citing, identification of any migratory corridor within the project study area	From different places within study area

4.5 SECONDARY DATA COLLECTION

The environmental monitoring stations were selected for ambient Air Quality, Ambient Noise Quality, Surface Water Quality, Ground Water Quality, and Soil Quality. A NABL accredited & MoEF&CC approved

laboratory is selected for conducting secondary environment baseline monitoring at project study area, under supervision of TÜV SÜD representative. In accordance with the Scope of Work, the baseline environmental monitoring will be carried out in the project footprint and study area during the February 2024.

4.6 PHYSICAL ENVIRONMENT

The study related to physical environment was conducted through site visits and review of the data from secondary sources such as Census of India, District Statistical Handbook, State of the Forests Report, Central Groundwater Development Board Report, District Revenue Office, and other published peer information in respect of the topographical and physiographical features, regional and the local geology of the project area, climatology, and seismicity.

Soil characteristics were established through physio-chemical tests of the soil samples revalidated though the published literature while land use and land cover; slope of the study area were established through remote sensing by using GIS tools. Prior the initiating the baseline survey, monitoring design was prepared in coordination with TÜV SÜD Environmental Experts and the same was fine-tuned during site survey prior to the baseline monitoring.

The components of physio-chemical environment discussed in this section include:

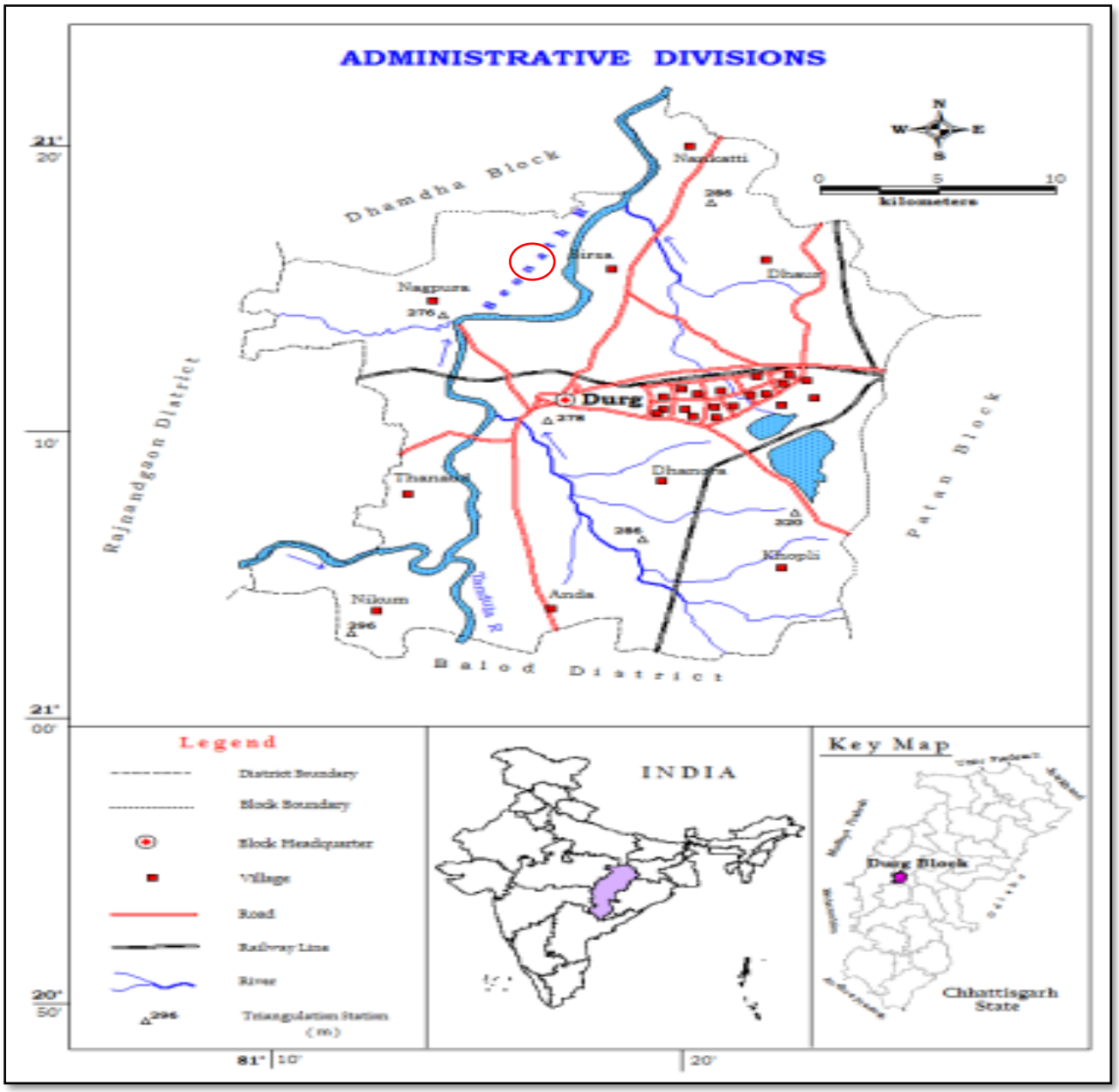
1. Physiography & Topography
2. Geomorphology and Drainage
3. Land-Use & Land Cover
4. Soil Quality
5. Seismicity & Natural Hazards
6. Climate & Meteorology
7. Ambient Air Quality
8. Ambient Noise Levels
9. Ground Water Quality
10. Surface Water Quality

4.6.1 Physiography and Topography

The underground natural gas pipeline project covers a total distance of 20.17 km in Durg District, Chhattisgarh. The pipeline for the CGD that run along ROW of the Durg GA is sub divided in the two pipeline route networks. The proposed Line GAIL SV-32 U/C to Vardhaman Highway takes off from Proposed GAIL SV-32 in Durg in Durg District in State of Chhattisgarh (81°16'28.37"E, 21°19'03.38"N) and terminates at Vardhaman Highway in Durg District of Chhattisgarh State (81°17'39.94"E, 21°12'52.16"N) and The Pipeline route is proposed fromSV-31 to BPCL Petrol Pump (Gill Goods Carrier) takes off from

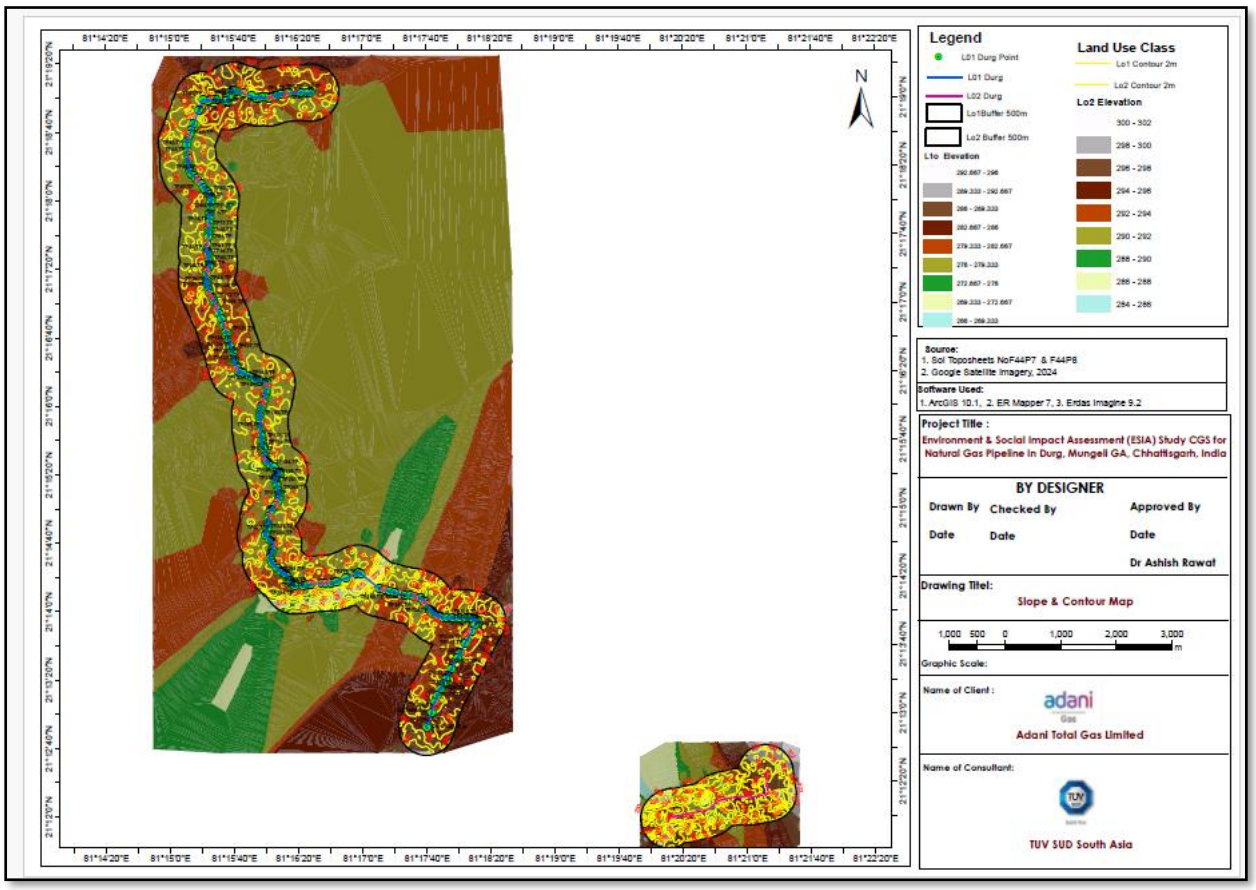
Supela in Bhilai City in Durg District of Chhattisgarh (81°21'11.32"E E, 21°12'25.24"N) and terminates at Khandelwal CNG Station in Durg District of Chhattisgarh State (81°20'11.08"E, 21°11'57.44"N).

Durg Block is situated in the western part of Durg district of Chhattisgarh and is bounded north by Dhamdha block, east by Patan block, in the west by Rajnandgaon district of Chhattisgarh, in the south and south-east by Balod district. The area lies between 21.04 and 21.37 N latitudes and 81.16 and 81.40 E longitudes. The geographical extension of the study area is 578 sq.km. Shivnath River, flowing through northward direction bisects the block from south to north. The administrative Map of the district has been depicted as **Figure 4-2**. The Contour Map **Figure 4-3** of the project AOI is shown below.



*(*Source: Aquifer Map and Management Plan- Durg District)*

Figure 4-2: District Administrative Map (Red Circle: Project AOI)



**Source: TUV SUD GIS Mapping Study (Toposheet No F44P7 &F44P8)*

Figure 4-3: Terrain and Contour Map of Project AOI

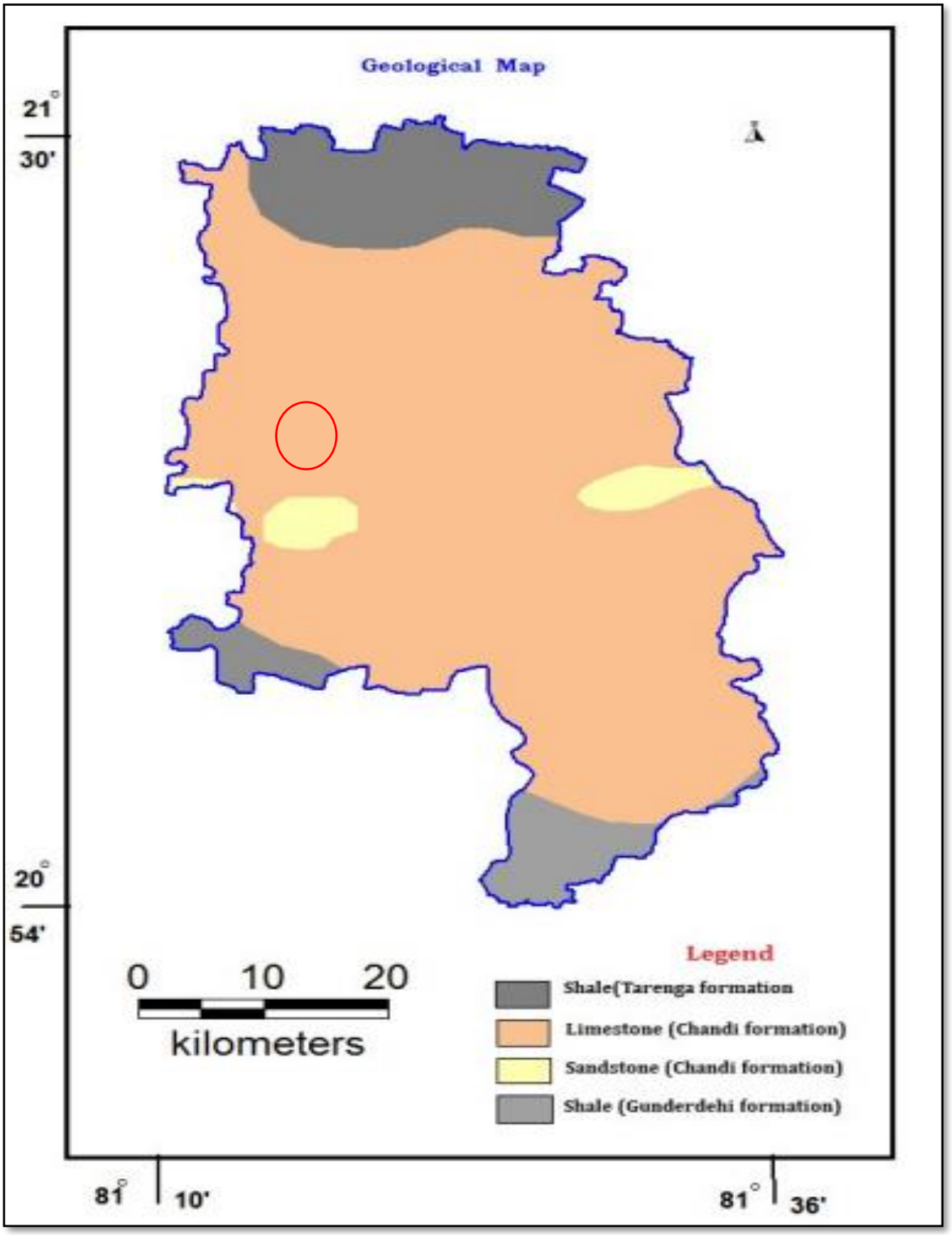
4.6.2 Geology

Geologically, the district comprises of rocks of Raipur Group of Chhattisgarh Supergroup of Proterozoic age. The rocks of Raipur Group are mainly represented by Gunderdehi formation, Chandi formation and Tarenga formation.

i) **Gunderdehi Formation**: Charmuria Formation is conformably overlain by Gunderdehi Formation, which is dominantly a calcareous argillite developed as a distinct facies in the sub-basin. Although the purple-coloured shale with intercalated limestone is the dominate member, a buff-coloured shale and a ferruginous arenite are also two prominent members occurring at the middle of the formation. The purple shale is generally calcareous, highly friable in character and is associated with impersistent limestone bands. Locally intra-formational conglomerate lenses are present in the upper part. Besides this, lenses and pockets of stromatolitic limestone appearing towards top indicate a gradational contact with the overlying formation. It is reported that at subsurface Gunderdehi purple shale grades to black shale.

ii) **Chandi Formation:** This comprises a major stromatolitic limestone sequence developed in the southern & western periphery of the district. Chandi Formation had been classified into three major carbonate members based on dominant carbonate facies. The Deodongar arenite include lensoidal pockets of siliciclastic rocks within Chandi Formation. They, however, occupy a definite stratigraphic level within the formation. The revised sequence stands as Newari, Pendri, Deodongar and Nipania Member in ascending order.

iii) **Tarenga Formation**: The Chandi Formation is conformably overlain by Tarenga Formation, which is classified into Kusmi argillite, Dagauri green clay-chert and Bilha dolomitic argillite from bottom to top. It is also developed in the southern & western part of the district. The rocks of the Chhattisgarh Super group show sub-horizontal dips. The overlying formations are nearly flat dipping. The district is also traversed by minor lineaments. The NE-SW trending lineaments are predominant. Most of the drainages are controlled by lineaments indicating drainage is probably due to structural disturbances (**Figure 4-4**).



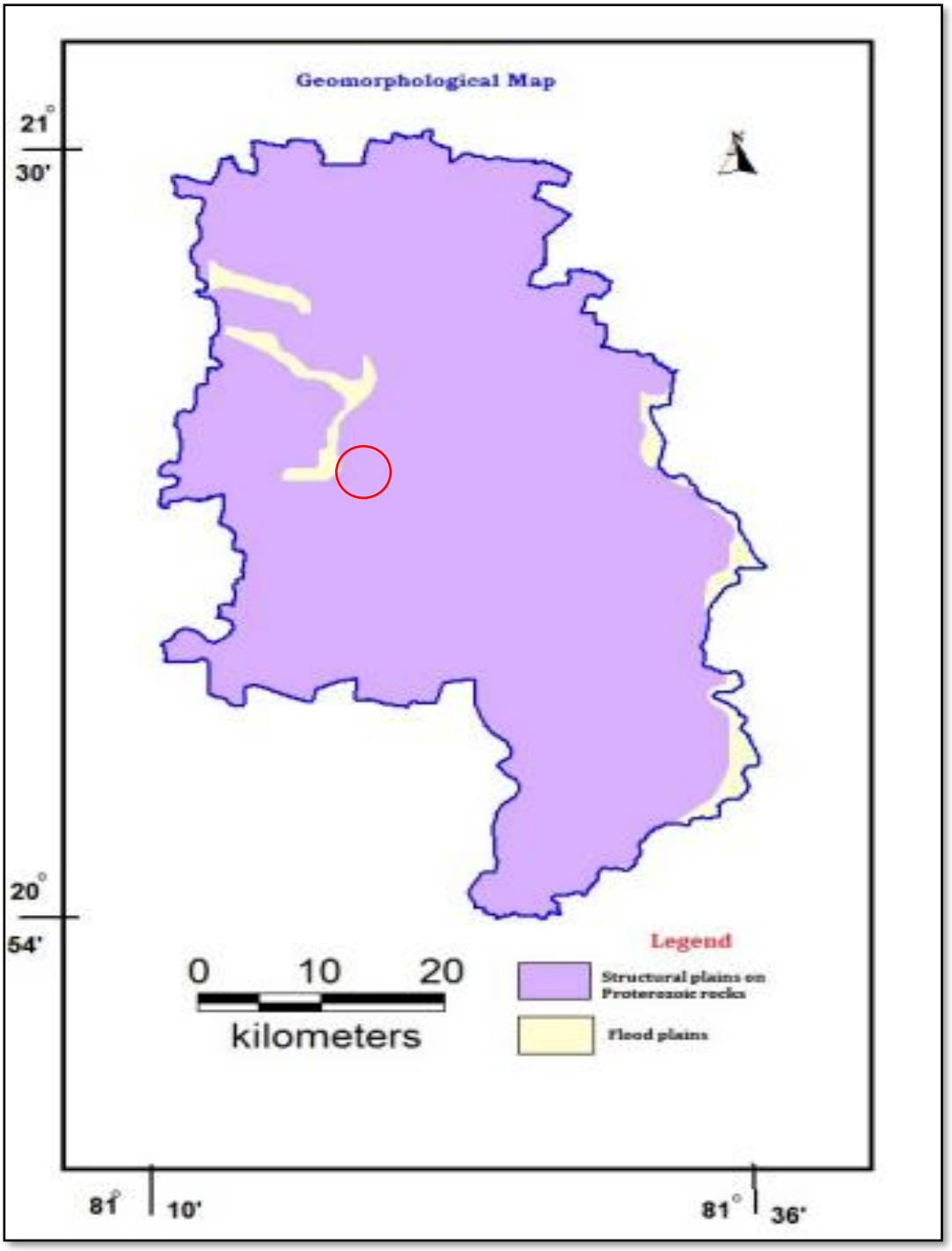
Source: Aquifer Map and Management Plan- Durg District

Figure 4-4: Geological Map of Durg District (Project Study Area demarcated with "Red Circle")

4.6.3 Geomorphology and Drainage

4.6.3.1 Geomorphology

Geomorphologically the study area displays structural plains, flood plain and pediment/pediplain which comes under the physiographic unit belonging to Chhattisgarh basin area. The Central Chhattisgarh Plain is represented by Structural Plain on Proterozoic rocks which cover major area of the study area. This unit is developed over rocks of Purana sedimentary basin of Chhattisgarh. Overall, the topography in the district varies between 241 m to 470 m amsl. The area has general slope towards north & north-east direction with average elevation of 300 m amsl. **Figure 3-5** shows the Geomorphology in the study area.



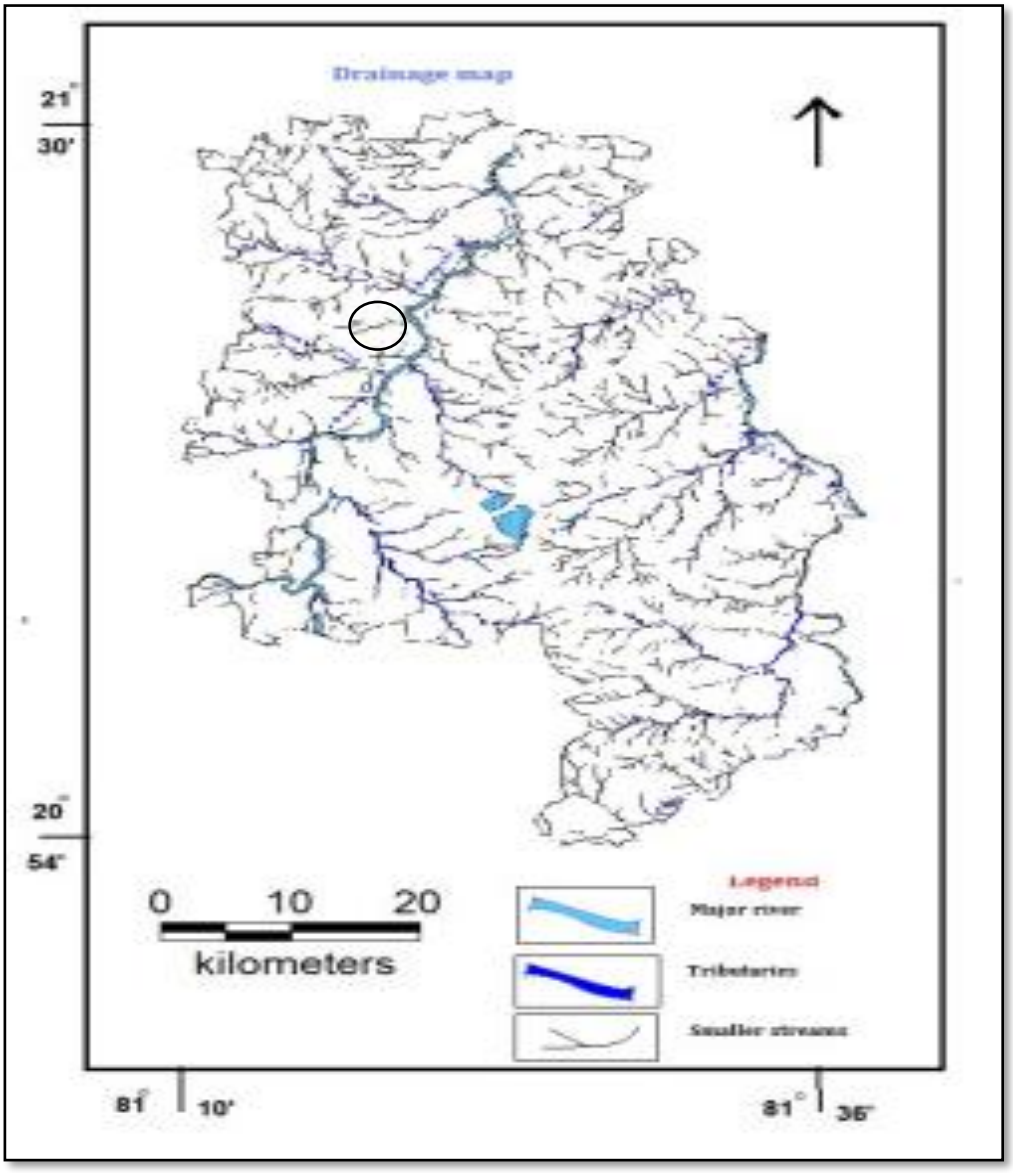
*Source: Aquifer Map and Management Plan- Durg District

Figure 4-5: Geomorphological Map of Durg District (Red Circle: Project AOI)

4.6.3.2 Drainage

The general slope of the district is towards the north and northeast and locally in some places towards east. Shivnath river is also often called as Shivnath River. Shivnath and Kharun rivers contribute the most

in the drainage system of the district. All the small rivulets and rivers are the tributaries either of Shivnath river or Kharun river. Shivnath river flows nearer to the western border of the district whereas river Kharun forms the eastern border of the district which ultimately joins Shivnath river. The river Shivnath itself forms the part of big Mahanadi basin. Drainage pattern of the area is dendritic to sub-dendritic in nature. Drainage density is same in most of the part of the study area. The drainage density is found comparatively low in the area which is attributed to plain area indicating somewhat low runoff and higher infiltration. Drainage Map of district indicating project study area has been depicted below in **Figure 4-6**.



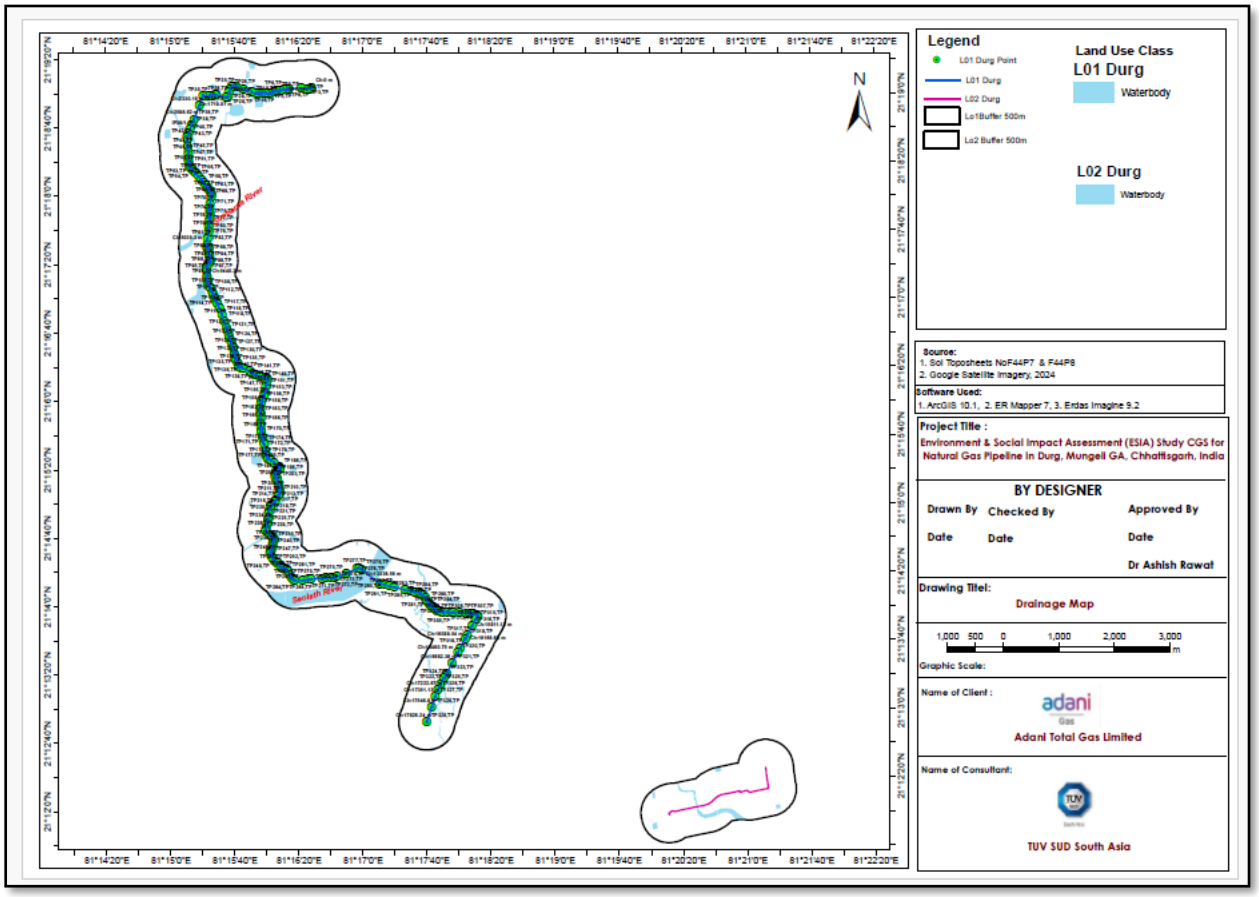
**Source: Aquifer Map and Management Plan- Durg District*

Figure 4-6: Drainage Map of Durg District (Black Circle- Project Study Area)

The pipeline crosses water bodies in its right of way i.e. Shivnath river and one tertiary streamline. The project study area has the following drainage patterns/river systems as mentioned in **Table 4-4**:

Table 4-4: Details of Waterbodies in Project Study Area

Sl. No.	Name of Water Body	Distance (Km)	Coordinates
1.	Shivnath river	Adjacent	21°14'16.78"N; 81°17'4.04"E
2.	Tertiary Streamline (Distributary of Shivnath River)	Adjacent	21°17'37.04"N; 81°15'24.06"E
3.	Pond at Nawagaon	26 m	21°18'58.50"N; 81°16'0.23"E
4.	Pond at Nawagaon	27 m	21°19'1.63"N; 81°15'42.22"E
5.	Pond at Dhaba	13 m	21°17'32.77"N; 81°15'24.80"E



**Source: TUV SUD GIS Mapping Study (Toposheet No F44P7 &F44P8)*

Figure 4-7: Drainage Map of Project Study Area

4.6.4 Land Use and Land Cover

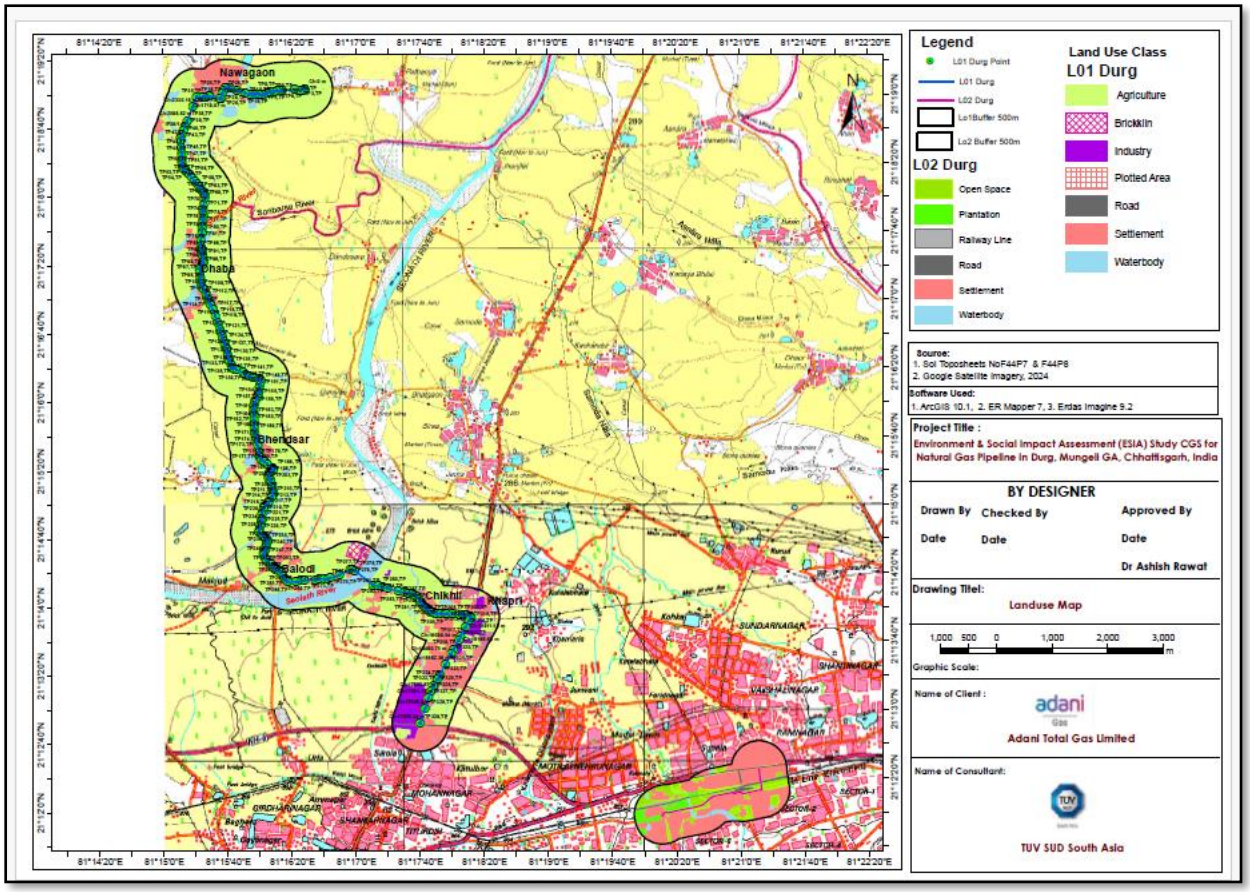
The proposed pipeline project primarily traverses rural areas, passing through populated residential zones, State highway (SH-7), major district roads, and village roads, including the Bhilai Sector 7, 6, and 2 regions. The assessment of land-use and land cover of project AOI reveals that the proposed project study

area in Route 1 predominantly consists of agriculture land (71.27%) followed by settlement (13.80 %), waterbody (7.81%), Industry (3.05%), road (2.17%), plotted area 1.12%), brick kiln (0.75%) respectively and Route 2 predominantly consists of settlements (54.41 %) followed by open space (20.81 %). road (13.25%), plantation (5.31%), waterbody (3.51 %). railway line (2.69 %). Major settlement within the project study area is in Nawagaon, Beloudi, Dhaba, Chikli village in Route 1 and Bhilai in Route 2 of Durg District. The detailed land-use breakup of the study area is given in **Table 4-5** as follows:

Table 4-5: Land use Details of Project Study Area

Sl. No.	Land Use	Area in Sq. Ha	Area in %
Pipeline Route 1			
1	Agriculture	13.085	71.273
2	Brick kiln	0.139	0.759
3	Industry	0.560	3.050
4	Plotted Area	0.207	1.128
5	Road	0.399	2.174
6	Settlement	2.535	13.806
7	Waterbody	1.434	7.810
Study Area		**18.359**	**100.000**
Pipeline Route 2			
1	Open Space	0.630	20.812
2	Plantation	0.161	5.313
3	Railway Line	0.082	2.697
4	Road	0.401	13.253
5	Settlement	1.647	54.410
6	Waterbody	0.106	3.515
Study Area		**3.027**	**100.00**

*(*Source: TUV SUD GIS Mapping Study)*



**Source: TUV SUD GIS Mapping Study (Toposheet No F44P7 &F44P8)*

Figure 4-8: Land Use Map of Project Study Area

4.6.5 Soil Quality

The soil in the district has wide variations. They are Vertisols (Kanhar-clayey), Inceptisol (Matasi-sandy loam), Alfisol (Dorsa-clayloam), Bharri and Entisol (Bhata-gravely). Lateritic soil is exposed in the northern, extreme eastern, central and south-eastern part of the Durg district.

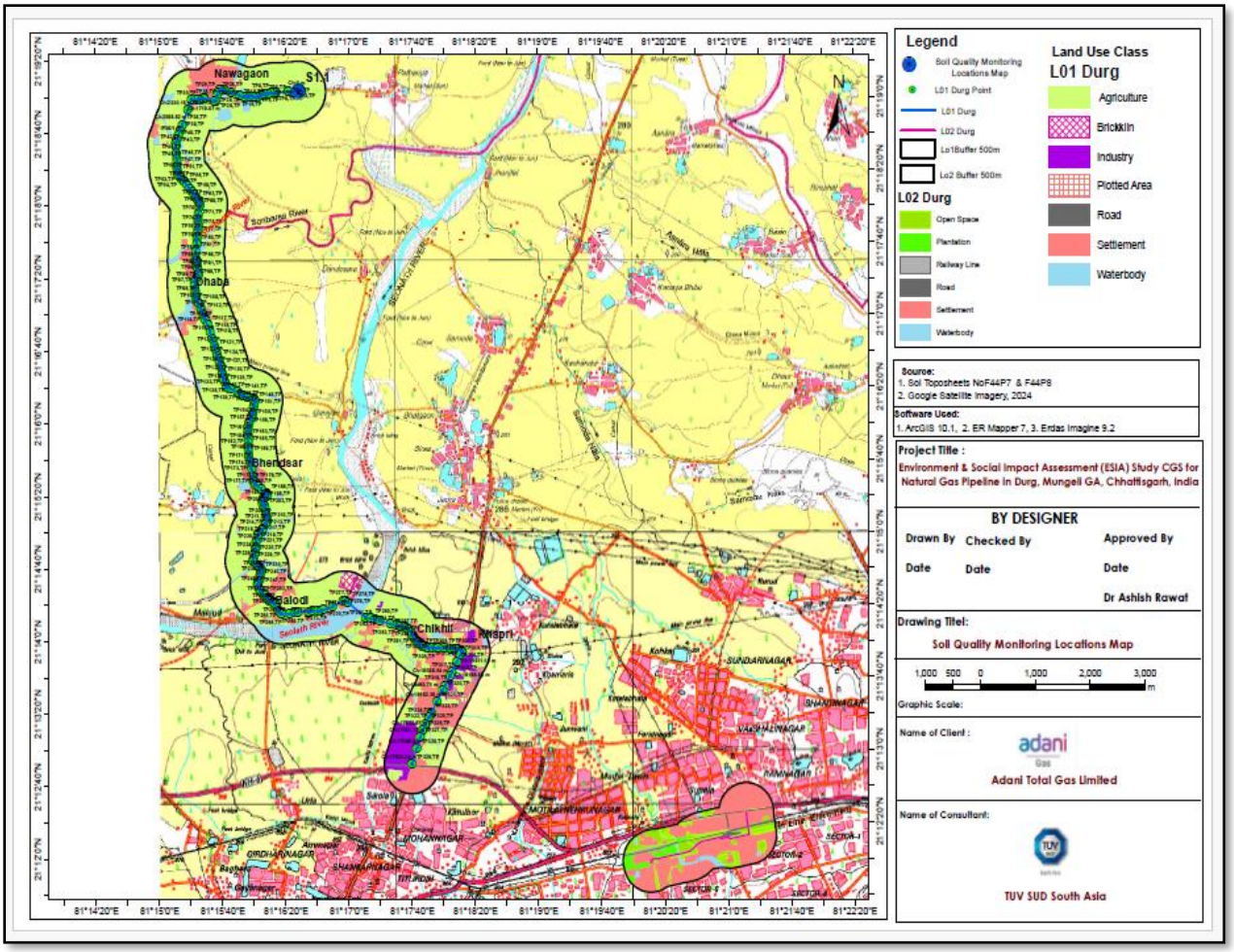
Vertisols: Vertisol is a soil in which the content of clay size particles is 30% or more by mass in all horizons of the upper half meter of the soil profile. They are characterized by a high content of expanding and shrinking clay known as montmorillonite. They may also be characterized by salinity and well-defined layers of calcium carbonate or gypsum. Vertisols contain a high level of plant nutrients, but, owing to their high clay content, they are not well suited to cultivation without painstacking management. Vertisols are especially suitable for rice because they are almost impermeable when saturated. Rainfaid farming is very difficult because vetisols can be worked only under a very narrow range of moisture conditions as they become very hard when dry and become very sticky when wet.

Alfisols: They are considered as very fertile soil and are frequently used for agriculture. This soil exhibits well developed contrasting soil horizons depleted in calcium carbonate but enriched in aluminum and iron bearing minerals. In this soil, below surface horizon accumulation of migrated layer 7 silicate clay is

present which is called as argillic horizon and is characterized by a relatively high content of available calcium, magnesium, potassium and sodium ions. The soil quality monitoring locations are provided in **Table 4-6** and **Figure 4-9** and the monitoring results are enclosed in the **Table 4-7**.

Table 4-6: Soil Quality Monitoring Locations

Sl. No.	Location code	Location name	Latitude (N)	Longitude (E)
1.	S-1.1	At Chainage 17.14 m (TP-1) near the Admin Building	21°19'2.81"N	81°16'28.36"E
2.	S-1.2	Bank of Shivnath River, Near Chainage 13336.58 m (TP278)	21°14'21.03"N	81°16'59.99"
3.	S-2.1	Near the rotary of underpass	21°12'11.60"N	81°21'0.17"E

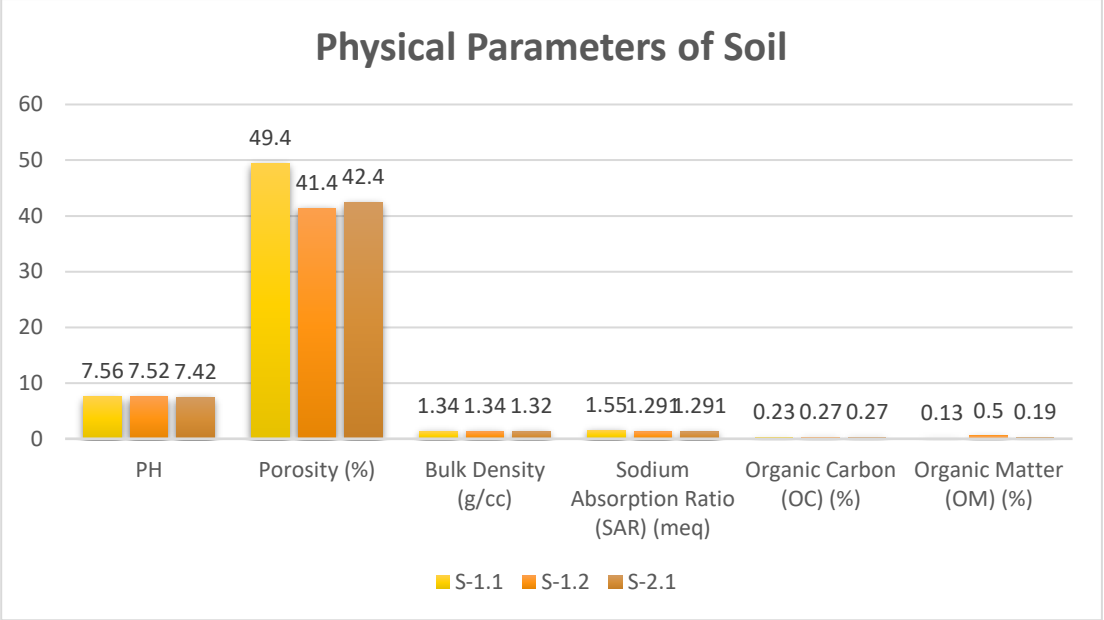


Source: TUV SUD GIS Mapping Study (Toposheets No F44P7 &F44P8)

Figure 4-9: Soil Quality Monitoring Locations

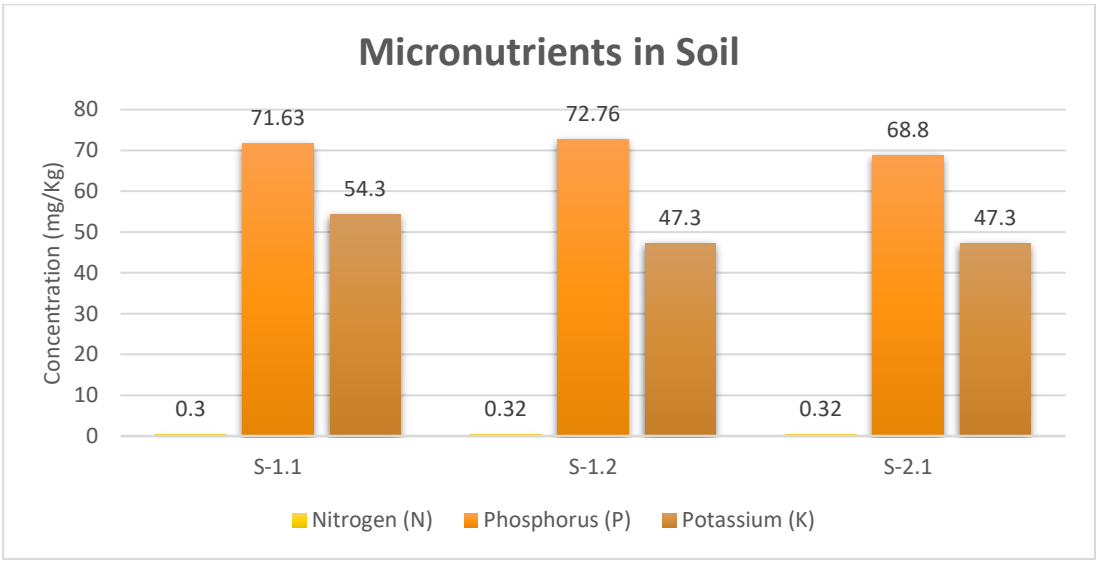
Table 4-7: Soil Quality Analysis Result

Sl. No.	Parameter	Unit	Test Protocol	S-1.1	S-1.2	S-2.1
1	Texture		IS: 2720 (part-4), 1985 Reaff:2015)	Sandy clay Loam	Sandy Loam	Sandy Loam
2	Sand		IS: 2720 (part-4), 1985,(Reaff:2015)	48.6	49.6	51.24
3	Silt	%	IS: 2720 (part-4), 1985,(Reaff:2015)	27.6	27.98	28.44
4	Clay		IS: 2720 (part-4), 1985,(Reaff:2015)	23.8	22.42	20.32
5	Porosity	%	STRL /STP/SOIL/01,	49.4	41.4	42.4
6	Bulk Density	g/cc	STRL /STP/SOIL/01	1.34	1.34	1.32
7	pH	….	STRL /STP/SOIL/01	7.56	7.52	7.42
8	E. Conductivity	µs/cm	STRL /STP/SOIL/01	0.46	0.38	0.39
9	Magnesium	mg/kg	STRL /STP/SOIL/01	38.6	31.5	34.5
10	Calcium	mg/kg	STRL /STP/SOIL/01	189.5	176.6	174.4
11	Chlorides	mg/kg	STRL /STP/SOIL/01	58.9	64.4	67.8
12	Sodium	mg/kg	STRL /STP/SOIL/01	82.4	84.0	64.4
13	Potassium	mg/kg	STRL /STP/SOIL/01	54.3	47.3	47.3
14	Organic Carbon	%	IS : 2720 (Part-24)-1976(R-2015)	0.23	0.27	0.27
15	Organic matter	%	IS : 2720 (Part-24)-1976(R..2015)	0.13	0.50	0.19
16	Phosphorous	mg/kg	IS: 2720 (part-26),1987. (R:2011)	71.63	72.76	68.8
17	SAR	meq	STRL /STP/SOIL/01	1.55	1.291	1.291
18	Nitrogen (as N)	mg/kg	STRL /STP/SOIL/01	0.30	0.32	0.32
19	Salinity (as NaCl)	%	STRL /STP/SOIL/01	0.33	0.29	0.31



**Source: TUV SUD Interpretation & Analysis*

Figure 4-10: Analysis of Physical Parameters of Soil



**Source: TUV SUD Interpretation & Analysis*

Figure 4-11: Micronutrient Concentration in Soil

Porosity & Soil Texture

Porosity of the soil in study area is 49.4%, whereas soil textured is mainly sandy loam and sandy clayey loam with sand percentage above 45% and silt percentage above 25%.

Organic Carbon & Organic Matter

Organic carbon content varies between 0.23% to 0.27%; whereas organic matter ranges between 0.13% to 0.5%.

N-P-K & and soil fertility

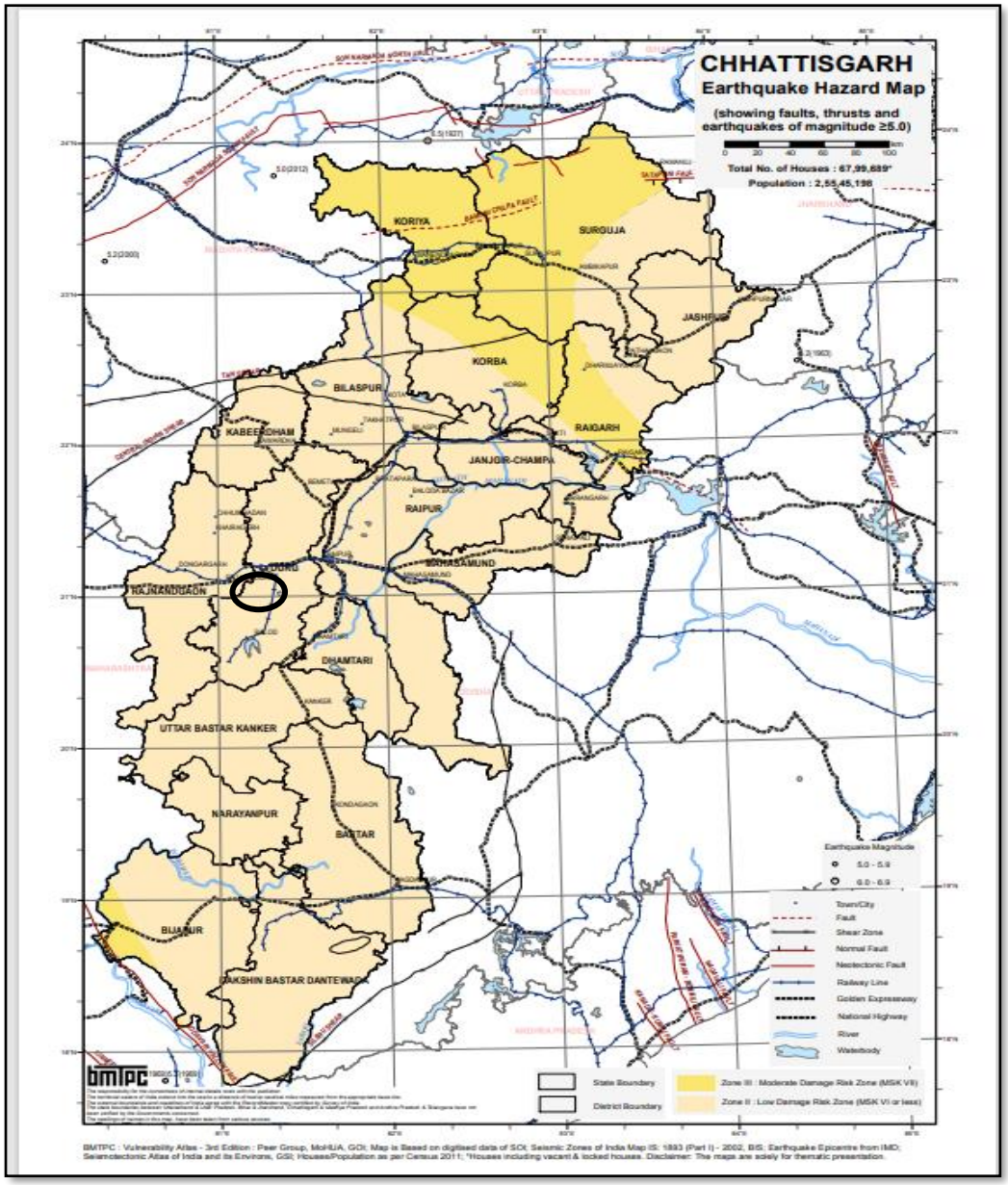
The Nitrogen content in the soil samples was found to be 0.30-0.32 mg/kg. which is considered as Low. Potassium content was found with a range of 47.3 mg/kg to 54.3 mg/kg, which can be considered as Low 'K' concentration. Phosphorus content ranged between 68.8 mg/kg to 72.76 mg/kg, which would be considered as high concentration of 'P'. Thus, 'NPK' concentration of the study area soil can be considered as 'NPK: Low-high-Low'. Considering, the overall soil quality of the project study area, the overall soil quality in the project area is deemed suboptimal for agricultural purposes.

4.6.6 Natural Hazards

Natural hazards naturally occur physical phenomena caused either by rapid or slow onset events which can be geophysical (earthquakes, landslides, tsunamis, and volcanic activity), hydrological (floods), climatological (droughts, etc.), meteorological (cyclones and storms/wave surges) or biological (disease epidemics and insect/animal plagues). Natural hazards can have impacts on the development; hence assessment of the natural hazards in the area is important for any proposed development.

4.6.6.1 SEISMICITY

The study area falls in ***Zone II: Low Damage Risk Zone (MSK IV or less)*** in accordance with the Earthquake Hazard map of Chhattisgarh, Vulnerability Atlas of 3rd edition, 2019 prepared by BMTPC. Hence, the threat of damage due to an earthquake is of very low intensity. The seismic map is shown in **Figure 4-12**Figure 4-12.

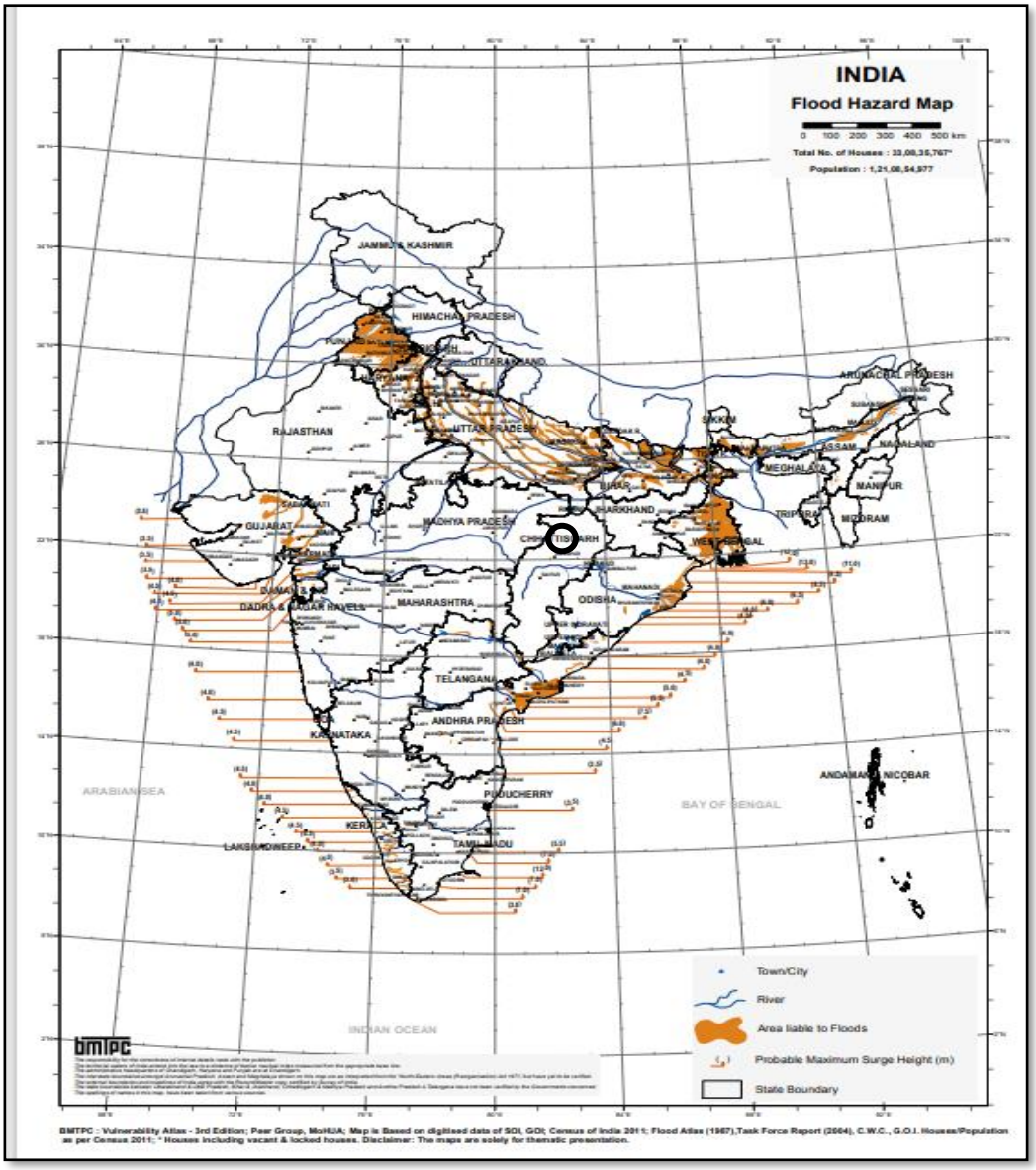


**Source-BMTPC Vulnerability Atlas*

Figure 4-12: Earthquake Hazard Map of Chhattisgarh (Black Circle-Project Study Area)

4.6.6.2 Flood

The project site does not have any major stream/ secondary surface water stream within the project AOI, in accordance with the Flood Hazard map of India, Vulnerability Atlas of 3rd edition, 2019 prepared by BMTPC. The Flood Hazard map of the India is provided in **Figure 4-13.**



Source-BMTPC Vulnerability Atlas

Figure 4-13: Flood Hazard Map (Project Area identified with "Black Circle")

4.6.6.3 Drought

Drought is cumulative effect of the lack of water. The effect of which results in the form of a natural disaster on agriculture, environment and related processes. If its effectiveness continues to increase, then the situation of famine(drought) arises. The Indian Meteorological Department has divided the drought into two parts - Drought and Intensive drought. Intensive drought has less than 50 percent rainfall, while the normal drought is 25 percent less than the average rainfall.

Table 4-8: Drought Affected Area in 2017-18 and its Loss

Drought Affected Area in 2017-18 and its Loss

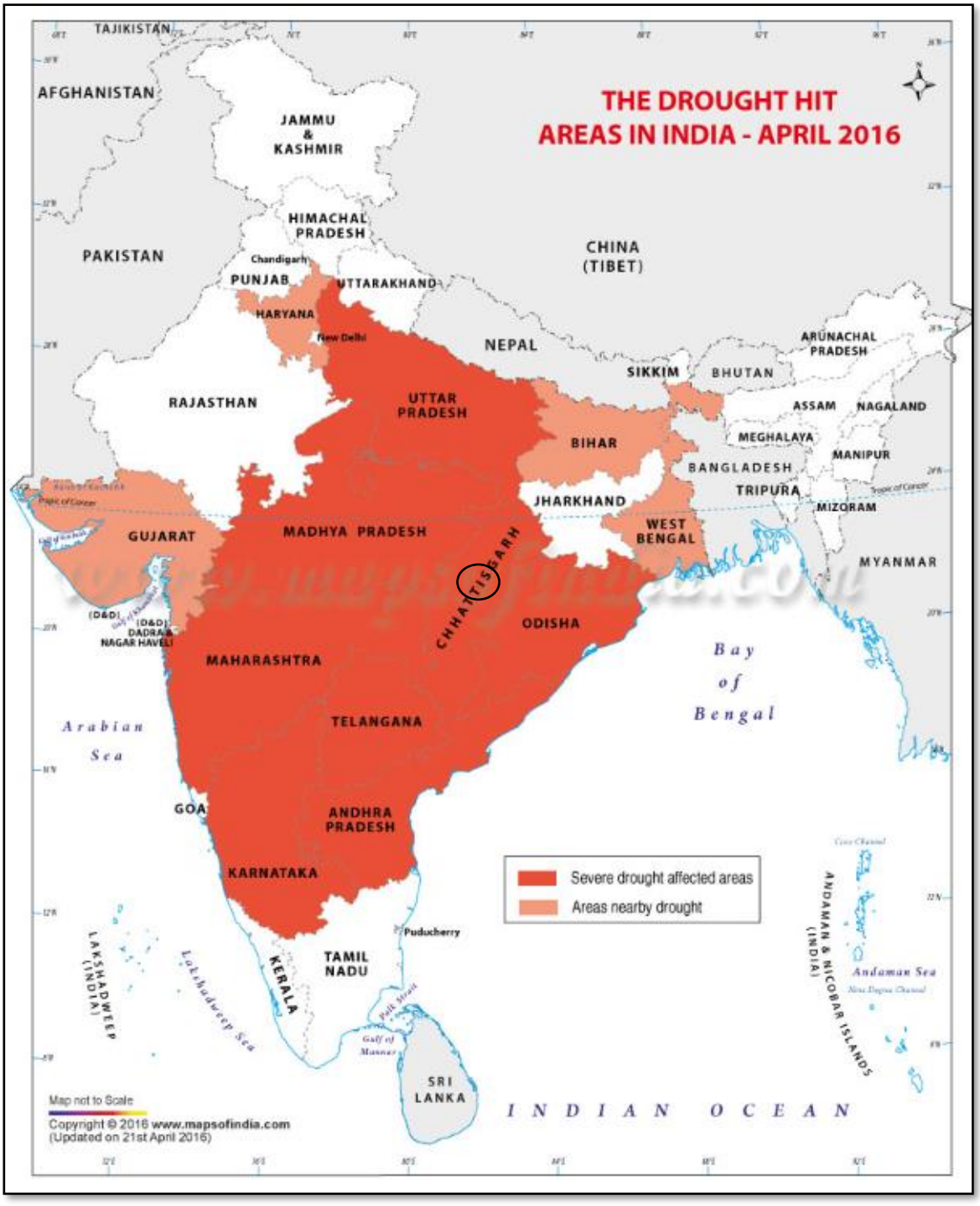
S.no.	Particular	Area	Remarks
1.	Affected Area	25998 ha.	The three-tehsil fort, Dhamdha and Patan have been declared drought-prone in Kharif year 2017-18 in Durg district.

*(*District Disaster Management Plan, Durg (C.G.))*

Table 4-9: Past Occurrence of Drought Declared in the District

Past Occurrence of Drought Declared in The District				
Sl. No.	**Year**	**State Name**	**District Name**	**Tehsil Name**
1	2015-2016	Chhattisgarh	Durg	Dhamdha, Patan
2	2017-2018	Chhattisgarh	Durg	Durg, Dhamdha, Patan

*(*District Disaster Management Plan, Durg (C.G.))*

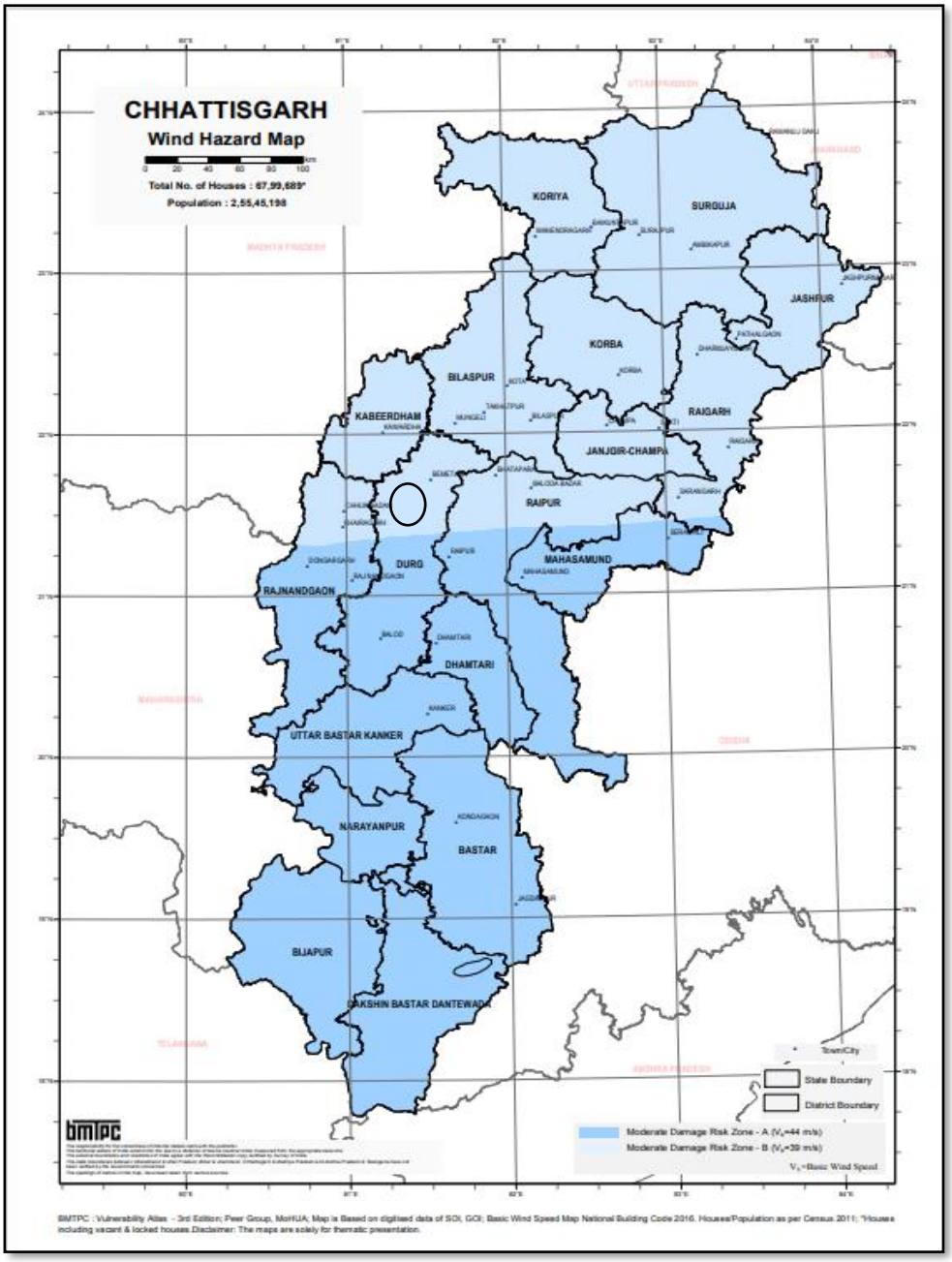


Source: Maps of India

Figure 4-14: Drought Prone Map of India (Black Circle indicating Project Area)

4.6.6.4 Wind Hazard

The project study area has been identified in Moderate Damage Risk Zone - B (Vb=39 m/s), according to the Wind Hazard map of Chhattisgarh, Vulnerability Atlas of 3rd edition, 2019 prepared by BMTPC. Wind Hazard Map of Chhattisgarh indicating project study area has been depicted in **Figure 4-15**.



**BMTPC Vulnerability Atlas*

Figure 4-15: Wind Hazard Map, Chhattisgarh (Project Area identified with "Black Circle")

4.6.7 *Climate and Meteorology*

In accordance with [2]Köppen–Geiger Climate Classification system (**Figure 4-16)** the climate zone of Project area in the Durg district is Tropical wet and dry or savanna climate (Classification: Aw/As).

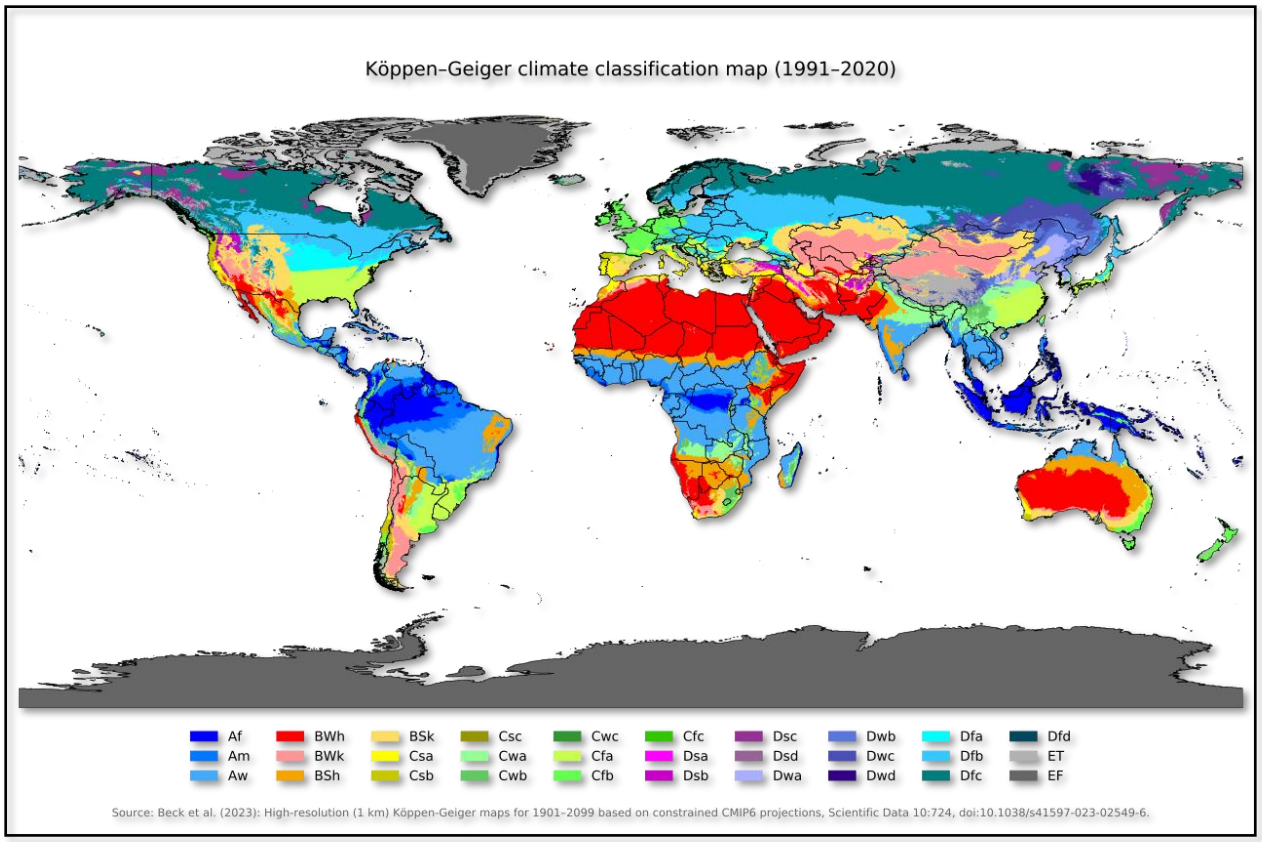
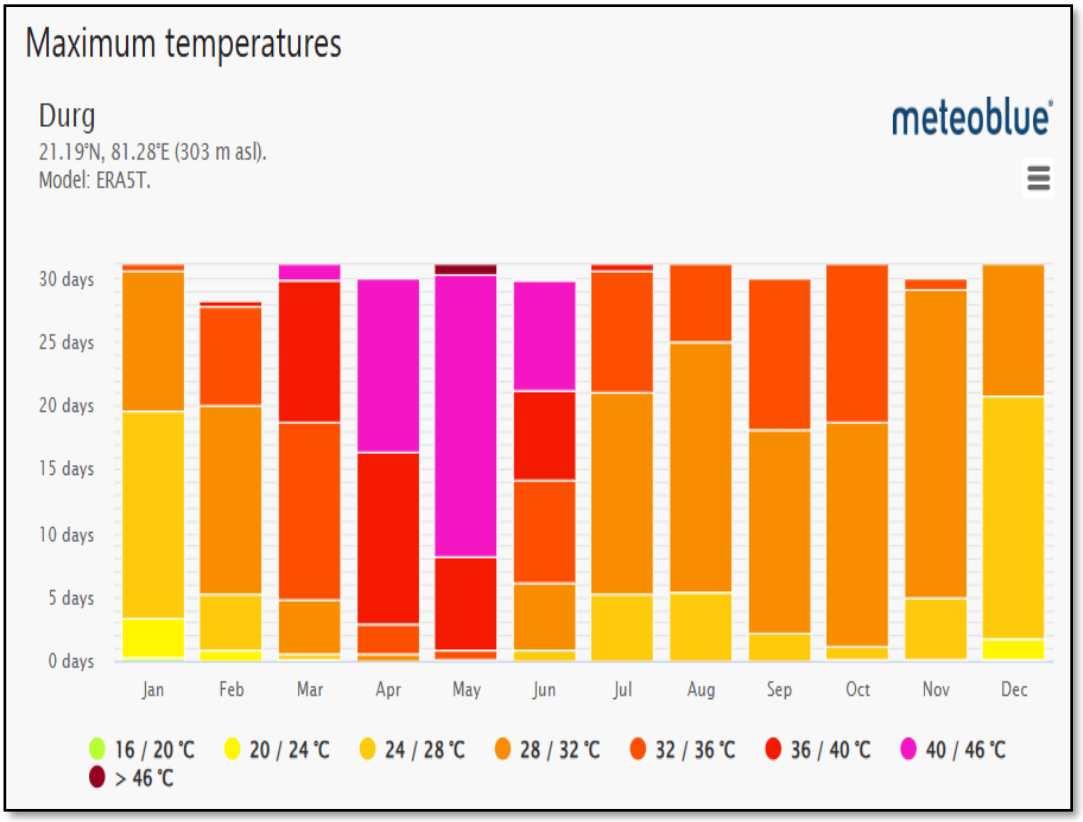


Figure 4-16: World Map of Köppen–Geiger Climate Classification

The Durg district experiences a subtropical climate and is characterized by extreme summer and winter seasons. The annual temperature of the district varies between 8°C and 46°C. The maximum temperature is observed in the months of May and June whereas the minimum is observed in the months of December and January. The rainy season extends from the month of June to September with well distributed rainfall through southwest monsoon. Monsoon generally breaks in the third week of June and is maximum in the months of July and August. Winter season is marked by dry and cold weather with intermittent showers during the months of December and January. The Durg district receives rainfall mainly from the south-west monsoon. It starts in third/fourth week of June and

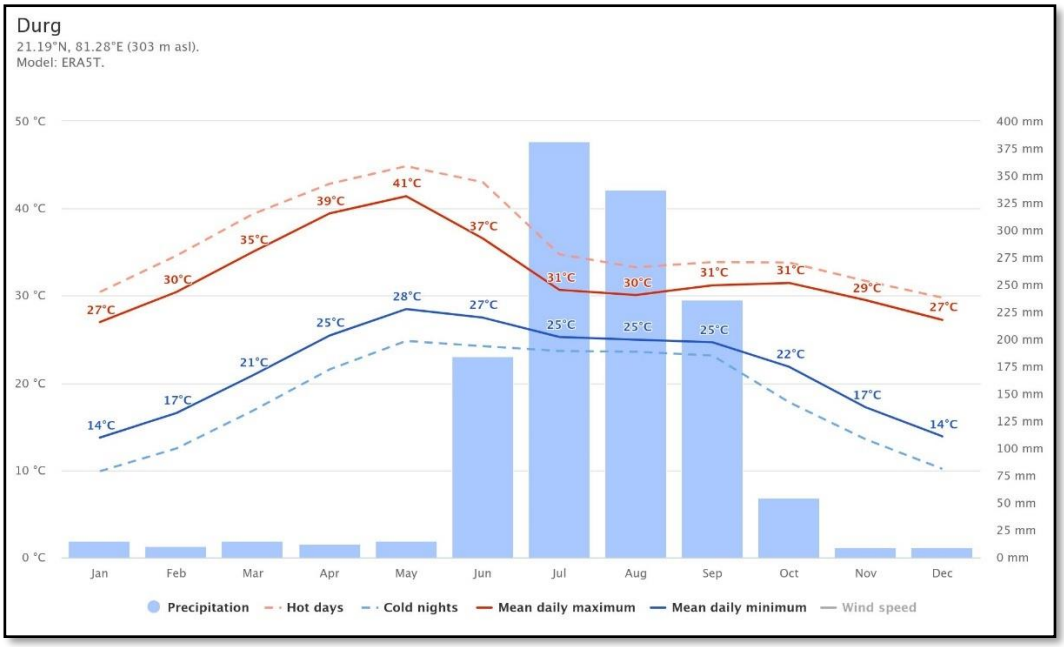
[2] Köppen-Geiger Climate Classification is one of the most widely used climate classification systems. The system is based on the concept that native vegetation is the best expression of climate. Thus, climate zone boundaries have been selected with vegetation distribution in mind. It combines average annual and monthly temperatures and precipitation, and the seasonality of precipitation.

continues till mid-August/September with the heaviest showers in the months of July and August.



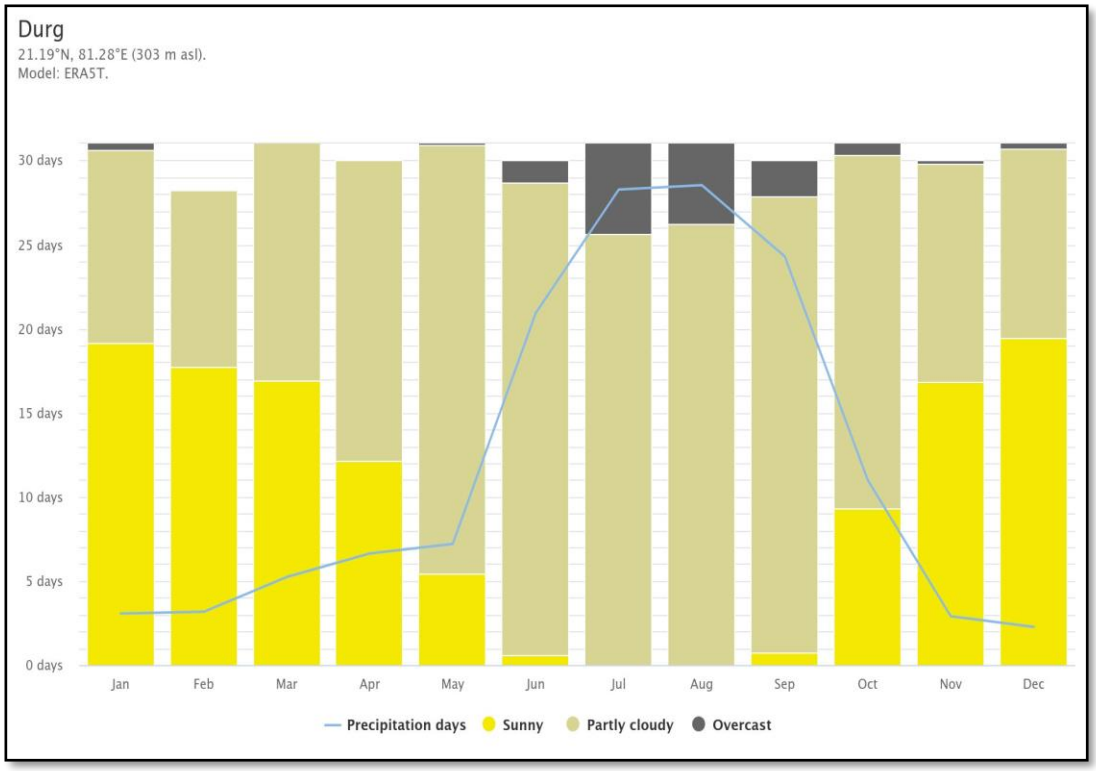
Source: Meteoblue.com

Figure 4-17: Temperature Trend in Study Area (Last 30 years)



Source: Meteoblue.com

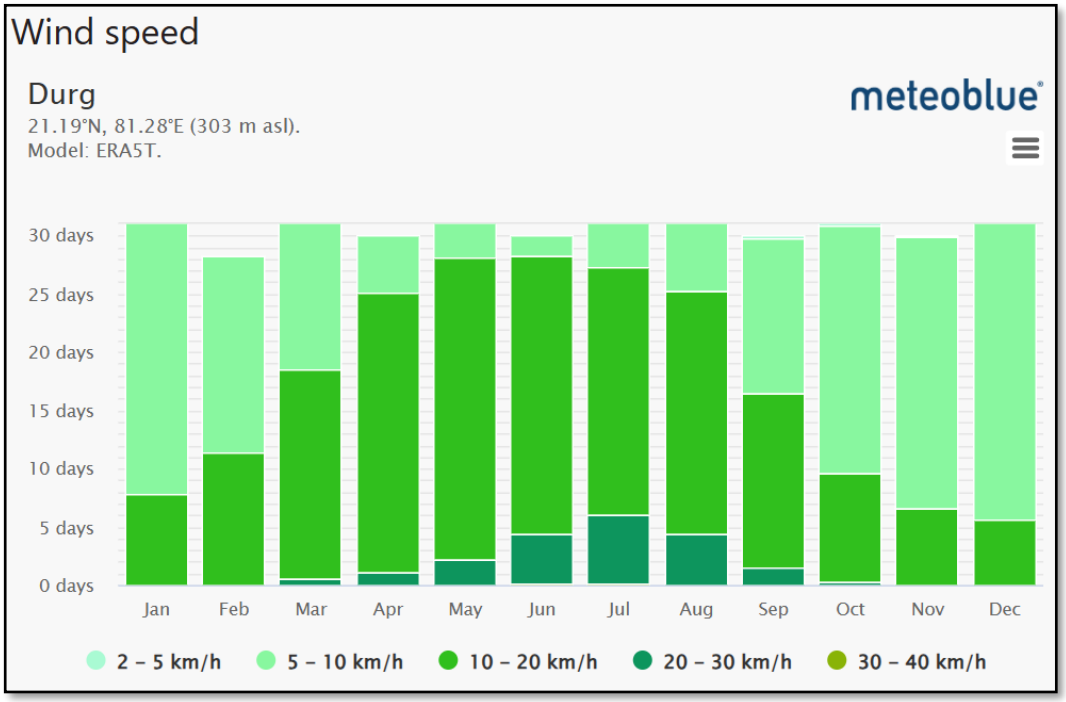
Figure 4-18: Climatological Trend in Study Area (Last 30 years)



Source: Meteoblue.com

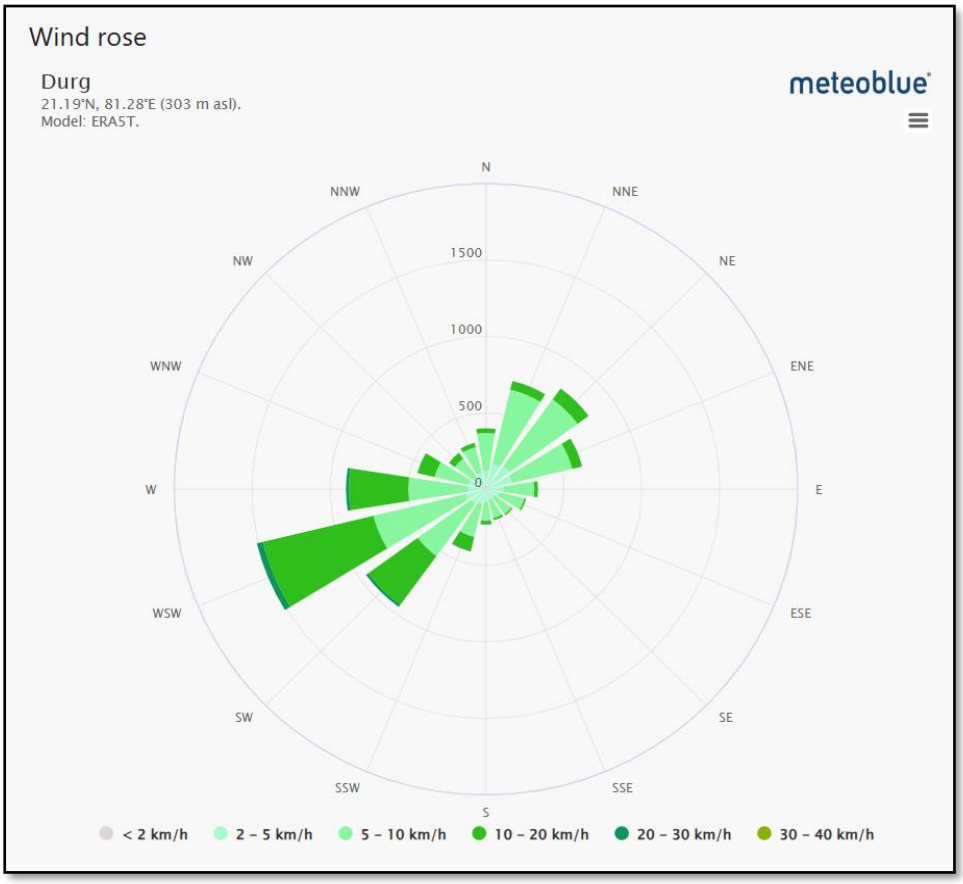
Figure 4-19: Precipitation Graph of Study Area

The predominant wind direction in the study area is primarily from the West-South-Western direction. The wind intensity analysis and wind-rose diagram for study area is given in **Figure 4-20** and **Figure 4-21** respectively.



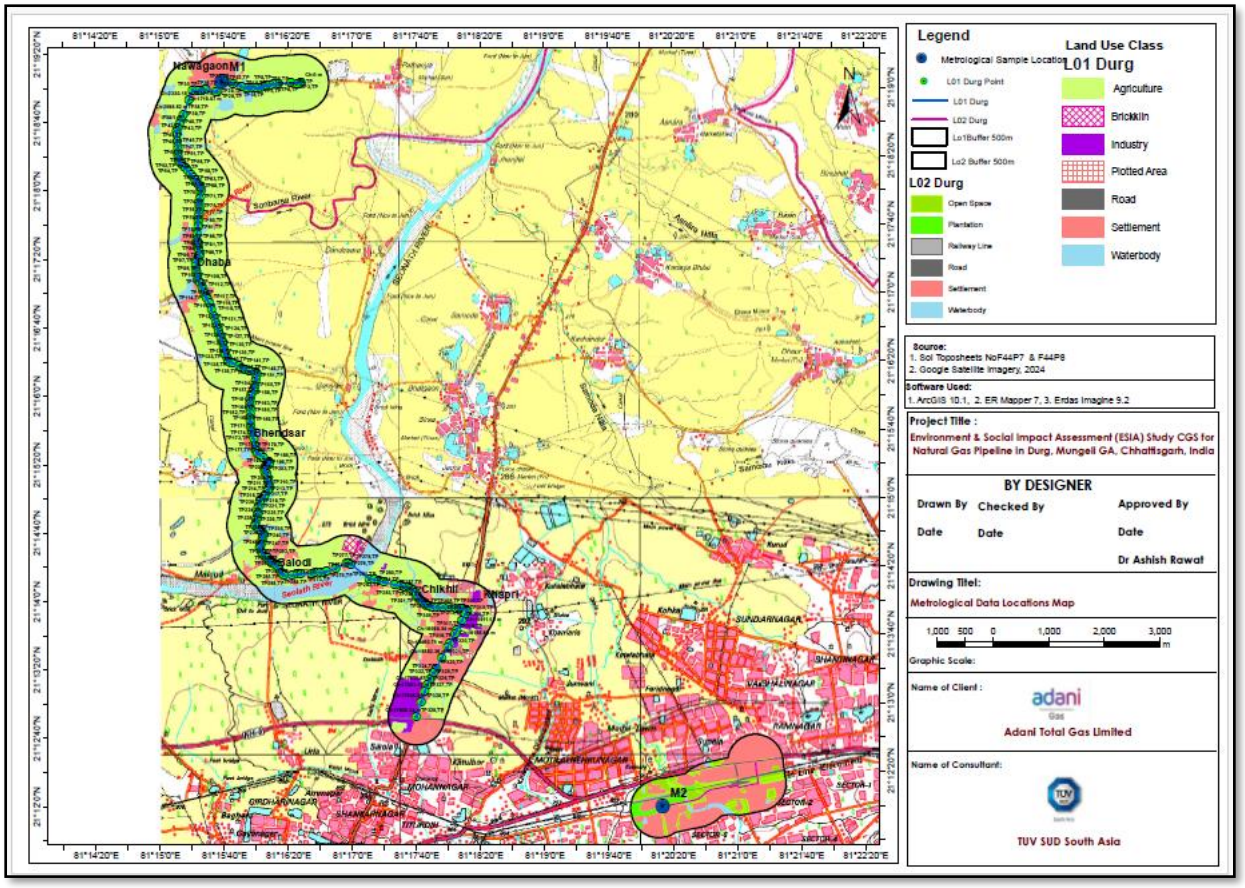
**Source: Meteoblue.com*

Figure 4-20: Wind Intensity of Study Area



**Source: Meteoblue.com*

Figure 4-21: Windrose Diagram of Project Study Area



**Source: TUV SUD GIS Mapping Study (Toposheets No F44P7 & F44P8)*

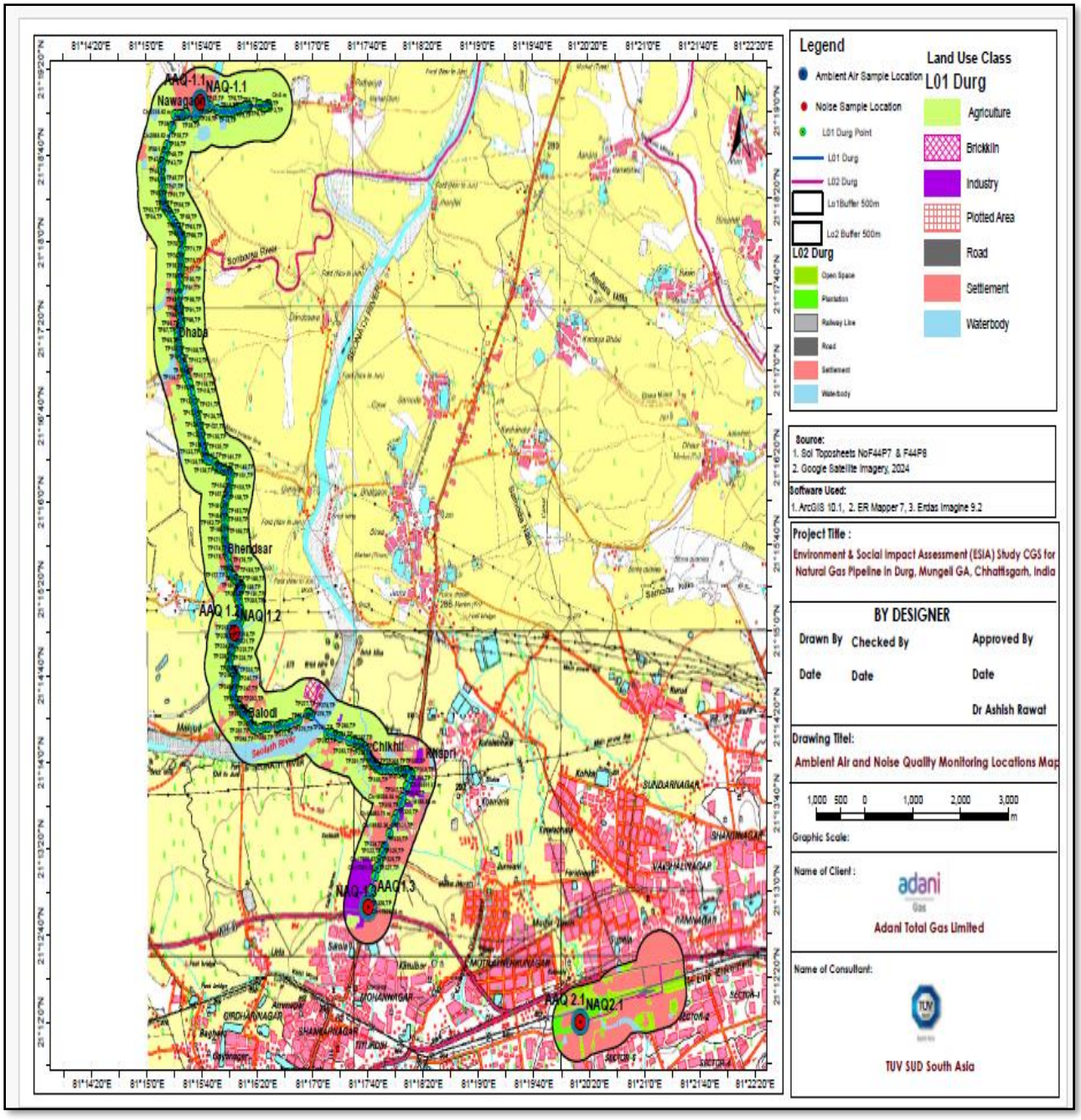
Figure 4-22: Meteorological Monitoring Locations within Project AOI

4.6.8 Ambient Air Quality

The ambient air quality monitoring will be carried out at four (4) locations. The sampling locations for air and noise quality are based on certain meteorological conditions such as wind direction, wind speed, surrounding receptors and in accordance with that, the monitoring sites are identified close to the proposed project activity area. These locations have been given in the following **Table 4-10** and depicted in **Figure 4-23**. The monitoring results are attached in the **Table 4-11**.

Table 4-10: Ambient Air Quality Monitoring Locations

Sl. No.	Location code	Location name	Latitude (N)	Longitude (E)
1.	AAQ-1.1	At Chainage 1464.12 m (TP24)	21°19'4.22"N	81°15'39.22"E
2.	AAQ-1.2	At Chainage 10440.22 m (TP215)	21°14'59.52"N	81°16'3.61"E
3.	AAQ-1.3	Near Chainage 17826.24 m (TP329)	21°12'52.94"N	81°17'40.22"E
4.	AAQ-2.1	At Maharana Pratap Chowk near the HP Petrol Pump	21°11'59.56"N	81°20'13.44"E

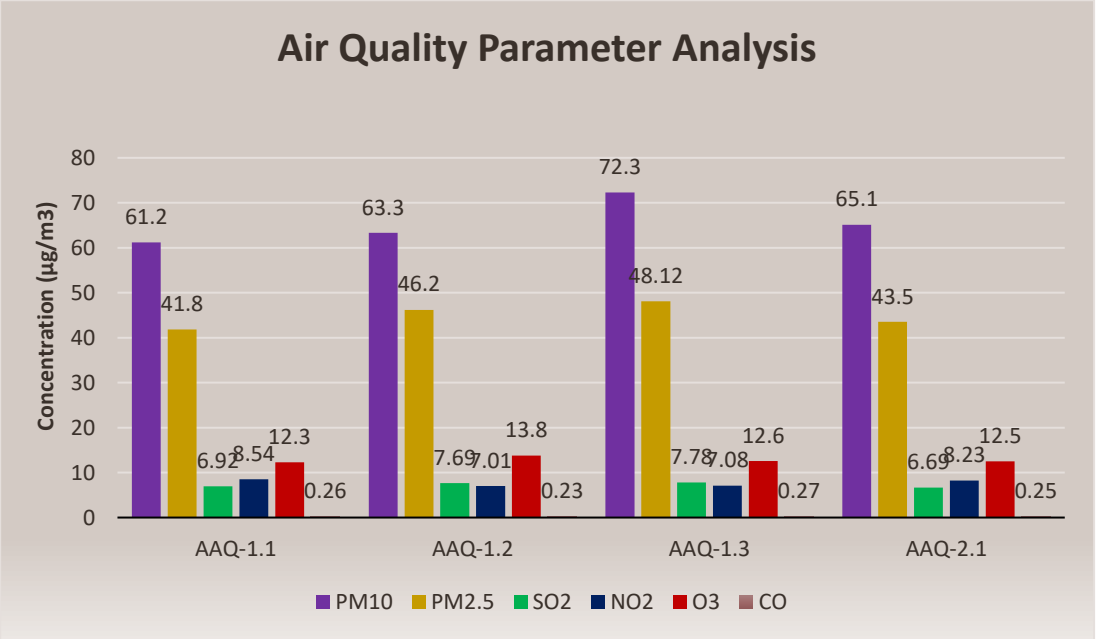


**Source: TUV SUD GIS Mapping Study (Toposheets No F44P7 & F44P8)*

Figure 4-23: Ambient Air and Noise Monitoring Locations within Project AOI

Table 4-11: Ambient Air Quality Analysis

Sl. No.	Parameter	Unit	AAQ-1.1	AAQ-1.2	AAQ-1.3	AAQ-2.1	NAAQS Standard
1.	Particulate Matter-10 (PM-10)	µg/m³	61.2.	63.3	72.3	65.1	**100**
2.	Particulate Matter-2.5 (PM- 2.5)	µg/m³	41.8	46.2	48.12	43.5	**60**
3.	Sulphur Dioxide (SO2)	µg/m³	6.92	7.69	7.78	6.69	**80**
4.	Nitrogen Dioxide (NO2)	µg/m³	8.54	7.01	7.08	8.23	**80**
5.	Ozone (O3) -8Hr.	µg/m³	12.3	13.8	12.6	12.5	**100**
6.	Lead (Pb)	µg/m³	<1.0	<1.0	<1.0	<1.0	**1.0**
7.	Carbon Mono Oxide (CO)-1.0 Hr.	mg/m³	0.26	0.23	0.27	0.25	**4.0**
8.	Ammonia (NH3)	µg/m³	< 10	< 10	< 10	< 10	**400**
9.	Arsenic (As)	µg/m³	<1.0	<1.0	<1.0	<1.0	**6**
10.	Nickel (Ni)	µg/m³	0.22	0.24	0.25	0.20	**20**
Air Quality Index			**(71) Satisfactory**	**(77) Satisfactory**	**(80) Satisfactory**	**(73) Satisfactory**	



**Source: TUV SUD Interpretation & Analysis*

Figure 4-24: Analysis of Air Quality Parameters

Ambient air quality monitoring was conducted at four locations (AAQ-1.1 to AAQ-2.1) to assess the baseline air quality in the vicinity of the AGTL Natural Gas Pipeline Project, Durg, Chhattisgarh. The parameters analyzed include PM_{10}, $PM_{2.5}$, SO_2, NO_2, O_3, CO, Lead (Pb), Ammonia (NH_3), Nickel (Ni) and Arsenic (As). The concentration of PM_{10} ranged from 61.2 to 72.3 µg/m³ and $PM_{2.5}$ ranged from 41.8 to

48.12 µg/m³ across the four locations. These values are well within the CPCB NAAQS limits of 100 µg/m³ for PM_{10} and 60 µg/m³ for $PM_{2.5}$ (24-hour standard). The levels of sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) were also found to be within safe limits, ranging between 6.69–7.78 µg/m³ and 7.01–8.54 µg/m³ respectively, compared to the CPCB permissible limits of 80 µg/m³ for both SO_2 and NO_2 (24-hour standard). Ozone (O_3) concentrations were observed between 12.3 and 13.8 µg/m³, which is significantly below the CPCB standard of 100 µg/m³ (8-hour average). Carbon monoxide (CO) levels ranged from 0.23 to 0.27 mg/m³, well below the prescribed standard of 2.0 mg/m³ (8-hour average).

Overall, the results indicate that ambient air quality in the project area is within acceptable limits as per CPCB guidelines and does not present any immediate concern regarding air pollution. The environment is currently experiencing low pollutant loads, suggesting minimal impact from existing sources. However, periodic air quality monitoring is recommended during project development phases to ensure continued compliance and early detection of any adverse changes.

4.6.9 Ambient Noise Quality

In the present study, sound pressure levels (SPL) have been measured by a sound level meter. Since loudness of sound is important for its effects on people, the dependence of loudness upon frequency must be considered in noise impact assessment. This has been achieved using A-weighting filters in the noise measuring instrument which gives a direct reading of approximate loudness. A-weighted equivalent continuous sound pressure level (Leq) values have been computed from the values of A-weighted sound pressure level measured with the help of noise meter. Noise monitoring will be carried out at Four (04) locations to identify the baseline noise level of the surrounding areas, so that noise pollution during construction phase can be predicted and cumulative effect of ambient noise can be identified. These locations have been given in **Table 4-12.**

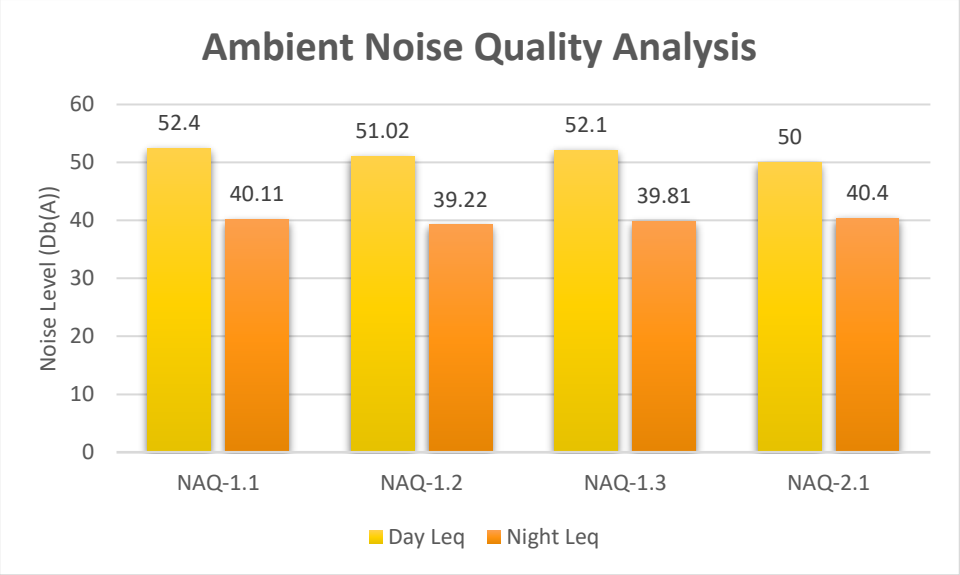
Table 4-12: Ambient Noise Quality Monitoring Locations

Sl. No.	Location Code	Location Name	Latitude (N)	Longitude (E)
1.	NAQ-1.1	At Chainage 1464.12 m (TP24)	21°19'4.22"N	81°15'39.22"E
2.	NAQ-1.2	At Chainage 10440.22 m (TP215)	21°14'59.52"N	81°16'3.61"E
3.	NAQ-1.3	Near Chainage 17826.24 m (TP329)	21°12'52.94"N	81°17'40.22"E
4.	NAQ-2.1	At Maharana Pratap Chowk near the HP Petrol Pump	21°11'59.56"N	81°20'13.44"E

Noise quality monitoring is conducted in areas close to the proposed project. At each location, noise monitoring is carried out over a period of twenty-four hours (once) to obtain Leq values at uniform time intervals of 1 hour. In each hourly time interval Leq values have been computed from SPL readings taken at uniform time intervals of 15 minutes. For each location, day and night-time Leq values have then been computed from the hourly Leq values so that comparison could be made with the national ambient noise standards. Day time Leq has been computed from the hourly Leq values between 6.00 AM - 10.00 PM and night-time Leq from the hourly Leq values between 10.00 PM- 6.00 AM. The result is attached in **Table 4-13**.

Table 4-13: Ambient Noise Quality Analysis

Sl. No.	Location	Location Code	Results in Db(A) Leq		Limits in Db(A) Leq Noise Regulation, 2000	
			Average Day Noise Level	Average Night Noise Level	Day Time	Nighttime
1	At Chainage 1464.12 m (TP24)	NAQ-1.1	52.4	40.11	55	45
2	At Chainage 10440.22 m (TP215)	NAQ-1.2	51.02	39.22	55	45
3	Near Chainage 17826.24 m (TP329)	NAQ-1.3	52.1	39.81	65	55
4	At Maharana Pratap Chowk near the HP Petrol Pump	NAQ-2.1	50.0	40.4	65	55



*Source: TUV SUD *Interpretation & Analysis*

Figure 4-25: Analysis of Noise Quality Parameters During Day & Night

Ambient noise monitoring was conducted at four locations (NAQ-1.1 to NAQ-2.1) within the project area for the Natural Gas Pipeline Project in Durg, Chhattisgarh. The equivalent continuous noise levels (Leq) recorded during the daytime ranged from 50.0 dB(A) to 52.4 dB(A), while nighttime levels varied between 39.22 dB(A) and 40.4 dB(A). All monitored values were found to be within the permissible limits prescribed by the Central Pollution Control Board (CPCB) for residential areas, which are 55 dB(A) for daytime and 45 dB(A) for nighttime. The results indicate a relatively quiet ambient environment with no significant noise pollution concerns. Overall, the findings confirm that the existing noise environment is within acceptable limits and poses no immediate concern; however, during the construction phases to ensure compliance with applicable standards.

4.6.10 Hydro Geology & Ground Water Quality

Hydrogeology

Hydro-geologically the Durg district can be categorized into three groups:

1. Basement crystalline province
2. Plutonic, Volcanic and meta-sedimentary province
3. Precambrian sedimentary province

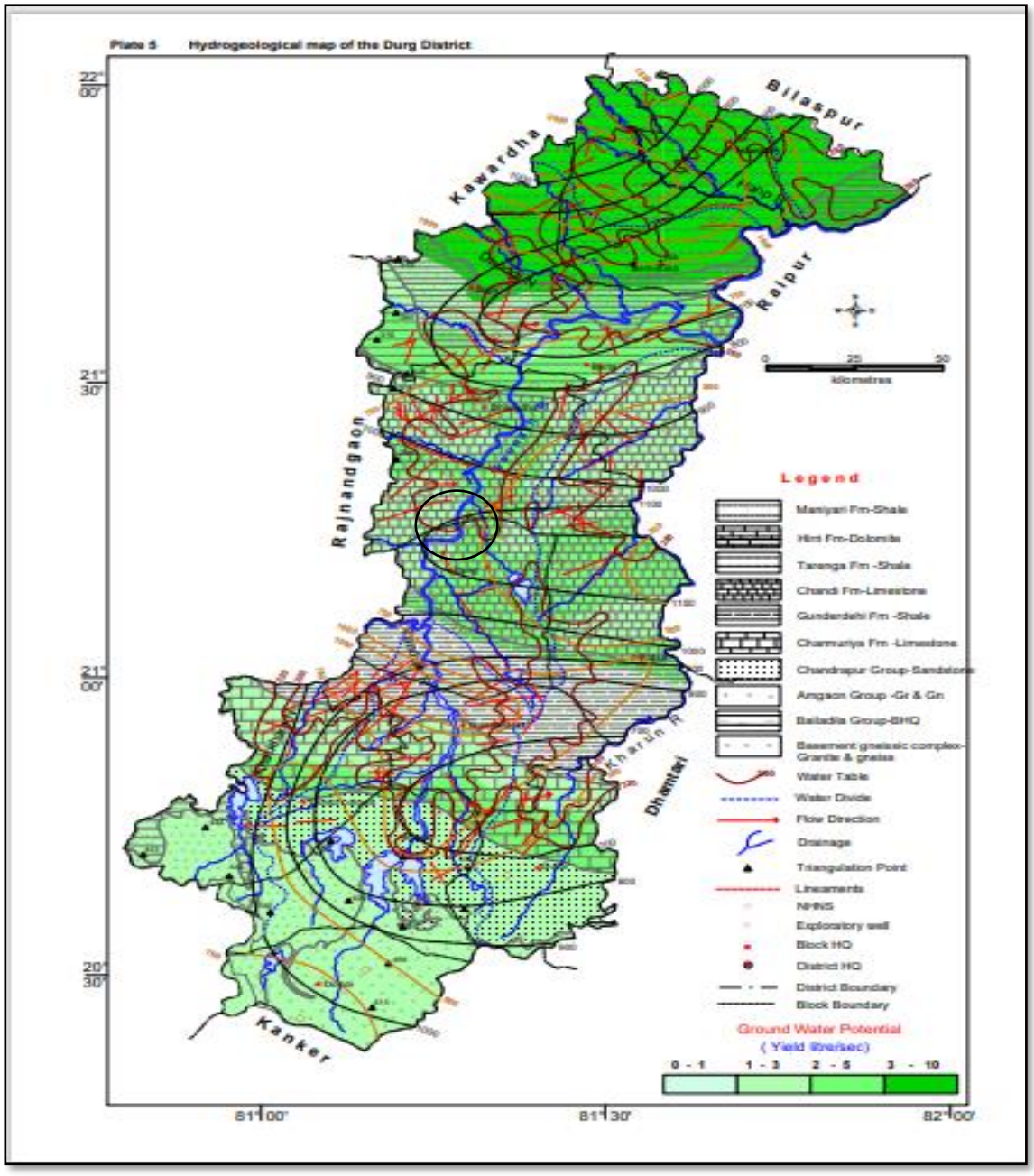
In the district, the Basement crystalline province of Archean age consists of the basement granite gneiss with enclaves of quartzite, quartz-mica schist and amphibolite belonging to the Bengpal Group. The ground water in this group of rocks occurs under phreatic/water table conditions in the weathered portion while semi-confined to confined conditions in deeper part consist of fractures/cracks/joints. The average thickness of the weathered portion in the area extends from 2 to 15m and in some places it goes up to 25m followed by shallow fracture zone down to depth of 70 mbgl. The occurrences of fractures at depth in the area are not common and whenever they occur there is less potential from ground water point of view. However, the thick weathered mantle in the coarse-grained granites of this group of rocks forms potential aquifers. In general, the discharge varies from 0.5 to 3 lps. The ground water development in these formations is mainly through dug wells, dug cum bore wells and shallow bore wells.

The Plutonic, Volcanic and meta-sedimentary province of the district of Palaeo Proterozoic to Archaean age consist of Banded Iron Formation, Shale and Phyllite belonging to Bailadila Group and Rhyolite, Rhyolitic tuffs, Basic pyroclastics, Basalt, Dolerite and Gabbro etc. belonging to Nandgaon Group. Ground water in these rocks mainly occur in phreatic to semi-confined condition. Weathered and fractured zones provide space for ground water occurrence and movement in these rocks. The thickness of the weathered zone varies from 6 to 36 m, followed by fractures down to depth of 150 mbgl. The ground water development in these formations is mainly through dug wells, dug cum bore wells and bore wells.

The Precambrian sedimentary province of the district includes Chhattisgarh Super Group of rocks of Upper Proterozoic age of marine origin. This province occupies nearly 90% of the district area. It mainly consists of arenaceousargillaceous-calcareous rocks and are dominated by limestone/ dolomite and calcareous shale. The ground water in these formations occurs under water table, semi-confined and confined conditions. The weathered, cavernous and fractured part of the formation constitutes the aquifers in the area. These formations are the most potential regarding ground water yield and development of the district. The weathered zone is restricted to upper 30 m depth and in exceptional cases it is observed up to 58 m. Most of the cavernous zones occur between 10 and 70 m depth and fractures are productive down to 150 to 200m. In this province, cavernous zones sometimes start just after soil horizon, particularly in the stratified calcareous rocks along the bedding. These caverns provide good channels for ground water movement when free from residual clay. But many times, the solution channels are filled with residual clay and cause hindrance to ground water movement. The gypsum karsts occurring in the Maniyari formation of this province are more productive. Though gypsum is more soluble than calcite,

their alternative assemblage with thinly laminated shale provides special condition where dissolution of gypsum laminae causes roof collapses to create larger openings. Artisian conditions are also reported from this province especially in gypsum's karstic terrain. Except Gunderdehi shales all the formation is productive. The contacts between different formations in this province are generally found productive. The ground water development in this province is through dug wells and bore wells. The dug wells are generally restricted up to 20m whereas bore wells are 30 to 180 m deep.

Hydrogeological Map of district indicating project study area has been depicted in **Figure 4-26.**



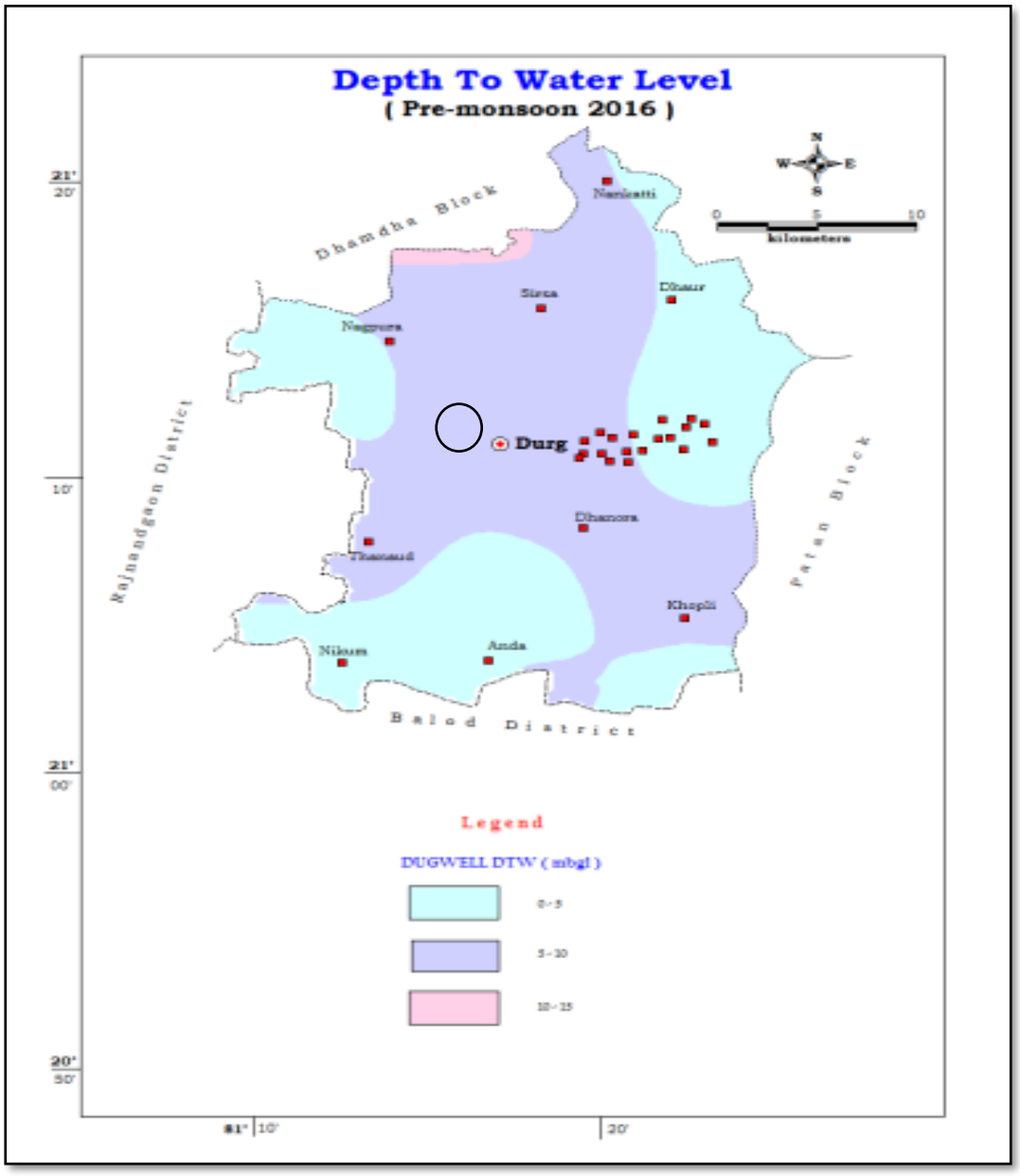
**Source: Aquifer Map and Management Plan, Durg District*

Figure 4-26: Hydrogeological Map of Durg District (Black Circle- Project Study Area)

As depicted in **Figure 4-26** the project study area falls in "*Chandi Fm- Limestone and Ferrugious Sandstone*" with yield of 1-5 liter/sec.

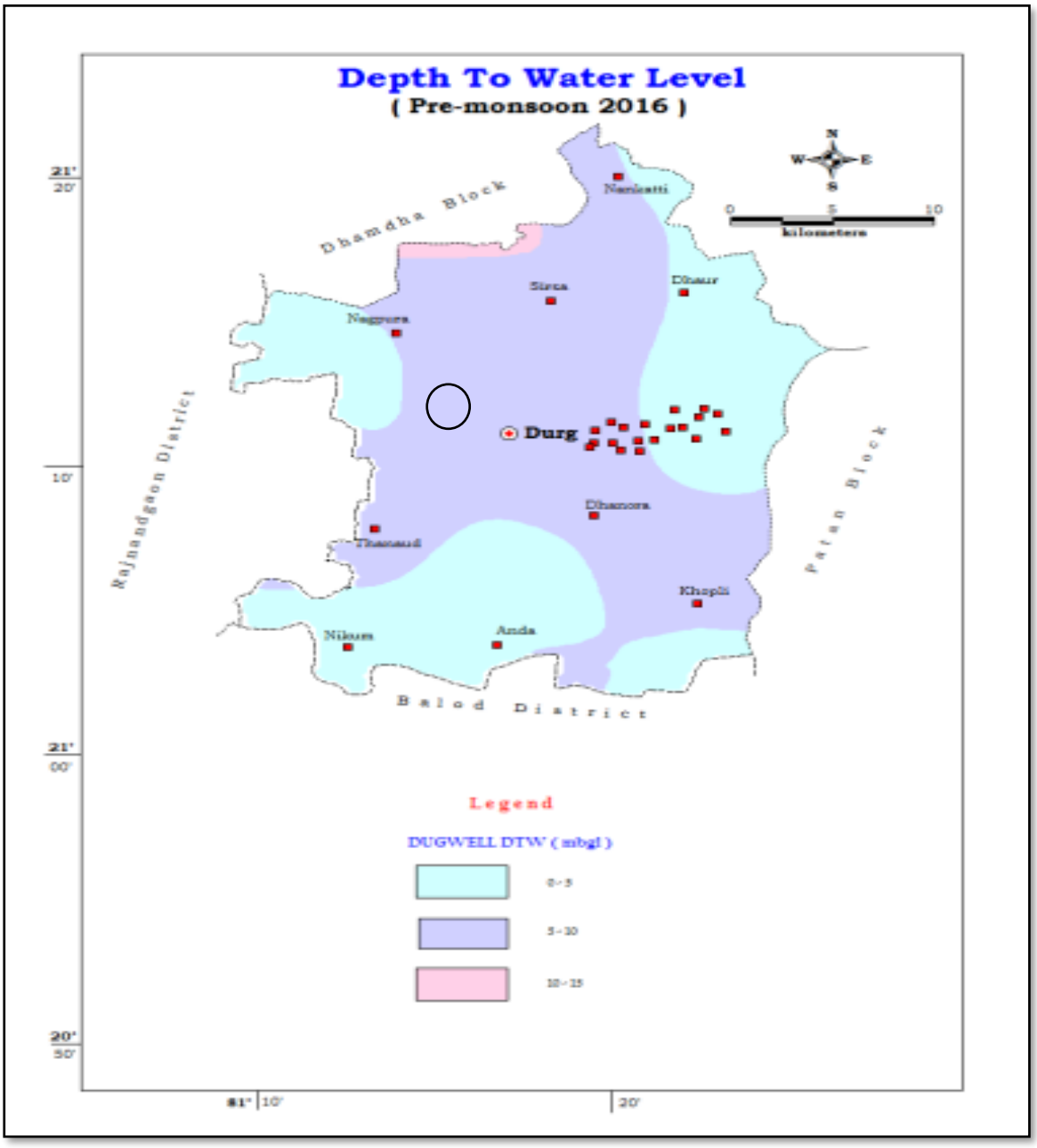
DEPTH TO WATER LEVEL

The depth to water level in the district ranges between 5-20 m bgl during pre-monsoon and post-monsoon. Maps indicating depth to water level during pre-monsoon & post-monsoon have been depicted in **Figure 4-27 & Figure 4-28.**



Source: Aquifer Map and Management Plan, Durg District

Figure 4-27: Pre-Monsoon Water Level, Durg District (Project Study Area demarcated with "Black Circle")



**Source: Aquifer Map and Management Plan, Durg District*

Figure 4-28: Pre-Monsoon Water Level, Durg District (Project Study Area demarcated with "Black Circle")

GROUND WATER RESOURCES

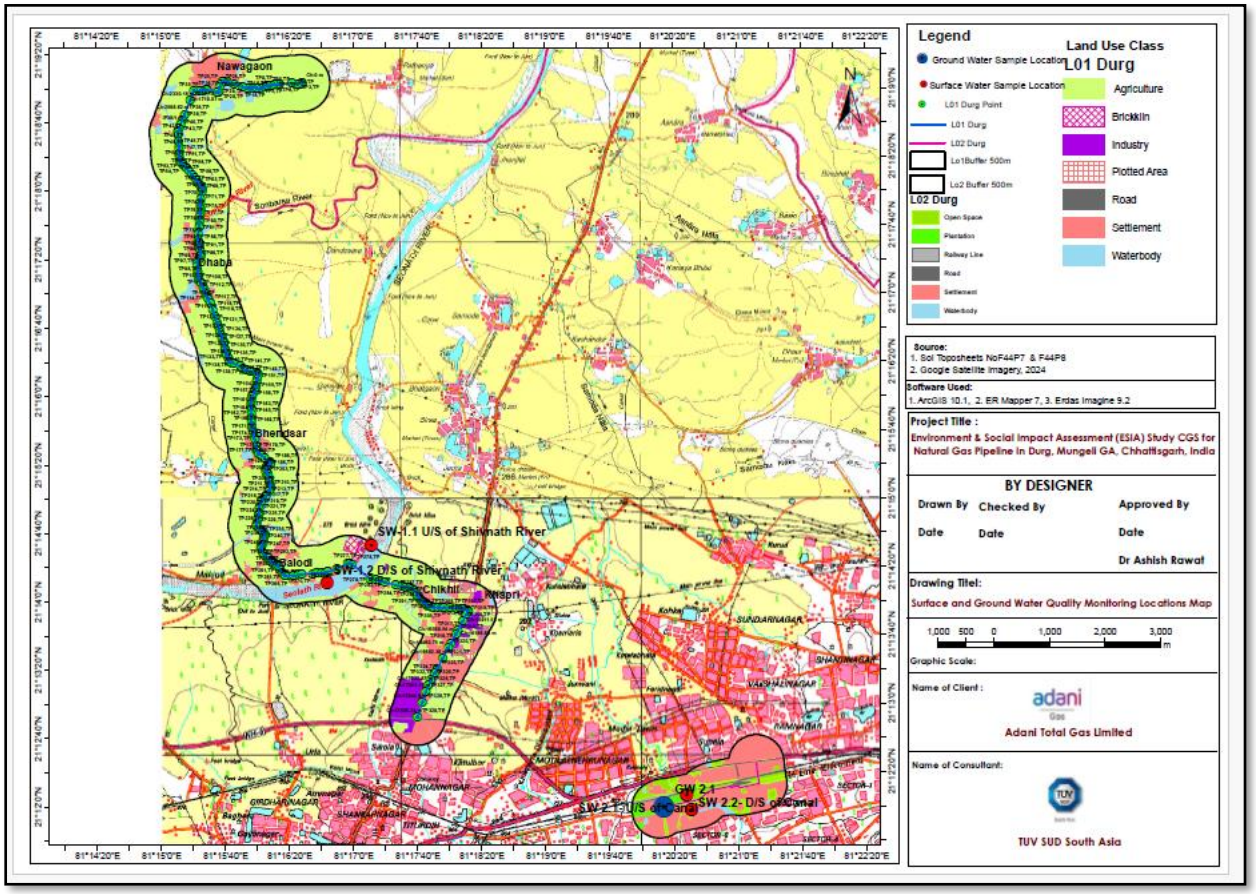
The groundwater development stage in the Durg district is 68.81%. Among the blocks, Gurur has the highest groundwater development at 96.55%, followed by Durg (83.74%), Bemetara (80.41%), Balod (79.84%), and Dhamdha (78.98%). In the district, six blocks have a groundwater development stage exceeding 70%, with a declining water table, classifying them as semi-critical.

4.6.11 Ground Water Quality

Groundwater monitoring is carried out in the project study area at three designated locations, as outlined below in **Table 4-14**. The monitoring assess both the quality of groundwater, and the surface water conditions in the area to evaluate the potential impacts due to natural gas pipeline projects. There are Three sample collected from bore/tube well from nearby Study area. The details of monitoring results are provided in **Table 4-14.**

Table 4-14: Ground Water Quality Monitoring Locations

Sl. No.	Location Code	Location Name	Latitude (N)	Longitude(E)
1	GWQ-1.1	At Chainage 17.14 m (TP1) near the Admin Building	21°19'2.81"N	81°16'28.36"E
2	GWQ-1.2	At Chainage 10440.22 m (TP215)	21°14'59.52"N	81°16'3.61"E
3	GWQ-2.1	At Maharana Pratap Chowk near HP Petrol Pump	21°11'59.56"N	81°20'13.44"E

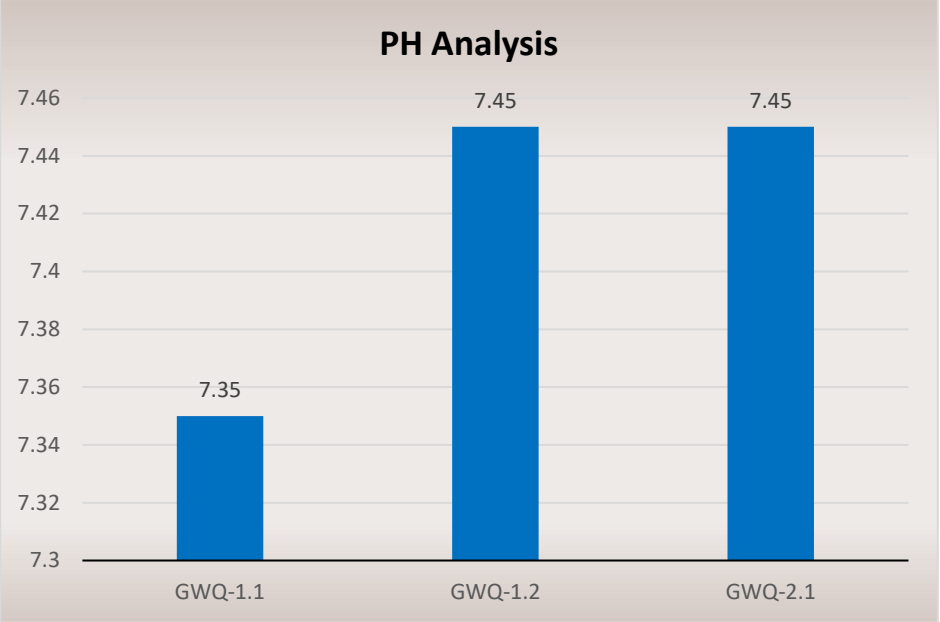


Source: TUV SUD GIS Mapping Study (Toposheets No F44P7 & F44P8)

Figure 4-29: Surface and Groundwater Quality Monitoring Locations

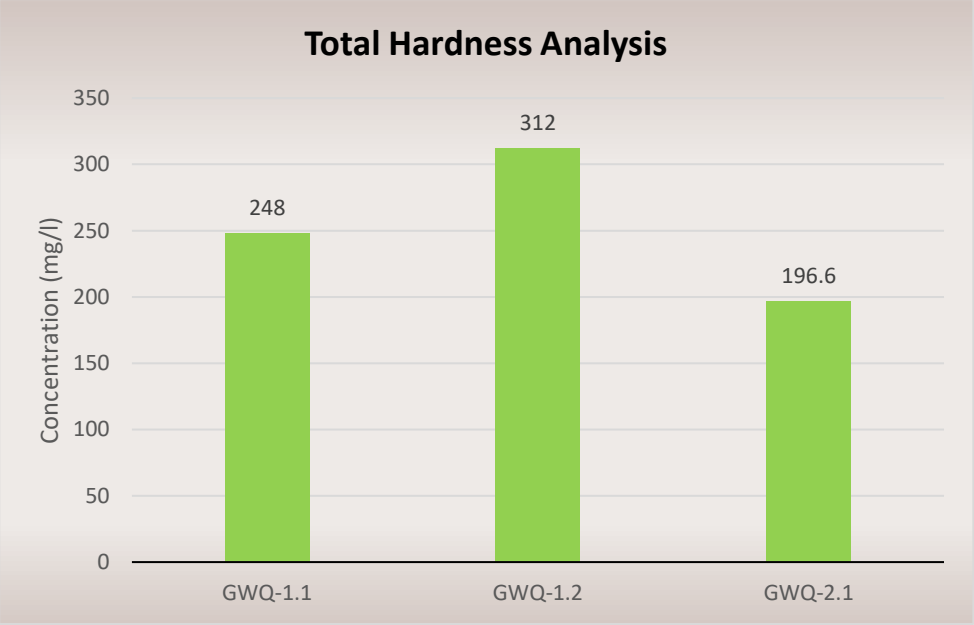
Table 4-15: Ground Water Quality Monitoring Result

Sl. No.	Parameter	Unit	GWQ-1.1	GWQ-1.2	GWQ-2.1	Limits (as per IS:10500-2012)	
						Desirable Limit	Permissible Limit
1	Color	--	0.1	0.1	0.1	--	--
2	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Temperature	^{o}C	20.3	23.4	20.6	-	-
5	pH	-	7.35	7.45	7.45	6.5-8.5	No Relaxation
6	Electric Conductivity	µhos/cm	815	868	439	-	-
7	Total Hardness (as CaCO3)	mg/l	248.0	312.0	196.6	200	600
8	Iron (as Fe)	mg/l	0.15	0.12	0.15	0.3	No Relaxation
9	Chlorides (as Cl)	mg/l	139.7	144.0	111.9	250	1000
10	Fluoride (as F)	mg/l	< 1.0	< 1.0	<1.0	1	1.5
11	TDS	mg/l	489	521.6	489	500	2000
12	Calcium (as Ca^{2+})	mg/l	48.8	52.1	37.8	75	200
13	Magnesium (as Mg^{2+})	mg/l	30.7	44.3	5.03	30	100
14	Sulphate (as SO4)	mg/l	36.4	38.1	36.4	200	400
15	Nitrate (as NO3)	mg/l	24.1	26.4	18.4	45	No Relaxation
16	Alkalinity (as CaCO3	mg/l	192.2	210.1	187.7	200	600
Bacteriological Parameters							
1	Total Coli form	Cfu/100gm	Not Detected (<2)	Not Detected (<2)	Not Detected (<2)	MPN/100ml	Shall Not Be Detectable
2	E. coli	Cfu/100g	Absent .	Absent .	Absent .	E. coli/100ml	Shall Not Be Detectable



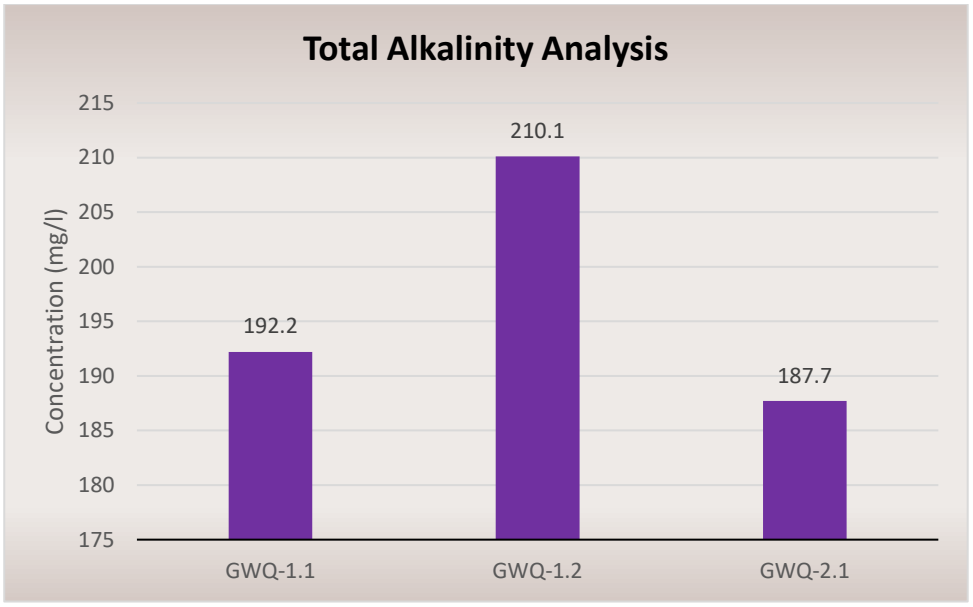
**Source: TUV SUD Interpretation & Analysis*

Figure 4-30: Analysis of pH at all Ground Water Monitoring Locations



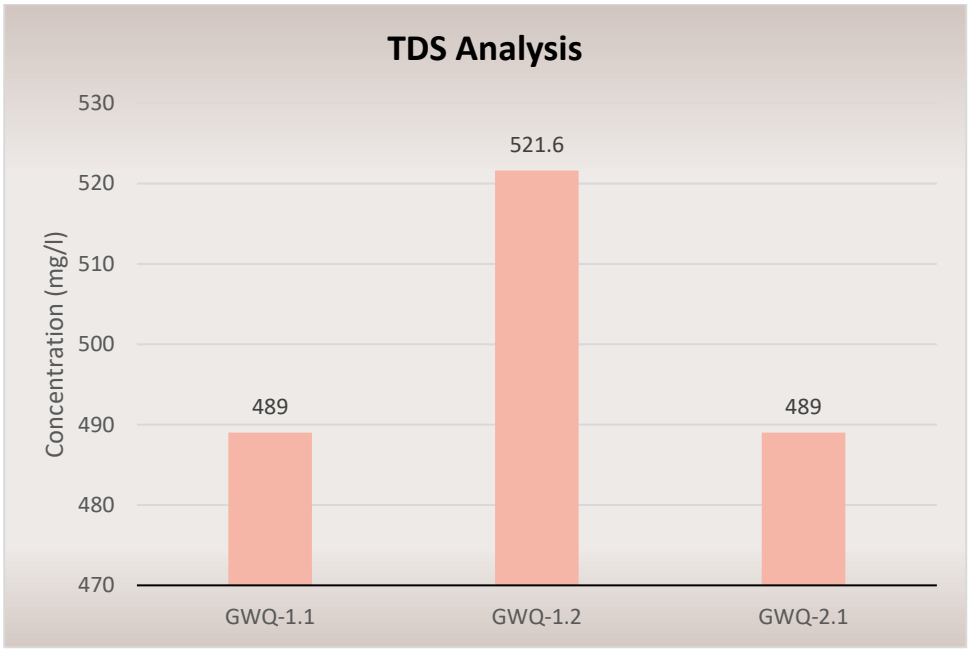
**Source: TUV SUD Interpretation & Analysis*

Figure 4-31: Analysis of Total Hardness in all Ground Water monitoring Locations



Source: TUV SUD Interpretation & Analysis

Figure 4-32: Analysis of Total Alkalinity in all the Ground Water Monitoring locations



Source: TUV SUD Interpretation & Analysis

Figure 4-33: Analysis of Total Dissolve Solids in all the Ground Water Monitoring locations

Ground water quality monitoring revealed that project study area having overall higher concentration of Total Hardness, which is ranging between 196 mg/l to 312 mg/l. Total Dissolved Solid concentration found between the range of 489 mg/l to 522 mg/l. Alkalinity concentration found between 187-211 mg/l. concentration found between 187-211 mg/l. Magnesium concentration of the groundwater samples were found to be within range 5 to 45 mg/l. All the other major parameters were found within the desirable limits for drinking use. Thus, it can be considered that the area located in safe ground water blocks, however, with the ground water resources are degrading due to urbanization of the area, commercial use of fertilizers and other contaminant. Thus, controlled and restricted use of GW in the project is highly advisable.

4.6.12 Surface Water Quality

Three samples were collected from different surface water bodies within the project study area. The details of monitoring locations are provided below in **Table 4-16.**

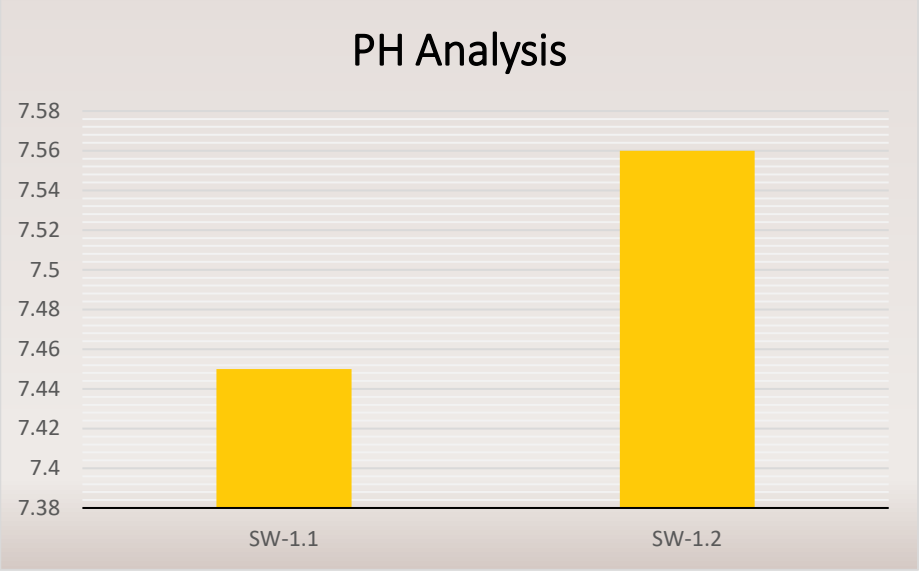
Table 4-16: Surface Water Quality Monitoring Locations

Sl. No.	Location code	Location name	Latitude (N)	Longitude (E)
1.	SW-1.1	U/S of Shivnath River, near Chainage 13336.58 m (TP278)	21°14'32.84"N	81°17'11.08"
2.	SW-1.2	D/S of Shivnath River, near Chainage 12827.76 m (TP273)	21°14'17.61"N	81°17'2.02"E

Analysis of the samples will be carried out as per established standard methods and procedures prescribed by CPCB, IS3025, IS 10500:2012 and APHA 22nd edition, 2012. The quality of water is determined with respect to the standard values provided by the Central Pollution Control Board (CPCB).

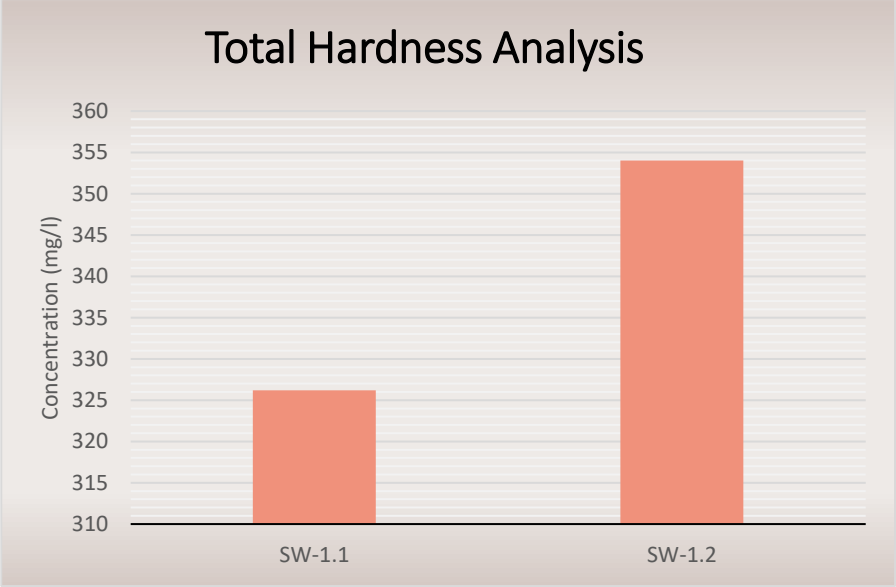
Table 4-17: Surface Water Monitoring Result

Sl. No.	Parameter	Unit	Result	
			SW-1.1	SW-1.2
1	Turbidity	NTU	3.5	2.92
2	pH (at 25°C)	-	7.45	7.56
3	Conductivity,	µS/cm	851	907
4	Total Dissolve Solids	mg/l	325`	420
5	Total Hardness as $CaCO_3$	mg/l	326.2	354.0
6	Calcium as Ca	mg/l	55.5	58.9
7	Magnesium as Mg	mg/l	42.4	50.1
8	Sodium as Na	mg/l	92	80.8
9	Potassium as K	mg/l	55	62.2
10	Chloride as Cl	mg/l	176.4	183.1
11	Sulphate as SO_4	mg/l	76.4	77.6
12	Nitrate as NO_3	mg/l	36.3	36.4
13	Total Alkalinity as $CaCO_3$	mg/l	204.2	257.3
14	Fluoride	mg/l	0.10	0.08
15	Cyanide	mg/l	<0.05	<0.05
16	Arsenic	mg/l	<0.01	<0.01
17	Boron as B	mg/l	<0.01	<0.01
18	Cadmium as Cd	mg/l	<0.01	<0.01
19	Chromium, Total	mg/l	<0.01	<0.01
20	Copper as Cu	mg/l	<0.05	<0.05
21	Lead as Pb	mg/l	<0.05	<0.05
22	Manganese as Mn	mg/l	<0.05	<0.05
23	Mercury	mg/l	<0.01	<0.01
24	Nickel as Ni	mg/l	<0.01	<0.01
25	Selenium as Se	mg/l	<0.01	<0.01
26	Zinc	mg/l	0.013	0.022
27	Dissolved Oxygen	mg/l	5.71	5.75
28	Total Suspended Solid	mg/l	46.1	38.2
29	Total Solid	mg/l	370.1	487.2
30	Chemical Oxygen Demand as O_2	mg/l	26	18.6
31	BOD, 3 days @27°C as O_2	mg/l	4.4	3.0
32	Oil & Grease	mg/l	<0.01	<0.01
33	Total Coliform	MPN/100 ml	20	14



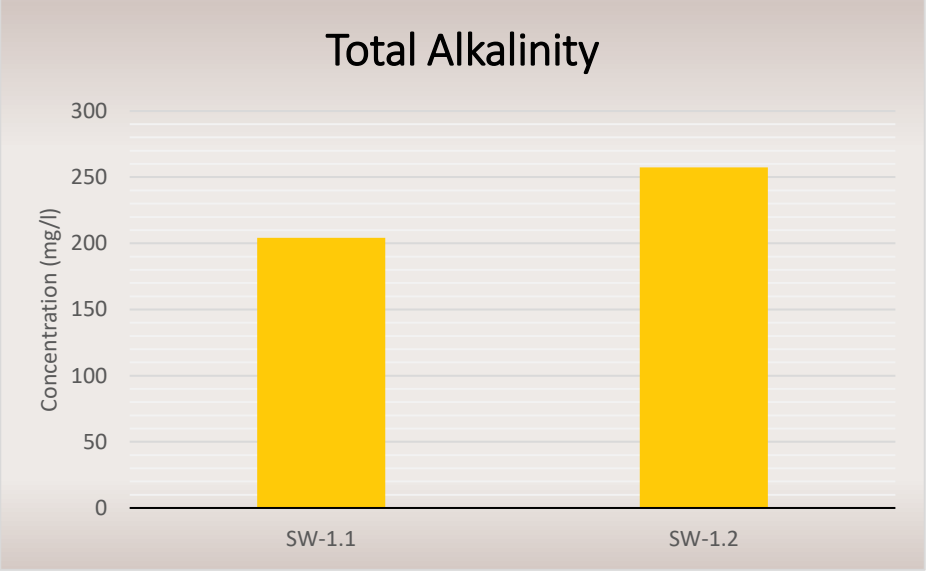
Source: TUV SUD Interpretation & Analysis

Figure 4-34: Analysis of pH at all Surface Water Monitoring Locations



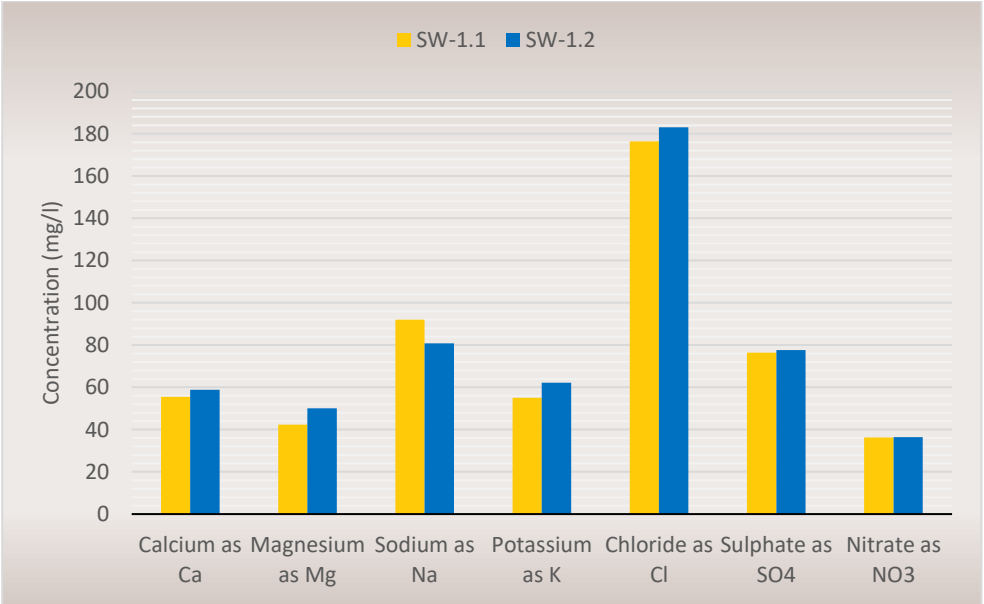
Source: TUV SUD Interpretation & Analysis

Figure 4-35: Analysis of Total Hardness at all Surface Water Monitoring Locations



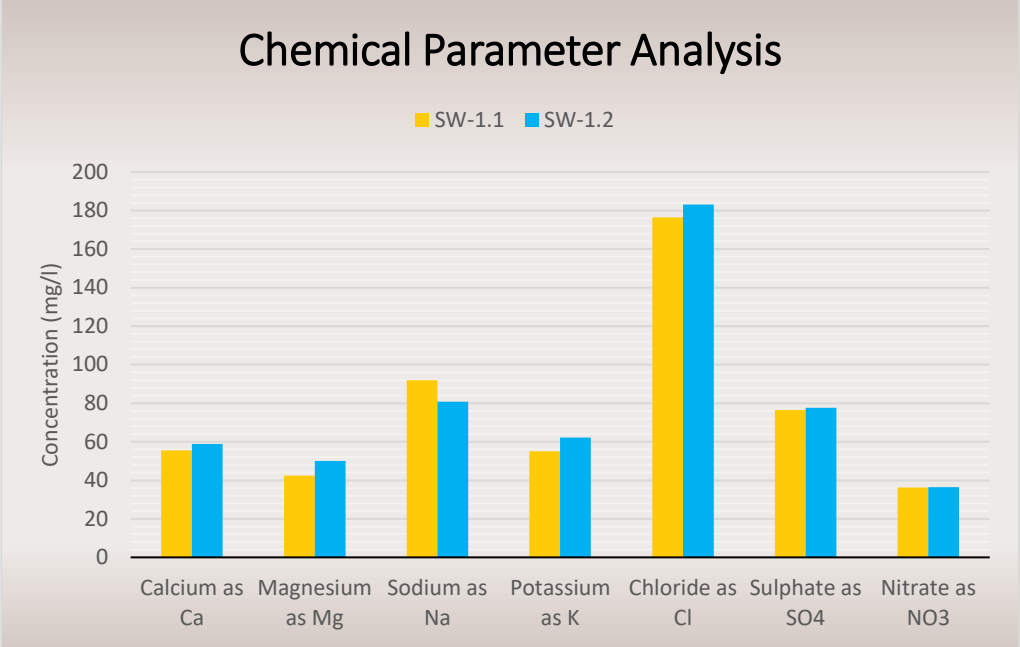
Source: TUV SUD Interpretation & Analysis

Figure 4-36: Analysis of Total Alkalinity at all Surface Water Monitoring Locations



Source: TUV SUD Interpretation & Analysis

Figure 4-37: Analysis of DO, BOD, COD at all Surface Water Monitoring Locations



**Source: TUV SUD Interpretation & Analysis*

Figure 4-38: Analysis of Chemical Parameter at all Surface Water Monitoring Locations

The surface water quality at the four sampling locations (SWQ-1.3 to SWQ-2.2) indicates that most parameters are within the permissible limits as per CPCB Class B standards. The pH values ranged from 7.45 to 7.61, falling within the acceptable range (6.5–8.5) and indicating neutral to slightly alkaline conditions. Dissolved Oxygen (DO) levels ranged between 5.71 to 5.75 mg/l, which meets the minimum requirement of ≥5.0 mg/l, suggesting adequate oxygenation to support aquatic life. Biochemical Oxygen Demand (BOD) ranged from 3.0 to 4.4 mg/l, which is slightly above the desirable threshold of ≤3 mg/l for Class B water at SWQ-1, indicating slight organic pollution possibly due to anthropogenic activities. Total Coliform counts ranged from 14 to 24 MPN/100 ml, within the limit of 500 MPN/100 ml, indicating low microbial contamination.

Other physio-chemical parameters such as turbidity, total dissolved solids (TDS), hardness, and major ions (calcium, magnesium, sodium, potassium, chloride, sulphate, and nitrate) were found within acceptable ranges and did not indicate any major water quality concerns. All heavy metals tested including arsenic, cadmium, lead, mercury, and others were below detectable limits, indicating no significant contamination from industrial or toxic sources.

Overall, the water quality at the sampled locations is generally compliant with CPCB standards for Class B water, with minor deviations in BOD at one location. The surface water is considered suitable for recreational and bathing use with minimal risk to public health or ecological function.

4.7 BIOLOGICAL ENVIRONMENT

Ecological studies are one of the important aspects of Environmental Impact Assessment (ESIA) with a view to conserving biodiversity. Ecological systems show complex inter-relationships between biotic and abiotic components including dependence, competition, and mutualism. Biotic components comprise of both plant and animal communities, which interact not only within and between themselves but also with the biotic components viz. physical and chemical components of the environment. Generally, biological communities are good indicators of climatic and edaphic factors. Studies on biological aspects of ecosystems are important for the safety of flora and fauna. The biological environment includes terrestrial and aquatic ecosystems.

The observations and assessments of overall ecological scenario presented in this chapter include details of flora, fauna, natural habitats, protected areas, wildlife species and their migration corridors etc. Such baseline information provides a better understanding of the situation and overall ecological importance of the area. This baseline information viewed against industrial activities helps in predicting their impact on wildlife and their habitats in the region.

This report describes the methodology adopted for secondary data collection, diversity of higher flora and fauna recorded through primary field studies and the secondary data sourced from published scientific literature, habitat profile and ecosystem services profile and nearest designated areas of the project site.

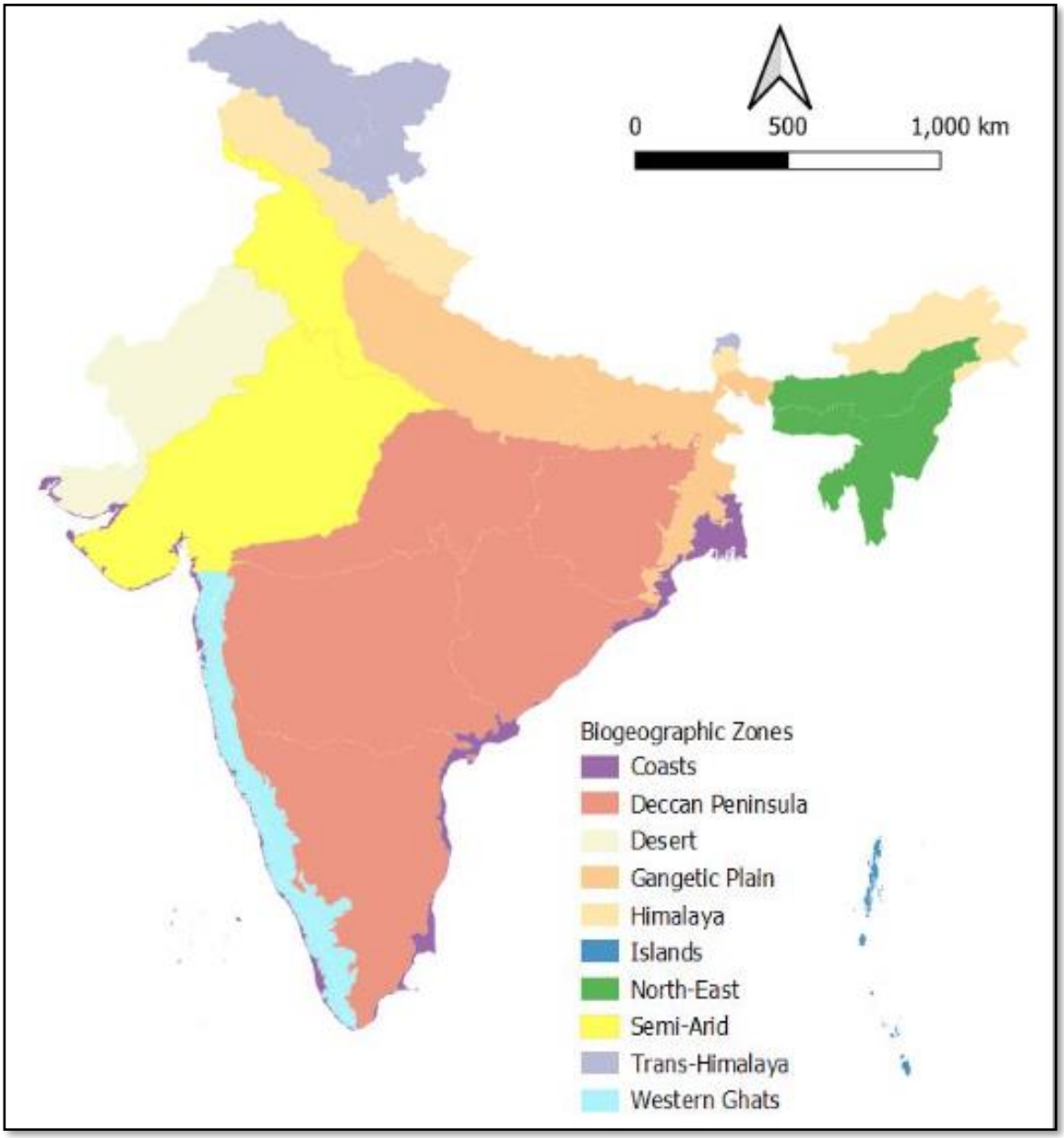
4.7.1 Scope and Objectives

The ecology & biodiversity study carried out at the project study area i.e., includes the Project Footprint Area (Pipeline) and surrounding 10 km radius area of buffer zone. Based upon the study and findings, impacts were assessed and subsequently mitigation measures were recommended. Thus, further primary objectives for ecological surveys are elaborated as follows:

- Review and analyze the available literature data related to habitats, flora, and fauna of the site around proposed project and surrounding areas of 10 km radius (Buffer Zone).
- Identification of critical habitats, wildlife corridors, national parks, wildlife sanctuary, and any other areas of ecological significance.
- Identification of native, alien, exotic, rare, threatened, and endangered species (if any).
- Assessment of impacts of the project on ecology during construction and operation phase.
- Identification of any notified area under international conventions, national or local legislation for their ecological, landscape, cultural or other related values within the study site.
- Suggestion of mitigation measures to minimize/avoid adverse impacts on ecology during construction and operation phase.

4.7.2 *Biogeographic Description of Study Area*

According to the Biogeographic provinces of India published by Wildlife Institute of India (Rodgers, Panwar and Mathur, 2002), the project site falls under the Biogeographic Province: Desert (**Figure 4-39**).



*Source: https://indiaflora-ces.iisc.ac.in/bio_zones.php

Figure 4-39: Biogeographic Regions of India

4.7.3 Methodology For Ecological Survey

4.7.3.1 Desktop Review

A desktop review was conducted to determine the land use and land cover (Toposheet, Satellite imagery), Forest type (Champion and Seth, 1962), Bio-geographic provinces and zones (Rodgers, Panwar and Mathur 2000) and floral & faunal assemblage in the study area from published documents/papers etc. To provide representative ecological status for the project, existing critical habitats, scrubs/vegetative cover and water bodies around the project area and other factors were searched/collected and selected for ecological survey in and around such habitats. To conduct the survey, a core and buffer zone was delineated, so that ecological receptors and impacts on them can be established during the ESIA process. The core and buffer zone are as follows:

- Project Footprint Area
- Area of Influence and the buffer zone

4.7.3.2 Baseline Survey

Secondary data collection and primary on-site survey were two components of the baseline survey. The primary baseline survey was carried out to determine the existing ecological conditions and was designed to fill any data gaps, and to facilitate an adequate assessment of the project impacts upon local ecology and the development of appropriate mitigation measures. Prior to that, secondary data regarding sensitive ecological habitat (national park, sanctuary, ecological sensitive area, migratory corridor, habitat of endangered, vulnerable and range restricted species etc.) has been reviewed from desktop study and further flora & fauna in the project area was recorded through undertaking primary baseline phytosociological analysis, public consultation and through referring other authentic published documents. Local people were interviewed to understand the major flora & fauna in the study area, assemblage of birds in the water bodies during peak winter in India, pressure on the local natural resources, presence of any Schedule-I species in the project area.

A primary survey was done at site & surrounding areas. Based on primary survey and secondary analysis of authenticated documents, inventory of floral and faunal species was made.

4.7.3.3 Study of Ecological Habitat

4.7.3.3.1 Forests

According to the Champion and Seth Classification of Indian Forests, the natural vegetation of the survey area represents the “Tropical Dry Deciduous Forests.”. These types of forests occur in the region between 600 mm to 1200 mm rainfall. These forests contain spare and stunted growth of species like Teak (*Tectona grandis*), Tendu (*Diospyros melanoxylon*), Dhaura (*Anogeissus latifolia*), Bija (*Pterocarpus marsupium*), and Haldu (*Haldina cordifolia*) etc. No major forested area located within 500 meters on either side of the pipeline route.

4.7.3.3.2 Scrubland

This type of vegetation is extensively found in non-cultivated lands, particularly revenue lands/grazing land located within the study area. This type of land gets grown by *Cassia auriculata, Calotropis procera, Azadirachta indica, Acacia chundra, Acacia nilotica, Ziziphus nummularia, Prosopis juliflora, Prosopis cineraria* and *Ziziphus jujuba* etc.

4.7.3.3.3 Cropping Pattern of Study Area

Agriculture is practiced in the area during Kharif and Rabi season every year. During the Kharif, cultivation is done through rainfall while during the Rabi season, it is done through ground water as well as partly through surface water like canals and other sources. The principal crops in the block are Paddy, Wheat and Gram. In some areas, double cropping is also practiced.

4.7.3.3.4 Water Bodies

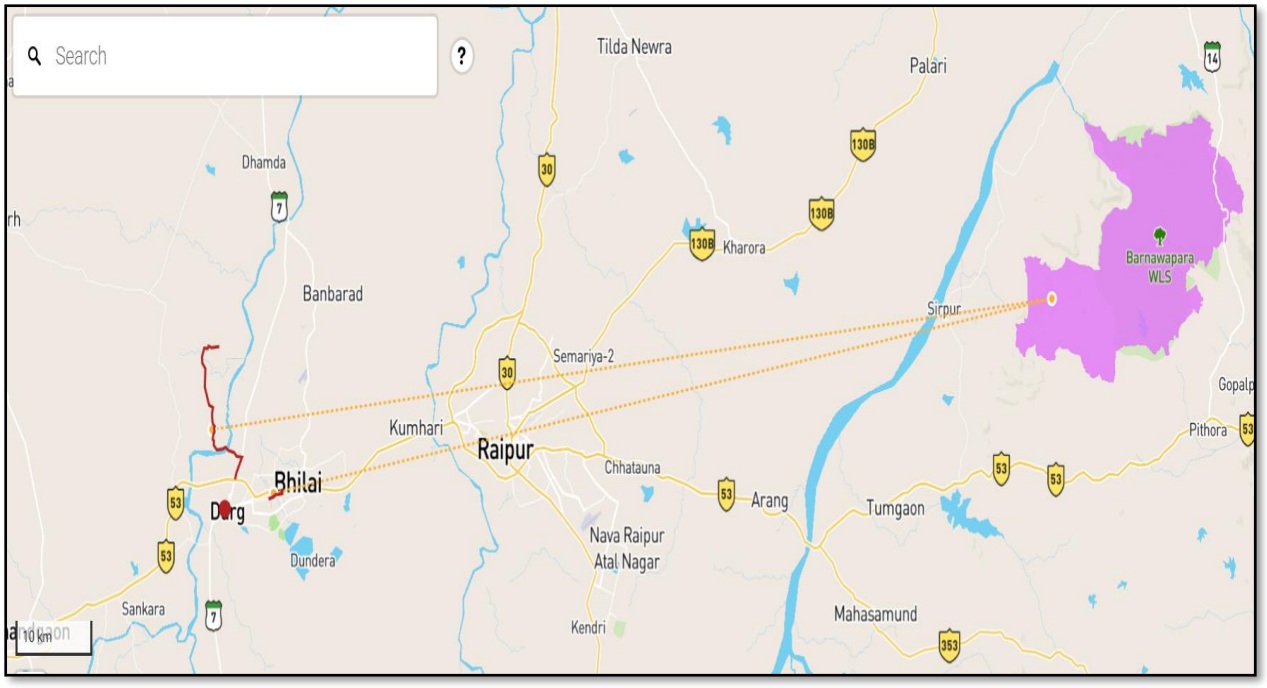
Several water bodies are situated within 500 meters on either side of the NG pipeline route. However, no water bodies are present within the project footprint area. The following table provides details of the water bodies located within the 500-meter buffer zone of the project site. Comprehensive information on these water bodies is outlined in **Table 4-18**.

Table 4-18: Major water bodies in the Study Area

Sl. No.	Name of Water Body	Distance (Km)	Coordinates	Chainage
1.	Shivnath river	Adjacent	21°14'16.78"N; 81°17'4.04"E	Ch:13757.36 m; Ch:13336.58 m
2.	Tertiary Streamline (Distributaries of Shivnath River	Adjacent	21°17'37.04"N; 81°15'24.06"E	Ch: 4933.08 m; Ch: 4805.14 m
3.	Pond at Nawagaon	26 m	21°18'58.50"N; 81°16'0.23"E	Ch: 787.25 m to Ch: 1011.87 m
4.	Pond at Nawagaon	27 m	21°19'1.63"N; 81°15'42.22"E	Ch: 1251.93 m to Ch: 1389.35 m
5.	Pond at Dhaba	13 m	21°17'32.77"N; 81°15'24.80"E	Ch: 4933.08 m to Ch: 5111.87 m

4.7.3.3.5 Protected Area and Eco-sensitive Areas

The study area comprising of core and buffer zone was assessed for the presence of important wildlife habitats and protected areas, mangroves, breeding and nesting habitats of fauna, coastal habitats, important wetlands, and grassland area from project locations and transmission line of core and buffer zones. These important areas such as Protected areas (National Park, Wildlife Sanctuaries, Conservation Reserves etc.), Wetlands of national importance, Ramsar sites, Important Bird Areas (IBAs), classified by Birdlife International and Bombay Natural History Society etc. Data collected and gathered from primary and secondary sources on flora, fauna, protected areas, natural habitats, wildlife species etc., were analyzed and results are presented below in **Table** 4-19**.** There is no eco-sensitive area present within the vicinity of the project influence area as depicted in the **Figure 4-40.**



*(*Source: IBAT)*

Figure 4-40: Eco-sensitive Areas of Project Study Area

Table 4-19: Details of Eco-sensitive Areas of Project Study Area

Ecological Sensitive Habitat	Description
National Parks/ Wildlife Sanctuary/ Biosphere reserves/ Elephant Reserve/ Any Other Reserves	None within 500 m on either side of the Pipeline route. • Achanakmar-Amarkantak Biosphere Reserve and wildlife sanctuary (approx. 200 km, NE) • Dongargarh-Khaara Reserve Forest (Aerial distance of 43.39 Kms, NW)
Important Bird Areas (IBAs)	None within 500 m on either side of the Pipeline route. The nearest Important Bird Area (IBA) is Wetland Biodiversity Park, Talpuri (7.28 km, SE)
Ramsar Wetland Site	Nil
Wildlife Corridors & Routes	Nil
Breeding/nesting areas of endangered species	Nil
Mangroves	Nil

**Source: BirdLife International (2022) Country profile: India (http://datazone.birdlife.org/country/india)*
https://wiienvis.nic.in/Database/ramsar_wetland_sites_8224.aspx
https://wiienvis.nic.in/Database/IBA_8463.aspx

4.7.3.3.6 Migratory Birds and Migratory Pathway

No Important Bird Area (IBA) is located within 500 m on either side of the pipeline route. India lies along the Central Asian Flyway, a global migratory pathway that connects the Palearctic (Europe and Northern Asia) to the Indian subcontinent. The birds that utilize this flyway, travel south to the Indian subcontinent

between October-early December depending on the end of the monsoon season and remain in the country till February-March. Bird species travelling along the Central Asian Flyway, utilize several large water bodies across India as congregation sites or rest stops. The closest rest stop to migratory birds is Wetland Biodiversity Park, Talpuri (7.28 km, SE).

4.7.4 Floral Diversity

The present study revealed that 14 tree species, 5 shrub species, 5 herb species, 6 grass species and 5 climber species were present in both core zone and buffer zone area within 500 m on either side of the pipeline route. Secondary data was also considered while listing the species for validation. Since open bare lands and Agri ecosystem is predominant in study areas, this region supports low plant diversity and therefore, not many large trees with sizable canopies were observed.

CORE ZONE HABITAT

The core zone of the pipeline project consists of *Acacia leucophloea, Ficus benghalensis, Ficus religiosa, Saraca asoca, Peltophorum pterocarpum, Dalbergia sissoo*, *Azadirachta indic*a, *Mangifera indica*. Jatropha and Calotropis are observed growing along roadsides. Tabulated details of flora recorded in study area have been provided below in **Table 4-20** below:

Table 4-20: List of Floral species in Study Area

Sl. No.	Scientific Name	Local Name	Family
TREES			
1	*Acacia leucophloea*	Hirmo, Haramu	Mimosaceae
2	*Acacia nilotica*	Deshi Bhaval, Bavar	Mimosaceae
3	*Azadirachta indica*	Neem	Meliaceae
4	*Commiphora wightii*	Gugar	Burseraceae
5	*Prosopis juliflora*	Gando Baval	Mimosaceae
6	*Ziziphus mauritiana*	Ber	Rhamnaceae
7	*Butea monosperma*	Palash	Fabaceae
8	*Mangifera indica*	Aam	Anacardiaceae
9	*Ficus benghalensis*	Bargad	Moraceae
10	*Ficus religiosa*	Pipal	Moraceae
11	*Artocarpus heterophyllus*	Kathal	Moraceae
12	*Saraca asoca*	Ashoka	Caesalpiniaceae
13	*Peltophorum pterocarpum*	yellow-flamboyant	Fabaceae
14	*Dalbergia sissoo*	Sisham	Fabaceae
SHRUBS			
6	*Abutilon indicum*	Khapato, Dabaliar	Malvaceae
7	*Calotropis gigantea*	Akado	Asclepiadaceae
8	*Capparis decidua*	Kar jo zad	Capparaceae
9	*Euphorbia caducifolia*	Thar	Euphorbiaceae
	Salvadora persica	Khari Zar	Salvadoraceae
HERBS			
11	*Achyranthes aspera*	Agado, Kandhero	Amaranthaceae
12	*Boerhavia diffusa*	Rati, Satodi	Nyctaginaceae
13	*Cassia italica*	Mindhiavar	Caesalpiniaceae
14	*Cleome viscosa*	Beddhro	Capparaceae

Sl. No.	Scientific Name	Local Name	Family
15	*Leucas aspera*	Gumu	Lamiaceae
GRASSES			
16	*Aristida adscensionis*	Jandhar Lambhaga	Poaceae
17	*Chloris barbata*	Rusadgha	Poaceae
18	*Cymbopogon martini*	Roshagha	Poaceae
19	*Desmostachya bipinnata*	Darabgha	Poaceae
20	*Echinochloa colonum*	Samu	Poaceae
21	*Bambusa tulda*	Bans	Poaceae
CLIMBERS			
22	*Cayratia carnosa*	Khatumvadi Jival	Vitaceae
23	*Citrullus colocynthis*	Tru Val, Tru Deda	Cucurbitaceae
24	*Coccinia grandis*	Tindora	Cucurbitaceae
25	*Convolvulus auricomus*	Rushad Nerival	Convolvulaceae
26	*Dalechampia scandens*	Char Val	Euphorbiaceae

**Source: TUV SUD Primary Survey & Secondary data from Chhattisgarh Forest Department Reports.*

4.7.5 Faunal Diversity

Diversity of faunal distribution shows the health of ecosystem. In this study area a total of 47 types of faunal species were observed or reported in which 8 species of mammals, 29 birds, 10 heterofaunas were recorded.

4.7.5.1 Mammals

Mammals are occupying higher tropic levels in many ecosystems and respond quickly to the changes in their habitats, therefore, serve as best indicators of the ecosystem health. Hence, the baseline information on distribution and abundance of mammals is prepared. A qualitative check list of mammals based on their presences and absence using indirect evidence and signs such as footprints, dens, droppings, diggings, scrap marks, etc. in the study area was prepared. The following list of mammal species as presented in **Table 4-21** were recorded in the project study area.

Table 4-21: List of Mammals Species in Project Study Area

Sl. No.	Common Name	Scientific Name	Schedule as per WPA,2022	IUCN Status
1.	Common Mongoose	Herpestes edwardsii	I	Least Concern
2.	Jackal	Canis aureus	I	Least Concern
3.	Indian Fox	Vulpes bengalensis	I	Least Concern
4.	Common House Rat	Rattus rattus	II	Least Concern
5	Nilgai	Boselaphus tragocamelus	II	Least Concern
6	Squirrel	Funambulus pennanti	II	Least Concern
7	Wild Pig	Sus scrofa	II	Least Concern
8	Fulvous Fruit Bat	Rousettus leschnaulti	II	Least Concern

**Sources: TUV SUD Primary Survey and secondary data Study*
IUCN-The IUCN Red List of Threatened Species. Version 2023-1.
Schedules I to II: Indian Wildlife (Protection) Act, 2022. LC: Least Concern, IUCN Red List of Threatened Species

4.7.5.2 Herpetofauna

The diversity of amphibian and reptilian species in an ecosystem is cumulatively called Herpetofaunal diversity. Amphibians are fauna which can survive on land as well as in water. They inhabit a wide variety of habitats with most species living within terrestrial, fossorial, arboreal or freshwater aquatic ecosystems. Their presence witness's the richness of ecosystem. They are omnivorous in feeding habits. The following species of herpetofauna were observed in the study area.

Table 4-22: Herpetofaunal Species recorded in Project Study Area

Sl. No.	Common Name	Scientific Name	Schedule as per WPA,2022	IUCN Status
1.	Indian Cobra	Naja naja	II	Least Concern
2.	Common Krait	Bungarus caeruleus	IV	Least Concern
3.	Russell's Viper	Daboia russelii	IV	Least Concern
4.	Saw-scaled Viper	Echis carinatus	IV	Least Concern
5	Indian Monitor Lizard	Varanus bengalensis	I	Least Concern
6	Common Toad	Duttaphrynus melanostictus	Not Listed	Least Concern
7	Indian Bullfrog	Hoplobatrachus tigerinus	IV	Least Concern
8	Bengal Monitor	Varanus bengalensis	I	Least Concern
9	Fan-throated Lizard	Sitana ponticeriana	Not Listed	Least Concern
10	Banded Kukri Snake	Oligodon arnensis	IV	Least Concern

**Sources: TUV SUD Primary Survey and secondary data Study*
IUCN-The IUCN Red List of Threatened Species. Version 2023-1.
Schedules I to II: Indian Wildlife (Protection) Act, 2022. LC: Least Concern, IUCN Red List of Threatened Species

4.7.5.3 Avifauna

A total of 29 bird species were observed or reported in the study area. Also, there is no Important Bird Area (IBA), Bird migratory paths and congregatory birds' locations were observed in study area. Indian Peafowl and are the Schedule-I species as per Wildlife Protection Act, 1972 (amended in 2022) were observed in the project study area. As per IUCN, Steppe Eagle has been categorized as "Endangered" and River Tern as "Vulnerable". The list of avifauna observed or reported in study area is presented in **Table 4-23.**

Table 4-23: List of Avifaunal species in Project Study Area

Sl. No.	Common Name	Scientific Name	Schedule as per WPA,2022	IUCN Status
1	Indian Peafowl	Pavo cristatus	I	Least Concern
2	Red-vented Bulbul	Pycnonotus cafer	Not Listed	Least Concern
3	Black Drongo	Dicrurus macrocercus	Not Listed	Least Concern
4	Common Myna	Acridotheres tristis	Not Listed	Least Concern
5	House Crow	Corvus splendens	Not Listed	Least Concern
6	Indian Roller	Coracias benghalensis	Not Listed	Least Concern

Sl. No.	Common Name	Scientific Name	Schedule as per WPA,2022	IUCN Status
7	White-throated Kingfisher	Halcyon smyrnensis	Not Listed	Least Concern
8	Cattle Egret	Bubulcus ibis	Not Listed	Least Concern
9	Little Egret	Egretta garzetta	Not Listed	Least Concern
10	Shikra	Accipiter badius	Not Listed	Least Concern
11	Indian Silverbill	Euodice malabarica	Not Listed	Least Concern
12	Long-tailed Shrike	Lanius Schach	Not Listed	Least Concern
13	Rufous-tailed Lark	Ammomanes phoenicura	Not Listed	Least Concern
14	Little Swif	Apus affinis	Not Listed	Least Concern
15	Rock Pigeon	Columba livia	Not Listed	Least Concern
16	Red Collared-Dove	Streptopelia tranquebarica	Not Listed	Least Concern
17	Spotted Dove	Spilopelia chinensis	Not Listed	Least Concern
18	Rose-ringed Parakeet	Psittacula krameri	Not Listed	Least Concern
19	Common Chiffchaff	Phylloscopus collybita	Not Listed	Least Concern
20	Baya Weaver	Ploceus philippinus	Not Listed	Least Concern
21	Asian Woolly-necked Stork	Ciconia episcopus	Not Listed	Near Threaten
22	Black Redstart	Phoenicurus ochruros	Not Listed	Least concern
23	Ashy-crowned Sparrow-Lark	Eremopterix griseus	Not Listed	Least concern
24	Gray Heron	Ardea cinerea	Not Listed	Least concern
25	Spotted Owlet	Athene brama	Not Listed	Least concern
26	Great Egret	Ardea alba	Not Listed	Least concern
27	Eurasian Hoopoe	Upupa epops	Not Listed	Least concern
28	Black Drongo	Dicrurus macrocercus	Not Listed	Least concern
29	Western grebe	Aechmophorus occidentalis	Not Listed	Least concern

**Sources: TUV SUD Primary Survey and secondary data Study*
e-Bird.org
IUCN-The IUCN Red List of Threatened Species. Version 2023-1.
Schedules I to II: Indian Wildlife (Protection) Act, 2022. LC: Least Concern, IUCN Red List of Threatened Species

4.7.5.4 Aquatic Ecology

PHYTOPLANKTONS: On secondary data analysis of the study area (Shrivastava et al., 2014 - Algal Biodiversity in Fresh Water Reservoir of Durg), the following phytoplankton species have been recorded:

Table 4-24: Details of Phytoplankton Species recorded in Study Area

Sl. No.	Species Name	Class	Order	Morphology	Seasonal Presence
1	Characium angustum	Chlorophyceae	Chlorococcales	Unicellular (non-motile)	Monsoon, Summer
2	Chlamydomonas globosa	Chlorophyceae	Volvocales	Unicellular (Motile)	Summer, Winter

Sl. No.	Species Name	Class	Order	Morphology	Seasonal Presence
3	Chlorella vulgaris	Chlorophyceae	Chlorococcales	Unicellular (non-motile)	Monsoon, Summer
4	Closterium parvulum	Chlorophyceae	Zygnematales	Unicellular	Winter, Monsoon
5	Scenedesmus abundance	Chlorophyceae	Chlorococcales	Coenobium	Monsoon, Summer
6	Pediastrum boryanum	Chlorophyceae	Chlorococcales	Colonial	Summer, Monsoon
7	Pediastrum simplex	Chlorophyceae	Chlorococcales	Colonial	Monsoon, Winter
8	Hydrodictyon reticulatum	Chlorophyceae	Chlorococcales	Colonial	Monsoon, Winter
9	Mougeotia recurva	Chlorophyceae	Zygnematales	Filamentous (Unbranched)	Monsoon
10	Oedogonium sp.	Chlorophyceae	Oedogoniales	Filamentous (Branched)	Monsoon, Summer
11	Spirogyra hyalina	Chlorophyceae	Zygnematales	Filamentous (Unbranched)	Monsoon, Winter
12	Zygnema pectinatum	Chlorophyceae	Zygnematales	Filamentous (Unbranched)	Monsoon, Summer
13	Ulothrix zonata	Chlorophyceae	Ulotrichales	Filamentous (Unbranched)	Winter, Summer
14	Chara zeylanica	Charophyceae	Charales	Multicellular (Branched)	Summer, Winter
15	Nitella flexilis	Charophyceae	Charales	Multicellular (Branched)	Monsoon, Winter
16	Anabaena verrucosa	Cyanophyceae	Nostocales	Filamentous	Monsoon, Summer
17	Nostoc commune	Cyanophyceae	Nostocales	Filamentous	Winter, Monsoon
18	Oscillatoria princeps	Cyanophyceae	Oscillatoriales	Filamentous	Monsoon, Summer
19	Rivularia sp.	Cyanophyceae	Rivulariales	Filamentous	Summer, Winter
20	Phormidium sp.	Cyanophyceae	Oscillatoriales	Filamentous	Monsoon, Winter
21	Lyngbya sp.	Cyanophyceae	Oscillatoriales	Filamentous	Monsoon, Summer
22	Euglena sanguinea	Euglenophyceae	Euglenales	Unicellular (Motile)	Monsoon, Winter
23	Euglena viridis	Euglenophyceae	Euglenales	Unicellular (Motile)	Summer, Monsoon
24	Euglena polymorpha	Euglenophyceae	Euglenales	Unicellular (Motile)	Winter, Summer
25	Euglena gracilis	Euglenophyceae	Euglenales	Unicellular (Motile)	Monsoon, Winter

ZOOPLANKTONS:

The highest density of zooplankton was observed in the Shivnath river, with *Daphnia* species showing significant abundance. On secondary data analysis of the study area (Chandrawanshi et. Al., 2019), the following Zooplankton species have been recorded:

Table 4-25: Details of Zooplankton Species recorded in Study Area

Zooplankton Group	Species Identified
Protozoa (15 species)	Arcella sp., Centropyxix sp., Coleps sp., Colpidium sp., Verticella sp., Filinia sp., Keratella sp., Monostyla sp., Gastropus sp., Oxytricha sp., Actinophrys sp., Harringia sp., Volvox sp., Tifflugia sp., Epistylis sp.
Rotifera (18 species)	Brachionus angularis, Brachionus angulosum, Brachionus calyciflorus, Brachionus caudatus, Brachionus falcatus, Brachionus forficula, Brachionus quadridentata, Brachionus vrceus, Asplanchna sp., Cephalotella sp., Colurella sp., Conochilus sp., Mytilina sp., Rotaria sp., Scaridiun sp., Trichocerea sp., Trichotria sp., Triplocheros limnias
Cladocera (20 species)	Alona sp., Alonella sp., Bosmina sp., Ceriodaphnia sp., Chydorus sp., Conochiloides sp., Daphnia sp., Diaphanosoma sp., Diaphanosoma sarsi, Moina sp., Moinamacrocopa sp., Sita sp., Leydigia sp., Macrothrix sp., Simocephalus sp., Streblocerus sp., Sida crystalline sp., Pleuroxus aduncus, Diaphanosoma excisum
Copepoda (5 species)	Cyclopoid Copepod, Cyclops sp., Diaptomus sp., Mesocyclops sp., Nauplius larvae

(**Source*- Chandrawanshi et. Al., 2019. A study of zooplankton in Shivnath River at Madku Dweep, District Mungeli (C.G.). International Journal of Development Research, 09(03), 26092-26097.)

FISH SPECIES: The following fish species have been recorded within the study area.

Table 4-26: Details of Fish Species recorded in Study Area

SL. NO.	SCIENTIFIC NAME	COMMON NAME/ENGLISH NAME
FISH SPECIES		
1	*Notopterus notopterus*	Patola
2	*Amblyopharyngodon mola*	Mohral
3	*Catla catla*	Catla
4	*Cirrhinus mrigala*	Mrigal
5	*Cirrhinus reba*	Borai
6	*Garra gotyla*	Butuwa
7	*Labeo bata*	Bata
8	*Labeo calbasu*	Kamach
9	*Labeo rohita*	Rohu
10	*Puntius sarana*	Kotra
11	*Puntius ticto*	Kotri
12	*Puntius sophore*	Sidhari
13	*Rasbora daniconius*	Dadhi
14	*Hypophthalmichthys molitrix*	Big Head
15	*Ctenopharyngodon idella*	Grass Carp
16	*Cyprinus carpio*	Komal Karp
17	*Crossocheilus oblongus*	Not Known
18	*Salmostoma bacaila*	Chela
19	*Lepidocephalichthys guntea*	Rudwa
20	*Ompak pabda*	Bolia

SL. NO.	SCIENTIFIC NAME	COMMON NAME/ENGLISH NAME
21	*Wallago attu*	Padhina
22	*Mystus tengara*	Tengna
23	*Mystus cavasius*	Tengna
24	*Mystus aor*	Singer
25	*Rita rita*	Marad
26	*Heteropneustes fossilis*	Singh
27	*Pangasius pangasius*	Padhina
28	*Clarias batrachus*	Mongri
29	*Clarias gariepinus*	Thai Mangur
30	*Channa gachua*	Birju
31	*Channa punctatus*	Khoksi
32	*Channa striata*	Bhunda
33	*Anabas testudineus*	Kenvai
34	*Glossogobius giuris*	Khasadda
35	*Oreochromis mossambicus*	Tilapia
36	*Chanda nama*	Chanda
PRAWNS		
1	*Macrobrachium rosenbergii*	Giant River Prawn
2	*Macrobrachium malcolmsonii*	Monsoon River Prawn
3	*Penaeus monodon*	Black Tiger Prawn
4	*Penaeus indicus*	Indian White Prawn
OTHERS		
1	*Amphipnous cuchia*	Tudum
2	*Macrognathus aculeatus*	Jat Bami
3	*Macrognathus armatus*	Bam
4	*Xenentodon cancila*	Cancila
5	*Pygocentrus nattereri*	Roop-Chanda

*(*Source: Thiske et al., 2024 - Fish Diversity in Shivnath River)*

4.8 SOCIO-ECONOMIC ENVIRONMENT

The primary objective of socio-economic study is to assess the current socio-economic status of the village(s) and communities within the project area and to assess the potential impact of the project on the community in terms of livelihood, health, education, and others. The study is also used to understand the existing issues and concerns of the community based on which mitigation measures and other community development activities are designed.

This section envisages presenting the socio-economic baseline of the project footprint area along with the synopsis of the stakeholder consultations conducted on the site.

4.8.1 Methodology

A mixture of both quantitative and qualitative approach has been adopted in the current socio-economic study. The study has been conducted based on secondary data from the Census of India 2011,. Details regarding population composition, number of literates, working population and access to basic facilities and others have been collected from secondary sources and analyzed.

Durg Dhamdha Road (Durg Bypas) (SH-7), Chikkli Nala, Khapri Alias pipardih, Beloudi, Malood, Bhendsar, Dhaba, Shanti Nagar, Dhaba, Nawagaon villages have been identified as the Project Impact Area of Route 1 and Sector-7, Sector-6, Sector-2, Supela are identified as the Project Impact Area of Route 2 to address the qualitative aspects of the study.

4.8.2 Concept and Definition of Terms Used

a) **Household:** A group of people who normally live together and take their meals from a common kitchen are called a household. People living in a household may be related or unrelated or a mix of both. However, if a group of related or unrelated people live in a house but do not take their meals from the common kitchen, then they are not part of a common household. Each person is treated as a separate household. There may be one member households, two member households or multi-member households.

b) **Density:** is a statistic that tells you how many people live in a certain geographical area. This type of measurement is called arithmetic density and is reported as the total number of people per land area.

c) **Sex Ratio:** Sex ratio is the ratio of females to males in each population. It is expressed as 'number of females per 1000 males'.

d) **Literates:** All persons aged up to 7 years and above who can both read and write with understanding in any language are taken as literate. It is not necessary for a person to have received any formal education or passed any minimum educational standard for being treated as literate. People who are blind but can read in Braille are also treated as literates.

e) **Literacy Rate:** Literacy rate of population is defined as the percentage of literates to the total population aged 7 years and above.

f) **Work:** Work is defined as participation in any economically productive activity with or without compensation, wages, or profit. Such participation may be physical and/or mental in nature. Work involves not only actual work but also includes effective supervision and direction of work. The work may be part time or full time or unpaid work in a farm, family enterprise or in any other economic activity.

g) **Worker:** All persons engaged in 'work' are defined as workers. Persons who are engaged in cultivation of land or milk production even solely for domestic consumption are also treated as workers.

h) **Main Workers:** Those workers who had worked for a major part of the reference period (i.e., 6 months or more in the case of a year) are termed as Main Workers.

i) **Marginal Workers:** Those workers who did not work for a major part of the reference period (i.e., less than 6 months) are termed as Marginal Workers.

j) **Work Participation rate (WPR):** The work participation rate is the ratio between the labour force and the overall size of their cohort (national population of the same age range). In the present study the work participation rate is defined as the percentage of total workers (main and marginal) to total population.

4.9 STATE PROFILE-CHHATTISGARH

Chhattisgarh is a state in the central part of India and was carved out of the state of Madhya Pradesh on November 1, 2000. The regions of southeast Madhya Pradesh were included in this new state which accounts for 15% of the steel production in the country. The state borders Maharashtra, Andhra Pradesh, Odisha and Uttar Pradesh. Raipur is the most prominent city in the state and has a popular domestic airport. The Chhattisgarh Census 2011 throws light on the most important stats about the state.

The state is spread over an area of about 135000 sq. km. making it the 7th largest state in the country in terms of area. The Population of Chhattisgarh according to the 2011 census stands at about 25 million, making it the 16th most populated state in India... Population density of the state was recorded as 191 persons per sq km. For administrative purposes, Chhattisgarh is divided into 18 districts and 149 tehsils. The state was further organized into five administrative divisions and has20,126 inhabited villages and 205 towns. Total population of Chhattisgarh as per 2011 census is 25,545,198 of which male and female are 50.2 percent and 49.8 percent respectively, with a sex ratio of 990. Literacy rate of the state was reported to be 73 percent with male and female literacy at 80.27 percent and 59.58 percent respectively. While the proportion of Scheduled Caste accounts for 30.62 percent Schedule Tribe population constitute 12.82 percent of the state's population.

Figure 4-41: State Map of Chhattisgarh

4.9.1 District Profile - Durg

Durg located on the eastern banks of the Shivnath River, holds a central position on the map of Chhattisgarh. Topographically, the district is bounded by Raipur and Dhamtari districts in the East, Rajnandgaon district in the West, Kabeerdham and Bilaspur districts in the North, and Uttar Bastar Kanker in the South. The district has an area of 8535 sq. km, which is 6.3 percent of the total area of the state. For administrative purposes, the district is divided into 13 tehsils and 12 community development blocks as per the Census of India 2011, the number of statutory towns recorded in the district are 25 whereas the total number of villages were recoded as 1773, which includes 1761 inhabited villages and 12 uninhabited villages.

As per Census of India 2011, the total population of the district is recorded as 3,343,872 of which male and female population accounted for to 50.3 percent and 49.7 percent respectively of the total population, suggesting a sex ratio of 988. The population density was reportedly 392 persons per sq. km, whereas the literacy rate of the district was recorded as 79.06 percent. While the Scheduled Castes population constituted 13.7 percent, Scheduled Tribe accounted for 11.88 percent of the of the total population of the district.

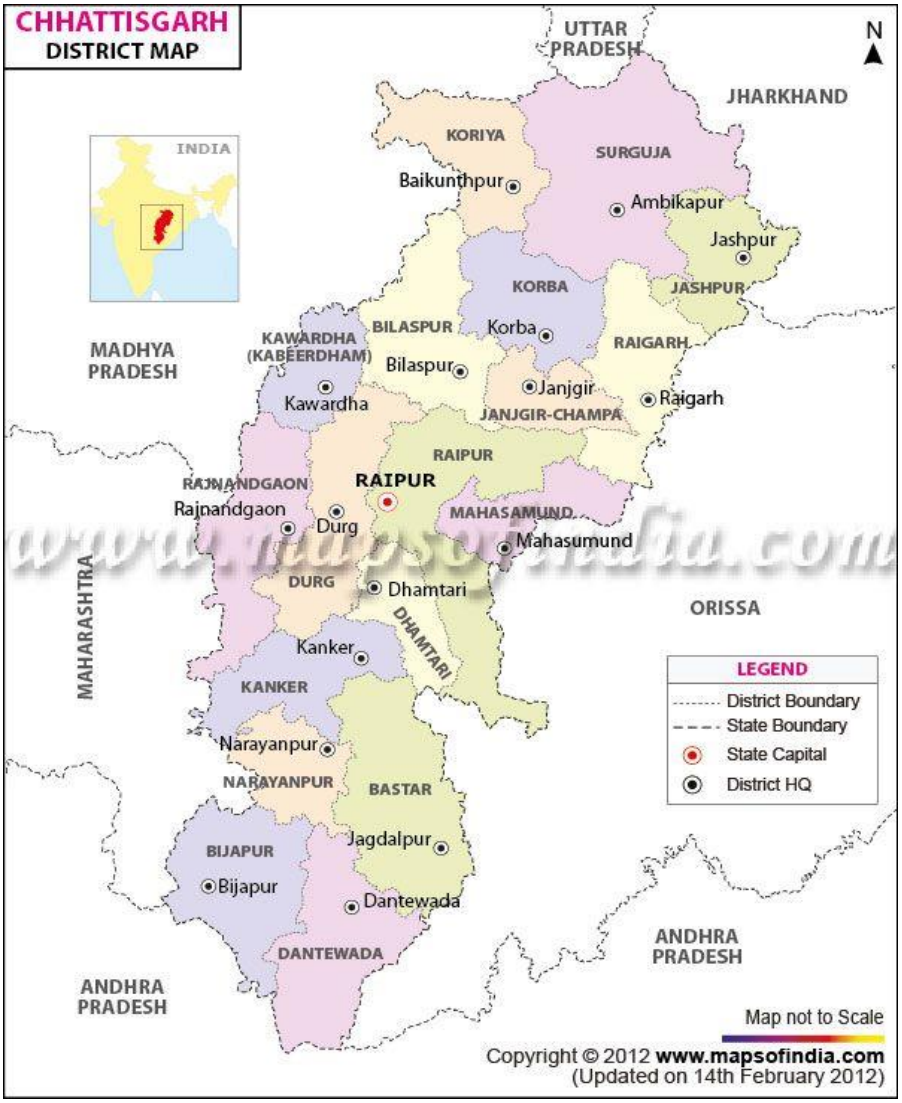


Figure 4-42: District Map of Durg

4.9.2 Block Profile

The route identified for the proposed project is located across two (02) blocks of the district which are Durg and Dhamda. As per the information provided by the project proponent, two (02) routes have been proposed, wherein Route 1 runs largely through the rural parts of Durg and Dhamda, whereas the second route is in Bhilai Nagar which is largely urban and administered under the Municipal Corporation.

Table 4-27: Block Profile

Block	No. of Villages	No. of Statutory towns
Durg*	80	04
Dhamda	162	03

**Source: Census of India,2011*
**Bhilai Nagar is a Statutory Town in Durg block*

Salient features of the blocks have been elucidated in subsequent sections.

4.9.3 Demography

Table 4-28 provides provides a brief demographic profile of the blocks through which routes of the gas pipelines have been proposed. While the geographical area of Dhamda is almost double Durg, the number of households and population are almost equivalent suggesting higher population density in Durg than Dhamda. Both the blocks reported SC and ST populations and lower literacy rates.

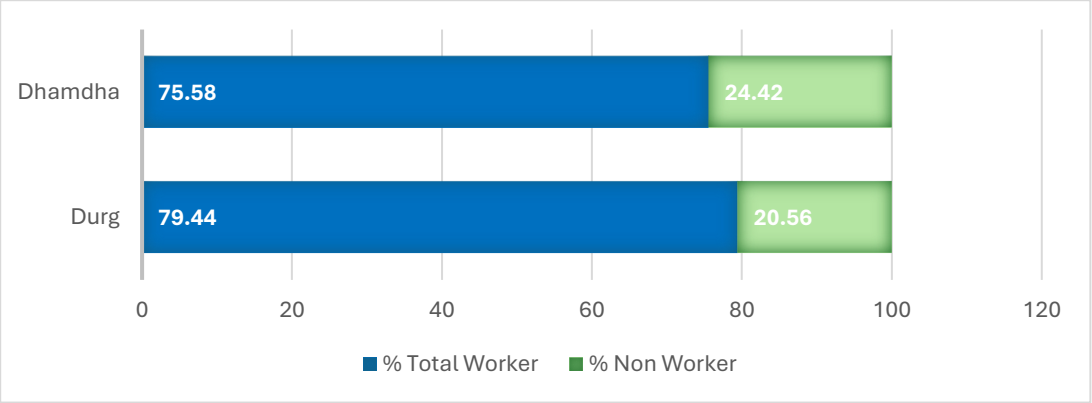
Table 4-28: Demographic Details of Block

Sl. No.	Block	Area (in Sq.Km)	No. of HH	Population	Male	Female	SC Population	ST Population	Literacy Rate
1	Durg	448.97	43,450	202,730	50.49	49.51	12.73	6.52	66.21
2	Dhamdha	803.57	42,149	204,491	50.06	49.94	19.42	5.40	61.91

**Source: Census of India 2011*

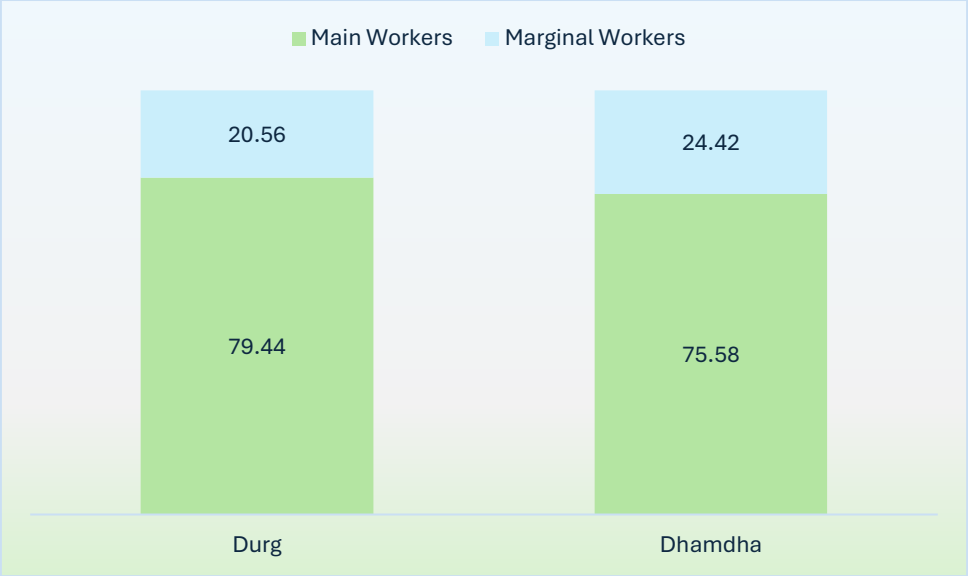
4.9.4 Working Population

As per the Census 2011, both Dhamda and Durg recorded approximately same proportion of working population at 75.58 percent and 79.44 percent respectively. **Figure 4-43** and **Figure 4-44** provides graphical representation of the working population and their categorization into main and marginal workers. In both blocks, the proportion of main workers were significantly higher than the marginal workers.



**Source: Census,2011*

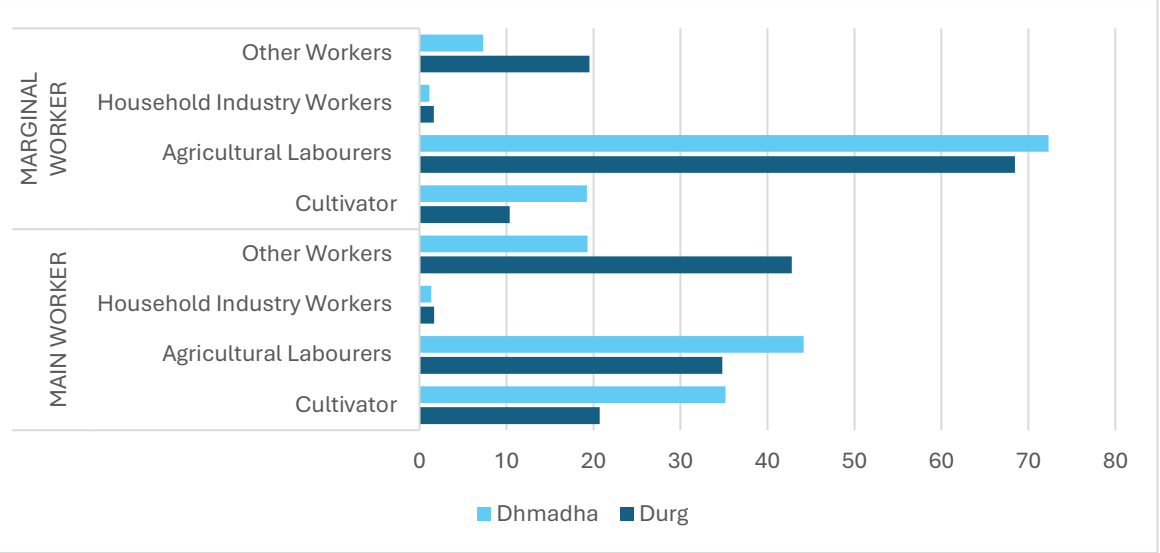
Figure 4-43: Segregation of Workers and Non-Workers



Source: Census,2011

Figure 4-44: Working Population: Main and Marginal Workers

Further segregation of the working and non-working population suggests larger proportion of working population engaged in activities other than agriculture. **Figure 4-45** provides a graphical representation of the segregation of workers w.r.t nature of work, where the proportion of main and marginal workers engaged in different occupation has been analyzed as per the data provided in the Census 2011. In Durg, majority of main workers were reportedly engaged as other workers, followed by agricultural laborers and cultivators, whereas in Dhamdha Block, most main workers are employed as agricultural laborers, followed by cultivators and other workers. Agricultural workers constitute a larger proportion of marginal workers in both Durg and Dhamdha Blocks.



Source: Census,2011

Figure 4-45: Segregation of Working Population by Nature of Work

4.10 PROJECT IMPACT AREA

As per the data shared by the project proponent, the proposed route traverses through five (05) villages in Durg block, one (01) village in Dhamdha and four (04) sectors in Bhilai Nagar, which is a statutory town in Durg block.

Table 4-29: Project Impact Area

S. No	Route	Block	No. of villages/towns	Name of villages/towns/sectors
1	Route 1	Durg	05	Chikli, Belaudi, Bhendsar, Dhaba, Malood,
2	Route 1	Dhamdha	01	Nawagaon
3	Route 2	Bhilai Nagar	04	Supela, Sector 2, Sector 6, Sector 7

** Source: Census of India 2011 & Field observations by TUV SUD team*

4.10.1 Demography

Table 4-30 provides details of the demographic profile of the villages and towns through which the proposed route traverses as indicated in the previous section. As per Census 2011, Bhendsar has been recorded as the largest village with a geographical area of 861.1 hectares and a total population of 3127 persons. Field observations also indicate large part of the Route 1 runs through Bhendesar.

While almost the villages and towns recorded higher proportions of male population, Malood in Durg, Nawagaon in Dhamda and Sector2 in Bhilai Nagar recorded higher female population. While higher proportions of ST population were recorded in Bhendesar and Belaudi accounting for approximately 11 percent of the total population, proportion of SC population were higher in Nawagaon, and Dhaba in Route 1 and Sector 7 Bhilai Nagar in Route 2.

Table 4-30: Demography- Project Impact Area

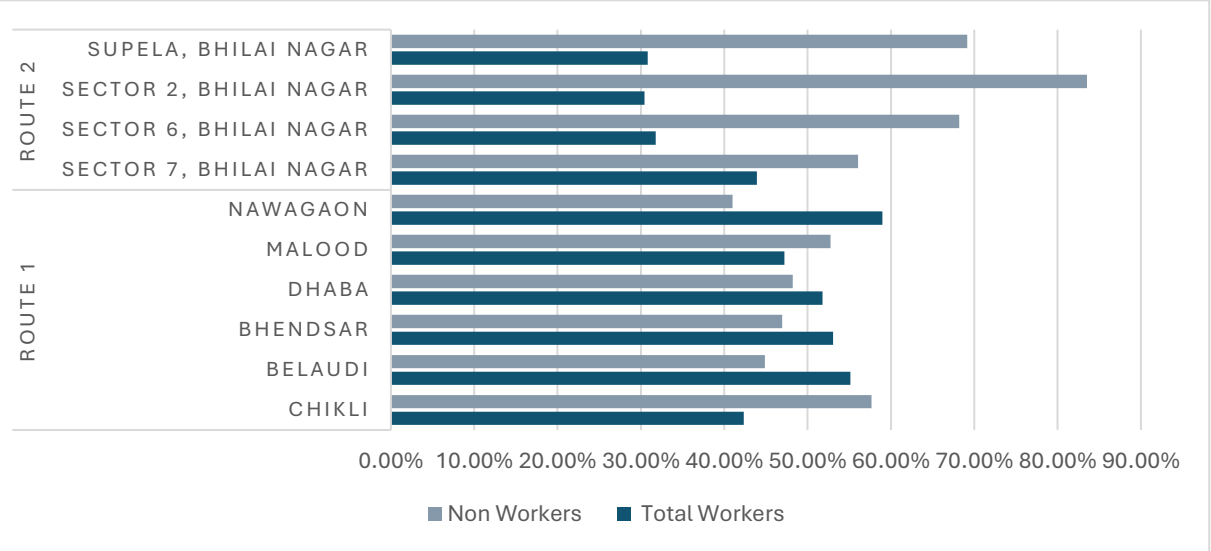
Sl. No.	Route	Name of village	Total area (in Ha)	No. of HH	Total Pop	Percent Male	Percent Female	Percent SC	Percent ST	Percent Literacy Rate
1	Route 1	Chikli	291.98	560	2697	50.61	49.39	17.13	4.82	63.00
2		Belaudi	292.13	488	2208	50.32	49.68	0.00	11.14	61.96
3		Bhendsar	861.1	739	3127	51.58	48.42	0.74	11.26	56.96
4		Dhaba	681.45	349	1632	50.98	49.02	26.72	3.06	61.52
5		Malood	191.43	180	885	48.36	51.64	2.03	0.00	65.20
6		Nawagaon	572.3	160	678	47.79	52.21	58.70	0.88	115.63
7	Route 2	Sector 7, Bhilai Nagar	142.32	767	3121	50.24	49.76	46.56	9.71	59.24
8		Sector 6, Bhilai Nagar		5962	26341	50.99	49.01	8.54	4.21	86.38
9		Sector 2, Bhilai Nagar		1505	6734	48.10	51.90	3.99	1.68	87.88
10		Supela, Bhilai Nagar		3207	14110	52.16	47.84	4.78	0.96	86.09

Source: Census of India,2011

4.10.2 Working Population

Error! Reference source not found. **Figure 4-46** provides details of the proportion of working and non-working populations of the villages and towns/sectors within the project impact area.

Analysis of census data suggests the average working population of the villages in the project impact area to be about 44.55 percent of the total population of the villages. In Route 1 (rural areas), while Nawagaon recorded the highest proportion of the working population at 59 percent, in Route 2 (urban areas of Bhilai Nagar), Sector 2, Bhilai Nagar recorded the lowest proportion of the working population at 30.43 percent.



Source: Census of India,2011

Figure 4-46: Working -Nonworking Pop- Project Impact Area

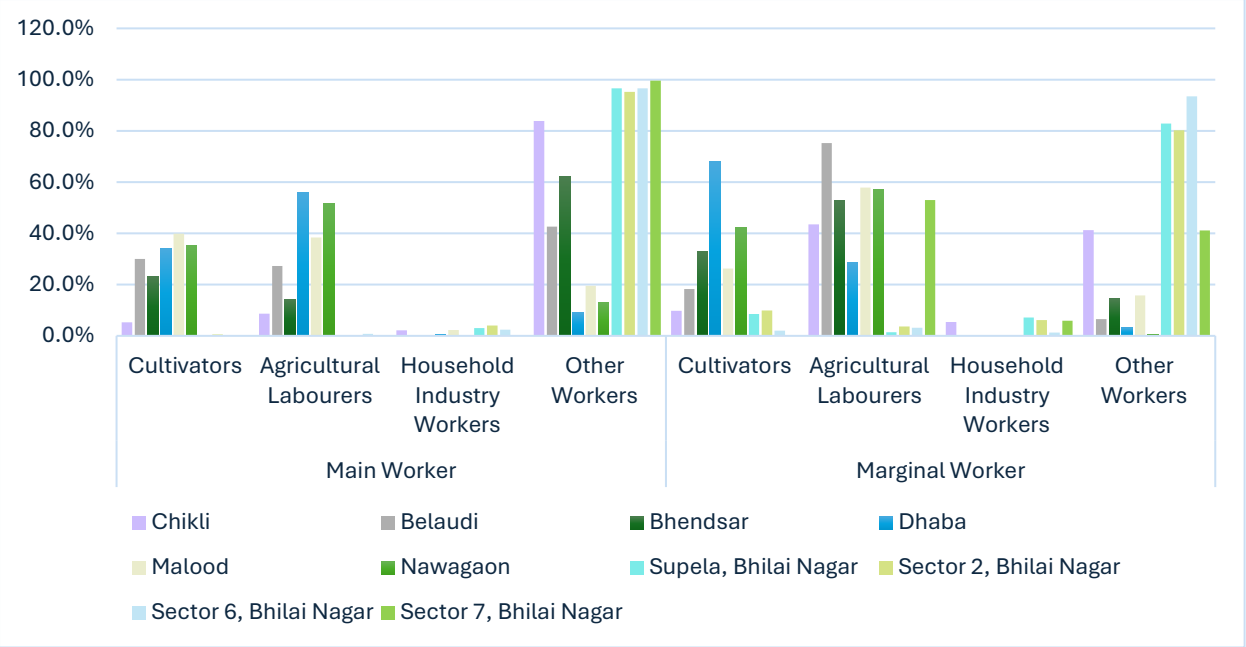
Figure 4-47 provides further categorization of working population into main and marginal workers in the Project Impact Area. While Malood recorded the highest proportion of the main workers at 39.85 percent, Supela recorded the lowest proportion of the main workers at 0.05 percent. The average proportion of marginal workers population of the villages within the area of influence has been estimated as 11.56 percent of the total population of the villages. While Dhaba recorded the highest proportion of the marginal workers population at 56.07, Bhilai Nagar sector 7 recorded the lowest proportion of the marginal workers population at 0.07 percent.

Source: Census of India,2011

Figure 4-47: Segregation of Main & Marginal Worker by Nature of Work

Figure 4-48 provides a graphical representation of the segregation of workers by nature of work, where the proportion of main and marginal workers engaged in different occupations has been analyzed as per the data provided in the Census 2011. Further segregation of main workers suggests that the majority of villages reported that a larger number of main workers are engaged in other work. The average proportion of main workers engaged in agricultural labor was calculated to be approximately 19.77%, whereas the average proportion of cultivators in the villages was calculated to be 16.86%. Workers engaged in other activities contributed to 61.85% of the total number of main workers.

Further disaggregation of marginal workers suggests that approximately 37.98% of the marginal workers are engaged as other workers, while only about 37.63% are engaged as agricultural labourers. Workers engaged in cultivator activities contributed 21.79% of the total marginal workers.



**Source: Census of Inida,2011*

Figure 4-48: Category wise Segregation of Main & Marginal Workers

4.10.3 Education Facilities

Table 4-31 provides details of the educational facilities present in the village and towns in the project impact area, the data for which has been sourced from Census of India 2011 In Route 1, Chikli has all levels of education available except senior secondary, while Belaudi has pre-primary within 5-10 km and higher levels within 5-10 km. Bhendsar reportedly did not have pre-primary education facilities, however reportedly has primary, middle, and secondary schools.

Table 4-31: Educational Facilities- Project Impact Area

Sl. No.	Routes	Village/ Town Name	Pre-Primary	Primary	Middle	Secondary	Senior Secondary
1	Route 1	Chikli	within 5km	Available	Available	Available	Not Available
2		Belaudi	within 5-10	Available	Available	within 5-10	within 5-10
3		Bhendsar	Not Available	Available	Available	Available	within 5-10
4		Dhaba	within 5km	Available	Available	within 5-10	within 5-10
5		Malood	within 5km	Available	Available	within 5km	within 5km
6		Nawagaon	Not Available	Available	within 5km	within 5km	within 5km
7	Route 2	Sector 7, Bhilai Nagar	Not Available	Available	Available	Available	Available
8		Sector 6, Bhilai Nagar					
9		Sector 2, Bhilai Nagar					
10		Supela, Bhilai Nagar					

Source: Census,2011

4.10.4 Drinking Water Facilities

The assessment of water resources along Route 1 and Route 2 highlights variations in water accessibility across different villages and towns. All the villages except Chikli did not have tap water facility and were reportedly primarily dependent on the wells and tubewells for sourcing water for meeting daily requirements. However, towns/sectors in Route 2 which was largely urban reportedly has piped water supply to all households.

Table 4-32: Drinking Water Facilities- Project Impact Area

Sl. No.	Routes	Village/ Town Name	Tap Water	Well Water	Hand Pump	Spring	River
1	Route 1	Chikli	Available	No	Available	Not Available	Available
2		Belaudi	Not Available	Available	Available	Not Available	Available
3		Bhendsar	Not Available	Available	Available	Not Available	Available
4		Dhaba	Not Available	Available	Available	Not Available	Not Available
5		Malood	Not Available	Available	Available	Not Available	Available
6		Nawagaon	Not Available	Available	Available	Not Available	Not Available
7	Route 2	Sector 7, Bhilai Nagar	Available	Available	Available	Not Available	Not Available
8		Sector 6, Bhilai Nagar					
9		Sector 2, Bhilai Nagar					
10		Supela, Bhilai Nagar					

Source: Census of India,2011

4.10.5 Health Facilities

The assessment of healthcare facilities along Route 1 and Route 2 highlights significant gaps in access to medical services, particularly in rural areas. Primary Health Subcentres were reportedly available in only two of the villages i.e. in Chikli and Bhendesar. Bhendesar also reportedly has maternity and child welfare centre. However, none of the villages in Route 1 have Community Health Centre in the village, the nearest one being located at a distance of more than 5 kms.

Route 2 which predominantly lies in the urban areas of Bhilai Town have access to Maternity and Child Welfare Cnetre but were largely dependent on private healthcare facilities.

Table 4-33: Health Facilities- Project Impact Area

Sl. No.	Routes	Village/ Town Name	Community Health Centre	Primary Health Centre	Primary Health Sub Centre	Maternity & Child Welfare Centre
1	Route 1	Chikli	within 5km	within 5km	Available	within 5-10
2		Belaudi	More than 10 km	within 5-10	within 5-10	within 5-10
3		Bhendsar	within 5-10	More than 10 km	Available	Available
4		Dhaba	More than 10 km	within 5-10	within 5km	More than 10 km
5		Malood	More than 10 km	within 5km	within 5km	within 5km

Sl. No.	Routes	Village/ Town Name	Community Health Centre	Primary Health Centre	Primary Health Sub Centre	Maternity & Child Welfare Centre
6		Nawagaon	More than 10 km	More than 10 km	within 5-10	within 5-10
7	Route 2	Sector 7, Bhilai Nagar	Not Available	Not Available	Not Available	Available
8		Sector 6, Bhilai Nagar				
9		Sector 2, Bhilai Nagar				
10		Supela, Bhilai Nagar				

(Source- Census 2011)*

4.10.6 Communication Facilities

Table 4-34 provides details of the availability of essential transport services in the project impact area. None of the villages reportedly railway stations. Government bus services were available in Chikli Belaudi and Malood in Route 1 and in all of the sectors in Route 2.

Table 4-34: Communication Facilities- Project Impact Area

Sl. No.	Routes	Village/ Town Name	Bus Service	Railway Station	NH	SH
1	Route 1	Chikli	Available	within 5-10	within 5-10	Available
2		Belaudi	Available	More than 10 km	More than 10 km	Available
3		Bhendsar	Not Available	within 5-10	within 5-10	within 5-10
4		Dhaba	Not Available	More than 10 km	More than 10 km	within 5-10
5		Malood	Available	More than 10 km	More than 10 km	Available
6		Nawagaon	Not Available	More than 10 km	More than 10 km	More than 10 km
7	Route 2	Sector 7, Bhilai Nagar	Available	within 5km	within 5km	within 5km
8		Sector 6, Bhilai Nagar	Available	within 5km	within 5km	within 5km
9		Sector 2, Bhilai Nagar	Available	within 5km	within 5km	within 5-10
10		Supela, Bhilai Nagar	Available	within 5km	Available	within 5km

**Source: Census of India,2011*

4.11 Social Sensitivity

Adani Gas Limited has been granted authorization for laying, building, operating or expanding the City Gas Distribution CGD Network in GA 11.10 i.e., Mungeli, Bemetara, Durg, Balod and Dhamatri districts and the proposed CGD covers four charge areas in the state of Chhattisgarh.

This section covers the social sensitivities observed in the proposed route in the Durg District GA where ATGL has planned to lay 8 inches diameter natural gas pipeline network in approx. 20.17 km stretch divided in two routes (L-01 and L-02), Durg and Dhamdha Block that covers the Charge Area number 3 namely Dhamdha, Durg, Patan Charge area.

4.11.1 Observation

The social sensitivity analysis for the natural gas pipeline project in Durg, Chhattisgarh highlights the proximity of critical community facilities to the proposed project. Observations for the proposed natural gas pipeline in Durg, Chhattisgarh, along the Route 1 (L-01) indicate several major crossings, including roads such as SH-7 (Durg to Dhamdha) and the Balodi-Bhendsar PCC Road, as well as water bodies like the Shivnath River, Sonbarsa River, and multiple nalas. The pipeline also intersects with an existing GAIL gas pipeline. Proximity to community facilities—including temples, schools, health centers, and Panchayat offices were also assessed during the exercise.

For Route 2, major crossings include key roads like the Circus Maiden Road, Railway Under Pass Road, and the Bhilai Nagar Station Road, along with the Railway line and water bodies such as the Samoda Nala and a major drain. The proximity of sensitive sites, including religious structures, a playground, and petrol pumps, necessitates specific safety protocols.

These primary observations during site visit are essential for risk assessment and ensuring that the necessary safety protocols and community engagement measures are implemented throughout the project lifecycle.

Table 4-35: Social Sensitive Area along the Route 1, Durg, Chhattisgarh

Sl. No.	Area	Coordinates	Chainage (m)		Distance from NG Pipeline Route (in metres)
Pipeline Route 1: GAIL SV-32 U/C to Vardhmaan Highway					
1	Unnamed Temple, Chikli	21°23'21.53"N, 81°30'05.84"E	15359.03	15483.66	10
2	Ram Mandir, Chikli	21°23'22.11"N, 81°29'80.17"E	15147.78	15069.84	25
3	Samudayik Bhaban & FPS (Fair Price Shop) Ration Shop, Chikli	21°23'22.22"N, 81°29'79.64"E	15147.78	15069.84	18
4	Primary Health Centre, Chikli	21°23'22.31"N, 81°29'73.55"E	15069.84	15040.18	2
5	Samudayik Bhaban, Chikli	21°23'23.27"N, 81°29'67.57"E	15040.18	14986.74	1
6	Anganwadi Kendra, Chikli	21°23'25.02"N, 81°29'62.29"E	14986.74	14951.25	7
7	Unnammed Temple, Chikli	21°23'33.91"N, 81°29'50.16"E	14809.67	14781.9	6
8	Govt. High School, Chikli	21°14'2.07"N 81°17'41.67"E	14748.58	14682.69	12
9	E.P.S. School, Beloudi	21°23'30.60"N, 81°29'56.00"E	14866.35	14848.09	7
10	Sant Shri Asharam Ji Ashram, Beloudi	21°23'91.97"N, 81°28'20.87"E	13253.04	13042.47	30
11	Primary School, Beloudi	21°24'02.08"N, 81°26'89.43"E	11721.48	11656.69	3
12	Maa Shitla Mandir Temple, Beloudi	21°24'44.13"N, 81°26'79.60"E	11111.46	11145.04	11
13	Gram panchayat office, Bhendsar	21°15'28.02"N, 81°15'58.96"E	9457.13	9479.83	15
14	Maa Durga Mandir, Bhendsar	21°15'28.53"N, 81°15'59.53"E	9457.13	9479.83	2
15	Sub Station, CGSPDCL, Bhendsar	21°26'45.45"N, 81°26'56.92"E	8581.23	8603.4	26
16	Krishi Mandi, Beloudi	21°16'2.40"N, 81°15'57.48"E	8344.55	8259.8	6
17	Fair Price Shop (Ration Shop), Dhaba	21°28'86.38"N, 81°25'64.68"E	5456.78	5440.2	7
18	Public School, Dhaba	21°28'61.98"N, 81°25'65.23"E	5753.21	5698. 17	6
19	Higher Secondary School, Nawagaon	21°31'63.63"N, 81°25'72.27"E	2136.62	1892.92	6
20	Gram Panchayat Office, Nawagaon	21°19'4.00"N, 81°15'40.21"E	1437.41	1415.18	6

Table 4-36: Social Sensitive Area along the Route 2, Durg, Chhattisgarh

Sl. No.	Social Sensitive area	Coordinates		Distance from NG Pipeline Route (in metres)
Pipeline Route 2: Supela to Khandelwal CNG Station				
1	Ayyappa Temple	21°20'00.64"N	81°35'43.73"E	20
2	Mritunjoy Mahadeb Temple & Astha Bridhashra	21°19'88.82"N	81°35'45.40"E	13
3	Playground, Sector 2	21°19'83.50"N	81°35'21.14"E	8
4	Jama Masjid (Mosque) & Karbala Maidan, Sector 2	21°20'15.07"N	81°35'06.04"E	15
5	Petrol Pump	21°12'9.87"N	81°20'56.78"E	23
6	Petrol Pump	21°11'56.72"N	81°20'10.52"E	15

Table 4-37: Details of Major Crossing within Proposed Pipeline Routes

Sl. No.	Description	Chainage (m)		Location
Pipeline Route 1: GAIL SV-32 U/C to Vardhmaan Highway				
ROAD CROSSINGS				
1	Asphalted Road (Nawagaon to PGSY Road (Nawagaon-Bori))	1470.64	1480.41	TP24-TP25
2	Murram Road (Nawagaon to PGSY Road (Nawagaon-Bori))	1847.58	1854.35	TP30-TP31
3	PGSY Road (Bori to Parsadapar)	2132.33	136.62	TP35-TP36
4	Asphalted Road (Parasda to PGSY Road)	2939.70	2949.61	TP41-TP42
5	Asphalted Road (Dhaba to PGSY Road)	5076.81	5082.48	TP82-TP83
6	PCC Road (Dhaba to PGSY Road)	5287.38	5291.23	TP91-TP92
7	PCC Road (Dhaba to PGSY Road)	5465.44	5470.17	TP98-TP99
8	PCC Road (Dhaba to PGSY Road)	5744.07	5753.21	TP104-TP105
9	PCC Road (Dhaba to PGSY Road)	5966.30	5968.28	TP110-TP111
10	PCC Road (Bhendsar to PGSY Road)	8981.08	8982.86	TP170-TP171
11	PCC Road (Bhendsar to PGSY Road)	9060.13	9063.12	TP171-TP172
12	PCC Road (Bhendsar to PGSY Road)	9186.73	9189.45	TP174-TP175
13	PCC Road (Bhendsar to PGSY Road)	9259.90	9262.93	TP174-TP175
14	PGSY Road (Nagpura to Ganiyari)	345.81	9352.32	TP177- TP178
15	Murram Road (Karuriadih to Balodi - Bhendsar Road (ASP))	10513.80	10518.47	TP218- TP219
16	Balodi - Bhendsar PCC Road (Balodi to Bhendsar)	11643.06	11656.69	TP251- TP252
17	PCC Road (Thelkadih -Durg Road to Balodi)	11666.51	11672.28	TP252-TP253
18	PCC Road (Thelkadih -Durg Road to Balodi)	11895.16	11898.09	TP261-TP262
19	Asphalted Road (Thelkadih - Durg Road to Balodi)	13279.21	13283.73	TP276- TP277
20	PCC Road (Thelkadih -Durg Road to Chikhli)	14732.73	14743.47	TP290-TP291
21	PCC Road (Thelkadih -Durg Road to Chikhli)	14929.98	14933.70	TP296-TP297
22	PCC Road (Thelkadih -Durg Road to Chikhli)	15042.90	15045.95	TP301-TP302

Sl. No.	Description	Chainage (m)		Location
23	PCC Road (Thelkadih -Durg Road to Chikhli)	15169.41	15171.84	TP303-TP304
24	PCC Road (Thelkadih -Durg Road to Chikhli)	15246.51	15249.38	TP304-TP305
25	PCC Road (Thelkadih - Durg Road to Chikhli)	15269.93	15271.79	TP305-TP306
26	PCC Road (Thelkadih -Durg Road to Chikhli)	15288.94	15290.55	TP305-TP306
27	PCC Road (Thelkadih -Durg Road to Chikhli)	15309.17	15311.40	TP305-TP306
28	PCC Road (Thelkadih -Durg Road to Chikhli)	15387.11	15389.24	TP306-TP307
29	PCC Road (Thelkadih -Durg Road to Chikhli)	15404.93	15407.55	TP306-TP307
30	PCC Road (Thelkadih -Durg Road to Chikhli)	15424.97	15426.87	TP306-TP307
31	SH-7 (Durg to Dhamdha)	15688.87	15699.30	TP311-TP312
32	PCC Road (SH-7 to Khapri)	15735.11	15741.08	TP313-TP314
33	urra Road (SH-7 to Plotting Area)	16083.36	16087.41	TP316-TP317
34	Junwani Road (SH-7 to Junwani)	16942.94	16974.60	TP323-TP324
WATER BODY CROSSINGS				
35	Nala	1616.72	1619.24	TP27-TP28
36	Sonbarsa River	2824.00	2843.71	TP39-TP40
37	Nala	4866.19	4901.87	TP80-TP81
38	Lined Canal	6484.18	6490.23	TP118- TP119
39	Nala	8563.96	8565.98	TP161- TP162
40	Seonath River	13527.63	13673.86	TP278- TP279
41	Nala	14605.83	14619.73	TP288- TP289
42	Nala	15754.57	15756.95	TP313- TP314
43	Nala	17033.79	17037.09	TP324- TP325
PIPELINE CROSSING				
44	Ex. GAIL Gas Pipeline	3734.56	--	TP57-TP58
Pipeline Route 2: Supela to Khandelwal CNG Station				
ROAD CROSSINGS				
1	Circus Maiden Road (Dakshin Gangotri,Supela to Supela Road)	114.58	120.71	TP1-TP2
2	Railway Under Pass Road (U/C)	316.96	323.76	IP4/2-TP5
3	Asphalted Road (Priyadarshini Parisar East to Garage Road)	997.38	1010.96	TP9-TP10
4	Bhilai Nagar Station Road (Bhilai Nagar RS to Rail Chowk)	1786.94	1803.09	TP16- TP17
RAILWAY CROSSING				
5	Garage Road (Raipur Naka to Maharana Pratap Chowk)	1868.06	1883.06	TP20- TP21
6	Southeast Central Railway ain Line(electrified) (Bhilai Nagar RS to Powerhouse Bhilai RS)	270.00	296.96	IP4/1- IP4/2
WATER BODIES CROSSING				
7	Major Drain	326.29	327.77	IP4/2-TP5
8	Samoda Nala	1325.47	1337.87	IP12/1- TP13

Route 1

Figure 4-49: Jai Maa Satti Temple, Chikli

Figure 4-50: Sant Shri Asharam Ji Ashram, Beloudi

Figure 4-51: Samudayik Bhaban & FPS (Fair Price Shop) Ration Shop, Chikli

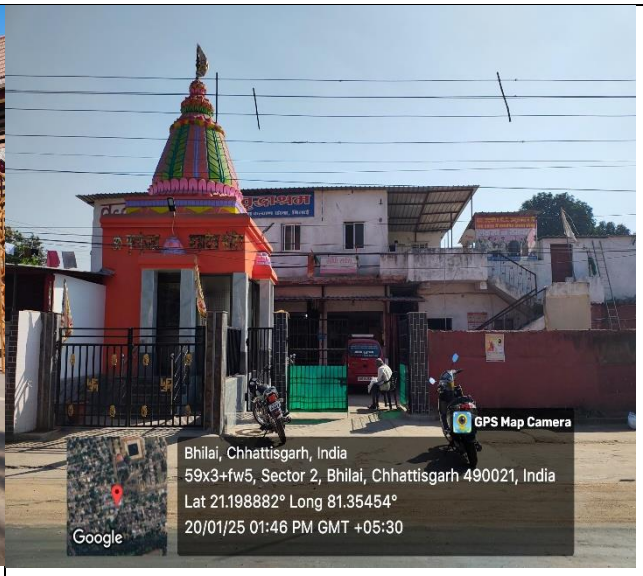
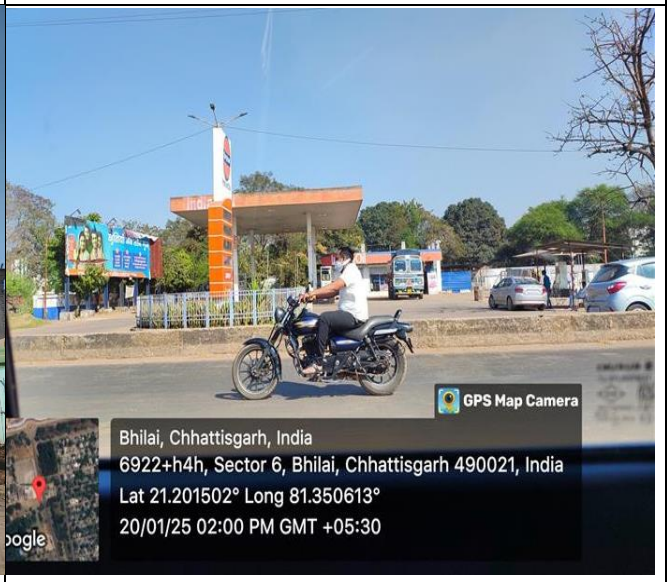
Figure 4-52: Gram Panchayat Office, Nawagaon

Figure 4-53: Sub Station, CGSPDCL, Bhendsar

Figure 4-54: Road Crossing at Dhaba Village

Figure 4-55: Primary Health Centre, Chikli

Figure 4-56: Higher Secondary School, Nawagaon

Route 2	
	
Figure 4-57: Ayyappa Temple & Marriage Hall, Sector-2, Bhilai Nagar	**Figure 4-58: Mahadev Temple & Astha Bridh Ashram, Sector 2, Bhilai Nagar**
	
Figure 4-59: Jama Masjid, Sector 6, Bhilai Nagar	**Figure 4-60: Petrol Pump, Sector 7, Bhilai Nagar**

4.11.2 Suggestive measures

The proximity of these community facilities calls for stringent safety measures to minimize potential risks during both construction and operation phases. It is advisable to perform thorough safety audits, create buffer zones, and deploy advanced monitoring technologies to reduce hazards. Regular community outreach programs should be conducted to keep the public well-informed and address safety-related concerns effectively. Recommended actions include conducting emergency response drills involving local

communities and collaborating closely with local authorities for effective traffic and crowd management. Utilizing horizontal directional drilling for railway crossings, implementing strong pipeline protection strategies, and maintaining open communication with stakeholders will enhance safety and minimize disruptions. The addition of clear signage, safety barriers, and real-time construction activity monitoring will further bolster safety. Both routes should adopt a proactive communication approach to ensure transparency and encourage community involvement throughout the project's duration.

5 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 INTRODUCTION

The proposed project may have impact on the environment & social conditions during construction and operation phases. This chapter describes various environmental impacts identified and assessed for during construction and operation phases of the project. The identification of impacts has been done based on review of available project information, primary observations during site visit and representatives of project proponent and other sector-specific professionals.

During the construction phase, the impacts may be regarded as temporary or short-term, while long term impacts may be observed during the operation stage. The major potential impacts associated with the proposed project are impact on soil, impact on water resources, air quality degradation, impact on ecological environment, impact on agriculture, impact on health and safety, impact on community activities, and impact on aesthetics. These impacts can occur at any stage i.e., the construction stage and the operation stage.

The identified impacts due to the proposed project can be mitigated through the incorporation of appropriate measures at different stages of the project. This will ensure the best design with minimal damage to or loss of significant or sensitive features such as roadside vegetation, local water resources, etc. This approach ensures the best pipeline design while minimizing damage or disruption to critical features such as residential areas, river bodies, and existing road networks. By carefully planning the pipeline crossings, the impact on houses, water resources, and transportation infrastructure can be reduced, preserving the local environment and community well-being. Special attention will be given to safeguarding roadside vegetation, ensuring water bodies remain uncontaminated, and maintaining the integrity of roads to prevent long-term disturbances.

5.2 IMPACT APPRAISAL CRITERIA

The identification of impacts has been done based on baseline environmental and social survey, review of available project information, discussions with project in charge of **ATGL** and other sector specific professionals. The criteria employed to appraise the proposed impacts on various social and environmental components has been presented as **Table 5-1** below.

Table 5-1: Impact Appraisal Criteria

Criteria	Sub-Classification	Defining Limit	Remarks
Spread: refers to area of direct influence from the impact of a	Insignificant/ Local spread	Impact is restricted within the project site.	Except for ecology (which is defined as loss of vegetation and wildlife habitat.

Criteria	Sub-Classification	Defining Limit	Remarks
particular project activity.	Medium Spread	Impact is spread from up to 2 km from the boundary of the project.	Except for ecology (which is defined as loss of vegetation and wildlife habitat.
	High Spread	Impact is spread up to 2 km to 5 km from footprint boundary of the project.	Except for ecology (which is defined as loss of vegetation and wildlife habitat.
Duration: based on duration of impact and the time taken by an environmental component to recover back to current state	Insignificant/ Short Duration	When impact is likely to be restricted for duration of less than 1 year.	The anticipated recovery of the affected environmental component within 2 years.
	Medium Duration	When impact extends up to 3 years.	With an anticipated recovery of the affected environmental component within 6 years.
	Long Duration	When impact extends beyond 3 years.	With anticipated recovery of prevailing condition to happen within 6 years or beyond or upon completion of the project life.
Intensity: defines the magnitude of Impact	Insignificant intensity	When resulting in changes in the environmental baseline conditions is up to 10%.	However, it shall be reconsidered where the baseline values are already high.
	Low intensity	When resulting in changes in the baseline conditions up to 20%.	For ecology it refers to minimal changes in the existing ecology in terms of their reproductive capacity, survival, or habitat change.
	Moderate intensity	When resulting in changes in the baseline conditions for up to 30%.	For ecology, it refers to changes that are expected to be recoverable.
	High intensity	When change resulting in the baseline conditions beyond 30%.	While for ecology, high intensity refers to changes that result in serious destruction to species, productivity, or their habitat.
Nature: refers to whether the effect is considered beneficial or adverse	Beneficial		Useful to Environment and Community.
	Adverse		Harmful to Environment and Community.
Likelihood: refers the possibility of a risk event occurring	Low	Will most likely not occur	Low likelihood refers that the impact will most likely not occur.
	Moderate	Possible to occur	Moderate likelihood refers that the chances of impacts are possible to occur.
	High	Likely to occur	High likelihood refers that a particular risk or impact will likely occur.

Impact identification is a continual process and completes only when the effects of the identified impact are assigned a mitigation strategy. The impacts shall be assessed based on the following criteria:

- Significance of the impact

- Duration of the impact
- Mitigation measures
- Residual impacts

5.3 ASSESSMENT OF IMPACT SIGNIFICANCE

A project specific significance assessment matrix has been developed to assess the impacts based on the appraisal criteria developed above. A reference impact significance matrix is given in **Table 5-2** below.

Table 5-2: Impact Significance Criteria

Spread	Duration	Intensity	Likelihood	Overall Significance	
				Adverse	Beneficial
Local	Short	Low	Low	Insignificant	Insignificant
Local	Short	Moderate	Moderate	Minor	Minor
Local	Medium	Low	Low	Minor	Minor
Local	Medium	Moderate	Moderate	Minor	Minor
Medium	Short	Low	Low	Minor	Minor
Local	Long	Low	Low	Minor	Minor
Local	Long	Low	Moderate	Minor	Minor
Local	Short	High	High	Moderate	Moderate
Local	Medium	High	High	Moderate	Moderate
Local	Long	Moderate	Moderate	Moderate	Moderate
Medium	Short	Moderate	Moderate	Moderate	Moderate
Medium	Medium	Low	Low	Moderate	Moderate
Medium	Medium	Moderate	Moderate	Moderate	Moderate
Medium	Long	Low	Low	Moderate	Moderate
Medium	Long	Moderate	Moderate	Moderate	Moderate
High	Short	Low	Low	Moderate	Moderate
High	Short	Moderate	Moderate	Moderate	Moderate
High	Medium	Low	Low	Moderate	Moderate
High	Medium	Moderate	Moderate	Moderate	Moderate
High	Long	Low	Low	Moderate	Moderate
Local	Long	High	High	Major	Major
Medium	Short	High	High	Major	Major
Medium	Long	High	High	Major	Major
High	Short	High	High	Major	Major
High	Medium	High	High	Major	Major
High	Long	Moderate	Moderate	Major	Major
High	Low	Low	Low	Major	Major
High	Low	High	High	Major	Major

The impacts for the proposed project have been covered under following subsections:

- Construction Phase
- Operational phase

The social impacts associated with construction and operations stages have been assessed qualitatively and, in some cases, quantitatively (subject to availability of data), using professional judgement and based on experience from similar projects.

5.4 IDENTIFICATION OF ENVIRONMENTAL IMPACTS

The identification of impacts has been done based on baseline environmental and social survey, review of available project information, discussions with project in charge of **ATGL** and other sector specific professionals. The environmental impacts associated with the proposed project on various environmental components such as air, water, noise, soil, flora, fauna, land, socioeconomic, etc. has been identified using Impact Identification Matrix as depicted in **Table 5-3** below:

Table 5-3: Impact Identificationa Matrix for NG Pipeline Route

Components	Physical				Biological		Socio-Economic		
	Ambient Air Quality	Ground/Surface Water (Qty/Quality)	Ambient Noise Quality	Land (Land use, Topography, drainage, soil)	Flora	Fauna	Livelihood and Occupation	Infrastructure	Health & Safety
AUGMENTATION OF FACILITIES									
CONSTRUCTION PHASE									
Civil and mechanical works	•	•	•	•	•	•	•	•	•
Movement of vehicles	•		•	•	•	•		•	•
Hydro testing									•
Waste generation, handling, and disposal			•	•	•	•			•
OPERATION PHASE									
Operation of pumps and compressors	•	•	•						
Storage of Gas/ Crude	•								•
Cleaning & maintenance									
Movement of vehicles		•		•					
Waste generation, handling, and disposal		•		•	•	•		•	•
Leakage from Pipeline	•	•			•	•			•
LAYING OF NEW PIPELINE									
CONSTRUCTION PHASE									
Preparation of Right of way	•	•	•	•	•	•	•	•	•
Pipe laying	•		•	•	•	•	•	•	•
Chemical use/handling	•	•		•					•
Movement of vehicles	•		•						
Waste generation, handling, and disposal	•	•		•					
OPERATION PHASE									
Operation of compressors	•	•	•						
Cleaning & maintenance	•			•					

5.5 PRE-CONSTRUCTION PHASE IMPACTS

5.5.1 Impact on Land Procurement

Context and Receptors

ATGL has identified the 20.17 km Natural Gas Pipeline spanning across Durg and nearby area, in two (02) pipeline routes Pipeline Route 1 (L-01) from GAIL SV-32 U/C to Vardhaman Highway for 17.826 Km, Pipeline Route 2 (L-02) from SV-31 to BPCL Petrol Pump (Gill Goods Carrier) for 2.35 Km.

Pipeline Route 1 (L-01): The entire length of this route traverses multiple villages, two rivers—Shivnath River and Sonbarsa River, one canal, and one State Highway 07 (SH-07), whereas the rest of the stretch passes through the other asphalted and RCC roads hence **ATGL** needs to seek the necessary permissions for these roads as well, with impacts related to road restoration and infrastructure integration. Therefore, obtaining permission and right of way (ROW) approvals from the Public Works Department and the Irrigation Department will be necessary.

Pipeline Route 2 (L-02): Approximately 2.35 km of Pipeline Route 02 runs through Bhilai Nagar, crossing at state highways, necessitating right of way (ROW) approvals from the Public Works Department (PWD). The remaining stretch traverses other asphalted and RCC roads, requiring ATGL to obtain the necessary permissions for these roads, along with addressing impacts related to road restoration and infrastructure integration. Additionally, L-02 crosses a railway line near Supela, making it essential to secure approval from the Railways as well.

Impact significance

The significance of this impact has been evaluated to be "**Moderate"**.

Mitigation Measures

- Permission/right of way (ROW) approvals will be required from the Public Work Department, (PWD), Bhilai steel plant road, other roads, railways, irrigation department for river and canal.
- Develop and implement detailed restoration plans for land, roads, and infrastructure affected during construction to ensure full post-project restoration.
- Designing of the overpasses or other infrastructure to cross canals should be such that the effect on water flow or canal operations is minimum.

Residual Impacts

After the implementation of these mitigation measures, the residual impact significance is expected to be **"Low"**.

Table 5-4: Impact Significance on Private/Revenue Land Acquisition

Impact	Impact on land Procurement
Impact nature	Negative
Impact Type	Direct

Impact Duration			Short-Term			
Impact Extent			Regional			
Impact Scale			Low			
Impact Magnitude (Without Mitigation			Negative-Moderate			
	Scenario	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Land Acquisition	Without Mitigation	Local	Long-term	Moderate	Moderate	Moderate
	With Mitigation	Local	Short-term	Low	Low	Low

5.6 IMPACTS DURING CONSTRUCTION PHASE

The construction activities shall comprise of following activities that may impact the environmental and social aspects, as described in sections below:

- Site Preparation
- Labour Engagement
- Material Handling and Storage
- Construction Demobilization

5.6.1 Topography, Land Use and Drainage

Impacts - Context & Receptor

The proposed natural gas pipeline project is mainly identified in Durg GA which is sub divided in the two pipeline route networks. The proposed Line route 01 GAIL SV-32 U/C to Vardhaman Highway in Durg District and the proposed Line route 02, passes through SV-31 to BPCL Petrol Pump (Gill Goods Carrier) takes off from Supela in Bhilai Nagar in Durg District and terminates at Khandelwal CNG Station in Durg District of Chhattisgarh. The pipeline route for Route 1 is predominantly flat; however, certain sections feature significant undulations due to the presence of rivers, canals, and nalas along its right of way and pipeline Route 2 is majorly flat with minor undulations in its right of way. The natural gas pipeline will be installed at a depth of 1.5 meters underground, following standard protocols and procedures. The project will result in minimal changes to the topographic characteristics within the designated footprint. Any alterations to the surface drainage pattern due to construction activities will be confined to small, localized areas within the project site.

Embedded/In-Built Control

- Using trenchless construction methods like Horizontal Directional Drilling (HDD) for road, canal & river crossings, where possible, to avoid direct excavation in the canals and minimize disruption to water flow and the surrounding ecosystem.
- Implement soil erosion control measures like silt fences, sedimentation ponds, and planting grass cover in disturbed areas to minimize soil loss, especially in agricultural fields and forest areas.
- Design and layout the pipeline route to avoid impacting high-value agricultural areas as much as possible.

Impact Magnitude

- There will be very limited change in the topographic character of the project footprint area. The alteration in surface drainage pattern of the area due to construction activities, if not maintained with appropriate control measures is probable. The natural flow of storm water will not be altered on contiguous larger area. Intensity of the effect can be considered as moderate, and duration of the effect would be short (during monsoon and post-monsoon season) in nature. Hence, impact magnitude is assessed to be **Moderate.** However, with controlled and managed construction work in water side and forest and agricultural land side may reduce the impact magnitude to **Low**.

Impact Significance

- As per the impact significant assessment matrix the impact has been assessed as **Moderate** considering the construction for transmission line during monsoon season along the drainage area, which can be mitigated, and magnitude of impact can be **Low** with use of mitigation measures.

Mitigation Measures

- Project shall ensure to avoid any unnecessary changes in the topography especially during the pre-construction and construction phase.
- Anti-buoyancy measures will be adapted during laying out of pipeline within water bodies.

Residual Impact Significance

- After implementation of mitigation measures, the significance of residual impacts for construction activities will be **Low**.

Table 5-5: Impact Significance for Topography and Drainage

Impact		Impact on Topography & Drainage				
Impact nature		Negative				
Impact Type		Indirect				
Impact Duration		Short-term				
Impact Extent		Regional				
Impact Scale		Uncontrolled construction work and waste generating from construction site may contaminate drainage of the area				
Impact Magnitude (Without Mitigation		Negative-Moderate				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Topography and Drainage	Without Mitigation	Regional	Short	Moderate	Moderate	Moderate
	With Mitigation	Local	Short	Low	Low	Low

5.6.2 *Water Resources and Availability*

Impacts - Context & Receptor

During construction phase, water will be primarily required for domestic activities by staff. Additionally, the pipeline is crossing at two water bodies i.e Shivnath River and Sonbarsa River in its right of way.

Freshwater will be sourced from private tankers. During the construction phase, sewage generated by workers, wastewater disposal from worker camps, and sludge accumulation will contribute to waste production. Additionally, improper disposal of fuel and lubricants from construction sites may lead to soil and water contamination, posing environmental risks. Additionally, there is a possibility of contamination of water bodies during laying of NG pipeline in the creeks coming within ROW of the pipeline.

Embedded/In-Built Control

NIL

Impact Magnitude

Water requirement for construction works will be temporary just during construction phase and short-lived while domestic water requirement for construction workers will be needed during the entire construction phase. The construction phase will be of duration of 3 to 4 months with peak construction period of 1.5 to 2 months. Hence, the magnitude of impact is assessed as **medium/ moderate.**

Impact Significance

As per the impact significant assessment matrix, a combination of medium-term impact duration, moderate intensity, moderate likelihood, and local level spread the impact magnitude has been assessed as **Moderate.**

Mitigation Measures

- The trench shall be excavated only so far in advance of pipe laying that it does not cause increased soil erosion and silting of water bodies.
- The discharge of the trench de-watering pumps shall be conveyed either to drainage channel or to natural drains after passing through a catch pit for settling the silt.
- The trench shall be excavated to the exact gradient specified so that no making of the sub-grade by back filling is required and the concrete bed, where required, may be prepared with greatest ease giving a uniform and continuous bearing and support for the pipe.
- Construction materials to be stacked together by fencing it with brick or earth to prevent spillage into the water bodies, also these materials to be stacked away from the water bodies.
- Concrete shall be evaluated in accorder with IS: specification and shall have a minimum compressive strength to avoid pressure on water body.
- Aggregates will be clean and free from injurious amounts of salt, alkali, deleterious substances, or organic impurities as per IS 383 & evaluated as per 2386 to avoid contamination of water bodies.
- Proper sanitation facilities to be provided at the construction site to prevent health related problems due to water contamination.
- Waste disposal and sanitation to workers in the construction camp will be properly maintained or taken care off to check their entry into the water bodies like ponds, streams etc.

- Vehicle maintenance and refuelling will be confined to areas near construction camps designed to trap discarded lubricants and fuel spills from entering the water bodies.
- Drinking water supply for the workers in the construction camps to meet the Indian National Standards. Assess the portability of the supplied water to the construction labour camps water quality to be periodically monitored.
- Garbage to be collected in tanks and disposed of daily to check the solid wastes entering the ponds, streams etc.
- Concrete will be placed within 30 minutes from the time of mixing and will be managed in such a way so as to prevent aggregate segregation and excessive moisture loss. Concrete container will be kept clean and free from hardened or partially hardened concrete.

Residual Impact Significance

After implementation of mitigation measures, the significance of residual impacts for construction activities will be **Low**.

Table 5-6: Impact Significance on Water Resource and Quality

Impact		Impact on water resource and quality				
Impact nature		Negative				
Impact Type		Direct				
Impact Duration		Short-term				
Impact Extent		Local				
Impact Scale		Uncontrolled construction works and waste generating from construction site may contaminate drainage of the area.				
Impact Magnitude (Without Mitigation		Negative-Moderate				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Impact on Water Resource	Without Mitigation	Local	Short	Moderate	Moderate	Moderate
	With Mitigation	Local	Short	Low	Low	Low

5.6.3 Ambient Air & Noise Quality

Impacts - Context & Receptor

Air: The air quality along the project stretch may get affected during the construction period. Particulate matter will be the predominant pollutant affecting the air quality during the construction phase as the construction activities are likely to generate dust. Operation of equipment and machineries for pipeline laying and civil works in pipeline ROW & other sites will generate dust that could impact the air quality. Mostly the additional automobile traffic and construction machineries involved during construction activities will generate pollutants like PM, SO_2 & NOx. Therefore, the receptor sensitivity is assessed as **"Moderate"**. However, this will not lead to any tangible effect, as the additional traffic volume related to construction activities will be low.

Noise: During construction phase, noise will be generated due to movement of vehicles, and operation of light and heavy construction machineries including pneumatic tools (hot mixer, dozer, tipper, loader, excavator, grader, scrapper, roller, concrete mixer, generator, pump, vibrator, crane, compressor, HDD

etc.). Operation of construction machinery may lead to rise in noise level in the range between 80-100 dB(A). The magnitude of impact from noise will depend upon types of equipment used, construction methods and on work scheduling. The main sources of noise during construction period are:

- Movement of vehicles during the construction period for procurement of construction material.
- During site preparation, surface preparation, pipeline laying etc.

Noise generated from sources mentioned above will be mostly during daytime. Moreover, villages / settlements being near to the route, significant impact on local people is apprehended (as a few congested human habitations are along the site), as the noise generated will be a problem. However, the workers are likely to be exposed to high noise levels that may affect them.

Embedded/In-Built Control

- Suppression of fugitive dust emissions by spraying water, wetting of the stockpile.
- Pre-identified proper locations of material stockpiles, especially sand.
- Screening or providing wind breaks for stockpiles, covering of trucks with tarpaulin sheets during transportation of material.
- Normal working hours of the contractor will be defined (preferable 8 am to 6pm). If work needs to be undertaken outside these hours, it would be limited to activities which do not generate noise.
- Avoid unnecessary honking in traffic movement.
- Barricading of project premises to avoid dispersion of dust and noise outside the project premises.

Impact Magnitude

The major source of emissions in the construction phase is fugitive dust emissions & emissions from excavation and other construction activities. In addition, operation of DG sets will also cause gaseous emissions. There will be some impacts due to plying of vehicles on the access roads which runs across settlement area.

The construction activities will occur for maximum 2-4 months whereas dust emitting activities such as site clearing, civil construction etc. will be of short/medium duration for 1-2 peak months. The impact magnitude has been categorized as small because the soil type is alluvial. Thus, dust emission would be restricted to construction phase only for shorter duration.

Impact Significance

As per the impact significant assessment matrix combination of low impact magnitude with medium receptor sensitivity results in impact significance as Moderate.

Mitigation Measures

- Proper and prior planning, appropriate sequencing and scheduling of all major construction activities will be done, and timely availability of infrastructure supports needed for construction will be ensured to shorten the construction period vis-à-vis reduce pollution.

- Construction materials will be stored in covered godowns or enclosed spaces to prevent the windblown fugitive emissions.
- Concrete will be mixed in a mechanical mixer to ensure thorough mixing of all materials to avoid dispersion of particulate matter into the ambient air. Reinforcements will be placed around the length of pipeline. Night Caps to be provided to both ends of line pipe before starting the work.
- Stringent construction material handling / overhauling procedures shall be followed.
- Adequate dust suppression measures such as regular water sprinkling on unpaved haul roads, at vulnerable areas of construction sites will be undertaken to control fugitive dust during material handling and hauling activities particularly near habitations especially in dry seasons.
- The construction material delivering vehicles will be covered to reduce spills.
- Low emission construction equipment, vehicles and generator sets to will be used.
- It will be ensured that all construction equipment and vehicles are in good working conditions, finely tuned and maintained to keep emission within the permissible limits and engines tuned off when not in use to reduce pollution.
- Vehicles and machineries will be regularly maintained so that emissions confirm to standards of Central Pollution Control Board (CPCB).
- Construction workers to be provided with appropriate PPEs during construction phase.
- Temporary labour sheds will be located away from the immediate vicinity of construction sites and major road traffic.
- Protective gears such as earplugs, etc. will be provided to construction personnel exposed to high noise levels as preventive measures.
- It will be ensured that all the construction equipment and vehicles used are in good working condition, properly lubricated and maintained to keep noise within the permissible limits and engines tuned off when not in use to reduce noise.
- Construction activities carried out near residential locations will be scheduled to the daytime (i.e. from 10.00 a.m. to 6.00 p.m.) only to have minimum disturbance to the residents.
- Whenever possible static noisy machinery will be placed on vibration isolators or temporary sheeting will be provided to check noise propagation.
- Noise level will be monitored at regular intervals during construction phase, which will help in taking appropriate action to maintain it within the prescribed limit

Residual Impact Significance

- The significance of residual impact will be **Low** after implementing mitigation measures.

Table 5-7: Impact Significance for Ambient Air & Noise Quality

Impact	Impact on Ambient Air & Noise Quality
Impact nature	Negative
Impact Type	Direct
Impact Duration	Short-term
Impact Extent	Regional

Impact Scale		Impact due to construction activity and operation of construction vehicles				
Impact Magnitude (Without Mitigation		Negative-Moderate				
Aspect	Scenario	Spread	Duration	Intensity	Likelihood	Overall
Ambient Air & Noise Quality	Without Mitigation	Regional	Short	Moderate	Moderate	Moderate
	With Mitigation	Regional	Short	Low	Low	Low

5.6.4 Land and Soil Environment

Impacts - Context & Receptor

The construction activities such as earth moving may lead to reduction in vegetation cover on ground thus leading to soil erosion. During the construction period the movement of heavy vehicles will result in compaction of soil by making it hard and impermeable. The erosion at construction stretches will result in increased sediment load in recipient streams. Any leakage of lubricants in equipment yard may cause soil contamination. Solid waste disposal along roadside also adds to impact on the land environment during the construction. During construction activity for laying of pipeline cutting of existing land will be done and the dug material generated will be replaced back after laying of the pipes. Loosening of topsoil and loss of vegetative cover (land clearing) along the route and construction areas due to excavation and back filling which lead to enhance soil erosion.

Embedded/In-Built Control

- Erosion and sediment control measures should be adopted including using silt fences to manage runoff, applying erosion control mats on disturbed soil, hydroseeding for vegetation restoration, and setting up sediment basins to collect runoff.
- To do topsoil management, the topsoil should be striped and stockpiled separately before construction, and it should be replaced after construction to restore soil fertility.
- For vegetation and habitat protection land disturbance should be minimization by keeping the construction area narrow and by the usage of controlled clearing methods for vegetation removal.
- To achieve the soil compaction prevention usage of mats or gravel paths for heavy machinery should be adopted.
- Water management and protection involves using trenchless technology for stream, canal and wetland crossings, designing proper drainage systems to prevent erosion, and managing de-watering to avoid soil erosion.
- Contaminant management includes setting up spill prevention and containment measures for fuel or oil spills and conducting soil testing to monitor contamination levels.
- Trench management focuses on stabilizing trenches during construction to prevent collapse and refilling trenches promptly to avoid long-term soil settlement.

Impact Magnitude

The overall magnitude of the land and soil impacts is expected to be moderate because the excavation of the land to lay the pipeline will disturb the soil structure and soil compaction, removal of topsoil, and trenching can alter the natural state of the soil.

Impact Significance

The significance can range from **Moderate**.

Mitigation Measures

- During excavation, care will be taken to see that the topsoil and the subsoil are stored separately. Topsoil (50cm) of route pits will be conserved and restored after excavation is over and will be replaced back for filling of the pit areas. Whereas the topsoil (25cm) stripped from the area stacked separately as topsoil dump of not more than 1m in height and the same will be redistributed to the pit after laying of pipeline. During refilling, care will be taken to see that the topsoil is replaced back at the top while refilling after laying of pipeline.
- Back filling shall be carried out immediately after the pipeline has been laid in the trench. On no account the topsoil from ROW shall be used for this purpose. The backfill material shall not contain any extraneous material and/or hard lumps of the soil. After the initial backfill has been placed into the trench to a level slightly above the surrounding ground, the backfill material shall be compacted.
- When the trench has been dug through driveways or roads all backfills shall be executed with sand or a suitable material and shall be thoroughly compacted.
- Trench excavated in dykes which are the property of the railways, or which is part of main road shall be graded and backfilled in their original profile and condition.
- Also, necessary contour bunding, gully plugging, and staggered trenching shall be carried out wherever required in the pipeline corridor and in areas where excavated soil will be dumped to check soil erosion.
- Stone pitching will be provided at the slopes near the irrigation and natural drainage / rivers to prevent silting of soil into these water bodies.
- Concrete shall be tested in accorder with IS: specification and shall have a minimum compressive strength as per concrete grade design and the same will be utilized for construction purposes.
- Approved quality of cement confirming to IS code will be used only OPC 53 grades.
- Concrete coating will be reinforced by a Single layer of steel reinforcement.

Residual Impact Significance

- The significance of residual impact will be Low after implementing mitigation measures.

Table 5 8: Impact Significance for Land and Soil Environment

Impact	Impact on Land and Soil Environment
Impact nature	Negative
Impact Type	Direct
Impact Duration	Short-term

Impact Extent		Regional				
Impact Scale		Erosion, sediment runoff, compaction, habitat loss, disruption of topsoil, Localized, with concentrated effects near water crossings, steep areas, and during trenching.				
Impact Magnitude (Without Mitigation		Medium				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Ambient Air & Noise Quality	Without Mitigation	Local	Short	Moderate	Moderate	Moderate
	With Mitigation	Local	Short	Low	Low	Low

5.6.5 Ecology and Biodiversity

Impacts - Context & Receptor

The construction works of the NG pipeline route involves clearance of land, but it does not include uprooting of trees since most of the stretch of the pipeline route will be conducted only on the RoW of the road. Although few shrubs and herbs will be cleared. Therefore, no significant impact on the ecological environment is envisaged due to the construction activity of the proposed pipeline project.

Embedded/In-Built Control

- The clearance of shrubs and herbs should be minimal. The design should ensure that no significant disruption to larger vegetation or habitats occurs during construction.
- Design provisions should allow for buffer zones around sensitive ecological areas, further reducing potential disturbances.
- To prevent erosion during and after construction, appropriate soil erosion control measures should be in place, such as silt fences and temporary revegetation.

Impact Magnitude

The magnitude of the impact on ecology and biodiversity is expected to be low. Since the land clearance is minimal, restricted to shrubs and herbs, the overall disturbance to plant species and ecosystems is limited. The temporary nature of the construction activity (lasting only for the duration of the pipeline installation) ensures that any impacts will be short-term and reversible.

Impact Significance

Given the minimal scope of vegetation clearance and the lack of uprooting of trees, the significance of ecological and biodiversity impacts is considered negligible to low.

Mitigation Measures

- No vegetation clearance will be undertaken in the pipeline route. Only few shrubs and herbs located within ROW of pipeline will be cleared.
- While planning / selection of route care to be taken to route the pipeline alignment in such a way to avoid areas with trees and shrubs and thus no major impact of loss of vegetation is anticipated.

Residual Impact Significance

- The significance of residual impact will be **insignificant** after implementing mitigation measures.

Table 5-8: Impact Significance for Ecology and Biodiversity

Impact		Impact on Ecology and Biodiversity				
Impact nature		Negative				
Impact Type		Direct				
Impact Duration		Short-term				
Impact Extent		Regional				
Impact Scale						
Impact Magnitude (Without Mitigation)		Medium				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Ambient Air & Noise Quality	Without Mitigation	Local	Short	Low	Low	Low
	With Mitigation	Local	Short	Insignificant	Low	Insignificant

5.6.6 Socio-Economic Environment

Impacts - Context & Receptor

The project will generate both direct and indirect employment opportunities for the local population to the greatest extent possible. However, the construction phase will require the migration of skilled labor from outside the project area, which may exert pressure on local settlements and resources. Preference will be given to hiring local skilled workers whenever feasible. Since the pipeline route intersects multiple major roads, the construction phase will lead to a temporary rise in traffic on surrounding roads, both within and beyond the project site. This increase will be driven by the transportation of raw materials and construction equipment. As a result, there may be public inconvenience and potential safety risks, considering the scale and nature of the project. As the pipeline route passes through villages with dense human settlements along the right of way (ROW), there is a potential health and safety risk for local residents. Additionally, the pipeline crosses two rivers, including the Shivnath River, where some people from nearby areas rely on fishing for their livelihood. The pipeline project poses a potential risk of water contamination, which could harm the aquatic ecosystem, disrupt marine biodiversity, and ultimately impact fishing activities. Ensuring strict environmental safeguards and pollution control measures will be crucial to minimizing these risks and protecting the livelihoods of local fishermen.

Impact Significance

The significance of this impact is evaluated to **Moderate**, which can be translated to positive beneficial impacts of the area.

Mitigation Measures

- Implement a traffic management plan to regulate the movement of construction vehicles and machinery.
- Schedule transportation of raw materials and heavy equipment during off-peak hours to minimize traffic congestion.

- Designate specific routes for construction vehicles to reduce disturbances in residential and high-traffic areas.
- Install appropriate road signage, speed limits, and warning signals to alert commuters and pedestrians.
- Deploy trained personnel for traffic control at critical junctions to ensure smooth vehicle movement and public safety.
- Conduct awareness programs for nearby residents on safety precautions related to pipeline construction.
- Implement strict safety protocols, including barricading construction areas and placing warning signs along the Right of Way (ROW).
- Establish emergency response plans and provide first aid facilities at construction sites.
- Regular monitoring of air and noise pollution levels in residential areas near the construction zone.
- Ensure compliance with occupational health and safety standards to protect both workers and the public.
- Adopt strict measures to prevent spills or leakages of hazardous substances into rivers and water bodies.
- Install silt traps and sedimentation barriers near river crossings to control soil erosion and prevent contamination.
- Conduct water quality monitoring before, during, and after construction to ensure no significant impact on aquatic life.
- Avoid construction activities near riverbanks during peak fishing seasons to minimize disruptions.
- Implement eco-friendly construction techniques to reduce the risk of river pollution and maintain biodiversity.
- Compensate affected individuals for any temporary disruptions to their livelihood due to construction activities.
- Promote local employment opportunities by prioritizing the hiring of skilled and unskilled workers from nearby villages.

Residual Impact Significance

- After the implementation of these mitigation measures, the residual impact significance is expected to be Positive low to moderately beneficial.

Table 5-9: Impact Significance for Ecology and Biodiversity

Impact	Impact on Socio-economic condition of the study area
Impact nature	Negative (with mitigation impact would be positive and beneficial)
Impact Type	Direct
Impact Duration	Short-term
Impact Extent	Local

Impact Scale		Construction activity may impact on public health in proximity of the project foot-print area. However, construction work may create jobs for local population/PAFs, which may convert the impact to beneficial.				
Impact Magnitude (Without Mitigation)		Negative-Low				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Socio-economic Impacts	Without Mitigation	Local	Short	Moderate	Moderate	Moderate
	With Mitigation	Local	Short	High	High	Moderate-beneficial

5.7 IMPACT DURING OPERATION STAGE

The impact during the operation phase will be continuous in nature. For a gas-based pipeline, the potential for imparting adverse impacts is not high. However, whatever impact on environment is present will be minimized through incorporation of efficient technologies for pollution control measures.

5.7.1 Air Environment

The pipeline will be 1.2 m below the ground and would be monitored via SCADA System. Some vehicular emissions during maintenance that will be short-term and temporary in nature. Therefore, there will be no impact on air environment due to operation of NG pipeline.

5.7.2 Noise Environment

The NG pipeline being underground in nature will not lead to noise pollution during its operation. However, noise could be generated during maintenance and repair works that will be temporary in nature.

5.7.3 Water Environment

Impacts

There will be no consumption of water during operation phase of the NG Pipeline. However, there are chances of water contamination due to unprecedented leakage of pipeline within the water bodies located in ROW of the pipeline.

Embedded/In-Built Controls

Nil

Impact Magnitude

The magnitude of potential impacts is also expected to be low during the operational phase. The pipeline's construction did not disturb any major water bodies.

Impact Significance

During the operation phase of the natural gas pipeline project, the impact on the water environment is expected to be minimal**.**

Mitigation Measures

- Leak Detection and Control System shall be in place.
- Mock Drills shall be conducted at regular intervals in line with Emergency Response and Disaster Management Plan.
- Edges of the spilled area will be undercut so as to provide a key lock for the repair material. A stiff mixture of cement, water and aggregate will be throttled into & through the reinforcement and built-up until the surface is level with coating around the repair. The pipe will then be carefully laid with the repaired area at the top and will be moist cured for twenty-four (24) hours before further handling.

Table 5-10: Impact Significance for Water Environment

Impact		Impact for Water Environment				
Impact nature		Operation of the pipeline involves minimal disturbance to water bodies.				
Impact Type		Temporary impacts, such as minor risks of water contamination due to accidental leakage or malfunction.				
Impact Duration		Long-term operational phase with minimal/Medium ongoing impact.				
Impact Extent		Local				
Impact Scale		Localized to the pipeline's specific route				
Impact Magnitude (Without Mitigation)		Low				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Socio-economic Impacts	Without Mitigation	Local	Long	Low	Moderate	Low
	With Mitigation	Local	Long	Low	Low	Insignificant

5.7.4 Environment, Health, and Safety

There could be impacts on environment, health, and safety due to leakage from pipelines from likely external physical forces (Earthquake, Floods & Cyclones). Natural Gas being inflammable in nature could lead to fire hazards. A significant portion of Route 1 passes through densely populated areas, encompassing human settlements, schools, temples, sacred sites, rivers, State Highway and other critical locations within their Right of Way (RoW). Additionally, Route 2 is entirely situated within the heavily populated Bhilai Nagar Municipal Corporation, where it intersects human settlements, schools, temples, sacred sites, and railway tracks. Ensuring the safety of workers during the construction phase, especially in highways and high-traffic areas along the pipeline route, requires the implementation of strict safety protocols and a comprehensive monitoring system. These precautions are essential to minimize risks related to natural gas leakage and to protect both workers and the surrounding community from potential hazards and accidents.

Embedded/In-Built Controls

- Project specific Health and Safety Management Plan will be put in place.

- Personal Protective Equipment (PPEs) including safety shoes, helmet, goggles, earmuffs, face shield, insulating (rubber) gloves with leather protectors, insulating sleeves, and flame-resistant (FR) clothing and face masks.
- Use of permit to work system
- Cranes and other lifting equipment are operated by trained and authorised persons.
- An up to date first aid box should be provided at all construction sites and a trained person should be appointed to manage it.

Impact Magnitude

As mentioned above, the O&M activities will be carried out by qualified team. With above embedded controls, the magnitude of impacts will be **Low**.

Impact Significance

As per the impact significant assessment matrix a combination of small impactmagnitude with medium receptor sensitivity results in impact significance as **Low.**

Mitigation Measures

- Leak Detection and Control System shall be in place.
- SCADA monitoring shall be carried out.
- Mock Drills shall be conducted at regular intervals in line with Emergency Response and Disaster Management Plan.
- Continuous metering will be done to provide a comparison between input and output for leak detection.
- Periodic audits of pipeline and its control measures will be conducted regularly.
- Demarcation of Hazard Zones and pipeline chainage will be done.
- Implement a well-defined traffic management plan to regulate vehicle movement near construction sites.
- Deploy traffic control personnel and place warning signs to alert drivers and pedestrians.
- Use barricades and reflective markers to separate the construction zone from moving traffic.
- Provide all workers with personal protective equipment (PPE), including high-visibility vests, helmets, gloves, and safety boots.
- Conduct regular safety training on working in high-traffic zones and emergency response procedures.
- Enforce strict adherence to safety guidelines, ensuring workers do not operate in hazardous zones without supervision.
- Ensure proper pipeline installation, welding inspections, and pressure testing before commissioning.

Residual Impact Significance

- Residual significance of impacts during operation phase will be **Low to Insignificant.**

Table 5-11: Impact Significance for Environment, Health, and Safety

Impact		Impact for Environmental Health and Safety				
Impact nature		Negative				
Impact Type		Direct				
Impact Duration		Long-term				
Impact Extent		Local				
Impact Scale		Operational activity may impact occasionally on health & Safety of operational work force				
Impact Magnitude (Without Mitigation)		Negative-Low				
Aspect	**Scenario**	**Spread**	**Duration**	**Intensity**	**Likelihood**	**Overall**
Socio-economic Impacts	Without Mitigation	Local	Long	Low	Moderate	Low
	With Mitigation	Local	Long	Low	Low	Insignificant

5.8 SUMMARY OF PRE & POST MITIGATION IMPACT SIGNIFICANCE

Table 5-12 below presents the summary outcome of the comprehensive assessment of identified impacts pre and post mitigation during various phases of the project. During impact assessment study, significant impacts have been considered, and mitigation plans have been developed in accordance to mitigate the impacts.

Table 5-12: Summary of Impacts

Category	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Planning Phase		
Impact due to Land Procurement	Moderate	Low
Construction Phase		
Topography and Drainage	Moderate	Low
Water resources and availability	Moderate	Low
Ambient air and noise quality	Moderate	Low
Ecology	Low	Insignificant
Socio-economic Impacts	Moderate	Low
Occupational Health and Safety	Moderate	Low
Operational Phase		
Water Environment	Low	Insignificant
Environment Health & Safety	Low	Insignificant

6 ANALYSIS OF ALTERNATIVES

Route selection is a process of identifying constraints, avoiding undesirable areas and maintaining the economic feasibility of the pipeline. Diversion of pipeline around obstacles can be very costly. The ideal route, of course, would be a straight line from the origin to the terminal point. However, physiographic, environmental, design and construction constraints usually alter the route

The pipeline route should be optimized based on the following considerations:

- Safety of public lives and property and safety of the pipeline from engineering and other considerations.
- Shortest pipeline length.
- Easy and favorable terrain condition free of large water bodies, low lying marshy lands, obstacles like ravines, depressions and unstable grounds, meandering rivers, etc.
- Ground profile for pipeline hydraulics and avoidance of steep rising and falling ground, hills and valleys having sloping right of way.
- Availability of infrastructure and access to the pipeline route during construction and maintenance.
- Environmental impact and avoidance of environmentally sensitive lands, such as reserved forests, marine parks, built-up areas, places of worship, burial and public events.
- Minimum crossing of existing pipelines, transmission lines, parallel alignment, etc.
- Minimum road, rail, river and canal crossings.
- Avoidance of rugged and intricate grounds with hard strata, exposed rocks, boulders and quarries.
- Existing and future developments in the region, such as roads, rail lines, canal network, reservoirs, townships, industrial units, etc.
- Scope for future expansion of the pipeline.
    - The Petroleum and Natural Gas Regulatory Board (PNGRB) was constituted under The Petroleum and Natural Gas Regulatory Board Act, 2006 (NO. 19 OF 2006) notified via Gazette Notification dated 31st March 2006. The Act provide for the establishment of Petroleum and Natural Gas Regulatory Board to protect the interests of consumers and entities engaged in specified activities relating to petroleum, petroleum products and natural gas and to promote competitive markets and for matters connected therewith or incidental thereto.
    - Further as enshrined in the act, the board has also been mandated to regulate the refining, processing, storage, transportation, distribution, marketing and sale of petroleum, petroleum products and natural gas excluding production of crude oil so as and to ensure uninterrupted and adequate supply of petroleum, petroleum products and natural gas in all parts of the country. Hence the project was acquired through the bidding process and the area, number of customers, total CNG stations were already mentioned in it. So, the route selection was done within the allotted area.

Since all the requirements in the projects were predefined, scope for alternate analysis was quite slim, as to which the route passes through mix and heavily populated area, forest areas, and mostly through the RoW of the road where the movement of heavy traffic is being observed and hence depending upon the technical and economic feasibility the proposed pipeline routes were selected.

7 ADDITIONAL STUDIES

7.1 QUANTITATIVE RISK ASSESSMENT

Quantitative Risk Assessment (QRA) study should be undertaken for the proposed 8" diameter underground pipeline for the transfer of natural gas. The aim of QRA study will be to identify potential hazards, assess the consequences and frequency of hazards and evaluate the risk to personnel, property and public. To assess the relative level of risk posed by the proposed project, a comparison will be made with risk criteria that is considered tolerable (ALARP) for similar operations.

The overall approach and methodology employed for the study will be based on the guidelines given in IS 15656: 2006, Indian Standard – Hazard Identification and Risk Analysis – Code of Practice, May 2006, using PHAST Software/Correlations.

The pipeline system will be provided with state-of-the-art safety systems like protection system, SCADA, leak detection system / pipeline application software, Fire and gas detection systems, etc. The proposed transfer of gas will be examined for inherent hazards or the potential to result in an unplanned event or sequence of events at different sections along the pipeline route. Several hazards that can cause failure of pipelines will be identified. This included loss of integrity/ damage due to interference from third parties, corrosion, accidents, human error, sabotage, etc., during normal operation. Analysis of past accidents are to be used to establish the credibility of accident scenarios.

7.2 GUIDELINES FOR EMERGENCY RESPONSE PLAN

Emergency response plan will be developed with the resources available within the company. The important stages of the response plan are declaration of an emergency, identification of resources & manpower, ending of an emergency and rehearsal of the plan. Declaration of an emergency would involve recognizing a leak and reporting to Station in charge of nearest compressor station.

Other features are summarized below:

Emergency Response Structure: An emergency response structure will be developed for effective response to the emergency. The structure defines the main functions of the decision makers and the individual roles as well.

Roles & Responsibilities of Team: Emergency response team (ERT) to respond to fire, accidents and technical emergencies will be constituted from operations personnel, who can be called upon 24 hours a day, supported by senior management field personnel as and when required. The ERT will receive specific training for their roles and exercised on a regular basis. The proposed functions of employees that are planned to be deployed will be finalized prior to commissioning.

Operations Control: The pipeline operation will be monitored and controlled through Local control system and POC in command which will have the provision for emergency shut down or isolation of

Pipeline. Security: Surveillance of the entire pipeline will be held periodically through ground patrolling. Using operators with knowledge of local area will be deployed for ground patrolling of the pipeline route.

Medical and First Aid: All arrangements will be made available at site offices and camps for medical and first aid. First–Aid facility will be provided at compressor stations, master pipeline operation center/ local control center, MLVs and M&Rs. Adequate first-aid training will be provided to employees at these locations.

Communication: Responsibility for external and internal communication will be assigned at each station. Dedicated fiber optic cable-based communication system will be provided for quick communication between the control stations, dispatch and delivery station(s) of the pipeline. The backup system will consist of appropriate combination of fixed telephone lines/data-bandwidth of the local service provider, mobile phones, VHF sets etc.

Emergency control room: A safe location will be designated as emergency control room (ECR) within the compressor stations.

Emergency Procedures: PP will evolve easy-to-follow procedures for responding to the identified situation. The plan will be rehearsed once in three months.

Ending of an emergency: After controlling an emergency, the site ERT Leader will declare as “All Clear”. The siren will be sounded for 2 minutes to indicate that the Emergency is over.

The basic elements for an effective plan have been included in the development. Prior to the commissioning of the project, copies of the plan are to be given to the authorities.

8 PROJECT BENEFITS

8.1 CONTRIBUTION TO NATIONAL ENERGY SECURITY

Energy is the key input for economic growth and Indian Energy sector play a vital role in country's Economy. Energy is a key input to the production processes that transform inputs to goods and services. India became the third largest energy consumer in the world after United States and China. Key drivers for increasing energy demand in India are population growth, industrialization, and urbanization. Energy security and sustainability are interdependent because emissions from energy consumption contributes to climate change in greater extend globally. Indian government is also committed to increase the share of natural gas in country's energy mix up to 15% by 2030 and Ministry of Petroleum and Natural Gas intervening with policy reforms in natural gas sector. India requires a sustained supply of energy to support its ambitious growth and welfare targets for the coming years. In a survey by NITI Aayog, it was noted that India's energy consumption will reach 2,300 million tons of oil equivalent by 2047 out of which natural gas will contribute 173 million tons of oil equivalent under the determined effect scenario.

According to the International Energy Agency (IEA), Indian gas market is considered one of the most growing energy markets in the world, the Agency expected that Indian gas demand will increase in the coming decades at 5.4% per annum over 2007-30 (IEA ,2009) reaching 132 BCM by 2030. With the growing need for oil and gas in India since the nineties of the last century, the Indian government has worked to develop the oil and gas sector through the development of mechanisms of action and the issuance of new regulatory laws, 1993, private investors have been allowed to import and market liquefied petroleum gas (LPG) and kerosene freely, private investment is also allowed in lubricants, which are not subject to price controls. In the 11th Five Year Plan, the Indian government has focused in particular on the energy sector in order to self-reliance for energy resources, particularly oil and gas by encouraging of exploration and extraction operations and reduce dependence on overseas.

8.2 REDUCED RISKS AND COSTS

Natural gas pipeline has been regarded as the most cost effective and safest channel of gas transportation and has extraordinary strategic significance for the country. Pipeline is regarded as the most cost effective and safest channel to transport the oil and gas from upstream oil field or port to the downstream users or refineries. The gas is significantly replaced by oil in all sectors i.e. power generation, domestic and transportation due to price hike in oil prices globally and cheaper availability of natural gas. The other reason for that may be the availability of cheaper, safe, and durable mode of gas transportation system (main and distribution network of pipeline), which is continuously expending.

The gas pipeline projects help in reducing the travel cost in comparison to other resources and it is also very safe and cheaper for domestic, commercial, and industrial uses. The proposed pipeline project would be very feasible and cost effective as it is totally underground and there will be continuous access to the gas for the use.

8.3 SOCIO-ECONOMIC DEVELOPMENT

The proposed project will create socio-economic development across the pipeline route and in the near vicinity as well. The project will provide employment during construction and operation phase to the local labours. Natural gas pipelines provide a reliable mode for transportation, reducing dependence on less stable energy supplies. Access to natural gas will decrease heating and electricity costs for residents and businesses. Usage of gas in domestic households and other commercial activities will reduce consumption of fossil fuels that would be lead reduction in pollution.

9 ENVIRONMENTAL, SOCIAL AND BIODIVERSITY MANAGEMENT & MONITORING PLAN

9.1 BACKGROUND

The Environmental, Social and Biodiversity Management Plan (ESMP) provides an essential link between predicted impacts and mitigation measures during implementation and operational activities. ESMP outlines the mitigation, monitoring and institutional measures to be taken during project implementation and operation to avoid or mitigate adverse environmental impacts, and the actions needed to implement these measures. The likely impacts on various components of environment due to the project during developmental activities have been identified and measures for their mitigation are suggested. The ESMP lists all the requirements to ensure effective mitigation of every potential biophysical and socio-economic impact identified in the ESIA. For each attribute, or operation, which could otherwise give rise to impact, the following information is presented:

- A comprehensive listing of the mitigation measures
- Parameters that will be monitored to ensure effective implementation of the action.
- Timing for implementation of the action to ensure that the objectives of mitigation are fully met.

The ESMP comprises a series of components covering direct mitigation and environmental monitoring, an outline waste management plan, and a project site restoration plan. Therefore, environmental management plan has been prepared for each of the above developmental activities.

9.2 ENVIRONMENT, HEALTH & SAFETY POLICY

AGTL believes that Environment, Health, Safety and Quality (EHS&Q) is integral part of their business. By embracing the best principles EHS&Q, the company sincerely attempts to have all overall positive impact on the environment and communities where they operate. **AGTL** is committed to continually improve their EHS&Q performance by including the points below: The EHS&Q Policy of **AGTL** emphasizes on the following objectives:

- Implement highest standards of Environment, Health, Safety & Quality in planning, construction, operations, and maintenance of projects throughout their lifecycle to provide a safe and conducive working environment to its employees.
- Identify, eliminate, or mitigate potential EHS&Q risks associated with our business by implementing a robust due diligence and monitoring mechanism.
- Evaluate and comply with applicable regulations related to EHS&Q.
- Provide adequate training & resources to its employees to achieve its EHS&Q targets.
- Voluntarily adopt to an integrated Management Systems, compliant with international standards ISO 14001, ISO 45001, and ISO 9001 for EHS&Q respectively.

This EHS&Q policy is applicable for **AGTL**'s all business and project related activities and its subsidiaries.

All employees and contractors of **AGTL** are required to adhere with this policy.

The HSE policy further ensures adherence of health and safety norms by hired contractor. The specific provisions to be followed includes the following:

- The contractor shall in its performance of the contract and carrying out of the work to ascertain and comply with all the relevant statutory laws and directives act as applicable.
- The contractor shall provide detail of EPF, ESIC, Labour License, medical fitness of workmen, valid photo id of workmen, undertaking letter mentioning workmen criminal record and other documents as applicable.
- All required safety item shall be supplied by contractor and any accident occurs during the contract period shall be to the contractor's account and **AGTL** will not be responsible for the minor/major accident/incident legally or financially.
- Workmen compensation policy must be obtained and kept in force.
- If contractor assigning the whole or partial work to third party should be intimated to **AGTL** in written with all required documents.
- Daily manpower and man-hour shall be reported by contractor.
- The contractor shall provide Attendance Register, Wages Register, EPF Remittance Challans, ESIC remittance challans every month or as on when required. This is also required for release of payment.
- The contractor shall make provisions for potable and domestic water for manpower, proper sanitary requirements with sufficient toilets and wastewater management for workmen which will be deployed for all ongoing work.
- Dedicated safety supervisor/officer should be available at site all the time during work execution.
- Mandatory PPE. (All PPE's Should be of IS standards)
    - ✓ Safety Helmet / Hard Hat.
    - ✓ Safety Shoes.
    - ✓ Safety Goggle.
    - ✓ Safety Jacket.
    - ✓ Safety Hand gloves.
- Job Specific PPE's

    a. Welding Work (Basic)

    - ✓ Safety Goggle / Welding Shield.

- ✓ Leather Hand Gloves.
- ✓ Leather apron.
- ✓ Full sleeves shirt
- ✓ Pant that covers the top of shoe.

b. Drilling Work (basic)

- ✓ Safety Goggle
- ✓ Nose mask.
- ✓ Hand Gloves.
- ✓ Ear Plug (as per requirement)

c. Electrical

- ✓ Insulating (rubber) gloves.
- ✓ Insulated tools.
- ✓ All electrical extension boards should have industrial plug to wherever required.
- ✓ All electrical extension boards should have 30mA ELCB MCB.

d. Civil Work

- ✓ Gum Boot with steel toe.
- ✓ Rubber Gloves.
- ✓ Nose mask.
- ✓ Safety Goggles.
- ✓ Ear plug if working in high noise area.

- Any other specific PPE required that will be intimated time to time.
- All required safety training will be provided by **AGTL** time to time.
- CONTRACTOR should adhere all the **AGTL** & end customer safety norm. Failing to adhere may result in suspension of work or penalty will be applicable.

9.3 ORGANIZATION STRUCTURE

The overall management and coordination of the project will be managed through Chief Executive Officer (AGTL) who will be supported by the Plant Manager and Head (EHS&S). The Head- EHS&S /ESG will overview, monitor and control the activities of Site Manger and Safety officer. The contractors will be controlled by the site manager during construction phase. The construction contractor shall have a Health, Safety and Environment supervisor in their team who shall work in coordination with the EHS officer.

The primary responsibility of management of EHS&S functions within **AGTL** lies with the head quality control and EHS&S Officer. For management of land related issues, the responsibility rests directly with the land procurement personnel and HR related issues is managed by dedicated HR team. CSR is managed by a separate team altogether and is responsible for overlooking all assets operated by **AGTL.**

9.3.1 Roles and Responsibilities

Head EHS

The Head EHS should be the designated EHS&S head at **AGTL**. The key Roles and Responsibilities are as follows:

- The overall responsibility for implementation and communication of the EHS&S and associated policies and meeting ESMS performance objectives for the organization with respect to project.
- Ensuring adherence of EHS&S Policy and procedures and Safety compliance by Contractors.
- Ensuring compliance of existing and future operations with respect to the applicable national laws, rules and regulations, permits pertaining to Environmental, Safety, Health and Social as well as international best practices including reference frameworks such as IFC Performance Standards.
- Communication of EHS&S related issues and concerns with the CEOs office and project heads as well as guiding them on Go and No-Go decisions for projects with serious EHS&S risks and issues.
- Decision on internal risk categorization and rating lies with the ESHS head.
- Approvals for commissioning of ESIA studies, Resettlement Action Plans etc.
- Responsible for recommendation and appointment of EHS&S personals.
- Responsible for taking up monitoring reports and audit reports with the CEO's office.
- Changes in this ESMS manual has to be sanctioned by the EHS&S head and formalized by the ESMS head.
- Responsible for decisions on higher level EHS&S non-compliance by external stakeholders such as contractors and vendors with respect to fines and associated penalties.

Corporate EHS&S Officer

EHS&S Manager at the corporate level will be responsible for the following:

- Overseeing successful EHS&S screening, audit and impact assessment of assets either internally or through external agencies as the case maybe.
- Overseeing the implementation of the systems, protocols and checklists of the ESMS at the corporate level and where necessary, transferring information and expertise at the site level.

- Interaction with other teams such as project team, land, procurement, HR etc. for handling and resolution of EHS&S issues and risks.
- Ensuring implementation of training and capacity building exercises at the corporate levels and project levels.
- Documentation and control of ESMS related documents.
- Development of processes with respect to EHS&S. Also includes internal updates of existing systems pertaining to EHS&S wherever feasibly and technically possible.

Functions of HR Department

The HR department is responsible only for the management of HR relations for internal employees within AGTL. Some of the primary roles and responsibilities undertaken by HR department are as follows:

- Responsible for implementation of the corporate HR Policy, manual and practices.
- Planning and recruitment of new employees as aligned with the business plan.
- Management of performance appraisal & review process.
- Implementation of desired employee engagement programs & practices.
- Management of any internal Human Resources Information System.
- Assessing and evaluation of competencies of existing employees.
- Carrying out of training programs and orientation of new employees.
- Liaise with law enforcement agencies whenever necessary.
- Manage harmonious industrial relations.
- Handling and management of employee grievances.

CSR Team

The CSR department established at the corporate level primarily has the following roles and responsibilities:

- Conducting need-based assessment studies (internal or external) for project relevant CSR programs and activities.
- Undertaking stakeholder identification, profiling, analysis, and influence impact matrix.
- Defining and developing strategies which underpin the company's CSR objectives in the aspects defined under the central CSR policy.
- Developing site specific CSR engagement plan.

- Liaison and maintaining good rapport with government, educational institutions & community-based organization & engaging them for CSR activities.
- Developing evaluation and monitoring indicators for implementation across locations & conducting review meetings at regular intervals.
- Establishing effective ways of measuring and articulating AGTL impact in social development through the various CSR programs.
- Disclosure of the impacts and other aspects of the project including emergency response plan for the community.
- Ensuring sharing of project benefits to the local community.
- Visit project sites on a regular basis, monitor program progress and resolve implementation obstacles to ensure the programs are being implemented in accordance with plans and agreements.

Legal Team

Broadly key functions of legal team at Corporate Office of AGTL are as follows:

- Managing compliance and statutory requirements and records applicable to AGTL businesses including necessary licenses and permits.
- Providing legal support to land, asset, contractual transactions.
- Ensuring legal compliance of contractors and vendors to established terms and conditions.
- Government sanction/approvals.
- Checking, proofing and validation of legal documentations.
- Addressing legal disputes and litigation.
- Maintenance of legal records.
- Review contractor/ supply chain engagement with compliance of all legal requirement related to EHS&S and HR provisions.

SITE LEVEL

Site Manager/ EHS&S Officer

The Project Manager/ EHS&S Officer are responsible for overall management of the project and ESMP implementation. The following tasks will fall within his/her responsibilities:

- Monitor site activities on a daily basis for compliance.
- Conduct internal audits of the construction site against the ESMP.
- Confine the construction site to the demarcated area.

- Reporting EHS&S related issues & incidents in respective area to Head-Solar Vertical.

Project Manager

- Responsible for the overall implementation of the EHS&S plan.
- Shall establish EHS&S organization for the effective implementation of this plan.
- Shall provide all resources to effectively implement the EHS&S plan.
- Shall initiate disciplinary actions for any violations of the EHS&S plan.
- Shall ensure project EHS&S plan is integrated with customer requirements and ensure its compliance.
- Communicate all kinds of events to customer and regulatory agencies as appropriate.
- Shall act as the highest authority in taking any decisions related to EHS&S violations.

EHS&S Officer

The EHS&S Officer will have the following responsibilities:

- Ensuring availability of resources and appropriate institutional arrangements for implementation of ESMP.
- Role may be combined with Project Security Manager's role.
- Ensuring this plan requirement are communicated to all sub-contractors and their contractors, employees, customers and visitors.
- Sub-Contractor shall take conduct periodic inspections to ensure compliance with the requirements of this plan.
- Provide support to implement the procedures of this plan for the respective project site.
- Ensuring that Identification Badges and Helmet Badges is not issued to his Employees, Visitors, Sub-Contractors and their contractors without undergoing the orientation training.
- Ensuring compliance with legislative, IFC's and other lender's requirements.
- Carrying out audits, and inspection of all the project activities at regular intervals and rectify non-compliances if any.
- Preparation of necessary documents and record keeping system.
- Reviewing and updating of ESMP for its effective implementation.
- Acting as a point of contact for residents and community members.
- The contractor should develop a code of conduct to guide the employees on how to behave with the community to avoid conflicts.

- Develop a Grievance Redressal Mechanism in lines with informing the local community about the Grievance Redressal Mechanism and ensuring effective implementation; and
- Conducting periodic meetings with local community for understanding their grievances and outcomes of the CSR activities; and
- Address training needs of contractors and other employees for social and community issues.

Sub-Contractors/ Labour Contractors

- The sub-contractor's / labour contractors working for AGTL is hereby responsible to comply with the guidelines of this plan.
- Sub-Contractor shall provide all resources to implement the requirements of this plan in their respective work area.
- Sub-Contractor is responsible to communicate the requirements of the plan to all their sub-contractors and their contractors, their employees and visitors.
- Sub-Contractor shall take disciplinary actions for any violations of this plan as required.
- Sub-Contractor shall not issue Identification Badges and Helmet Badges to his employees, his Sub-Contractors and their contractors without undergoing the orientation training on the plan.
- Sub-contractor shall ensure commitment and compliance for no child/forced labour involvement in the project.

Training and capacity building

Training is one common method of supplying individuals with additional skills and knowledge. In order to be successful in EHS&S management, training programs need to be thought out carefully and systematically. A robust social and environmental, health and safety training plan is important for effective implementation of ESMS.

The Corporate EHS&S head at AGTL along with recommendations from EHS&S officers will ensure that the job specific training and EHS&S induction training needs are identified based on the specific requirements of the ESMS and existing capacity of site and project personnel (including the Contractors and Sub-contractors) to undertake the required actions and monitoring activities. Some of the specific trainings that will be carried out on routine basis are as follows:

- ESMS Checklists and procedural guidance
- Occupational Health & Safety
- Fire Safety and Prevention
- Emergency Response Preparedness
- Operational Training

- HR Induction Training
- PPE Training
- Driver Safety
- Implementation of Environmental and Social Management/Action plans

The above listed trainings are the preliminary trainings which will be undertaken at the inception stage once the employee/worker joins the company and/or Project. Post that, monthly refresher trainings will be undertaken, especially for the workers. Other training will be identified and implemented during the project lifecycle as per the need assessment, as part of mitigation measure and also capacity building of the staffs.

An environmental and social management training program will be conducted to ensure effective implementation of the management and control measures during construction and operation of the project. The training program will ensure that all concerned members of the team understand the following aspects:

- Purpose of action plan for the project activities.
- Requirements of the specific Action Plans.
- Understanding of the sensitive environmental and social features within and surrounding the project areas.
- Aware of the potential risks from the project activities.

In case of contractors or turnkey contractors having sufficiently well-developed standards on EHS&S management, the training can be sub-let to the same for their respective employees and AGTL will monitor the completion and sufficiency status of these programs. In case of subcontractors, the training and capacity building will be done by the site level EHS&S's officers along with the contractor's EHS&S manager to ensure such trainings of the contracted staffs either directly or through trainers of **AGTL**. Subsequently the responsibility can be passed on to the sub-contractors for all future training programs.

It is further advised that **AGTL** shall consider engaging a third party EHS&S audit to monitor and evaluate the EHS compliance during the construction phase. The EHS&S officer shall be responsible for checking compliance of the contractor(s) with the requirements of this ESMP and any other relevant environmental legislation for all activities associated with the contract. The general duties of the EHS&S officer will be as follows:

- Third Party EHS&S Officer will be responsible for conducting of an EHS&S audit during the construction phase of the project according to the provisions of the Environmental Management Plan.
- Conduct independent environmental audits.
- Submit audit reports to the EHS&S Specialist/ Head EHS&S and if required, relevant authority.

9.4 CONTRACTORS MANAGEMENT PLAN

The overall responsibility of the project will be of **AGTL** It shall thus ensure that the ESMP is implemented by its contracts through contractual arrangements. **AGTL** has developed a Vendor's Code of Conduct which requires that all service providers and their directors, employees, agents, suppliers, and subcontractors (collectively Service Providers' representatives) always conduct themselves with integrity and in full compliance with this Code of Conduct and applicable laws, rules and regulations that govern their business activities. All **AGTL** service providers will be required to educate and, when appropriate, train their representatives to ensure they understand and comply with this Code of Conduct. The code of conduct principles of **AGTL** are as follows:

- Corruption & Prohibited Business Practices
- Health and Safety
- Environment
- Labor Standards
- Acting in Concert
- Mirroring of Contractual Requirements towards sub-suppliers
- Human Rights

The EHS norms in the code of conduct covers the following elements:

- The service provider shall secure that its workers are provided with a healthy and safe working environment in accordance with recognized standards. The Service Provider shall do its utmost to control hazards and take necessary precautionary measures against accidents and occupational diseases. The Service Provider shall ensure compliance with the provisions of Building and other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1976. Whenever necessary the workers are to be provided with, and instructed to use, appropriate personal protective equipment, and are adequately & regularly trained to ensure that they are adequately educated on health and safety issues.
- Compliance with labour laws and legislations i.e. the Contract Labour (Regulation and Abolition) Act, 1970, Employees State Insurance Company Act, 1948, Employees' Provident Funds and (Misc. Provisions) Act 1952, Payment of Bonus Act 1965, Payment of Gratuity Act, 1972, Equal Remuneration Act, 1976, Maternity Benefit Act, 1961, Labour Welfare Fund Laws, Minimum Wages Act, 1948, Payment of Wages Act, 1936, Shops and Establishment Act and Inter-State migrant workmen (Regulation of Employment) and (Conditions of service) Act, 1979.
- Non-engagement of child labour and bonded labour.
- Non-discrimination based on caste, creed, religion, or sex.

- Ensuring that women employees of Service Provider are given full protection from sexual harassment as per guidelines laid down by the Supreme Court of India.
- Ensuring adherence of EHS policies and procedures by Contract Agreement in order to secure that its own suppliers', sub-supplier's, business partners and other third parties directly or indirectly used by the Service Provider in the provisioning of services to accept and adhere to the EHS requirements.

General environmental awareness will be increased among the project's team to encourage the implementation of environmentally sound practices and compliance requirements of the project activities. The same level of awareness and commitment will be imparted to the contractors and sub-contractors prior to the commencement of the project through a EHS Management Plan prepared for Project and Contractors engaged for the project. It shall ensure compliance with meeting **AGTL**'s Environmental Performance Guidelines for New Projects and Developments, minimizing the safety hazards through good engineering design through the implementation of the Group Integrity Management Standard, and achieving a record of 'zero' Lost Workday Case (LWDC) injuries and incidents on the Project. Itcomprises of the following aspects:

- Project Management Plan Deliverables Register
- Project Contractor Requirements
- Project Risk Management Plan
- Project Training Matrices
- Project Reward & Recognition Program
- Project Safe Work Practices
- Project Document Management Procedure
- Project Records Management Procedure
- Project Communications Table
- Project Audit Program
- Project Emergency Response Plan

AGTL shall ensure that the job specific training and EHS Induction Training needs are identified based on the specific requirements of ESMP and existing capacity of site and project personnel (including the Contractors and Sub-contractors) to undertake the required actions and monitoring activities. Special emphasis will be placed on traffic management and operation of Cranes.

An environmental and social management training program will be conducted to ensure effective implementation of the management and control measures during construction and operation of the project. The training program will ensure that all concerned members of the team understand the following aspects:

- Purpose of action plan for the project activities.
- Requirements of the specific action plans.
- Understanding of the sensitive environmental and social features within and surrounding the project areas; and
- Aware of the potential risks from the project activities.

A basic occupational training program and specialty courses should be provided, as needed, to ensure that workers are oriented to the specific hazards of individual work assignments. Training shall be provided to management, supervisors, workers, and occasional visitors to areas of risks and hazards. Workers with rescue and first-aid duties shall receive dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their co-workers.

Through appropriate contract specifications and monitoring, the employer should ensure that service providers, as well as contracted and subcontracted labour, are trained adequately before assignments begin.

9.5 COMMUNITY/ STAKEHOLDERS ENGAGEMENT PLAN (SEP)

AGTL shall adhere to Stakeholder Engagement Plan (SEP) for engagement with community, government bodies during the lifecycle of the project and to assess the efficiency of the communication process in meeting the objectives of the SEP and ensuring the projects' 'social license to operate'.

Table 9-1: Stakeholder Group Categorization

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Community	Sub-contractors, local labours	Local community, agricultural labour, vulnerable communities
Institutional Stakeholders	Gram Panchayat, Project Investors	Village Institutions, (schools, health centers etc.)
Government Bodies	Regulatory Authorities, District Administrations	-
Other Groups	-	Media, other industries, projects

9.5.1 Aims and Objectives of SEP

The engagement plan is to guide all the stakeholders' engagement during construction phase and operations phase. The objectives of the SEP are:

- Enable management to develop effective stakeholder management strategies for various projects in order to build long term relationship so as to ensure smooth functioning of the projects.
- To define and standardize the process that the project will use to communicate with respective stakeholders.
- To ensure regular and timely sharing of information with project team to spruce up their understanding and skills of engaging with the stakeholders.

- Ensuring coordination in approach and message to be shared with the community regarding the company and the projects.
- To assess the efficiency of the communication process in meeting the objectives of the SEP and ensuring the projects' 'social license to operate.'

The community engagement process is informally managed by the QHSE Head and is limited to liaison with local authorities and the panchayat. To ensure the implementation of the ESMP and engage all the stakeholders identified, this process will need to be formalized through the social officer defined as above.

The two important elements of community engagement will be disclosure and consultation. This implies that as a first step, the findings of the ESIA, especially the ESMP will have to be disclosed to the community. The ESMP should be finalized through consultation with the community and an action plan shall be developed. Further, the community should be regularly updated about the implementation of the ESMP and all other relevant information pertaining to the construction phase, activities, health, and safety risks etc. The community shall also be made aware of the available job opportunities from time to time.

The project will engage with the affected people to understand the stakeholders on the common property resources (roads, grazing areas etc.) which would be impacted. It shall work closely with the Panchayat and local administration to identify and develop alternate areas for common resources (fodder,) if required.

To understand community expectations and manage any local concerns, **AGTL** will constitute a Grievance Redressal Mechanism to be managed by the Social Officer. This grievance mechanism will respond to the concerns and grievances of local communities, NGOs, Panchayats and any other aggrieved party or stakeholder. The project will share information about these mechanisms to the stakeholders through locally appropriate communication tools.

The Grievance Redressal Procedure will also outline the process and steps to be taken and the time limit within which the issue would need to be resolved to the satisfaction of the complainant. The project will endeavor to get all complaints recorded and addressed in a uniform and consistent manner. For disputes that cannot be internally resolved, the project will set up an independent mechanism with representation from community, Panchayats, and locally respected citizens of the area to sort these conflicts. If it has a legal implication the district administration will be approached.

9.6 ESMP REVIEW & AMENDMENT

ESMP is a social and environment management tool which shall be reviewed periodically (at least once in 2 years or earlier) to address changes in the project design, life cycle processes and activities, organization, and regulatory requirements.

9.6.1 Inspection, Monitoring & Audit

To implement the ESMP, the on-site team will develop a time-bound and action- oriented Environmental and Social Action Plan to implement the mitigation measures provided for each of the identified environmental and social impacts. This ESMP will have to be monitored on a regular basis, quarterly or half-yearly and all outcomes would need to be audited in accordance with existing EHS commitments.

The monitoring process will cover all stakeholders including contractors, labourers, suppliers, and the local community impacted by the project activities and associated facilities. Inspection and monitoring of the environmental and social impacts of construction and operation phase activities will increase the effectiveness of suggested mitigations. Through the process of inspection, audit, and monitoring, the company will ensure that all the contractors comply with the requirements of conditions for all applicable permits including suggested action plans. The inspections and audits will be done by **AGTL** 's trained team and external agencies/experts. The entire process of inspections and audits will be documented. The inspection and audit findings will be implemented by the contractors in their respective areas.

9.6.2 Reporting and Review

AGTL will develop and implement a program of reporting through all stages of the project viz., construction and commissioning, operation, and decommissioning. Contractors will be required to fully comply with the reporting requirements in terms of timely report submission with acceptable level of details. Reporting will be done in form of environmental, health, safety and social check list, incident record register, environmental, health, safety, and social performance reports (weekly, monthly, quarterly, half yearly, yearly etc.).

9.6.3 External Reporting and Communication

All complaints and enquiries are to be appropriately dealt with, and records be maintained in a Complaint/Enquiry Register by QHSE Head or other delegated staff.

9.6.4 Internal Reporting and Communication

Inspection and audit observations along with their improvement program are to be regularly reported to the senior management for their consideration. The same are also to be communicated within the staff working on the project. To maintain open communication between the staff and management on EHS&S issues the following shall be used:

- Team Briefings,
- On-site work group meetings.
- Key Incidents/accidents and lessons learnt.
- Work Specific Instructions; and
- Meeting with stakeholders.

9.7 DOCUMENT & RECORD KEEPING

Documentation and record keeping system must be established to ensure updating and recording of requirements specified in ESMP. Responsibilities must be assigned to relevant personnel for ensuring that the ESMP documentation system is maintained, and that document control is ensured through access by and distribution to identified personnel in form of the following:

- Documented Environment management system.
- Legal Register.
- Operation control procedures.
- Work instructions.
- Incident reports.
- Emergency preparedness and response procedures.
- Training records.
- Monitoring reports.
- Auditing reports; and
- Complaints register and issues attended/closed.

The following table provides a sample summary of engagements which are required in a typical project lifecycle. It indicates the methodology on how these stakeholder consultations are accomplished.

Table 9-2: Methods of Consultations and Engagement

Stakeholder	Stakeholder Category	Objective of Engagement	Stakeholder Influence	Methods of Consultation and Engagement	Frequency of Consultations and Engagement
Sub-contractors/ Labours/Employees	Primary Stakeholder	To appraise about labour working condition and EHS compliance	Medium	Periodic Meetings (for the purpose of information dissemination, including information regarding labour laws, safety measures and discussions of grievances) as per the working duration, Information dissemination regarding welfare provisions for Labourers Information dissemination regarding welfare provisions for Labourers, employment opportunities, grievances, EHS and CSR activities though notice board and display of key messages on billboard.	Meetings and periodic reporting in the operation phase

Stakeholder	Stakeholder Category	Objective of Engagement	Stakeholder Influence	Methods of Consultation and Engagement	Frequency of Consultations and Engagement
Gram Panchayats And Village institutions	Primary Stakeholder	For necessary information disclosure of SEP. As Part of GRM Ensured involvement in CSR activities and local procurement if required	High	Consultations, meetings (FGD and individual interview) and Discussions; Sharing of documents, if required, as part of the disclosure mechanism; Meetings as a part of the Grievance Redressal mechanism, if required; Attendance at Panchayat meetings and participation in CSR activities and agreements with communities documented in minutes of meetings	• As and when required; and • As per the regulatory requirements
Regulatory Authorities	Primary Stakeholder		High	Meetings and Discussions	• As per the regulatory requirements • As and when required
District Administration (Tehsildar, SDO, Patwari)	Primary Stakeholder	Regular engagement Participation in CSR Activities	High	Regular meetings and participation in CSR events	• Regular Meetings; or • Monthly or as & when required
Landowner	Primary Stakeholder	Discussion on land purchase modalities.	Very Low	Discussion during various festivals and other relevant occasions.	• As and when required.
Community	Primary Stakeholder	Managing and ensuring participation in CSR activities. As part of GRM.	Low	• Open Meetings, • Interactions with community at Gram Panchayat, • Discussion on CSR programs	• As and when required

9.8 GRIVANCE REDRESSAL MECHANISM (GRM)

AGTL has a well-defined Grievance Redressal Mechanism (GRM) procedure. This GRM serves as one of the components of **AGTL** 's Environmental and Social Management for managing overall performance of its projects as well as providing more accountability to its stakeholders. The GRM which caters to both internal and external grievances is based on four (4) guiding principles of the company which include:

- Transparency

- Fairness
- Respect
- Accountability

9.8.1 Internal Grievances

Employee Grievance: These include the employees hired specifically for the site.

9.8.2 External Grievances

Contractor and labour related grievances (directly /indirectly controlled by **AGTL**). Community grievances including those on land and resettlement issues, project activities, CSR intervention, employee/worker-community conflicts, and other project related issues (Directly/Indirectly controlled by **AGTL**).

This grievance mechanism shall respond to the concerns and grievances of local communities, NGOs, Panchayats and any other aggrieved party or stakeholder. The project shall share information about these mechanisms to the stakeholders through locally appropriate communication tools.

In case, the contractors have their own GRM, **AGTL** should ensure that it is functioning effectively and even review the grievance records. However, if the contractors lack GRM in the first place, **AGTL** should ensure that the workers are linked to their GRM process.

The project shall endeavor to get all complaints recorded and addressed in a uniform and consistent manner. For disputes that cannot be internally resolved, the project shall set up an independent mechanism with representation from community, panchayats, and locally respected citizens of the area to sort these conflicts. If it has a legal implication the district administration shall be approached.

AGTL has developed procedures for handling grievances, reviewing, and investigating grievances, grievance closure, monitoring, and review procedures.

A grievance body, leaded by designated Grievance officer is proposed for effective implementation of GRM and coordinating day to day functions. The grievance body would be reporting back to the appropriate authority including functional areas such as HR, Project, O&M, BD/Land, CSR, EHS etc. as per requirement. The mandate of this cell would be managed as part of the ESG forum. **AGTL** should ensure appropriate budget allocation in coordination with **AGTL** to deal with grievance tracking and handling with consent of appropriate authority. Awareness shall be provided in the company's policy and practices for both employee and appropriate stakeholder grievance mechanisms, relevant to their exposure and responsibilities

9.9 CORPORATE SOCIAL RESPONSIBILITY (CSR) POLICY

AGTL will focus on the following areas for CSR projects from amongst the activities specified under Schedule VII of the Companies Act, 2013 and the Rules made thereunder including but not limited to Education, Empowerment, Environment and Health:

- Promoting gender equality & empowering women

- Employment enhancing vocational skills and livelihood enhancement programs
- Rural Infrastructure Development Projects

CSR committee may recommend to the Board of Directors additional CSR initiatives, based on specific merit, provided that these projects fall under the scope of schedule VII of the Companies Act, 2013, as may be amended from time to time.

As part of its devising and planning for CSR activities and programs, prior to the commencement of projects, AGTL carry out impact assessment studies or need based assessment studies within the proposed project footprint area in order to understand the basic needs, problems and requirements where interventions/intervention activities can be implemented in.

The study encompasses various parameters such as-health indicators, access to infrastructure, vulnerability, literacy levels, workforce participation, employment opportunities, sustainable livelihood options, and demographic profile including population data –below the poverty line and above the poverty line, state of infrastructure. From the data generated, project specific CSR plans are developed for implementation. CSR programs and activities can also be reactive in nature where the need and requirement for the same may arise even outside the purview of the impact assessment or the need-based assessment or may be entirely disassociated from any project implementation. Proper budgeting and scheduling are carried out for the programs.

AGTL will seek to identify suitable projects/programs for implementation in line with the CSR policy of the Company.

By and large, it may be endeavored to execute most of the CSR programs/ activities forming part of defined scope in and around the areas adjoining projects.

The medium of implementation of CSR programs would be directly by the CSR department or company's own foundation or collaboration/ tie-ups with Trust/ Society/ Section 8 Company/ NGOs as per the decision taken by the CSR committee.

Monitoring And Reporting

The CSR department will be responsible for regular monitoring & reporting of the CSR programs and provide regular progress report to the CSR Committee of the Board. This report would indicate:

- Achievement of the year-to-date in terms of coverage compared to the target, reason for variance, plans to overcome shortfalls if any and support required from the CSR Committee/Board to overcome the shortfalls.
- Actual year-to-date spends compared to the budget and reasons for variance.
- In respect of activities undertaken through outside Trust/Society/NGO's/Government recognized funds, etc. there will be mechanism of reporting of progress on each such activities and the amount incurred thereon at the subsequent CSR Committee Meeting.
- The Board shall seek a progress report from the CSR Committee at least twice in a year.

9.10 LABOUR MANAGEMENT PLAN

The construction of the project has not yet started, and locals have been proposed to be hired for the project during construction phase. However, in case of hiring migrant labour, **AGTL** needs to adhere to implementation of *Labour Camp Management Plan Guidelines* as provided under "*Worker's Accommodation Processes and Standards: A Guidance Note by IFC and EBRD*[3]" and ensure that the worker's accommodation should be at clean, safe place and, at the minimum, should meet the basic requirements of workers. In particular, the provision of accommodation should meet national legislations and international good practices in relation, but not restricted, to the following:

- Practice for charging for accommodation.
- Provision of minimum amounts of space for each worker.
- Provision of sanitary, laundry and cooking facilities and potable water.
- Location of accommodation in relation to the workplace.
- Any health, fire safety or other hazards or disturbances and local facilities.
- Provision of first aid and medical facilities; and heating and ventilation.
- Workers' freedom of movement to and from the employer-provided accommodation should not be unduly restricted.

9.10.1 Drinking Water Resources and Monitoring Water Quality

- Access to adequate & convenient supply of free potable water should be always available to workers.
- Depending on climate, weather conditions and accommodation standards, 80 to 180 liters per person per day are available.
- Drinking water should meet national/local or WHO drinking water standards.
- All tanks used for the storage of drinking water should be constructed and covered as to prevent water stored therein from becoming polluted or contaminated.
- Drinking water quality should be regularly monitored.

9.10.2 Wastewater and Solid Waste

- Arrangements for discharge of wastewater, sewage, and disposal of food, kitchen waste and any other waste materials should be made without causing any impact on biophysical environment or surrounding communities.
- Specific containers for rubbish collection should be provided and emptied on a regular basis.

[3] https://www.ifc.org/wps/wcm/connect/60593977-91c6-4140-84d3-737d0e203475/workers_accomodation.pdf?MOD=AJPERES&CACHEID=ROOTWORKSPACE-60593977-91c6-4140-84d3-737d0e203475-jqetNIh

- Adequate number of rubbish containers to providing leak proof, non-absorbent, rust and corrosion-resistant containers protected from insects and rodents needs to be provided.
- The garbage/rubbish containers should be 30 meters from each shelter on a wooden, metal, or concrete stand. Such containers must be emptied at regular intervals (to be determined based on temperatures and volumes generated) to avoid unpleasant odors associated with decaying organic materials.
- Pest extermination, vector control and disinfection should be carried out throughout the living facilities in compliance with local requirements and/or good practice. Where warranted, pest and vector monitoring should be performed on a regular basis.

9.10.3 Labour Camp Room/ Dormitory Facilities

- Rooms/dormitories should be kept in good condition.
- Rooms/dormitories should be aired and cleaned at regular intervals.
- Rooms/dormitories are built with easily cleanable flooring material.
- Sanitary facilities should be located within the same buildings and provided separately for men and women. Usual standards range from 10 to 12.5 cubic meters (volume) or 4 to 5.5 square meters (surface).
- A minimum ceiling height of 2.10 meters is provided.
- In collective rooms, which are minimized, in order to provide workers with some privacy, only a reasonable number of workers are allowed to share the same room. Standards range from 2 to 8 workers.
- All doors and windows should be lockable and provided with mosquito screens where conditions warrant.
- There should be mobile partitions or curtains to ensure privacy.
- Every resident should be provided with adequate furniture such as a table, a chair, a mirror, and a bedside light.
- Separate sleeping areas should be provided for men and women, except in family accommodation.

9.10.4 Bed Arrangements and Storage Facilities

- A separate bed for each worker should be provided. The practice of “hot bedding” should be avoided.
- There should be a minimum space between beds of 1 meter.

- Double deck bunks are not advisable for fire safety and hygiene reasons, and their use is minimized. Where they are used, there must be enough clear space between the lower and upper bunk of the bed. Standards range from to 0.7 to 1.10 meters.
- Each worker should be provided with a comfortable mattress, pillow, cover, and clean bedding.
- Bed linen should be washed frequently and applied with repellents and disinfectantswhere conditions warrant (malaria).
- Facilities for the storage of personal belongings for workers should be provided.
- Separate storage for work boots and other personal protection equipment needs to be provided.

9.10.5 Sanitary and Toilet Facilities

- Sanitary and toilet facilities should be constructed of materials that are easily cleanable.
- Sanitary and toilet facilities should be cleaned frequently and kept in working condition.
- Sanitary and toilet facilities should be designed to provide workers with adequate privacy, including ceiling to floor partitions and lockable doors.
- Sanitary and toilet facilities should not be shared between men and women, except in family accommodation.
- An adequate number of toilets should be provided to workers. Standards range from 1 unit to 15 persons to 1 unit per 6 persons. For urinals, usual standards are 1 unit to 15 persons.
- Toilet facilities should be conveniently located and easily accessible. Standards range from 30 to 60 meters from rooms/dormitories. Toilet rooms shall be located so as to be accessible without any individual passing through any sleeping room. In addition, all toilet rooms should be well-lit, have good ventilation or external windows, have sufficient hand wash basins, and be conveniently located.

9.10.6 Showers/Bathrooms and Other Sanitary Facilities

- Shower/bathroom flooring should be made of anti-slip hard washable materials.
- An adequate number of handwash facilities should be provided to workers. Standards range from 1 unit to each 15 persons to 1 unit per 6 workers. Handwash facilities should consist of a tap and a basin, soap, and hygienic means of drying hands.
- An adequate number of shower/bathroom facilities need to be provided to workers. Standards range from 1 unit to 15 persons to 1 unit per 6 persons.
- Showers/bathrooms should be conveniently located.

- Shower/bathroom facilities should be provided with an adequate supply of cold and hot running water.

9.10.7 Cooking Facilities

- Places for food preparation should permit good food hygiene practices, including protection against contamination between and during food preparation.
- Kitchens should be provided with facilities to maintain adequate personal hygiene including sufficient washbasins designated for cleaning hands with clean, running water and materials for hygienic drying.
- Wall surfaces adjacent to cooking areas should be made of fire-resistant materials. Food preparation tables are also equipped with a smooth durable washable surface. Further, to enable easy cleaning, it is good practice that stoves are not sealed against a wall, benches and fixtures are not built into the floor, and all cupboards and other fixtures and all walls and ceilings have a smooth durable washable surface.
- All kitchen floors, ceiling and wall surfaces adjacent to, or above food preparation and cooking areas are built using durable, non-absorbent, easily cleanable, non-toxic materials.
- Wall surfaces adjacent to cooking areas should be made of fire-resistant materials. Food preparation tables are equipped with a smooth, durable, easily cleanable, non-corrosive surface made of non-toxic materials. Further, to enable easy cleaning, it is good practice that stoves are not sealed against a wall, benches and fixtures are not built into the floor, and all cupboards and other fixtures have a smooth, durable, and washable surface.
- Adequate facilities for cleaning, disinfecting and storage of cooking utensils and equipment should be provided.
- Food waste and other refuse are to be adequately deposited in sealable containers and removed from the kitchen frequently to avoid accumulation.

9.10.8 Medical Facilities

- A number of first aid kits adequate to the number of residents should be available.
- First aid kits should be adequately stocked.
- An adequate number of staff/workers (1 first aider for every 50 persons) should be trained to provide first aid.
- Where possible and depending on the medical infrastructures existing in the community, other medical facilities should be provided (nurse rooms, dental care, minor surgery).

9.10.9 Leisure, and Social Facilities

- Basic collective social/rest spaces should be provided to workers. Standards range from providing workers multipurpose halls to providing designated areas for radio, TV, cinema.
- Recreational facilities should be provided for the workers.

9.10.10 Security of Workers' Accommodation

- A security plan including clear measures to protect workers against theft and attack should be implemented.
- Security staff should be checked to ensure that they have not been implicated in any previous crimes or abuses. Where appropriate, security staff from both genders should be recruited.
- Security staff should have a clear mandate and have received clear instruction abouttheir duties and responsibilities, in particular their duties not to harass, intimidate, discipline, or discriminate against workers.
- Security staff should have received adequate training in dealing with domestic violence and the use of force.
- Security staff should have a good understanding about the importance of respecting workers' rights and the rights of the communities.
- Workers and the locals residing in nearby areas in villages should have specific means to raise concerns about security arrangement and staff.
- **AGTL** should also adhere to Standard Operating Procedure for Work Resumption after Lockdown prepared by **AGTL** and ensure compliance with respect to following measures:
- Maintaining Social Distancing in Labour Accommodation (2 meter)
- Soap solutions / hand sanitizers to be placed in all quarters / washroom's places wherever required and replenished periodically.
- Ensuring that all doors / windows/fittings are sanitized frequently.
- Special attention to be given for the washrooms / toilets by periodical cleaning, Swabbing, disinfecting, and maintaining dry.
- Emergency Facilities to be available for 24 X 7 and displayed emergency key contacts.
- Soap solutions / hand sanitizers to be placed in all quarters / washroom's places wherever required and replenished periodically.
- To ensure that all the workers who are coming for work are healthy and not having any symptoms of COVID-19 (Fever, Dry cough, breathing problem).

- Arrangements to be made to supply all essential items like rice, wheat, groceries, water, etc. to colony itself so as to restrict movements of Labourers.
- Appropriate masks to be distributed to all Labourers.
- All labour engaged at site shall be advised to wear mask always while at colony, movement outside and during duty timings.
- Always ensuring availability of the following

    1. Sanitizer
    2. Face mask
    3. Hand gloves
    4. Hand Wash
    5. Dettol
    6. Soap
    7. Thermometer
    8. BP checking machine
    9. First Aid Box

- Tie up with nearest Hospital/COVID-19 Rescue Team shall be made for getting medically examination of all people for any Covid-19 symptoms.
- Quarantine hall or room shall be established in labour colony for the said purpose.
- Contractor shall display precautions measures - dos and don'ts at colony premises in all languages spoken by the workers.
- Vehicle shall be kept ready or tip up for vehicle shall be made for emergencypurpose.
- Minimum social distancing shall be ensured in keeping occupants in a single room.
- Disinfecting spray done at all the areas of colony after workers are left for work daily.
- A team comprising **AGTL** Admin, **AGTL** HSE and Contractor site in charge shall visit labour colony daily to ensure availability of essential things and regarding no off occupants, cleanliness, sanitization status, etc. and submit a report to Construction Manager and Project Manager.
- Feedback in written form or through personal interaction regarding labour colony requirements shall be obtained from contract labours on weekly basis.

9.11 WASTE MANAGEMENT PLAN

The proposed project should handle all incoming waste materials, all waste generated on site and both the disposal, and potential recycling of such materials. The exact quantities need to be detailed once agreed packaging and quantities of incoming material is identified. The project waste is primarily related to civil works, and packaging of incoming materials. The following principles are put in place to reduce the amount of waste generated:

- Packaging will be optimized to reduce non-recyclable content.
- Orders of cables and other consumables will be kept to a minimum.
- The amount of earth works is kept to a minimum, including optimized road works to reduce required import of material to site.

Registered vendors are appointed by **ATGL** for collection of waste generated from their natural gas pipeline projects.

9.12 DISASTER MANAGEMENT PLAN

The district of Durg is prone to natural and man-made disasters. The study area falls in Low Damage Risk Zone II (MSK VI or less) in accordance with the Earthquake Hazard map of India, Vulnerability Atlas of, 3rd edition, 2019 prepared by BMTPC. Durg Taluka has no recorded history of flooding, and the entire district falls within a low-damage risk zone. However, since the pipeline route crosses two rivers—Shivnath River (TP278- TP279) and Sonbarsa River (TP39-TP40) on Route 1. thus, special care needs to be taken during period construction work.

During the construction of the site the site will at times consist of loose and/or un-compacted soil and removed or destroyed vegetative cover. During this phase temporary drainage system will have to be installed. This will consist of landforms, both trenches, and deep pits to collect and dissipate water. The temporary drainage will either be converted into permanent drainage with masonry (where co-located) or closed off after completion of the planned system.

9.13 TRAFFIC MANAGEMENT PLAN

9.13.1 Introduction

The Traffic Management Plan (TMP) is designed to ensure the safe and efficient movement of vehicle and pedestrian traffic through and around construction zones. It also aims to safeguard workers and minimize disruptions to the public. This plan outlines the procedures, safety measures, and control devices to be implemented during road construction activities.

This TMP has been developed based on the preliminary site survey conducted during the Environmental and Social Impact Assessment (ESIA) phase. As such, it reflects the anticipated traffic conditions and construction impacts identified at that stage. However, recognizing that actual site conditions may vary during implementation, the TMP will be reviewed and updated by the contractor during the construction phase to ensure it remains responsive to real-time requirements and evolving site-specific challenges.

9.13.2 Objectives

The primary objectives of the TMP are:

- To ensure the safety of road users and construction workers.

- To maintain efficient traffic flow during construction.
- To provide clear and timely information to road users.
- To minimize environmental and social impacts due to traffic disruptions.

9.13.3 Key Principles

- **Warning Sign**: Inform road users well in advance of any changes or hazards.
- **Safe Guidance**: Provide clearly marked and safe lanes for traffic.
- **Work Zone Protection**: Establish buffer zones and barriers to protect workers.
- **Driver Behavior Control**: Use signage and devices to influence safe driving behavior.

9.13.4 Planning Considerations

Traffic control plans will be tailored to specific site conditions, considering:

- **Traffic Volume**: Peak and non-peak hour densities.
- **Lane Requirements**: Width and number of lanes needed for construction.
- **Junction Complexity**: Number and type of intersections.
- **Pedestrian Infrastructure**: Availability and condition of footpaths.
- **Speed Limits**: Regulatory and advisory limits in the area.
- **Lane Geometry**: Changes in lane width or alignment.

9.13.5 Construction Zone Layout

Construction Zone is an integral part of any road construction system. The safety practices in construction will, therefore, be oriented towards reducing conditions, which lead to such hazards and consequent stress whereby the risk of accident increases.

Safety measures will be aimed at avoiding hazardous conditions, especially in work sub-zones where major construction activities are going on.

The construction zone is divided into four sub-zones:

i. Advance Warning Sub-zone

- **Purpose:** Alert drivers to upcoming construction. The warning system should educate the driver well in advance by providing information regarding distance, extent and type of hazard ahead so that he can gradually reduce the speed of his vehicle.
- **Features:** Warning signs placed ~60m before the work zone.
- **Devices:** Retro-reflective signage, flashing beacons.

ii. Transition Sub-zone

- **Purpose**: Guide traffic into the diversion path. This is the most crucial sub-zone from safety point of view since most of the movements are turning movements.
- **Features:** Begins ~30m before the work zone.
- **Devices:** Barricades, channelizers, directional signs.

iii. Work Sub-zone

- **Purpose:** Area of active construction, and therefore the safety of the Project workers / pedestrians / members of the road are the major concern at site from the plying traffic.
- **Features:** The path of the traffic must be clearly delineated to prevent vehicle intrusion.
- **Devices:** Cones, barriers, safety signage, flagmen.

iv. Terminal Sub-zone

- **Purpose:** Indicate the end of the construction zone.
- **Features:** "End of Work Zone" signage.
- **Devices:** Informational signs, speed normalization signs.

Other Aspects: Following sections are from guidelines for Safety Construction, Indian Road Congress, IRC: SP: 55: 2001.

The pictorial representation of the sub-zones is depicted in **Figure 9-1** and the recommended length of traffic control zones are shown in the **Table 9-3**.

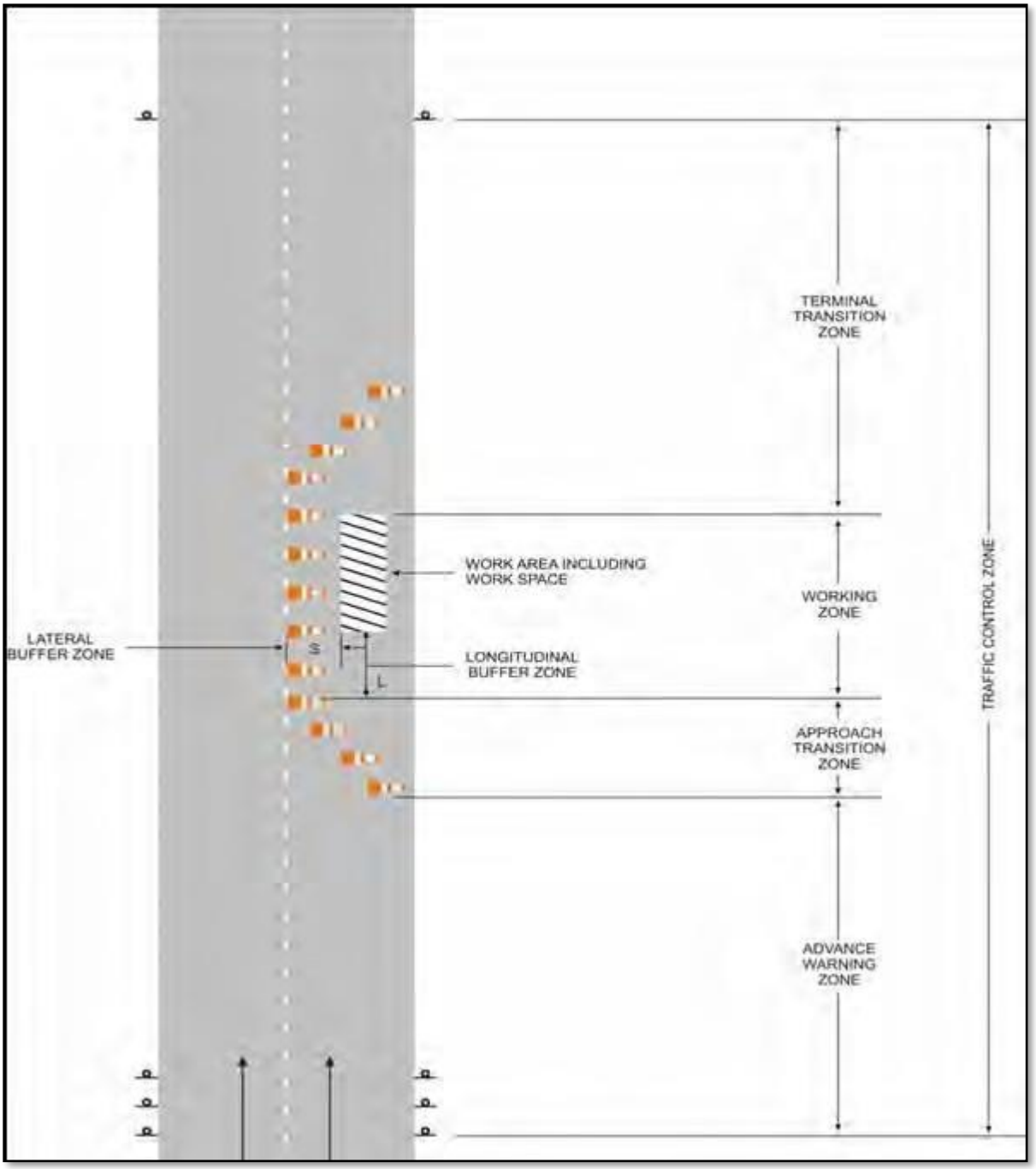


Figure 9-1: Recommended length for Construction Zones as per IRC: SP:55-2001

Table 9-3: Recommended Lengths of Traffic Control Zones

Average Approach Speed (Km/h)	Length of advance warning Zone (M)	Length Approach Transition Zone(M)	Length of working Zone(M)
50 or less	100	50	Varies
51-80	100-300	50-100	
81-100	300-500	100-200	
Over 100	1000	200-300	

9.13.6 Traffic Control Devices

Traffic control devices are essential components of a safe and effective traffic management system within construction zones. These devices serve the critical functions of warning, informing, guiding, and protecting both road users and construction personnel. Their proper deployment ensures smooth vehicular movement, minimizes confusion, and significantly reduces the risk of accidents.

This section is prepared in accordance with the Indian Roads Congress (IRC) Guidelines for Safety in Construction Zones (IRC: SP: 55-2001) and other relevant standards.

9.13.6.1 Purpose and Function

Traffic control devices are strategically installed across all sub-zones of the construction area to:

- Alert drivers to upcoming changes in road conditions.
- Provide clear guidance on lane usage and diversions.
- Protect workers and pedestrians from vehicular intrusion.
- Ensure safe passage for vehicles through or around the work zone.

These devices must be:

- Easily understandable and unambiguous.
- Clearly visible during both day and night.
- Stable under adverse weather conditions.
- Easy to install, maintain, and remove.

As per Specification 112.4, the use of barricades, signs, markings, flags, lights, and flagmen is mandatory for the safety and information of traffic approaching or passing through construction or maintenance zones.

9.13.6.2 Types of Traffic Control Devices

1. Regulatory Signs

These signs impose legal restrictions and must be installed in consultation with local traffic authorities. Common regulatory signs used in construction zones include:

- Do Not Enter
- Road Closed
- Give Way to Pedestrians
- Speed Limit

2. Warning Signs

Warning signs alert drivers to potential hazards ahead. Typical examples include:

- Lane Closed
- Diversion to Other Carriageway
- Divided Carriageway Starts/Ends
- Two-Way Traffic

These signs may be supplemented with rectangular definition plates placed 0.15 m below the warning triangle for added clarity.

3. Directional (Guide) Signs

Guide signs provide navigational information and differ in appearance from standard informatory signs. As per IRC: 67-1977, construction zone guide signs should have: Black text and arrows on a Traffic Yellow (IS: 5-1978) background.

Common examples include:

- Diversion
- Road Ahead Closed
- Sharp Deviation of Route

4. Delineators and Channelizing Devices

Delineators help guide traffic safely through the construction zone. As per IRC: 79-1981, these include:

Traffic Cones: Typically, 0.5–0.75 m high and 0.3–0.4 m in diameter, made of plastic or rubber with red and white retro-reflective bands. Cones should be anchored securely and spaced 3–9 m apart, depending on speed and visibility requirements.

Traffic Cylinders and Tapes: Used for lane separation and guidance.

Drums: Metal or plastic drums (0.8–1 m high, 0.3 m diameter) painted with alternating black and white circumferential stripes. Metal drums offer high visibility and psychological deterrence, while plastic drums are lightweight and easier to handle.

5. Barricades

In urban construction zones, barricades are used to restrict unauthorized access and protect traffic from hazards such as excavated areas. These are typically constructed using MS frames and reinforced with horizontal bamboo or wooden posts to maintain continuity. Openings are provided only at designated access points such as shop entrances or residential driveways.

6. Flagmen

Flagmen play a vital role in ensuring on-site safety. Their responsibilities include:

- Controlling vehicle speed and movement near active work areas.
- Providing visual signals to drivers.
- Assisting in the safe movement of construction equipment such as cranes and excavators.

Flagmen must be properly trained, clearly visible to drivers, and equipped with appropriate signalling tools.

7. Vehicle Parking

A designated parking area will be developed to accommodate all work-related vehicles. This area will be:

- Firm and leveled to prevent vehicle instability.
- Free from obstructions to allow safe maneuvering.
- Clearly marked and labeled for easy identification.
- Located away from pedestrian pathways to avoid conflicts.
- Equipped with safety protocols requiring all raised parts of equipment (e.g., booms, backhoe buckets) to be fully lowered to the ground when parked.

Safe Parking Protocols

To ensure safety during vehicle parking, the following measures will be strictly enforced:

- The vehicle engine must be turned off.
- Keys must be removed from the ignition.
- Hand brakes must be applied.
- Wheel chocks must be used when parking on slopes.

8. Material Transportation

All construction materials will be transported to the site using suitable trucks or other appropriate vehicles. The following precautions will be taken:

- Materials will be securely fastened to prevent shifting or falling during transit.

- Wooden blocks or padding will be used between the load and vehicle body to ensure stability and minimize damage.
- Unloading and storage of materials will be done in a manner that does not obstruct traffic or cause congestion.

9. Speed Control

To maintain safety within the construction site:

- The maximum vehicle speed limit will be restricted to 20 km/h, except for emergency vehicles during critical situations.
- Speed limit signs will be prominently displayed at strategic locations across the site.
- In areas with high pedestrian activity, reduced speed limits will be enforced and clearly indicated.

Speed Limit Violations

Violations of the prescribed speed limits will be treated with strict disciplinary action, including:

- Temporary suspension of the vehicle operator.
- Permanent removal from the site in cases of repeated or severe violations.

10. Personnel Safety

To ensure the safety of all personnel working near or on the roadway:

- All workers will always wear high-visibility reflective jackets.
- Additional personal protective equipment (PPE) such as helmets, safety shoes, and protective goggles will be mandatory based on the nature of the task.
- Site engineers and supervisors will be responsible for monitoring compliance and enforcing the use of PPE.

11. Signage and Visual Aids

The following standard traffic signs will be used throughout the construction site to guide and inform both workers and road users:

- Regulatory Signs: Stop, Entry Prohibited, Parking Prohibited, Speed Limit, Heavy Vehicle Prohibition.
- Warning Signs: Go Slow, Men at Work, Pedestrian Prohibited.
- Informational Signs: Parking Area, Pedestrian Only, Diversion.

All signs will be:

- Retro-reflective for night visibility.
- Mounted at appropriate heights and locations.

- Maintained regularly to ensure legibility and effectiveness.

For Sensitive Receptors no honking board should be provided with the minimal construction activity during the day time.

		
Stop Sign	**Entry Prohibited**	**Parking Prohibited**
		
Pedestrian Prohibited	**Speed Limit**	**Heavy Vehicle Prohibition**
		
Go Slow	**Parking Area**	**Pedestrian Only**
		
Diversion	**Diversion**	**Men at Work**

Figure 9-2: Traffic Regulatory Signs

9.13.7 Traffic Diversion Planning

During the construction phase, traffic diversions will be implemented based on actual site conditions to ensure minimal disruption and maximum safety for road users and workers. The diversion routes will be designed in accordance with the Indian Roads Congress (IRC) guidelines and will be finalized in coordination with local traffic authorities.

A detailed Traffic Diversion Plan will be prepared for each affected road segment, considering factors such as pipe diameter, road width, junction complexity, and availability of alternative routes. The plan will be updated dynamically as construction progresses as depicted in the **Table 9-4.**

In addition, visual diagrams (the

Figure 9-3**, Figure 9-4** and **Figure 9-5)** will be provided to illustrate :

- Traffic management during survey activities.
- Traffic control during active work zone operations.
- Diversion plans during full or partial road closures.

Table 9-4: Proposed Details of Traffic Diversion Plan

S. No.	Road/Location	Dia of Pipe	Chainage	Total Length	Road Blockage	Alternative Route	Available Road Width	Type of Road
1.								
2.								
3.								
4.								
5.								
6.								

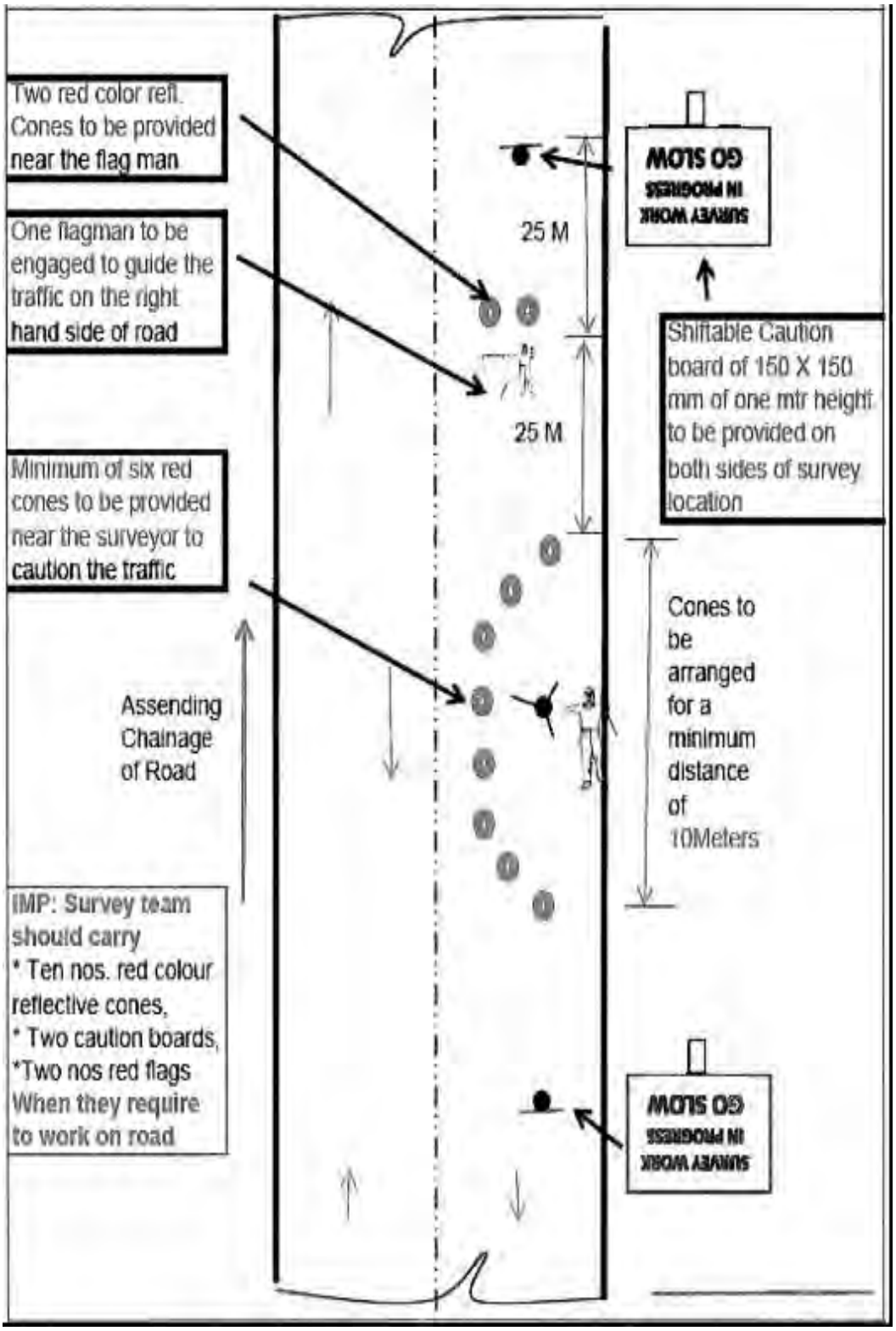


Figure 9-3: Traffic Management Plan for doing Survey

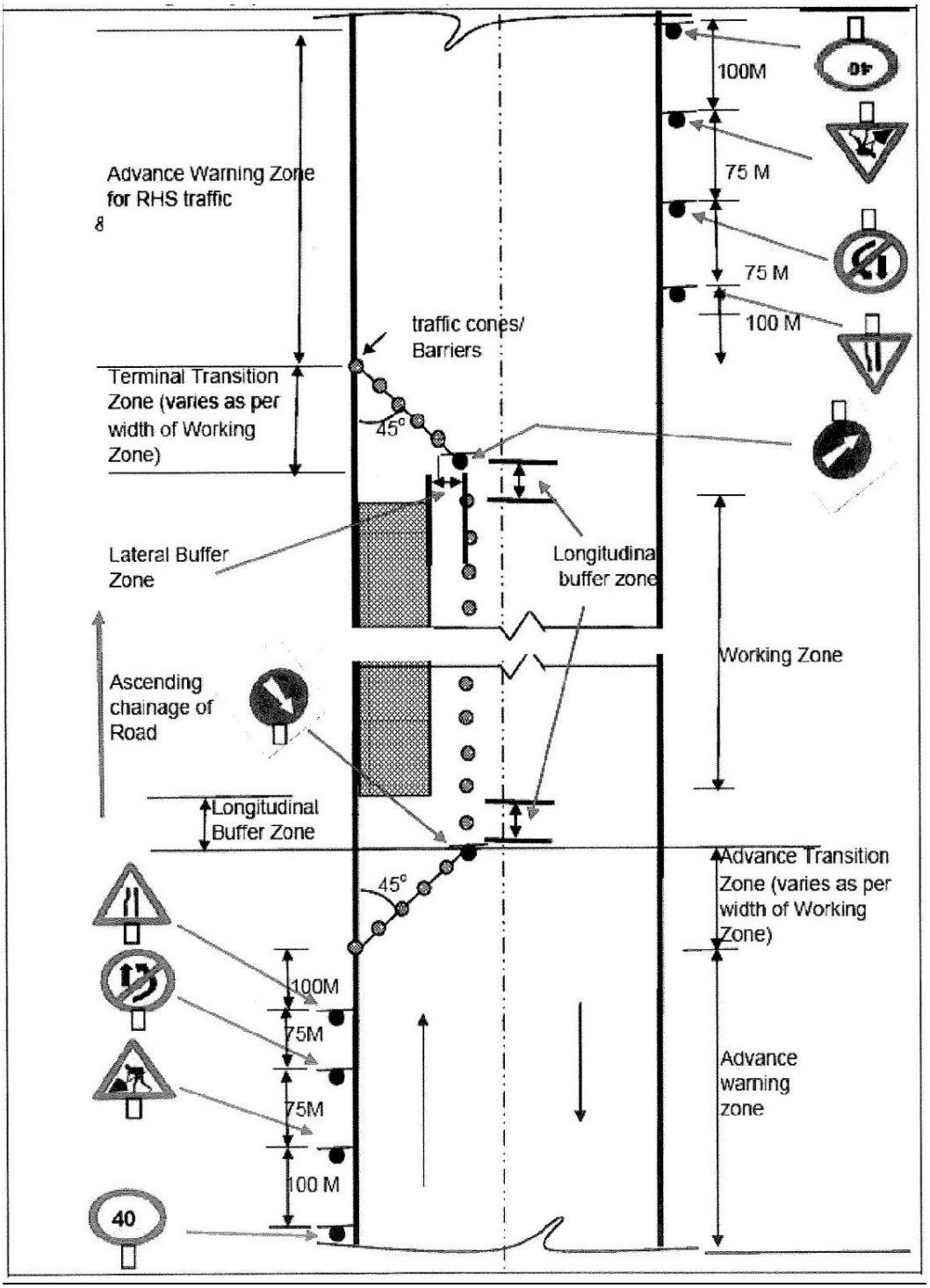


Figure 9-4: Traffic Management Plan for Working Zone

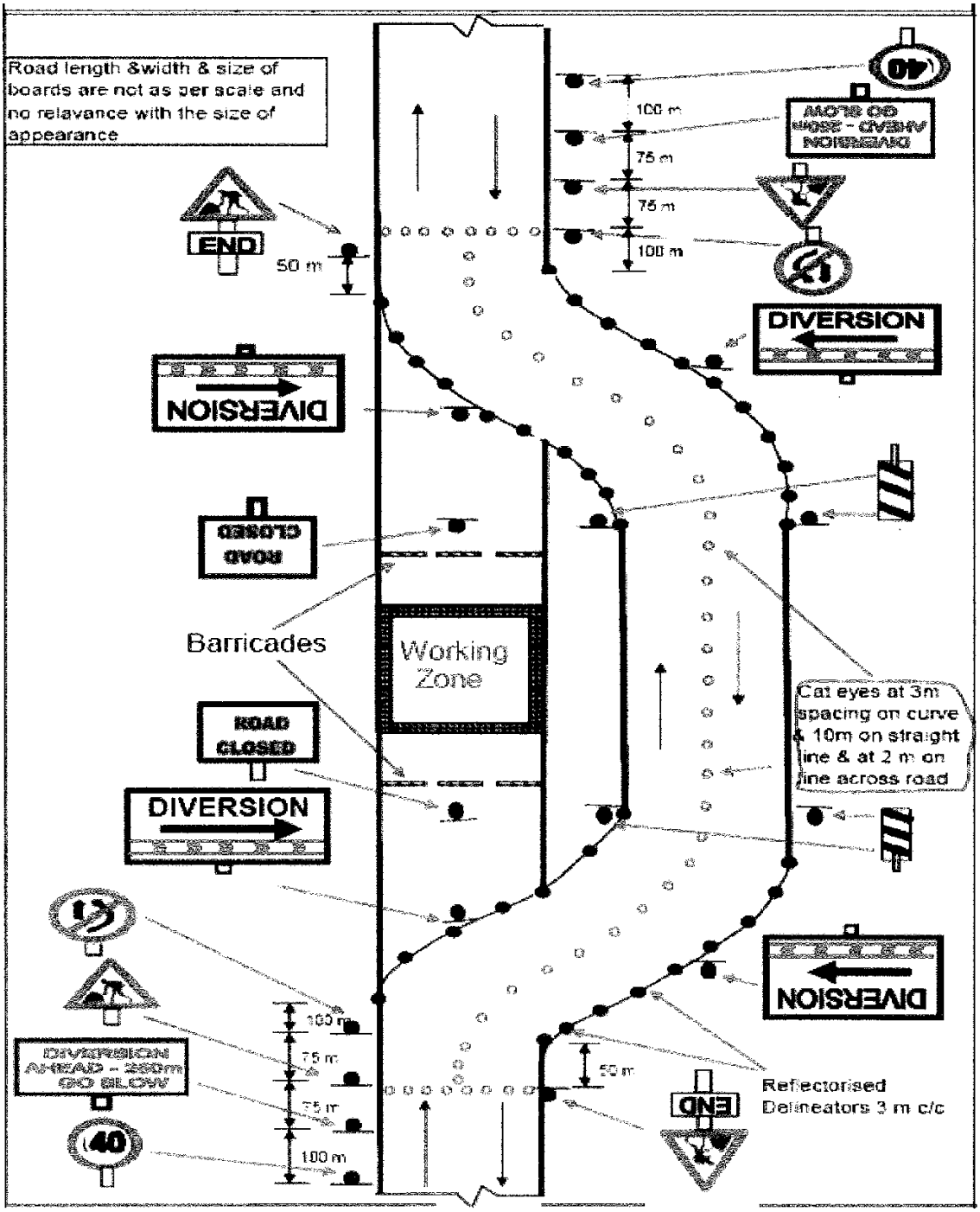


Figure 9-5: Traffic Management Plan for Diverting the Traffic

9.13.8 *Traffic Management Practices*

The implementation of traffic management during construction will be guided by the following operational principles:

- **Optimal Use of Existing Lanes**: Existing carriageways will be utilized to the maximum extent possible to minimize the need for diversions.
- **Intersection Management**: At major intersections, turning movements will be maintained wherever feasible to reduce congestion.
- **Lane Bifurcation**: In constrained areas, two-way traffic may be temporarily accommodated on a single carriageway with appropriate signage and barriers.
- **Speed Control**: Vehicle speeds through construction zones will be reduced using speed breakers, warning signs, and visual cues.
- **Standardized Signage**: All advance warning and information signs will comply with IRC standards for visibility, placement, and content.
- **Equipment Placement**: Construction materials, machinery, and equipment will be stored away from berms and pedestrian paths, within the available road land.
- **Safe Machinery Parking**: All parked machinery will be clearly marked with red flags and red lights. Only the minimum quantity of material required for immediate operations will be stored at the work site.
- **Wildlife Safety**: In areas with dense vegetation, precautions will be taken to prevent snake encounters. This includes clearing bushes, applying carbolic acid, and mandating the use of gumboots.
- **Heat Stress Prevention**: During summer months, workers will be provided with adequate rest intervals to prevent heat-related illnesses such as sunstroke.

9.14 PROPOSED ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

An Environment and Social Management Plan has been developed following the delineation of impacts and mitigation measures. These measures will be adopted by the project proponent and imposed as conditions of contract of the sub-contractor employed for respective phases of the power project. The mitigation measures suggested during operation will be made part of the regular maintenance and monitoring schedule.

The ESMP includes the following:

- Investigations suggested for adverse environmental and social impacts and associated risks.
- Institutional arrangement - management tools and techniques for the implementation of environmental impacts and risk mitigations.
- Monitoring and reporting of requirements and mechanisms for the effective implementation of the suggested mitigations.

- Monitoring arrangements for effective implementation of suggested mitigations for the proposed project; and
- Reporting requirement to the regulatory agencies and funding institutes

Table 9-5: Environment and Social Management Plan

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
Planning Phase				
• Land Acquisition	• Land procured for the project is prominently in RoW of government land. Permission must be obtained from the respective government or private authorities wherever the pipeline route crosses their jurisdiction.	• As per land acquisition policy	• AGTL	• Pre-Construction
Construction Phase				
Soil Characteristics				
• Erosion and compaction	• Loose soil to be protected from wind and runoff by covering / watering / other means of covering. • Existing roads to be used for transport of material to extent possible. • All construction materials should be kept within the project footprint area. • Re-fueling of machinery at site should be undertaken over paved surface. • In case of any accidental spill, soil should be cut and stored securely for disposal with waste.	• Project representative to make observations on storage and handling of construction material. • Drivers should be instructed about use of dedicated tracks within the site workers to be trained on handling and storage of waste by contractor. • Workers handling activity to be briefed about the need to prevent contamination. • Inspection/Monitoring to conduct construction activities within the site boundary only. • Soil monitoring for physical properties to be at least once during construction phase.	• EPC contractor/Site supervisor/ Project Director to make observations and convey it to the contractors. • EHS Personnel/ Project Director should monitor implementation of ESMP.	Throughout project cycle
Waste Disposal				
• Accumulation of	• Construction debris should be utilised for levelling of land and	• AGTL representative should brief specific	• Contractors will be abided	• Should be incorporated

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
construction waste • Unhygienic conditions for labours. • Hazardous waste from machinery, generators etc. • Soil and land contamination due to accidental leakage. • Run off into rainwater channels.	unused debris shall be disposed-off to C&D Disposal Site. • Proper sanitation and sewage facility in terms of septic tank with soak pit should be provided. • Nearby municipality should also be contacted for regular disposal of the labour camp waste. • Other wastes like packaging material, metal, jute, etc. to be sold to scrap dealers/ buyers. • Random stocking of raw material, storage of debris, piling of loose soil etc. should be strictly controlled. • Portable toilets/ suitable arrangements with septic tank-soak pit arrangement should be provided for workers.	needs as per country's requirement for further execution, as and when required. • Workers should be instructed to maintain neat, clean & hygiene at facilities. • Contractors should be briefed about need for proper storage and disposal of construction waste.	with Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2023. • Site Engineer to make observations and convey it to the contractors. • Monthly report of EHS Officer to include the compliance and observations if any.	as part of project budget, no additional cost is envisaged. • During Construction Phase
Water Resource and Quality				
• Run off into rainwater channels and drains passing through the site and ultimately into nearby surface water body. • Wastage of water and sewage discharge from labour camp	• Water for construction and consumption to be arranged by suitable local contractors through authorized tanker water suppliers. • Arrangement for storm water management in construction area should be made to avoid sediment run off. • Storm water flow during monsoon should be directed to existing drains. • Natural flow and topography of the drains as flowing inside the project boundary should be maintained. • Septic tank with soak pits should be provided at site to facilitate the sewage generated from labour area.	• Daily consumption of water should be recorded. • Storm water arrangements should be monitored. • Performance parameters are EC, TSS, TDS, Oil & Grease, Total Coliforms, BOD, etc. • Workers should be instructed about optimal use of water	• Conditions should be the part of contract with the EPC contractor. • Project Director or EHS personnel should make observations and convey it to the contractors. Report of Project Director/ Site EHS Officer should be sent to EHS head.	Construction Phase
Ecology				

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
• Clearance of vegetation	• Tree cutting or shrub clearance should be limited to those patches directly affecting solar panel exposure. • Workforce should be instructed to avoid any other activity likely to affect the local flora & fauna. • Movement of construction & transport vehicles should follow dedicated paths to avoid any injury/mortality to the wildlife.	• Visual damage loss inspection should be undertaken by Site Engineer • Construction contractor should instruct and inform workers to refrain from activities that may adversely affect the ecology in near vicinity of the project.	Project Director/EPC Contractor	Construction Phase
Traffic and Transport				
• Break-down and Improper halt of vehicles. • Discomfort due to air and noise pollution due to raw materials transportation. • Damage to road and related structure from heavy vehicles.	• Vehicle movement and parking within the project premises should be managed properly to avoid accidents. • Routes for use by construction traffic should be planned to minimize impact on adjoining activities. • Dedicated path within the site for exclusive entry and exit of construction vehicles should be provided. • Only PUC certified vehicle should be deployed. • Construction material should be transported in covered trucks. • Transportation should be undertaken along pre-identified paths only. • High noise generating activities should be restricted to daytime with proper mitigation measures.	• Necessary training to the driver of construction vehicles for speed restrictions. • Drivers should be assessed for their knowledge on traffic rules before engagement. • During the construction phase, number of vehicles as well as any incidents and accidents need to be reported, and their outcomes should be monitored.	• Project Director/ site EHS person should provide the training. • Should be mentioned in the contract with the construction contractor.	• Regular maintenance of vehicle and upkeep of roads should be included in O&M budget. • For all construction related activities during construction and operation phases.
Air Quality				
• Fugitive dust • Emissions from diesel engines/ vehicles	• Regular water sprinkling while undertaking dust generation activities. • Construction activities should be avoided during high wind speed time. • Construction material should be covered to prevent any fugitive dust from these areas.	• Awareness should be developed among the site workers for fugitive dust management. • Air Quality monitoring specifically for particulate matter in nearby settlement	• Project Director should regularly coordinate and supervise work. • Monitoring agency should take out the	Water sprinkling will be done throughout construction phase.

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
	• Regular maintenance of construction machineries. • Deployment of only PUC certified vehicles. • Flyable Construction material should be transported in covered trucks only. • Vehicle speed should be restricted to 30km/hour at site to minimize potential for dust emission in the surroundings.	areas once during construction for compliance to NAAQ Standards.	monitoring work. • Should be incorporated in the contract with contractor	
Noise and Vibration				
• Disturbance to habitations • Occupational Hazard	• Only well-maintained equipment should be operated on site. • DG sets should only be used for emergency power/ backup. • Scheduling of the construction activities should be done. • Loud, sudden noise emissions to be avoided wherever possible.	• Arrangements/facilities for noise reduction should be monitored as and when required. • Personal protective devices for site workers working near high noise equipment. • Schedule of activities should be discussed and finalized between site manager and the contractor. • Noise monitoring in nearby settlement areas once during construction period to ensure compliance with Noise Rules	• Project Director should take care of the compliance of ESMP. • External training on use of PPE should be the responsibility of EPC Contractor	Throughout construction phase
Cultural				
Cultural differences amongst workers	To the extent possible sourcing of construction labour should be done from local region by contractor for unskilled activities.	Workers should be briefed about need for cooperation and harmony with the community.	EPC Contractor	Normal Practice
Health and Safety				
• Operation of heavy machinery • Accidents leading to injuries fatalities.	• Operation of loading–unloading equipment should be undertaken under the guidance / supervision of trained professional. • Sufficiently competent person should be engaged in driving or operating construction machineries.	• Proper training of the workers regarding health and safety procedures. • Workers should be trained through sub-contractors regarding use of Personal protection	• Project Director should ensure compliance of safety guidelines. • Safety Officer of contractor should be	Training of workers shall mostly be given by internal resources during Construction phase

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
• Occupational health hazards	• Should ensure personal protective equipment for all personnel present at site are made available during Construction period. • Arrangement for fire control measures • Display of Emergency phone numbers at site.	equipment and its importance. • Operation of Cranes shall normally be limited for transmission line as per requirement. Crane (If required) should be operated as per contractor's Crane Safety Plan only.	responsible for implementation of safety guidelines. • To form part of the contractor's contract	
Social				
Expectations for infrastructure development benefits	• Project officials should communicate and discuss with the community in a transparent manner on a regular basis and demonstrate their concerns. • Consultation with women 's groups should also be held during construction and operation phases to listen to their issues and concerns regarding labour, health, and safety etc. as well as to solicit their ideas on various community initiatives.	• Project officials should hold regular consultations with appropriate stakeholders. • All concerns must be addressed through systematic process.	Project Director	Normal Practice
Local Employment	• Assess the exact number of workers should be required at each stage through contractor/ own resource in the construction period. • Should ensure priority is given to local people for short term/long term employment opportunities, based on required skill and education level.	• Explore possibilities of training and capacity building to enable the community to be able to secure the available jobs and contracts, as per the applicability and requirement of the business.	EPC contractor in discussion with project director should assess potential for engagement of local community and for women.	Normal Practice
Demands for materials	Should ensure local contracting and vendor opportunities aligned with the scope and demand as far as possible.	-	Project proponent/Contractor	Normal Practice

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
Livelihood of roadside vendor might be impacted during to construction period at daytime.	• Construction time should be selected in such a manner that minimum livelihood loss occurs due to construction and other project related activities. • Compensation paid to roadside vendor if inconvenience caused due to construction of pipeline project.	Fair Compensation Policy	Land Team	Normal Practice
• Excess load on existing resources	• Local labour should be preferred for unskilled work. • Awareness camp for communicable disease understanding. • Medical camp as part of CSR activities	Awareness training for applicable regulatory regulations.	Project Director through EPC Contractor	During Construction Phase
Operation Phase				
Waste Generation				
Construction waste	• Should earmark designated areas for storage of waste separately. • Waste should be given to approved recyclers.	Training and briefing of the staff involved in waste management.	Project Director	Normal Process
Ecological Impact				
Impacts on existing flora and fauna	• A monitoring of bird and bat species within the project study area should be undertaken that may help understand the presence of threatened species inside the project area and their movement. This will further help in assessing the site-specific impacts and updating the mitigation measures. • Any dead animals/carcass shall be removed in time from the site so that it does not attract movement of raptors. • General awareness regarding wildlife shall be enhanced through trainings, posters, etc. among the staff and labourers.	Training and briefing of the staff involved for record keeping for any electrocution or carcass incident.	Plant EHS or Safety Officer	On regular basis
Water Resources				
surface water body located across	• Natural slope of the site shall be maintained laying of pipeline structures require very less topographical correction.	• Regular check on water use quantity	Plant EHS or Safety Officer	-

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
pipeline route.	• Used oil and Waste should be stored in separate designated areas to avoid any contamination due to run-off. • Avoidance of water wastage to the maximum extent • Proper storm water facility	• Awareness campaign for effective use of water		
Soil Quality Degradation				
Soil quality might be impacted due to construction work	• Topsoil Preservation: Strip and store topsoil separately before excavation to facilitate land restoration after construction. • Soil Stabilization: Use geotextiles, mulch, or temporary vegetation cover to prevent soil erosion. • Controlled Excavation: Minimize the area of disturbance by restricting excavation to designated work zones.	Regular record management of waste materials.	Plant EHS or Safety Officer	-
Health and Safety				
• Accidents leading to Injury / fatality. • Fire Risk	• Schedule high-risk work (such as excavation and pipe laying) during non-peak traffic hours to minimize risks. • install warning signs, barricades, and reflective cones well in advance of the worksite. • Fire extinguisher in accident prone areas. • High-visibility safety jackets, hard hats, safety boots, gloves, Protective Eye Wear.	• Health and safety awareness training on regular interval • Safety incidents should be recorded and monitored with an aim that numbers are never significant, and gradually reduce.	Plant EHS or Safety Officer	-
Social Aspects				
• Local Economy • Upgradation of infrastructure	• Should boost the local economy though local contracting to the extent possible. • Infrastructure upgradation as part of CSR	-	CSR Team	Continuous improvement
Decommissioning Phase				
• Impacts due to disposal	• Segregate waste into recyclable (metal scraps,	-	Plant EHS or Safety Officer	-

Impact Identified	Suggested Mitigation	Monitoring/ Training	Management Responsibility	Timeline
of material after construction work., • Contamination of soil,	plastic, wood) and non-recyclable (hazardous, non-biodegradable) materials. • Reuse excavated soil for backfilling and land restoration. • Recycle metal pipes, concrete debris, and plastic materials wherever possible.			

9.14.1 On-Site Emergency Management Plan

The probability of inevitable residual risk, arising out of operations, capable of causing emergencies cannot be ruled out no matter how well a process is being controlled or safeguarded by instruments and process safety procedures. Such emergencies could be the result of malfunction, ignorance, non-observance of operating instructions or be the consequence of acts outside the control of people.

Hence the needs to prepare an **ON-SITE EMERGENCY PLAN (OSEP)** for dealing with accidents and natural calamities which may still occur and are likely to affect health, safety, life, property, and environment both at site and in the immediate neighborhood. An OSEP mitigates the effects of a major accident/emergency when these effects are contained within the boundary of the site.

This plan is guideline for employees, workers, contractors, sub-contractors, visitors etc., informing about prompt rescue operations, medical treatment, coordination, and communication among various internal & external members. The plan should be pro-active to avoid any confusion/panic and should direct to handle the emergency with clear instructions.

Purpose

AGTL has prepared an Emergency Management Plan for implementation at the project site in the event of an emergency so that the loss of life and damage to the properties and natural resources are minimized.

Objective

The overall objective of a good emergency preparedness plan is for what to do and what not during an emergency. The following aspects shall be included in emergency preparedness plan: -

- To assess what dangers could arise to people on and offsite as a result of these foreseeable emergencies and what the effects could it pose on the environment.
- To contain and control incidents.
- To assess the risk involved, and to mitigate the same by pre-planned remedial and rescue measures using, when necessary, the combined resources of the organization concerned and the public emergency services.

- To safeguard residents, employees and any one nearby who might be affected and to minimize the damage to property or the environment.
- The training of the individual personnel with duties under the plans will be familiarizing on site personnel with their roles, their equipment, and the details of the plans.
- The onsite emergency plan should be based on the specific needs of each particular site for dealing with those emergencies which it is for seen may arise.
- For an emergency plan to be successful, it should be tested, when first devised and thereafter to be rehearsed at suitable intervals.

9.14.2 Environmental Monitoring Plan

Environmental monitoring is an effective tool in making necessary recommendations and adopt suitable control strategies so that the menace of rising environmental pollution could be minimized, and a relief be extended to the people including labours in case of any damage caused under occupational health hazards. Monitoring is necessary for the following reasons:

- To verify the results of the impact assessment study.
- To assess what impacts have occurred.
- To evaluate the performance of mitigation measures proposed in the ESMP.
- To ensure that the conditions of necessary consent and approvals are adhered.
- To suggest improvements in management plan, if required.
- To ensure that any additional parameters, other than those identified in the impact, do not become critical after the commissioning of proposed project.
- Considering the short duration of construction phase (around 3-5 months), environmental monitoring can be considered on yearly basis during operation phase only. However, other mitigation measures suggested for construction phase shall be maintained for env. protection.

10 SUMMARY AND CONCLUSION

10.1 SUMMARY OF IMPACTS

Among the pipeline lifecycle stages of construction and operations, due to temporary nature of the pipeline laying/construction, most impacts are likely to be short term and reversible in nature. The impacts that shall be most significant and of primary concern are summarized in the subsequent sections.

10.2 IMPACT DUE TO PIPELINE ROUTE SELECTION

The proposed pipeline route has been so selected such that there are:

- Shortest length of the pipeline between source and destination points
- Avoidance of sensitive areas such as national parks, sanctuaries, and wildlife corridors
- No impact to reserve forests and other sensitive areas as there is no reserve forest or any other sensitive area comes in the pipeline route.
- Minimum number of water crossings.
- Minimum impact to the environment.
- Easy access to the route during construction, operation, and maintenance of the pipeline.

10.3 IMPACTS DUE TO CONSTRUCTION OF PIPELINE

- The land identified for the proposed pipeline project is located mostly within Durg District. The Durg GA is divided into two pipeline route networks. The first proposed pipeline runs from GAIL SV-32 U/C to Vardhaman Highway in Durg District, covering a length of 17.826 km. The second proposed pipeline extends 2.35 km from the planned SV-31 to the BPCL Petrol Pump (Gill Goods Carrier), originating from Supela in Bhilai Nagar, Durg District, Chhattisgarh. Permission for laying of NG pipeline within the Durg GA taken from Petroleum & Natural Gas regulatory Board, Irrigation Department and Public Work Department respectively. Therefore, there will be no impact on land procurement due to proposed pipeline project.
- Earth work excavation, transport of construction materials, handling, laying and jointing of pipelines - These activities would cause a general increase in levels of dust and suspended particulate matter in the ambient air. However, this increase in concentration would be of temporary nature and localized.
- Movement of vehicles for transportation of construction material could lead to PM and other air emissions. However, the impact shall be short-term & temporary in nature.
- There will be no abstraction of ground water from project as freshwater for domestic purposes will be supplied by private tankers. Domestic sewage will be disposed of in septic tanks with soak pits.
- Water consumption during hydro-testing of pipeline - Efficient use of water will be made to reuse test water in different test sections. Water will be tapped from different sources along the pipeline route, without unduly disturbing its normal users.

- At major crossings, Horizontal Directional Drilling (HDD) method will be deployed so there will be no disturbance to the natural water flow or cause any pollution to the water body. Hence there will not be any obstruction/damage to fishing, recreational and navigation activities.
- The pipeline will be buried all along its length hence impact on land use pattern will be marginal and reversible. Appropriate reinforcements will be done to avoid contamination.
- Some quantity of earth excavated for pipeline laying will become surplus after installation of the pipeline and may be required for disposal. However, as this excess of earth will be taken to low lying area for filling purpose, the aesthetics of the pipeline and soil quality will not be affected.
- Noise Generation - The major human settlements are along the pipeline route where the noise levels due to construction activities are estimated to be around 70-90 dB(A). Such onetime exposure is not expected to last for more than few weeks and shall not exceed the stipulated standards.
- Selection of the pipeline route has been done in such a way that eco-sensitive areas which may be affected during the construction of the pipeline are minimized.

IMPACTS DURING OPERATION OF PIPELINE

- No impact on any ecological sensitive area is envisaged during operation.
- No air emissions will be generated during the operation phase except during maintenance that could be temporary in nature.
- There will be no significant impact on ecological environment during the operational phase of the project.
- The probability of leakage will be significantly reduced by adoption of appropriate safety measures and SCADA system.
- The probability of leak from a pipeline is remote. Pipeline will be buried minimum 1.2 m at major crossings.

10.4 MITIGATION AND ENVIRONMENTAL MANAGEMENT PLAN

10.4.1 General

The mitigation measures to reduce environmental impacts, described in this ESIA, can be divided into the following categories:

- Project decisions taken by ATGL with environmental protection in mind.
- Such measures are designed to avoid, eliminate, or reduce potential impacts that may occur to the environment during the proposed activities.
- Mock Drills shall be conducted at regular intervals in line with Emergency Response and Disaster Management Plan.

10.4.2 Post Monitoring Program

The implementation of mitigation measures during construction and operation phases will be monitored. The monitoring plan would provide for periodic revision, if necessary, considering the baseline status to

indicate progress in project implementation and changing environmental conditions to provide a basis for evaluation of project impacts. The post monitoring program would include the following:

- Approved means of leak detection would be employed as per the provisions of Schedule I -E of PNGRB Regulations, 2008 and as per ASME B 31.8, Appendix - M.
- Regular and adequate patrolling of pipeline particularly at crossing locations and settlements.
- Monitoring of pressure, coating conditions and cathodic protection

10.5 CONCLUSION

There will be a beneficial effect from pipeline project that will directly and indirectly boost the living standards of the people, save foreign exchange and with increase in industrial activities, create more employment opportunities in the local economy. Thus, it can be concluded on a positive note that after the implementation of the mitigation measures and EMP, the proposed activities of **ATGL** will have negligible impact on environment and will improve economy of the state and the nation.

ANNEXURE-I PMGSY PROPOSAL LETTER

adani
Gas

Ref.: ATGL/Durg GA/PMGSY_Roads/Per/2024/001 Date: 27.08.2024

To,
The Executive Engineer,
CGRRDA, PMGSY,
Project Implementation Unit No.1,
Durg, Chhattisgarh State.
Pin- 491 001

Sub.: **Durg Connectivity (GAIL SV-32 (U/C), Nawagaon Village to Vardhaman Highway, Durg) :** Request for granting permission for laying 8"dia steel pipeline to set up a Gas Distribution Network in Durg City and surrounding area in Durg District- **Pipeline laying along & across to various Asphalted/R.C.C Roads along the pipeline route in Durg District.**

Dear Sir,

Petroleum and Natural Gas Regulatory Board ("PNGRB") statutory body of Government of India is engaged in regulation of refining, transportation, distribution, storage, marketing, supply, and sale of petroleum products and natural gas so as to protect the interests of consumers and to ensure uninterrupted and adequate supply of petroleum, petroleum products and natural gas in all parts of the country.

PNGRB, has authorized Adani Total Gas (ATGL) having its registered office at Ahmedabad, Gujarat, via letter no. **PNGRB/Auth/CGD (23)/2021/11.10, dated 15/03/2022** for development of City Gas Distribution Network in the Geographical area of **Mungeli, Bemetara, Durg, Balod & Dhamtari Districts**. Based on the Authorisation granted by PNGRB, we are presently constructing and developing the CNG Station at various locations of Mungeli, Bemetara, Durg, Balod & Dhamtari District and in future we are providing pipe natural gas to Domestic, industrial and commercial establishments in the district.

This project is being implemented as per the directives of **PNGRB (Under Ministry of Petroleum & Natural Gas)** with primary objective is to reduce the pollution level and penetrate the usage of green fuel in authorized GA and to participate Central Governments objective to minimize the carbon emissions by 2030 by using natural gas as fuel against all other fuel.

Adani Total Gas Limited (ATGL) proposes to lay Pipeline for transportation of natural gas to various CNG stations and other consumers for city gas distribution in the Durg GA. The proposed pipeline route starts from Gail NJPL U/C (SV-32) Station near village Nawagaon, Tehsil-Dhamdha, Dist - Durg and terminated at Vardhaman Highway in Durg, Tehsil/District- Durg in Chhattisgarh State.

The diameter of proposed pipeline will be of 8" diameter Steel. The proposed pipeline network will be laid along and within the ROW of various Asphalted Road/State Highway/R.C.C Road at a depth of at least 1.2 meter below the finished ground level. Company shall follow all the best standards of safety as prevailing in Gas distribution industries.

Adani Total Gas Limited
(Formerly known as Adani Gas Ltd)
Crest 4 - 5, Inspire Business Park
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S.G. Highway, Ahmedabad - 382 421
Gujarat, India
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customercare.gas@adani.com
www.adanigas.com
Registered Office: "Adani Corporate House", Shantigram, Nr. Vaishnodevi Circle, S. G. Highway, Khodiyar, Ahmedabad - 382421

Adani Total Gas Limited

The details of pipeline along & across to various Asphalted /R.C.C Roads are furnished in Annexure-A.

All the relevant drawings of the above said pipeline including the location of various Asphalted/R.C.C Road along & across are enclosed herewith for your reference. ATGL is ready to pay the necessary fee/ charges as per the norms (if any) as and when intimated by your good office.

Considering the fact that this is a project of National importance infrastructure development its timely completion is utmost important and so we request you to grant permission at the earliest possible.

In case you need any further information/ clarification, please feel free to contact Pankaj Kumar (M: 8791843026/ *Email:* Pankaj.Kumar8@adani.com/ Or Brajesh Kumar (M: 9924143723/ brajesh.kumar@secon.in).

For extending timely support you may communicate to Mr. Ranjan Singh (Team Leader), Mo. 9316747957 at our Rajnandgaon/Durg office.

Your early response in this matter will be highly appreciated.

Thanking You,

Yours sincerely,

For Adani Total Gas Limited,

Pankaj Kumar
Assistant Manager - Projects

Encl.: As above

Adani Total Gas Limited

Annexure – A

Statement showing the details of pipeline along & across to various Asphalted /R.C.C Roads under PMGSY, PIU-1, Durg in Durg District

Sr. No.	Name of Road	ATGL Pipeline length/ Chainage in Km.	Location of Parallel/Crossing
1	Crossing of Asphalted Road (Patharia Nawagaon Road) PMGSY Road	0/010.00	Near GAIL SV-32 (U/C) in Village Nawagaon
2	Pipeline laying parallel to Asphalted Road (Patharia – Nawagaon Road) PMGSY Road from P/L Ch. 0/017.14 Km to 2/125 Km	L=2/108	From GAIL SV-32 (U/C) near village Nawagaon to upto Govt Higher Secondary School Nawagaon.
3	Crossing of Asphalted Road (Bori- Nawagaon-Dhaba Road) PMGSY Road	2/132.33	Near Village Nawagaon
4	Pipeline laying parallel to Asphalted Road (Bori- Nawagaon-Dhaba Road) PMGSY Road from P/L Ch. 2/136.62 Km to 5/240.33 Km	L= 3/103.71	From nearer Govt Higher Secondary School Nawagaon village to village Dhaba
5	Crossing of Asphalted Road (Parsada Village to PMGSY Road)	2/939.70	Near Village Nawagaon
6	Pipeline laying parallel to R.C.C Road (Dhaba-Ganiyari-Nagpura Road) PMGSY Road from P/L Ch. 5/240.33 Km to 6/266.15 Km	L= 1/025.82	From Village Dhaba to Village Bhendsar
7	Pipeline laying parallel to Asphalted Road (Dhaba- Ganiyari-Nagpura Road) PMGSY Road from P/L Ch. 6/266.15 Km to 9/340.87	L= 3/074.72	From Village Dhaba to Village Bhendsar
8	Crossing of Asphalted Road (Ganiyari-Nagpura Road) PMGSY Road	9/345.81	Near Village Bhendsar

Adani Total Gas Limited

ANNEXURE-II: P.W.D PROPOSAL LETTER

adani
Gas

Ref.: ATGL/Durg GA/P.W.D_Roads/Per/2024/001

Date: 27.08.2024

To,
The Executive Engineer,
P.W.D (B/R) Division, Pulgaon Road,
Civil Lines, Durg.
District-Durg, Chhattisgarh State.
Pin- 491 001

Sub.: **Durg Connectivity (GAIL SV-32 (U/C), Nawagaon Village to Vardhaman Highway, Durg) :** Request for granting permission for laying 8"dia steel pipeline to set up a Gas Distribution Network in Durg City and surrounding area in Durg District - **Pipeline laying along & across to various SH/Asphalted/R.C.C Roads along the pipeline route in Rajnandgaon District.**

Dear sir,

Petroleum and Natural Gas Regulatory Board ("PNGRB") statutory body of Government of India is engaged in regulation of refining, transportation, distribution, storage, marketing, supply, and sale of petroleum products and natural gas so as to protect the interests of consumers and to ensure uninterrupted and adequate supply of petroleum, petroleum products and natural gas in all parts of the country.

PNGRB, has authorized Adani Total Gas (ATGL) having its registered office at Ahmedabad, Gujarat, via letter no. **PNGRB/Auth/CGD (23)/2021/11.10, dated 15/03/2022** for development of City Gas Distribution Network in the Geographical area of **Mungeli, Bemetara, Durg, Balod & Dhamtari Districts**. Based on the Authorisation granted by PNGRB, we are presently constructing and developing the CNG Station at various locations of Mungeli, Bemetara, Durg, Balod & Dhamtari District and in future we are providing pipe natural gas to Domestic, industrial and commercial establishments in the district.

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Adani Total Gas Limited (ATGL) proposes to lay Pipeline for transportation of natural gas to various CNG stations and other consumers for city gas distribution in the Durg GA. The proposed pipeline route starts from Gail NJPL U/C (SV-32) Station near village Nawagaon, Tehsil-Dhamdha, Dist - Durg and terminated at Vardhaman Highway in Durg, Tehsil/District- Durg in Chhattisgarh State.

The diameter of proposed pipeline will be of 8" diameter Steel. The proposed pipeline network will be laid along and within the ROW of various Asphalted Road/State Highway/R.C.C Road at a depth of at least 1.2 meter below the finished ground level. Company shall follow all the best standards of safety as prevailing in Gas distribution industries.

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Adani Total Gas Limited

The details of pipeline along & across to various P.W.D Roads are furnished in **Annexure-A**.

All the relevant drawings of the above said pipeline including the location of various SH/Asphalted Roads along& across are enclosed herewith for your reference. ATGL is ready to pay the necessary fee/ charges as per the norms (if any) as and when intimated by your good office.

Considering the fact that this is a project of National importance infrastructure development its timely completion is utmost important and so we request you to grant permission at the earliest possible.

In case you need any further information/ clarification, please feel free to contact Pankaj Kumar (M: 8791843026/ *Email*: Pankaj.Kumar8@adani.com) Or Brajesh Kumar (M: 9924143723/ brajesh.kumar@secom.in)

For extending timely support you may communicate to Mr. Ranjan Singh (Team Leader), Mo. 9316747957 at our Rajnandgaon/Durg office.

Your early response in this matter will be highly appreciated.

Thanking You,

Yours sincerely,

For Adani Total Gas Limited,

Pankaj Kumar
Assistant Manager - Projects

Encl.: As above

Adani Total Gas Limited

29-8-24

The details of pipeline along & across to various P.W.D Roads are furnished in **Annexure-A**.

All the relevant drawings of the above said pipeline including the location of various SH/Asphalted Roads along& across are enclosed herewith for your reference. ATGL is ready to pay the necessary fee/ charges as per the norms (if any) as and when intimated by your good office.

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For extending timely support you may communicate to Mr. Ranjan Singh (Team Leader), Mo. 9316747957 at our Rajnandgaon/Durg office.

Your early response in this matter will be highly appreciated.

Thanking You,

Yours sincerely,

For Adani Total Gas Limited,

Pankaj Kumar
Assistant Manager - Projects

Encl.: As above

Adani Total Gas Limited

29-8-24

ANNEXURE-III: MONITORING REPORT

SHRI OM TESTING & RESEARCH LABORATORY

Plot No. 296, 1st FNG Road, Sector-121, Ghari Chaukhandi, Noida - 201301
Mob. : 9821154906, 8076937396
E-mail. : shriomlab@gmail.com, **Web.** : www.shriomlab.com, www.shriomlab.in
GSTIN : 09ADHFS2444J1ZS

N.A.B.L. Accredited, ISO 9001, ISO 14001 & ISO 45001 Certified Laboratory.

TEST REPORT

Report No: STRLA- 3103202501-01 Issue Date. 31.03.2025
Issued To : M/s. Environment & Social Impact Assessment (ESIA) Study for CGD for Natural Gas Pipeline in durg GA 11.10 Mungeli Chhattisgarh India
Project Location A : L1 and L2 at Durg (GA 11.10 Mungeli) Chhattisgarh India

RESULTS
(Ambient Air Quality Analysis)

SAMPLING DETAILS			
Sampling Protocol	STRL/LAB/AIR/STP/01	Sampling Duration	24 Hours
Flow Rate of Air	1.0 M^3/Min	Flow Rate of Gas	1.0 LPM
Sample Packing	Plastic Bottle / Zip Polybag	Analysis Duration	10.03.2025 to 30.03.2025

S. No.	Parameters	Unit	Line Route-1 AAQ-1.1 At Chainage 1464.12 m (TP24) 21°19'4.22"N 81°15'39.22"E	Line Route-1 AAQ-1.2 At Chainage 10440.22 m (TP215) 21°14'59.52"N 81°16'3.61"E	Line Route-1 AAQ-1.3 Near Chainage 17826.24 m (TP329) 21°12'52.94"N 81°17'40.22"E	Line Route-2 AAQ-2.1 At Maharana Pratap Chowk near the HP Petrol Pump 21°11'59.56"N 81°20'13.44"E	NAAQ Standards
1.	Particulate Matter-10 (PM-10)	µg/m^3	61.2.	63.3	72.3	65.1	100
2.	Particulate Matter-2.5 (PM-2.5)	µg/m^3	41.8	46.2	48.1.2	43.5	60
3.	Sulphur Dioxide (SO_2)	µg/m^3	6.92	7.69	7.78	6.69	80
4.	Nitrogen Dioxide (NO_2)	µg/m^3	8.54	7.01	7.08	8.23	80
5.	Ozone (O_3) -8Hr.	µg/m^3	12.3	13.8	12.6	12.5	100
6.	Lead (Pb)	µg/m^3	<1.0	<1.0	<1.0	<1.0	1.0
7.	Carbon Mono Oxide (CO)-1.0 Hr.	mg/m^3	0.26	0.23	0.27	0.25	4.0
8.	Ammonia (NH_3)	µg/m^3	< 10	< 10	< 10	< 10	400
9.	Arsenic (As)	ng/m^3	<1.0	<1.0	<1.0	<1.0	6
10.	Nickel (Ni)	ng/m^3	0.22	0.24	0.25	0.20	20

End of Report (Page No 01 of 01)

Shri Om Testing & Research Laboratory
Ravinder Kumar Sharma
Technical Manager
Authorised Signatory
(Name, Designation & Signature with Seal)

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TEST REPORT

Report No: STRLA- 3103202501-02 Issue Date. 31.03.2025
Issued To : M/s. Environment & Social Impact Assessment (ESIA) Study for CGD for Natural Gas Pipeline in durg GA 11.10 Mungeli Chhattisgarh India
Project Location A : L1 and L2 at Durg (GA 11.10 Mungeli) Chhattisgarh India

RESULTS
(Ambient Noise Quality Analysis)

SAMPLING DETAILS

Sample Description : Ambient Noise
Sample Collected by : STRL STAFF
Monitoring Protocol : IS- 9989: 1981
Monitoring Duration : 24 Hours

S. No.	Location	Observed Value Leq, dB (A)		Limit for A Per CPCB Guidelines ;Leq, dB (A)		
		Day Time*	Night Time**	ZONE	Day Time*	Night Time**
1.	**Line Route 1** NAQ-1.1 At Chainage 1464.12 m (TP24) 21°19'4.22"N 81°15'39.22"E	52.4	40.11	Residential area	55	45
2.	**Line Route 1** NAQ-1.2 At Chainage 10440.22 m (TP215) 21°14'59.52"N 81°16'3.61"E	51.02	39.22	Commercial area	65	55
3.	**Line Route 1** NAQ-1.3 Near Chainage 17826.24 m (TP329) 21°12'52.94"N 81°17'40.22"E	52.1	39.81	Industrial area	75	70
4.	**Line Route 2** NAQ-2.1 At Maharana Pratap Chowk near the HP Petrol Pump 21°11'59.56"N 81°20'13.44"E	50.0	40.4	Silence area	50	40
* Day Time	6.00 a.m. to 10.00 p.m	**Night Time	10.00 p.m. to 6.00 a.m			

** End of Report ** Page No (01 of 01)

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TEST REPORT

Report No: STRLA- 3103202501-03 **Issue Date. 31.03.2025**

Issued To : M/s. Environment & Social Impact Assessment (ESIA) Study for CGD for Natural Gas Pipeline in durg GA 11.10 Mungeli Chhattisgarh India

Project Location A : L1 and L2 at Durg (GA 11.10 Mungeli) Chhattisgarh India

---

Sample Description: Ground Water

RESULTS
(Water Quality Analysis)

SAMPLING DETAILS

Sample Collected by	: STRL STAFF
Sampling Protocol	: IS-3025(P-1)1987
Weather Condition	: Clear Sky
Sampling Quantity	: 5L+500ml
Sample Packing	: Plastic/Glass Bottle

S. No.	Parameters	Units	Limits (as per IS:10500-2012)		Results Line Route-1 GWQ-1.1 At Chainage 17.14 m (TP1) near the Admin Building 21°19'2.81"N 81°16'28.36"E	Results Line Route-1 GWQ-1.2 At Chainage 10440.22 m (TP215) 21°14'59.52"N 81°16'3.61"E	Test Methods
			Desirable Limit	Permissible Limit			
1	Color	--	--	--	0.1	0.1	IS : 3025(Pt-4) 1983, Reaff. 2017
2	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	IS : 3025(Pt-5) 1983, Reaff. 2017
3	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	IS : 3025(Pt-8)-1984, Reaff. 2017
4	Temperature	°C	-	-	20.3	23.4	IS: 3025(Pt-9)1984 Reaff 2002
5	pH	-	6.5-8.5	No Relaxation	7.35	7.45	IS : 3025(Pt-11)1983, Reaff. 2017
6	Electric Conductivity	µhos/cm	-	-	815	868	IS : 3025 (Pt-14)-2013
7	Total Hardness (as $CaCO_3$)	mg/l	200	600	248.0	312.0	IS : 3025(Pt-21)1983, Reaff. 2014
8	Iron (as Fe)	mg/l	0.3	No Relaxation	0.15	0.12	APHA 22nd Ed., 3120B (3111B (AAS),
9	Chlorides (as Cl)	mg/l	250	1000	139.7	144.0	IS : 3025(Pt-32)1988, Reaff. 2014
10	Fluoride (as F)	mg/l	1	1.5	< 1.0	< 1.0	APHA 22nd Ed., 4500F(D)
11	TDS	mg/l	500	2000	489	521.6	IS: 3025(Pt-16)1984, Reaff. 2017
12	Calcium (as Ca^{2+})	mg/l	75	200	48.8	52.1	IS :3025(Pt-40)1991, Reaff. 2014
13	Magnesium (as Mg^{2+})	mg/l	30	100	30.7	44.3	APHA 22nd Ed., 3500-Mg (B)
14	Sulphate (as SO_4)	mg/l	200	400	36.4	38.1	IS : 3025(Pt-24)1986, Reaff. 2014
15	Nitrate(as NO_3)	mg/l	45	No Relaxation	24.1	26.4	IS : 3025(Pt-34)1988, Reaff. 2014
16	Alkalinity (as $CaCO_3$	mg/l	200	600	192.2	210.1	IS: 3025(Pt-23)1986, Reaff. 2014
			Bacteriological Parameters				
1	Total Coli form	Cfu/100gm	MPN/100ml	Shall Not Be Detectable	Not Detected (<2)	Not Detected (<2)	IS : 1622-1981 (Reaff.2003)
2	E.coli	Cfu/100g	E.coli/100ml	Shall Not Be Detectable	Absent	Absent	IS : 1622-1981 (Reaff.2003)

*END OF REPORT *** Page (01 of 01)

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Ravinder Kumar Sharma
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TEST REPORT

Report No: STRLA- 3103202501-03 Issue Date. 31.03.2025

Issued To : M/s. Environment & Social Impact Assessment (ESIA) Study for CGD for Natural Gas Pipeline in durg GA 11.10 Mungeli Chhattisgarh India

Project Location A : L1 and L2 at Durg (GA 11.10 Mungeli) Chhattisgarh India

Sample Description: Ground Water

RESULTS
(Water Quality Analysis)

SAMPLING DETAILS
Sample Collected by : STRL STAFF
Sampling Protocol : IS-3025(P-1)1987
Weather Condition : Clear Sky
Sampling Quantity : 5L+500ml
Sample Packing : Plastic/Glass Bottle

S. No.	Parameters	Units	Limits (as per IS:10500-2012)		Results Line Route-2 GWQ-2.1 At Maharana Pratap Chowk near the HP Petrol Pump 21°11'59.56"N 81°20'13.44"E	Test Methods
			Desirable Limit	Permissible Limit		
1	Color	--	--	--	0.1	IS : 3025(Pt-4) 1983, Reaff. 2017
2	Odour	-	Agreeable	Agreeable	Agreeable	IS : 3025(Pt-5) 1983, Reaff. 2017
3	Taste	-	Agreeable	Agreeable	Agreeable	IS : 3025(Pt-8)-1984, Reaff. 2017
4	Temperature	°C	-	-	20.6	IS: 3025(Pt-9)1984 Reaff 2002
5	pH	-	6.5-8.5	No Relaxation	7.45	IS : 3025(Pt-11)1983, Reaff. 2017
6	Electric Conductivity	µhos/cm	-	-	439	IS : 3025 (Pt-14)-2013
7	Total Hardness (as $CaCO_3$)	mg/l	200	600	196.6	IS : 3025(Pt-21)1983, Reaff. 2014
8	Iron (as Fe)	mg/l	0.3	No Relaxation	0.15	APHA 22nd Ed., 3120B (3111B (AAS),
9	Chlorides (as Cl)	mg/l	250	1000	111.9	IS : 3025(Pt-32)1988, Reaff. 2014
10	Fluoride (as F)	mg/l	1	1.5	<1.0	APHA 22nd Ed., 4500F(D)
11	TDS	mg/l	500	2000	489	IS: 3025(Pt-16)1984, Reaff. 2017
12	Calcium (as Ca^{2+})	mg/l	75	200	37.8	IS :3025(Pt-40)1991, Reaff. 2014
13	Magnesium (as Mg^{2+})	mg/l	30	100	5.03	APHA 22nd Ed., 3500-Mg (B)
14	Sulphate (as SO_4)	mg/l	200	400	36.4	IS : 3025(Pt-24)1986, Reaff. 2014
15	Nitrate(as NO_3)	mg/l	45	No Relaxation	18.4	IS : 3025(Pt-34)1988, Reaff. 2014
16	Alkalinity (as $CaCO_3$	mg/l	200	600	187.7	IS: 3025(Pt-23)1986, Reaff. 2014
			Bacteriological Parameters			
1	Total Coli form	Cfu/100gm	MPN/100ml	Shall Not Be Detectable	Not Detected (<2)	Not Detected (<2) Absent / IS : 1622-1981 (Reaff.2003)
2	E.coli	Cfu/100g	E.coli/100ml	Shall Not Be Detectable	Absent	IS : 1622-1981 (Reaff-2003)

***END OF REPORT *** Page (01 of 01)

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TEST REPORT

Report No: STRLA- 3103202501-04 **Issue Date. 31.03.2025**

Issued To : M/s. Environment & Social Impact Assessment (ESIA) Study for CGD for Natural Gas Pipeline in durg GA 11.10 Mungeli Chhattisgarh India

Project Location A : L1 and L2 at Durg (GA 11.10 Mungeli) Chhattisgarh India

Sample Description: Surface Water

RESULTS
(Water Quality Analysis)

SAMPLING DETAILS

Date of Sampling : 14.08.2023
Sample Collected by : STRL Staff
Sampling Protocol : IS-3025(P-1)1987
Sampling Quantity : 5L+500ml

S.NO	Parameter	Unit	Result Line Route 1 SW-1.1 U/S of Shivnath River, near Chainage 13336.58 m (TP278) 21°14'32.84"N 81°17'11.08"	Result Line Route1 SW-1.2 D/S of Shivnath River, near Chainage 12827.76 m (TP273) 21°14'17.61"N 81°17'2.02"E
1	Turbidity	NTU	3.5	2.92
2	pH (at 25°C)	-	7.45	7.56
3	Conductivity,	µS/cm	851	907
4	Total Dissolve Solids	mg/l	325	420
5	Total Hardness as $CaCO_3$	mg/l	326.2	354.0
6	Calcium as Ca	mg/l	55.5	58.9
7	Magnesium as Mg	mg/l	42.4	50.1
8	Sodium as Na	mg/l	92	80.8
9	Potassium as K	mg/l	55	62.2
10	Chloride as Cl	mg/l	176.4	183.1
11	Sulphate as SO_4	mg/l	76.4	77.6
12	Nitrate as NO_3	mg/l	36.3	36.4
13	Total Alkalinity as $CaCO_3$	mg/l	204.2	257.3
14	Fluoride	mg/l	0.10	0.08

Page (01 of 02)

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TEST REPORT

Report No: STRLA- 3103202501-04

S.NO	Parameter	Unit	Result **Line Route 1** SW-1.1 U/S of Shivnath River, near Chainage 13336.58 m (TP278) 21°14'32.84"N 81°17'11.08"	Result **Line Route1** SW-1.2 D/S of Shivnath River, near Chainage 12827.76 m (TP273) 21°14'17.61"N 81°17'2.02"E
15	Cyanide	mg/l	<0.05	<0.05
16	Arsenic	mg/l	<0.01	<0.01
17	Boron as B	mg/l	<0.01	<0.01
18	Cadmium as Cd	mg/l	<0.01	<0.01
19	Chromium, Total	mg/l	<0.01	<0.01
20	Copper as Cu	mg/l	<0.05	<0.05
21	Lead as Pb	mg/l	<0.05	<0.05
22	Manganese as Mn	mg/l	<0.05	<0.05
23	Mercury	mg/l	<0.01	<0.01
24	Nickel as Ni	mg/l	<0.01	<0.01
25	Selenium as Se	mg/l	<0.01	<0.01
26	Zinc	mg/l	0.013	0.022
27	Dissolved Oxygen	mg/l	5.71	5.75
28	Total Suspended Solid	mg/l	46.1	38.2
29	Total Solid	mg/l	370.1	487.2
30	Chemical Oxygen Demand as O_2	mg/l	26	18.6
31	BOD, 3 days @27°C as O_2	mg/l	4.4	3.0
32	Oil & Grease	mg/l	<0.01	<0.01
33	Total Coliform	MPN /100 ml	20	14

*** End of Report ***

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TEST REPORT

Report No: STRLA- 3103202501 -05 **Issue Date. 31.03.2025**

Issued To : M/s. Environment & Social Impact Assessment (ESIA) Study for CGD for Natural Gas Pipeline in durg GA 11.10 Mungeli Chhattisgarh India

Project Location A : L1 and L2 at Durg (GA 11.10 Mungeli) Chhattisgarh India

Sample Description: Soil RESULTS

SAMPLING DETAILS (Soil Quality Analysis)
Date of Sampling : 14.08.2023 Sample
Collected by : STRL Staff Sampling
Protocol : STRL/STP/SOIL/01
Sampling Quantity : *5 kg*

S.No	PARAMETERS	UNIT	RESULTS	RESULTS	RESULTS	TEST PROTOCOL
			Line Route-1 At Chainage 17.14 m (TP-1) near the Admin Building 21°19'2.81"N 81°16'28.36"E	Line Route-1 Bank of Shivnath River, Near Chainage 13336.58 m (TP278) 21°14'21.03"N 81°16'59.99"	Line Route-2 SQ-2--1 Near the rotary of underpass 21°12'11.60"N 81°21'0.17"E	
1.	Texture		Sandy clay Loam	Sandy Loam	Sandy Loam	IS: 2720 (part-4), 1985 Reaff:2015)
2.	Sand	%	48.6	49.6	51.24	IS: 2720 (part-4), 1985,(Reaff:2015)
3.	Silt		27.6	27.98	28.44	IS: 2720 (part-4), 1985,(Reaff:2015)
4	Clay		23.8	22.42	20.32	IS: 2720 (part-4), 1985,(Reaff:2015)
5	Porosity	%	49.4	41.4	42.4	STRL /STP/SOIL/01,
6.	Bulk Density	g/cc	1.34	1.34	1.32	STRL /STP/SOIL/01
7.	pH	....	7.56	7.52	7.42	STRL /STP/SOIL/01
8.	E. Conductivity	µs/cm	0.46	0.38	0.39	STRL /STP/SOIL/01
9.	Magnesium	mg/kg	38.6	31.5	34.5	STRL /STP/SOIL/01
10.	Calcium	mg/kg	189.5	176.6	174.4	STRL /STP/SOIL/01
11.	Chlorides	mg/kg	58.9	64.4	67.8	STRL /STP/SOIL/01
12.	Sodium	mg/kg	82.4	84.0	64.4	STRL /STP/SOIL/01
13.	Potassium	mg/kg	54.3	47.3	47.3	STRL /STP/SOIL/01
14	Organic Carbon	%	0.23	0.27	0.27	IS : 2720 (Part-24)-1976(R-2015)
15	Organic matter	%	0.13	0.50	0.19	IS : 2720 (Part-24)-1976(R..2015)
16.	Phosphorous	mg/kg	71.63	72.76	68.8	IS: 2720 (part-26),1987. (R:2011)
17.	SAR	meq	1.55	1.291	1.291	STRL /STP/SOIL/01
18.	Nitrogen (as N)	mg/kg	0.30	0.32	0.32	STRL /STP/SOIL/01
19.	Salinity (as NaCl)	%	0.33	0.29	0.31	STRL /STP/SOIL/01

** End of Report**

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TEST REPORT

REPORT NO : STRLM- 3103202501-01 ISSUE DATE : 31.03.2025

Issued To : M/s. Environment & Social Impact Assessment (ESIA) Study for CGD for Natural Gas Pipeline in durg GA 11.10 Mungeli Chhattisgarh India

RESULTS

(Metrological Data)-7 days

1- **Location :-** M-1 At Chainage 1464.12 m (TP24)
21°19'4.22"N 81°15'39.22"E
Time Duration :- **10.03.2025 to 17.03.2025**

TEST PARAMETERS	(Day 1)	(Day 2)	(Day 3)	(Day 4)	(Day 5)	(Day 6)	(Day 7)
Wind Speed, km/h	8	16	10	11	08	09	11
Wind Direction	East	West North West	West North West	West	West	West	West
Temperature, (Min-Max), °C	22-36	20-37	20-34	15-34	15.-35	17-37	19-36
Humidity %	53	56	52	56	54	55	56
Rainfall, mm	<0.5 mm	<0.5 mm	<0.5 mm	<0.5 mm	<0.5 mm	<0.5 mm	<0.5 mm
Cloud	Clear	Clear	Clear	Clear	Clear	Clear	Clear

2 – **Location** M-2 At Maharana Pratap Chowk near the HP Petrol Pump 21°11'59.56"N 81°20'13.44"E
Time Duration :- **18.03.2025 to 24.03.2025**

TEST PARAMETERS	(Day 1)	(Day 2)	(Day 3)	(Day 4)	(Day 5)	(Day 6)	(Day 7)
Wind Speed, km/h	11	12	13	14	10	08	10
Wind Direction	West	West	West North West	West	West	East-West	West
Temperature, (Min-Max), °C	21-37	20-39	23-40	22-40	22-40	25-39	24-40
Humidity %	55	54	56	58	53	56	55
Rainfall, mm	<0.5 mm	<0.5 mm	<0.5 mm	<0.5 mm	<0.5 mm	<0.5 mm	<0.5 mm
Cloud	Clear	Clear	Clear	Clear	Clear	Clear	Clear

**End of Report **

Page (01 of 01)

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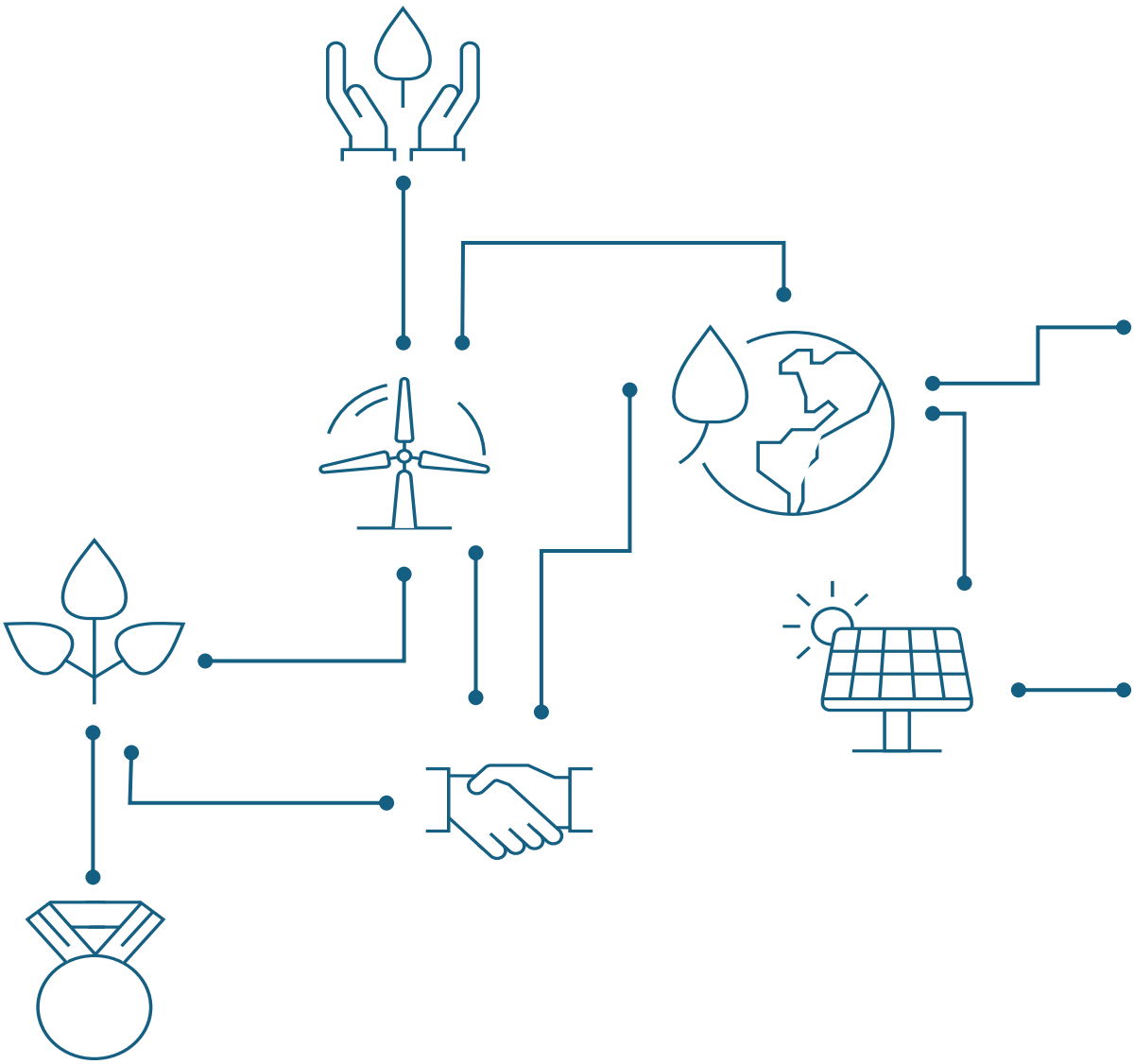
3. This certificate shall not be used in any advertising media or as evidence in the court of Law without prior written consent of the laboratory.
4. The samples received shall be destroyed after 30 days from the date of issue of the certificate unless specified otherwise and sample for biological testing will be destroyed after 7 days of testing.

Add value.
Inspire trust.



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