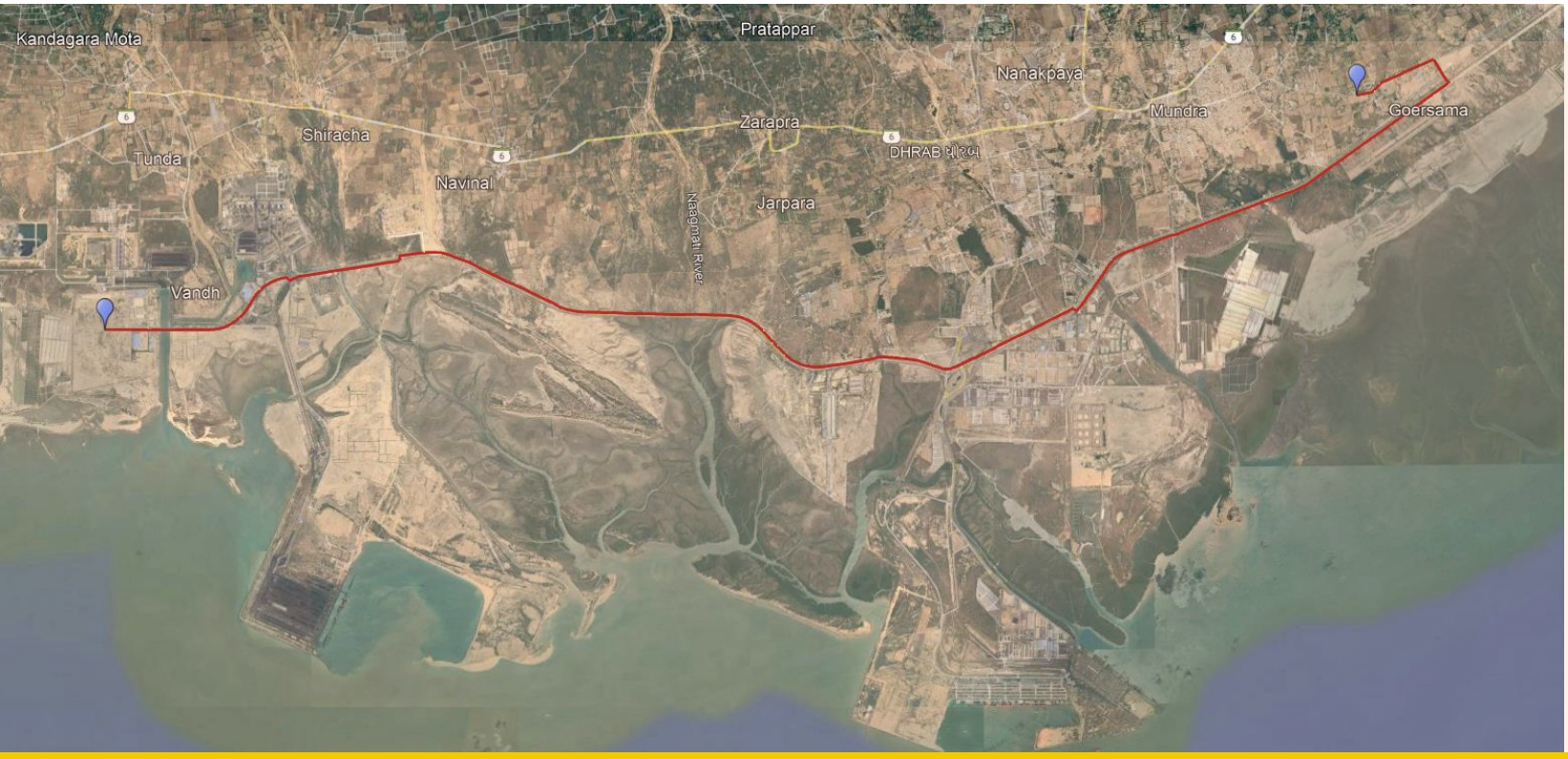

FINAL REPORT

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STUDY FOR NATURAL GAS PIPELINE (GSPL TO MSTPL) IN VILLAGE-MUNDRA, DISTRICT-KACHCHH, GUJARAT

SUBMITTED TO

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REPORT NO.: 2024/ET-006908/AD/NA/NA/55472

AUGUST, 2024

Name of the Project	Natural Gas Pipeline (GSPL to MSTPL) in Village-Mundra, District-Kachchh, Gujarat		
Assignment	Environmental Impact Assessment (EIA) Study for Natural Gas Pipeline (GSPL to MSTPL) in Village-Mundra, District-Kachchh, Gujarat		
Enquiry Number	ET-006873		
Project Code	4153941757		
Assignment to be submitted	ADANI TOTAL GAS LIMITED		
Assignment/ report prepared by	TÜV SÜD SOUTH ASIA PRIVATE LIMITED		
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1.	Rev. 0 – Draft EIA Report	24.05.2024	
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Disclaimer:

*This report has been prepared for the use of **Adani Total Gas Limited** (hereinafter referred as **"ATGL"**) in the context of the project mentioned above. We expressly disclaim any responsibility of whatsoever nature or legal liability with respect to any third parties, other than **ATGL**, in relation to the contents of the present report. This report shall not be relied upon for any purpose other than the project above mentioned or relied on any parties other than **ATGL**. The contents of this report are strictly confidential and subject to legal property and privilege. Neither this report nor any of its content may be disclosed to any third parties other than **ATGL** or their officers and employees who are directly involved in the project, nor may it be referred or quoted to, or filed with, any other person or body without our express written consent This report is strictly limited to the matters set forth herein and is not to be interpreted or construed as extended by implication to any other matter. We have strictly limited our report to those matters relevant to the environmental and social issues as reflected in the documents that were provided to us. In completing this report, we have relied upon what follows:*

-that the information supplied to us for the purpose of preparing this report was (when supplied) and continues to be true, accurate and not misleading in any respect.

-that there are no other materials or other facts of which we have not been informed in relation to such matters.

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1 INTRODUCTION

1.1 BACKGROUND

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.

Energy is fundamental to economic development and plays a vital role in driving a country's growth. In India's energy portfolio, the Oil and gas sector holds a significant share of around one-third and is posed to continue serving as a critical enabler of India's rapidly growing economy. Energy is the mainstay of socio-economic growth and development for a nation like India which is currently the third largest primary energy consumer while its per-capita energy consumption is only a third of the global average. As per various projections, India's Energy Demand is expected to grow at 2.7% till 2050 as compared to World's 0.6%. India constitutes ~6% of the global primary energy demand wherein it constitutes 9.4% of the global oil demand and 2.2% of the global gas demand.

The demand for energy is met mostly by fossil fuels as fossil fuels make up 88% of India's primary energy requirement. Coal accounts for 55% of the energy mix, oil, and gas account for 28% and 6%, respectively. During the financial year 2022-23, 67% of natural gas production was by National Oil Companies from nomination regime, 33% of natural gas production was by Private/JV companies/ NOCs from Contract regimes (inclusive of ~2% was from Coal Bed Methane). The import dependency on crude oil and natural gas based on consumption of petroleum products in 2022-23 was about 87.4 % and 43.9 %, respectively. This provides a scope and opportunity for increasing energy consumption by India in near future and it being the central driving force in the global energy narrative. The Oil & Gas sector holds a prominent position as one of India's eight core industries, exerting significant influence on decision-making across various sectors of the economy. [1]

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 in APSEZ Mundra, **ATGL** has planned to develop "***30.786 kms Natural Gas Pipeline Infrastructure***".

[1] Indian Petroleum and Natural Gas Statistics (2022-23), Ministry of Petroleum & Natural Gas, GOI

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 "**30.786 *kms Natural Gas Pipeline Infrastructure in APSEZ Park of Mundra Port, Village-Mundra, District-Kachchh, Gujarat."*** The pipeline has been planned in approx. 30.786 kms of natural gas throughout APSEZ Park in Mundra Port. The pipeline will be laid from GSPL Pooling Substation located in Goresema Village and will terminate in Mundra Solar Techno Park Limited (MSTPL). Currently, the NG pipeline has been laid within the APSEZ Park till MSTPL line only. The pipeline has not been laid from GSPL PSS to Entry gate of APSEZ Park. GSPL PSS is located approx. 1.64 kms away from entry point of APSEZ Park.

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 "EIA") 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 EIA 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 EIA Notification,2006 & its subsequent amendments.

1.3 PROJECT DEVELOPER

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. The company specializes in the development of city gas distribution (CGD) networks for the continuous supply of piped natural gas (PNG) and compressed natural gas (CNG). These networks provide natural gas as a convenient, economical, dependable, and environmentally friendly fuel option, offering consumers safety and convenience. ATGL has ventured into e-mobility and biomass business through two wholly owned subsidiaries – Adani Total Energies E-mobility Limited (ATEL) and Adani Total Energies Biomass Limited (ATBL) respectively.

The company is expanding its operations to include the production and distribution of clean energy derived from biomass, as well as the establishment of electric vehicle charging infrastructure. ATGL

is adopting a comprehensive approach by providing a unified wallet offering that encompasses basket of services. Additionally, ATGL has entered the gas meter manufacturing sector (mechanical and smart meters), through its JV, SMTPL.

The company has already set up city gas distribution networks in Ahmedabad and Vadodara in Gujarat, Faridabad in Haryana, and Khurja in Uttar Pradesh. In addition, the development of Allahabad, Chandigarh, Ernakulam, Panipat, Daman, Dharwad, and Udhamsingh Nagar gas distribution is awarded to consortium of Adani Total Gas Limited and Indian Oil Corporation Limited.

1.4 NEED AND SCOPE OF EIA

The purpose of this EIA is to assess the potential environmental impacts due to the proposed project in a study area of 10 km radius around and 500 m on both sides of the pipeline. The assessment covers both construction and operation phases of the project. The EIA 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.

1.5 REGULATORY FRAMEWORK

The Ministry of Environment, Forest, and Climate Change (MoEF&CC) has notified the Environmental Impact Assessment (EIA) 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 EIA 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 (SEIAA) following the procedure prescribed under the EIA Notification, 2006. As per project/ activity 6 (a) of Schedule of EIA Notification 2006, oil and gas transportation pipelines that pass through national parks, sanctuaries, coral reefs, or ecologically sensitive areas sites require Environmental Clearance (EC).

Although, the component has been covered in Environmental & CRZ Clearance of Multi-Product SEZ by Adani Ports & Special Economic Zone Limited granted by MoEF&CC vide F. No. 10-138/2008-IA.III dated 15th July,2014. Since, natural gas line network has already been covered within the accorded permission, separate Environmental Clearance for the proposed project is not required.

ATGL has also attained permission for laying of pipeline within APSEZ premises as well as Goresema village in ROW of Gandhidham-Mundra Road from Adani Ports & Special Economic Zone Limited and Road & Building Department, respectively.

Although, the pipeline network crosses through two water bodies (One Minor Stream and one Major Creek), therefore, **ATGL** is advised to take permission from Irrigation Department and other concerned authorities.

Table 1-1: 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, CPCB, GPCB	Yes (NG pipeline network has already been added in the accorded EC for Multi SEZ project).
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 flowing water course of all canals, branches, distributaries, major-minor channels etc.	Water Resources Department (CGWA), Government of Gujarat	Yes Permission/NOC is required from Irrigation Department as the NG pipeline crosses 2 water bodies (Baradi Mata Creek & Kotdi Creek)
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 4 locations.
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	Yes. Permission/NOC is required since laying of pipeline will be done in approx. 1.86 kms stretch along ROW of Gandhidham Mundra Road.
5.	Environmental Impact Assessment (EIA) Notification, 2006	To provide environmental clearance to new development activities following environmental impact assessment.	As per project/ activity 6 (a) of Schedule of EIA 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	Yes (However, NG line network has already been added in the accorded EC for Multi-SEZ project.

Sl. No.	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable (Yes/No)
6.	Forest (Conservation) Act, 1980 and amendments thereof	To check deforestation by restricting conversion of forested areas into non-forested areas.	For using reserve/protected forest land for laying of NG pipeline	Forest Department, MoEF&CC (Kachchh)	Yes. However, the ROW of pipeline being in APSEZ premises, it has already been covered in accorded EC of Multi-SEZ.
7.	National Forest Policy (Revised), 1988	To maintain ecological stability through preservation and restoration of biological diversity	Eco sensitive zone exists along the project corridor, from which the pipeline passes through.	Forest Department Mundra, MoEF&CC	
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 and amendments thereof	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 mix plant, construction camp, workers' camp, etc.	Gujarat Pollution Control Board	Yes
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.	Gujarat Pollution Control Board	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.	Gujarat Pollution Control Board	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.	Gujarat Pollution Control Board	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	Contractor needs to stock hazardous material like diesel, Bitumen, Emulsions etc. safely in designated	Gujarat Pollution Control Board	Yes

Sl. No.	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable (Yes/No)
		hazardous substance and for matters connected therewith or incidental thereto	locations within the construction camp		
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	Gujarat Pollution Control Board	Yes
15.	Solid Waste Management Rules, 2016	Management and handling of solid waste	For disposal of solid waste generated during construction	Gujarat Pollution Control Board	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	Gujarat Pollution Control Board	Yes
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	Gujarat Pollution Control Board	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	Gujarat Pollution Control Board	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 Gujarat	Ministry of Petroleum & Natural Gas & Gujrat Government	Yes

Sl. No.	Legal Instrument	Objective	Reason for Applicability	Authority	Applicable (Yes/No)
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 consumers and entities engaged in specified activities	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

Environmental issues during pipeline laying & construction stage generally involve equity, safety, and public health issues. The construction agencies require complying with laws mentioned below as well:

- **Workmen's Compensation Act 1923** (the Act provides for compensation in case of injury by accident arising out of and during employment).
- **Payment of Gratuity Act, 1972** (gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years).
- **Employees PF and Miscellaneous Provision Act 1952** (the Act provides for monthly contributions by the employer plus workers).
- **Maternity Benefit Act, 1951** (the Act provides for leave and some other benefits to women employees in case of confinement or miscarriage, etc.).
- **Contact Labor (Regulation and Abolition) Act, 1970** (the Act provides for certain welfare measures to be provided by the contractor to contract labour).
- **Minimum Wages Act, 1948** (the employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions).
- **Payment of Wages Act, 1936** (it lays down as to by what date the wages are to be paid, when it will' be paid and what deductions can be made from the wages of the workers).
- **Equal Remuneration Act, 1979** (the Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees).
- **Payment of Bonus Act, 1965** (the Act provides for payments of annual bonus subject to a minimum of 83.3% of wages and maximum of 20% of wages).
- **Industrial Disputes Act, 1947** (the Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing the establishment).
- **Industrial Employment (Standing Orders) Act; 1946** (the Act provides for laying down rules governing the conditions of employment).
- **Trade Unions Act, 1926** (the Act lays down the procedure for registration of trade unions of workers and employers. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities).
- **The Child Labour (Prohibition and Regulation) Amendment Act, 2016**: An Act further to amend the Child Labour (Prohibition and Regulation) Act, 1986. (The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labour is prohibited in Building and Construction Industry).
- **Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979** (the inter-state migrant workers, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home to the establishment and back, etc.).

- **The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996** (all the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act; the employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for Workers near the workplace, etc.).
- **The Factories Act, 1948** (the Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours and rendering information-regarding accidents or dangerous occurrences to designated authorities).

1.6 LIMITATIONS OF THE STUDY

The EIA Report has been prepared based on professional judgement to ascertain facts with resultant subjective interpretations. Professional judgments expressed herein are based on the facts available within the limits of the scope of work, information provided by the client or its representatives, prevailing secondary data, budget, and schedule.

The consultation undertaken during the site visit was 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.

1.7 CONTENTS OF EIA REPORT

The report has been divided into the following chapters.

Table 1-2: Contents of EIA 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-2	Project Description	This chapter presents the details of the proposed project with description of the resources required and emissions, waste and wastewater anticipated to be generated.
Chapter-3	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-4	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-5	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-6	Analysis of Alternatives	The chapter entails the alternative options for the project.

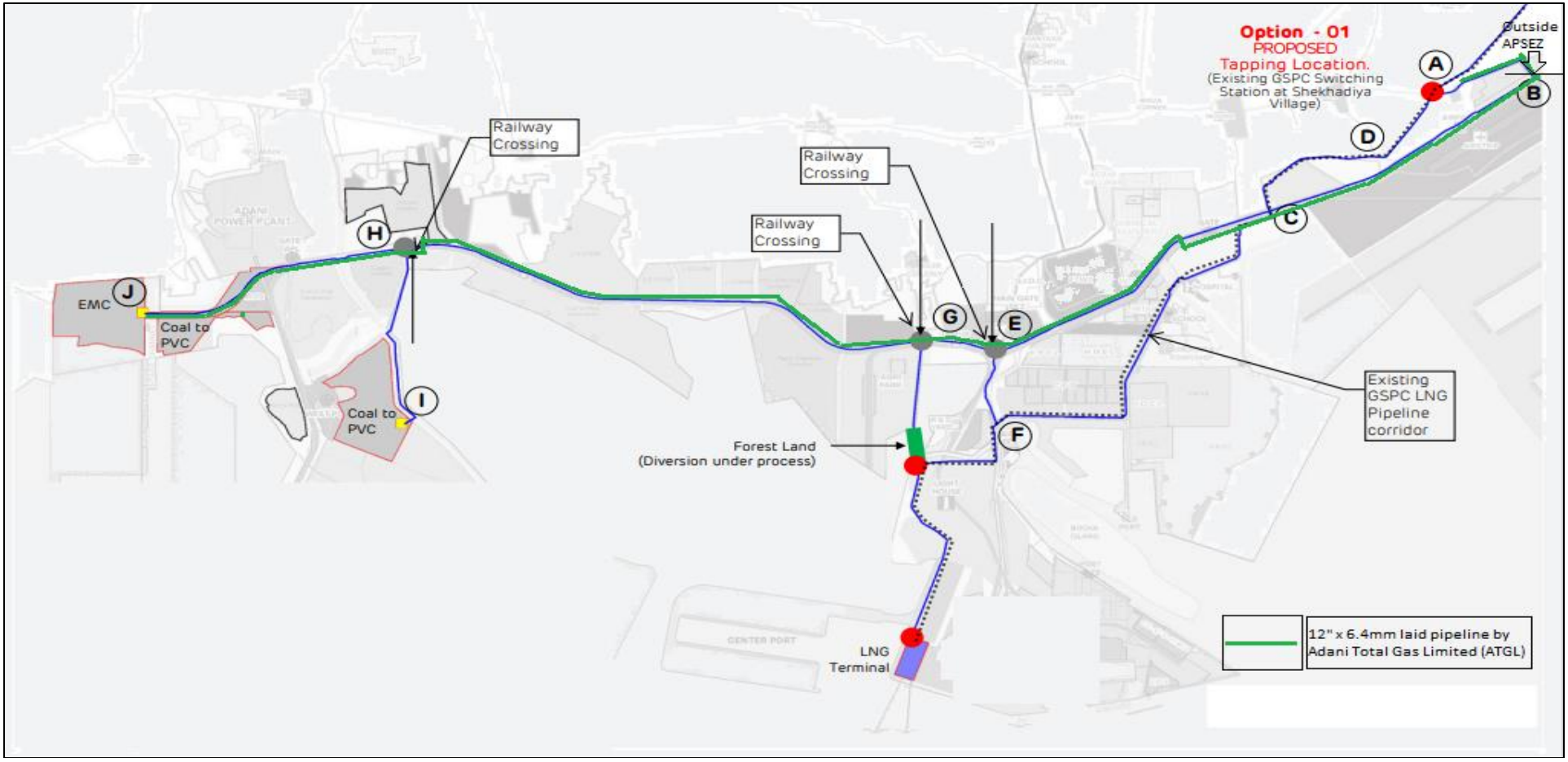
Chapter	Title	Description and Details
Chapter-7	Project Benefits	This chapter presents the details of direct and indirect benefits due to proposed project.
Chapter-8	Environment Monitoring & Management Plan	This chapter describes the details of the monitoring schedule to be implemented for checking the 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-9	Summary & Conclusions	This chapter summarizes the potential positive and negative environmental impacts of the project.

2 PROJECT DESCRIPTION

2.1 DESCRIPTION OF NATURAL GAS PIPELINE NETWORK

ATGL has planned to lay 12 inches diameter natural gas pipeline network in approx. 30.768 kms stretch across Adani Ports and SEZ Park at Mundra Port. The pipeline network shall start from pooling sub-station of GSPL (Gujarat State Petronet Limited) located outside the APSEZ park to MSTPL within APSEZ Park.

Adani Gas Limited 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 NG pipeline network will be adequate to maintain uninterrupted flow of natural gas. Detailed layout of the pipeline network gas been provided below in **Figure 2-1**.



Source: ATGL

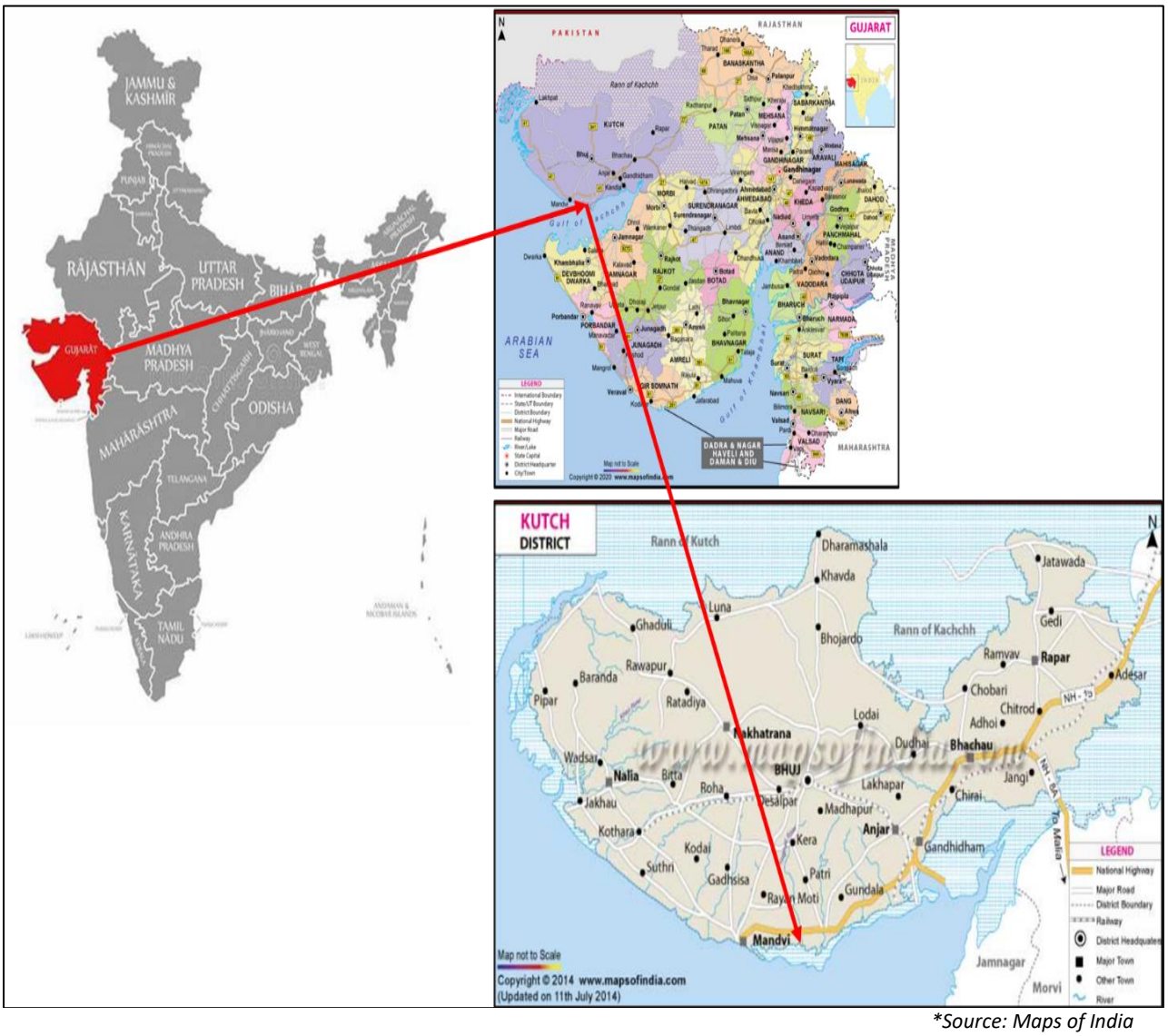
Figure 2-1: Route Map of Proposed Natural Gas Pipeline Network

2.2 PROJECT IMPLEMENTATION SCHEDULE

Currently, the NG pipeline has been laid within the APSEZ Park till MSTPL line only. The pipeline is yet to be laid from GSPL PSS to Entry gate of APSEZ Park. GSPL PSS is located approx. 1.64 kms away from entry point of APSEZ Park.

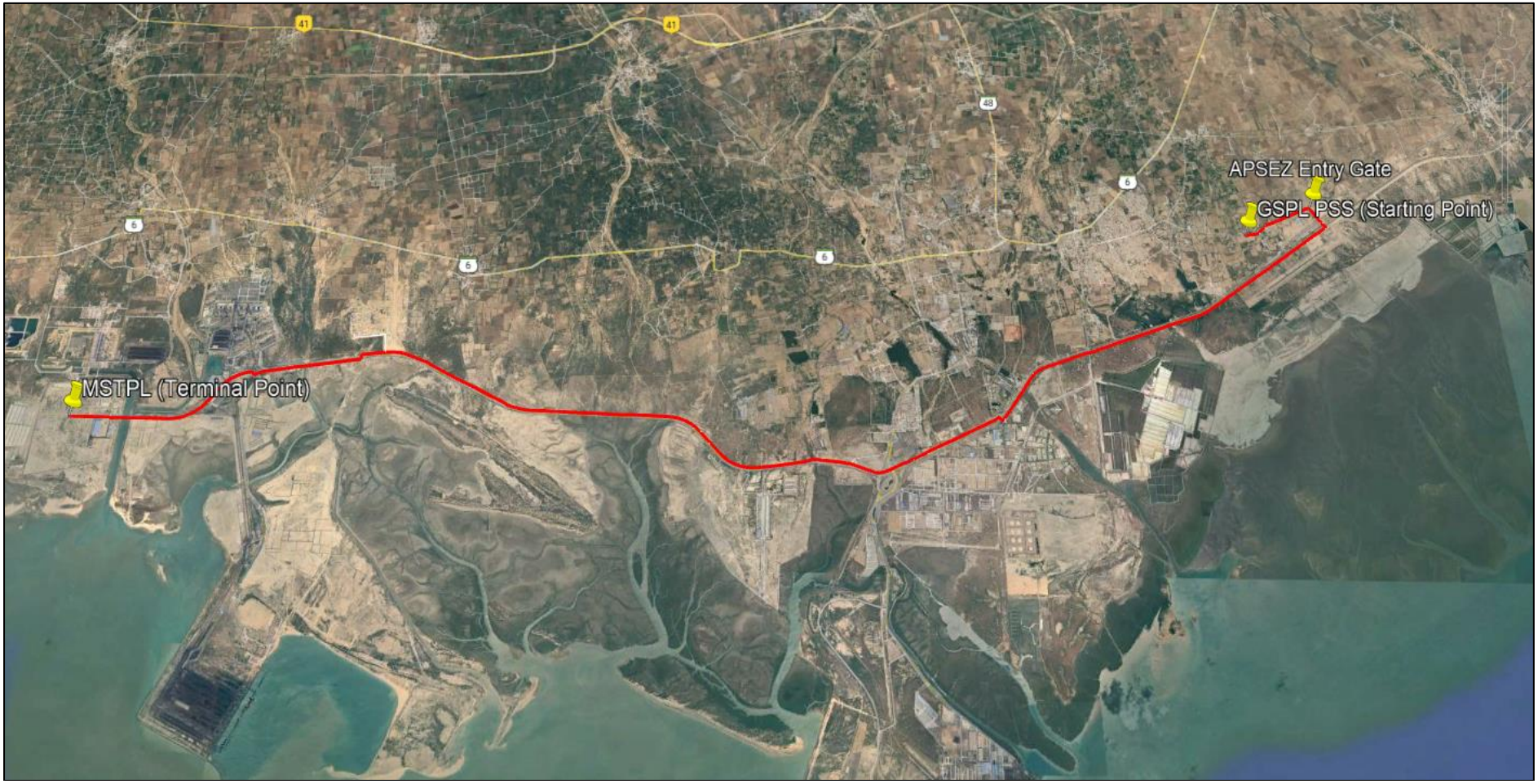
2.3 PIPELINE ROUTE & ACCESSIBILITY

The pipeline runs along ROW of Gandhidham-Mundra Road (for pipeline stretch outside the complex) and Adani Power Road (for pipeline stretch within the complex).



Source: Maps of India

Figure 2-1: Location Map of Project Site



Source: Adani Total Gas Limited & Google Earth

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

Source: TUVSUD Primary Survey

Figure 2-3: GSPL Pooling Substation (Starting Point)

Source: TUVSUD Primary Survey

Figure 2-4: Site for Proposed NG Network, Goresema Village

Figure 2-5: Entry Point of NG Pipeline into APSEZ Park, Mundra Port

**Source: TUVSUD Primary Survey*

Figure 2-6: Laid pipeline network nearby MSTPL i.e., Terminal Point

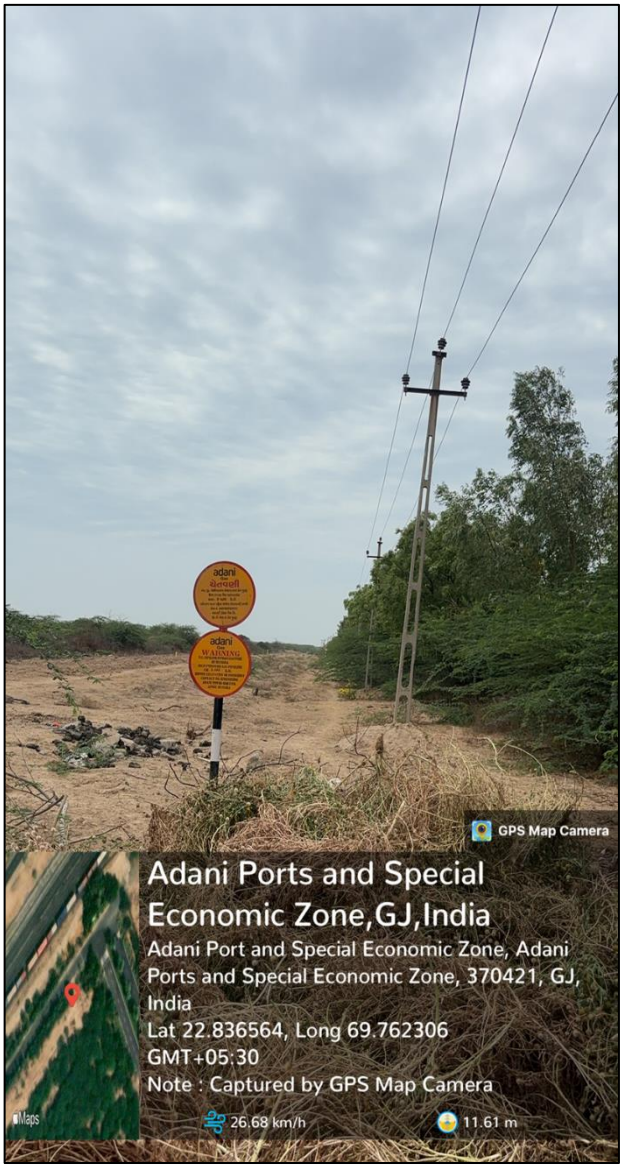
**Source: TUVSUD Primary Survey*

Figure 2-7: Demarcation of Pipeline & its specifications in route (APSEZ Park, Mundra Port)

**Source: TUVSUD Primary Survey*

Figure 2-8: Areas nearby Pipeline Route

Figure 2-9: Cathodic Protection Device/Rectifier in Pipeline Network



**Source: TUVSUD Primary Survey*

Figure 2-10: Areas in vicinity of Pipeline Stretch within APSEZ Park, Mundra Port

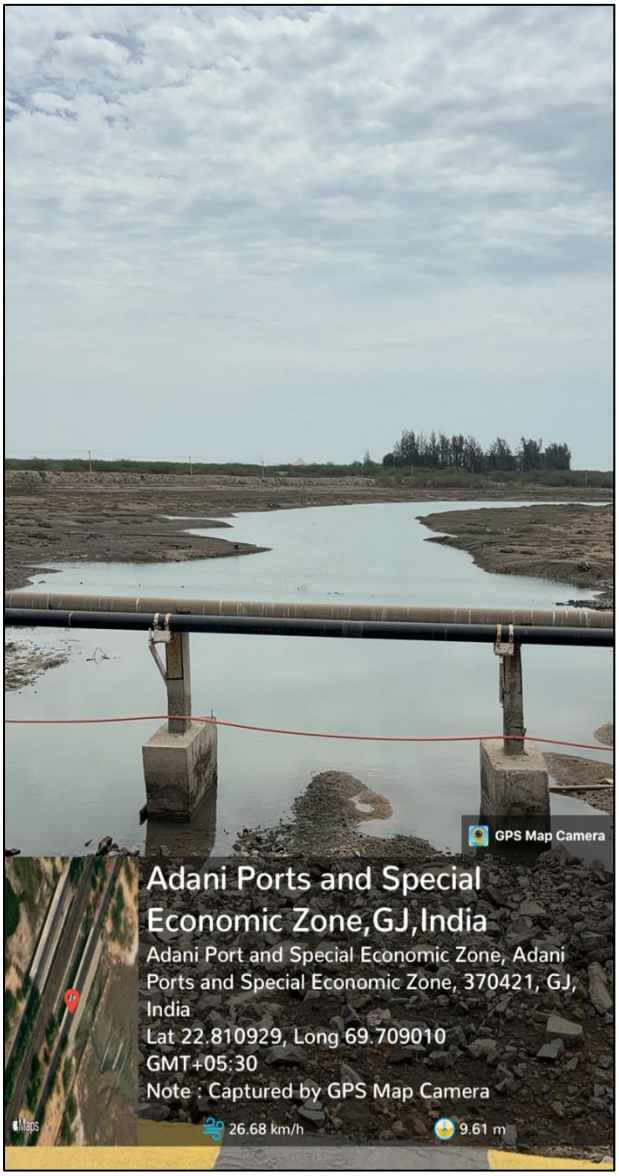
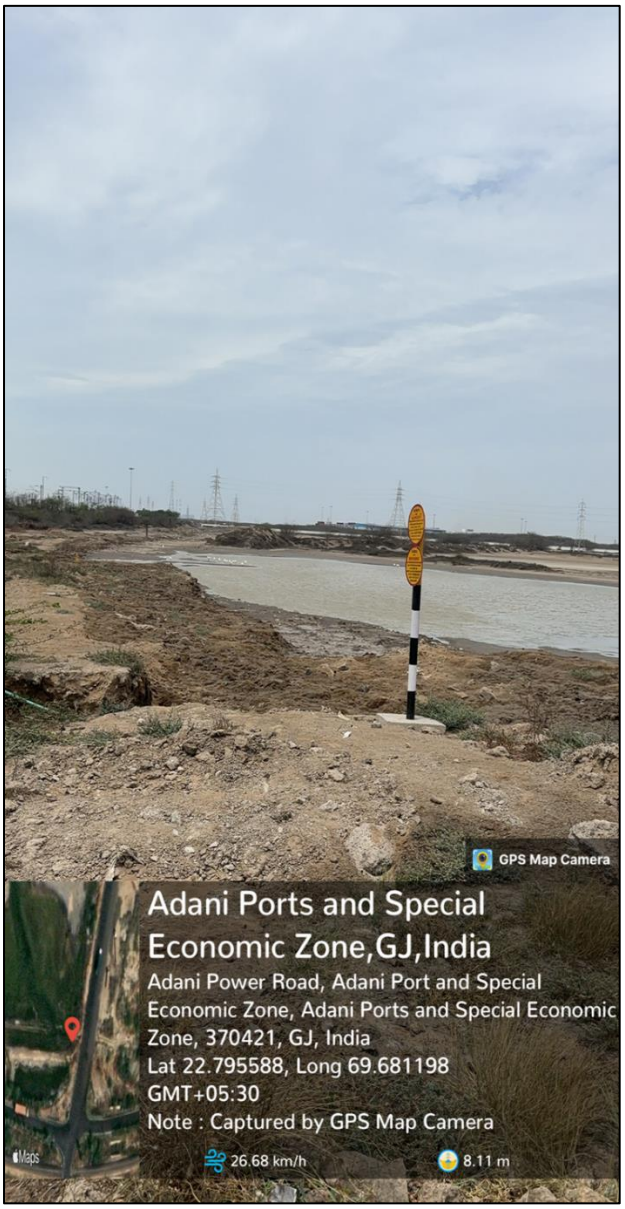
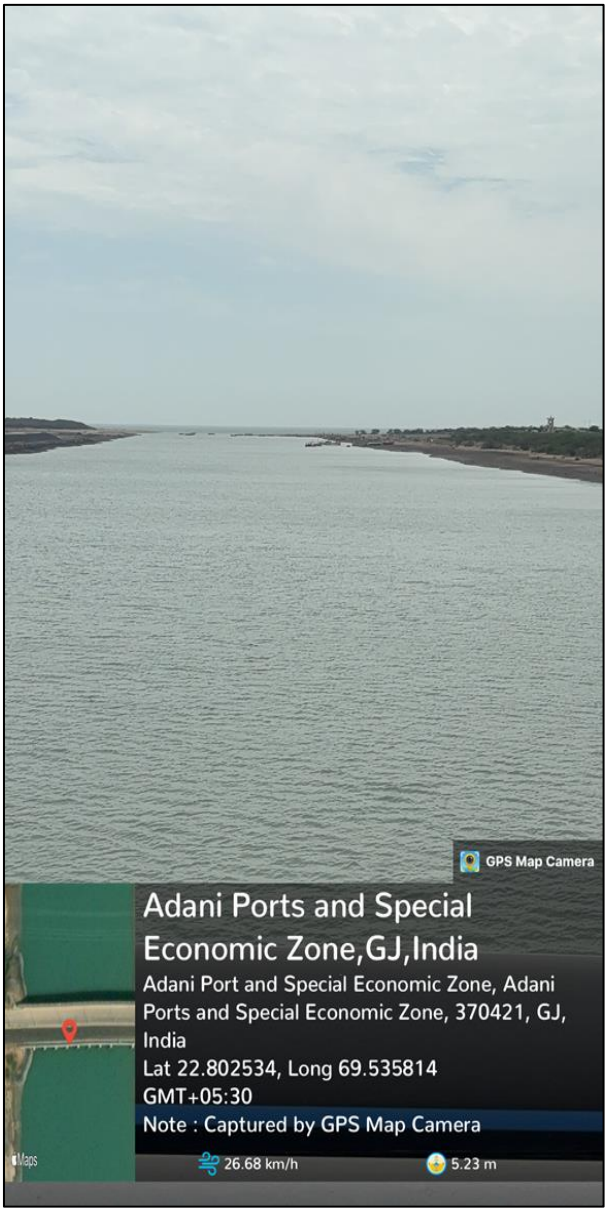


Figure 2-11: Minor Stream Crossing in NG Pipeline Network

**Source: TUVSUD Primary Survey*

Figure 2-12: Avenue Plantation in NG Pipeline Network





**Source: TUVSUD Primary Survey*

Figure 2-13: Water Body nearby NG Pipeline Stretch

Figure 2-14: Creek crossing in NG Pipeline Network

Details of environmental & infrastructural facilities falling within the pipeline route has been provided below:

Table 2-1: Details of Environmental & Infrastructural Features falling within Pipeline Route

Sl. No.	Environmental & Infrastructural Features	Coordinates at Crossing
	ROAD CROSSINGS	
1.	Gandhidham-Mundra Road	22°50'53.93"N; 69°46'16.84"E
2.	APSEZ Internal Road Crossing	22°50'39.55"N; 69°46'26.65"E
3.	Adani Power Road Crossing	22°48'52.33"N; 69°34'46.64"E

Sl. No.	Environmental & Infrastructural Features	Coordinates at Crossing
4.	APSEZ Internal Road Crossing	22°47'48.90"N; 69°41'4.98"E
5.	Pragpar-Mundra Port Highway Road Crossing	22°47'44.36"N; 69°40'52.87"E
6.	Adani Power Road Crossing	22°48'40.61"N; 69°33'37.18"E
RAILWAY LINE CROSSING		
7.	Railway Line Crossing	22°50'40.85"N; 69°46'26.41"E
8.	Railway Line Crossing	22°48'20.61"N; 69°42'16.88"E
9.	Railway Line Crossing	22°48'51.71"N; 69°34'46.67"E
10.	Railway Line Crossing	22°48'39.07"N; 69°33'32.79"E
WATER BODY CROSSINGS		
11.	Crossing at Baradi Mata Creek	22°48'45.14"N; 69°34'5.89"E
12.	Kotdi Creek Crossing	22°48'6.97"N; 69°32'12.13"E

**Source: Primary Survey by TUVSUD*

2.4 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 2-2: Applicable Standards and Codes

Sl. No.	Standards & Schedule	Applicability
1	ASME B 16.25	Butt welding Ends
2	ASME B 31.8	Gas Transmission and Distribution Piping Systems
3	ASME B 16.11	Forged Fittings, Socket Welding and Threaded
4	ASME B 31.3	Process Piping
5	ASME B 31.4	Pipeline Transportation System for Liquid Hydrocarbons and Others
6	ASME B 16.5	Pipeline flanges and flanged fittings

Sl. No.	Standards & Schedule	Applicability
7	ASME B 16.9	Factory made- Wrought Steel Butt welding Fittings
8	ASME PTC 10	Performance Test Code on Compressors and Exhausters
9	PNGRB T4S	Pipeline Design & Material Selection
10	PNGRB Regulation, 2008- Schedule–I A	Material And Equipment
11	PNGRB Regulation, 2008- Schedule–1B	Welding
12	PNGRB Regulation, 2008- Schedule–I C	Piping System Components and Fabrication
13	PNGRB Regulation, 2008- Schedule–I D	Design, Installation and Testing
14	PNGRB Regulation, 2008- Schedule–I E	Operating and Maintenance Procedures
15	PNGRB Regulation, 2008- Schedule–I F	Corrosion Control
16	PNGRB Regulation, 2008- Schedule–I E	Miscellaneous

**Source: Secondary Data Survey, TUVSUD*

Table 2-3: Applicable Codes and Standards

Sl. No.	Code No.	Description
1.	PNGRB T4S	Technical Standards & Specifications including Safety Standards" for City or Local Natural Gas Distribution Network
2.	ASME B.31.8	Transmission and Distribution Piping Systems" – Latest edition and all Codes it refers to.
3.	API RP 1102	Steel pipelines Crossings Railroads and Highways" – Latest edition
4.	API 1104	Welding of pipelines and related facilities" – Latest edition.
5.	AS/NZS 2885.5	Pipelines – Gas and liquid petroleum – Field Pressure Testing"
6.	OISD 141	Design and construction requirements for cross-country hydrocarbon pipeline–" - latest edition.
7.	OISD 226	Natural Gas Transmission Pipelines and City Gas Distribution Network
8.	DIN 30670	Polyethylene coating for steel pipes and fittings".
9.	DIN 30671	"Thermoset plastic coating for buried steel pipes"
10.	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 50^{o}C
11.	DIN 30673	Bitumen coatings and linings for steel pipes, fittings and vessels".
12.	DIN 30675-1	External corrosion protection of buried pipes & range of applications for steel pipes."
13.	DIN 30677	Protection of buried valves against corrosion coating (external) with duroplastics."
14.	EN 12062	Nondestructive examination of welds – General rules for metallic materials".
15.	EN 12068	Cathodic Protection – External organic coatings for the corrosion protection of buried or immersed steel pipelines used in conjunction with cathodic protection – Tapes and Shrinkable materials.
16.	IS 8062	Code of practice for Cathodic protection of steel structures
17.	IS 12944-5	Paints and Varnishes – Corrosion Protection of Steel Structures by protective paint system
18.	ISO-8502-3	Preparation of steel substrates before application of paints and related products – Tests for the assessment of surface cleanliness".
19.	ISO 9305	"Seamless steel tubes for pressure purposes full peripheral ultrasonic testing for the detection of transverse imperfections".
20.	ISO 10124	Seamless & welded (except submerged arc welded) steel tubes for pressure purposes. Ultrasonic testing for the detection of laminar imperfections".
21.	ISO 12094	Welded steel tubes for pressure purposes. Ultrasonic testing for the detection of laminar imperfections in strips/plates used in the manufacture of welded tubes.
22.	ISO 15741	Paints and varnishes – friction – reduction coatings for the interior of on – and offshore steel pipelines for non-corrosive gases."

Sl. No.	Code No.	Description
23.	ISO 15590-1	Petroleum and Natural Gas Industries – Induction bends, fittings and flanges for pipeline transportation system – Part I: Induction Bends".
24.	ISO 21809-3	Petroleum and natural gas industries – External coatings for buried or submerged pipelines used in pipeline transportation systems.

**Source: Secondary Data Survey, TUVSUD*

Table 2-4: Technical Specifications of Pipeline

Sl. No.	Description	Piping Details
1.	Pipeline internal Diameter (Inches)	12"
2.	Pipeline Wall Thickness (mm)	6.4
3.	Pipeline Grade/Material Specifications	APL 5L Gr. L290M PSL2
4.	Type of Coating	External 3-Layer Polyethylene Coating
5.	Normal Operating Pressure	42 Bar
6.	Maximum Allowable Operating Pressure (Design Pressure)	49 Bar
7.	Design Throughput (MMSCMD)	1.9811 MMSCMD
8.	Pipeline Design Life	35 years
9.	Design Temperature (°C)	60 °C
10.	Mainline Valve Stations	Will be installed at regular interval as per design for the entire length of the pipeline

**Source: DPR, Adani Total Gas Limited*

2.5 ASSOCIATED FACILITIES

2.5.1 SCADA, Telecommunication and 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.

2.5.2 Filtration Skid

Cartridge type filters will be installed to remove entrained particles (filtration efficiency 99%) made up of Borosilicate fibre glass cartridge type. Equipment like regulators and metering are quite sensitive to dirt. Metering requires no particles above 5 microns.

2.5.3 Pressure Reduction Skid

The pressure reduction system shall consist of the following:

- Slam-shut valve actuated to close in case of downstream pressure increase above safe level; it needs local manual reset.
- *Monitor*: A Pressure Control Valve (PCV) which takes over control in case the Active PCV fails to maintain downstream pressure below required maximum pressure; Fail-safe is to open.
- *Active Pressure Control Valve (PCV)* that regulates the downstream pressure as required.
- Such concept is called “Non-Venting Pressure Safety” and allows avoiding the "Safety Relief Valves" more common in industrial plants. Indeed, large relieves as may be needed by the “Venting Pressure Safety” is then avoided and relevant hazards suppressed.

2.5.4 Metering Skid

Custody transfer metering will be provided before the gas is transferred to the end users. The custody transfer metering system will be Ultra Sonic Meter. The flow meters are connected to a flow computer which calculates the mass flow and corrects for temperature and pressure. Gas quality and gas compressibility data will be provided to the flow computer by a gas chromatograph located at a place before comingling of the gas from various sources.

2.5.5 Odorizer

Natural gas is, by nature, odourless what makes detection of leaks impossible without special gas detection tools. End-users connected to a Natural Gas Distribution System being not supposed to have adequate skill for gas handling, it is mandatory to add an odorant to the gas before it enters the CGD System. Odorization shall be based on the injection of suitable sulphur compound in adequate proportion (in function of actual flow) on the primary network system.

2.5.6 Fire Alarm and 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.

2.5.7 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.

2.6 LAYING OF PIPELINE

The pipeline construction is proposed to be conducted through deployment of 4 to 5 spreads. The sequence and methodology of construction of new pipeline is given below:

- **Clearing and grading**: A 30 m wide Right of Use (RoU) area will be cleared off for vegetation and other obstacles such as boulders. Tree felling will not take place.
- **Stringing**: Pipes are transported to the site on trucks will be offloaded using side booms. Pipes are then strung adjacent to the trench. Trailers and cranes will be used for manoeuvring of pipes. This activity may be done before or after trenching.
- **Trenching**: Trenchers and backhoe type excavators will be used to dig the trench for laying the pipeline. The topsoil in agricultural areas will be removed and stockpiled for restoration. The excavated sub-soil will be stockpiled separately for backfill.
- **Bending**: Pipes will be bent using a bending machine to the appropriate angle to match the vertical and horizontal alignment of the trench.
- **Welding:** Welding will be done using conventional manual/ semi-automatic welding involving a crew of welders and fitters. Once the pipe is strung a line-up crew will position the pipe using side booms in preparation for welding. Pipe strings to be welded will be effectively earthed. During welding, at least one end of the pipe string will be closed to prevent a forced draught effect.
- **Non-Destructive Inspection**: Mechanized Ultrasonic Testing (MUT) is the specified method to be applied for the execution of NDT. Each field weld will be 100% radiographed to evaluate for soundness of the weld in compliance with specifications. NDT and its evaluation shall be performed in accordance with API Standard 1104.
- **Coating**: After welding at each weld joint, coating of field joints of bare pipes and the repair of coating shall be done by.
- **Burial**: General burial depth of the pipeline along the route will be with a minimum 1.0 m cover. Burial cover will be compacted to avoid future erosion by all weathers.
- **Backfilling**: The excavated sub-soil will be returned to the trench. The topsoil, which has been preserved on the side of the ROU, will be spread over the filled-up trench. A crown of soil will be kept on top of the trenched portion to allow for future settlement. Backfilling will be managed so that damage from sizable rocks is not used or any other materials that may damage the pipeline.

- **Crossings**: The method used for the crossing of waterways and other infrastructure facilities will vary from place to place depending on the environmental setting and the geo-technical features of the area. The detail method of various types of crossings is specified below.

Table 2-5: Type of Crossings

Sl. No.	Type of Crossing	Method of Crossing
1	National Highway	Conventional Trenching/ Horizontal Directional Drilling (HDD)
2	State Highway	Conventional Trenching/ HDD
3	Other Roads	Conventional Trenching/ HDD
4	Railway Crossing	HDD
5	Major Lined Canal	HDD
6	Unlined Canal	HDD

(Source: PNRGB Notification, 2008)

- **Restoration** - Restoration of the ROU will be conducted progressively following the completion of construction work. This will involve removal of foreign materials such as construction debris and wastes. The ROU will be returned to its original condition by spreading the topsoil over the areas from where it was stripped, so that green belt activities will be restored along roadside of the SEZ area. Special focus will be given to restoration of side slopes and beds of natural water body crossings.
- **Pipeline warning markers**–In the final stages of construction, warning marker posts will be erected indicating the location of the pipeline and the crossing of other pipelines, cables, and features. A marker tape will be placed in the trench 500 mm above the pipeline to indicate to future excavators that a pipeline is below and that they are nearing.

The major construction activity involved during laying of pipeline are as follows:

- Transport of pipes from the place of availability to stock/lining yard.
- Transporting of pipes from the stock / lining yard to suitable places along the route of the pipeline.
- Application of lining and coating.
- Fabrication of fittings and special lining and coating of the same.
- Excavation and preparation of trenches for the pipes. Topsoil to be kept separately.
- Lowering the pipes into the trench.
- Jointing of pipes inside the trench.
- Welding of pipes.
- Rectification of defects and re-testing
- Finishing the coating and lining at weld joints.
- Back-filling of the trench with topsoil layer.
- Construction of valve chambers and erection of valve.
- Construction of necessary pipe supports anchor blocks.
- Providing line markers

2.6.1 Site Preparation and 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.

2.6.2 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 1.0- 1.5 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 2-6: 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)

2.6.3 Testing, Cleaning and Drying

2.6.3.1 Filling of Nitrogen for 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.

2.6.3.2 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.

2.6.3.3 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.

2.6.3.4 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.

2.6.3.5 Swabbing and 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.

2.7 PROJECT REQUIREMENT

2.7.1 Land

The land required for the project is only for natural gas pipeline network measuring 30.786 kms. The tapping off point is already available at GSPL Pooling Station located 1.64 kms away from entry point of APSEZ Park.

2.7.2 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 100-200. **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.

2.7.3 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.

2.7.4 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. The same shall be supplied via SEZ department.

2.7.5 Emission and Discharges

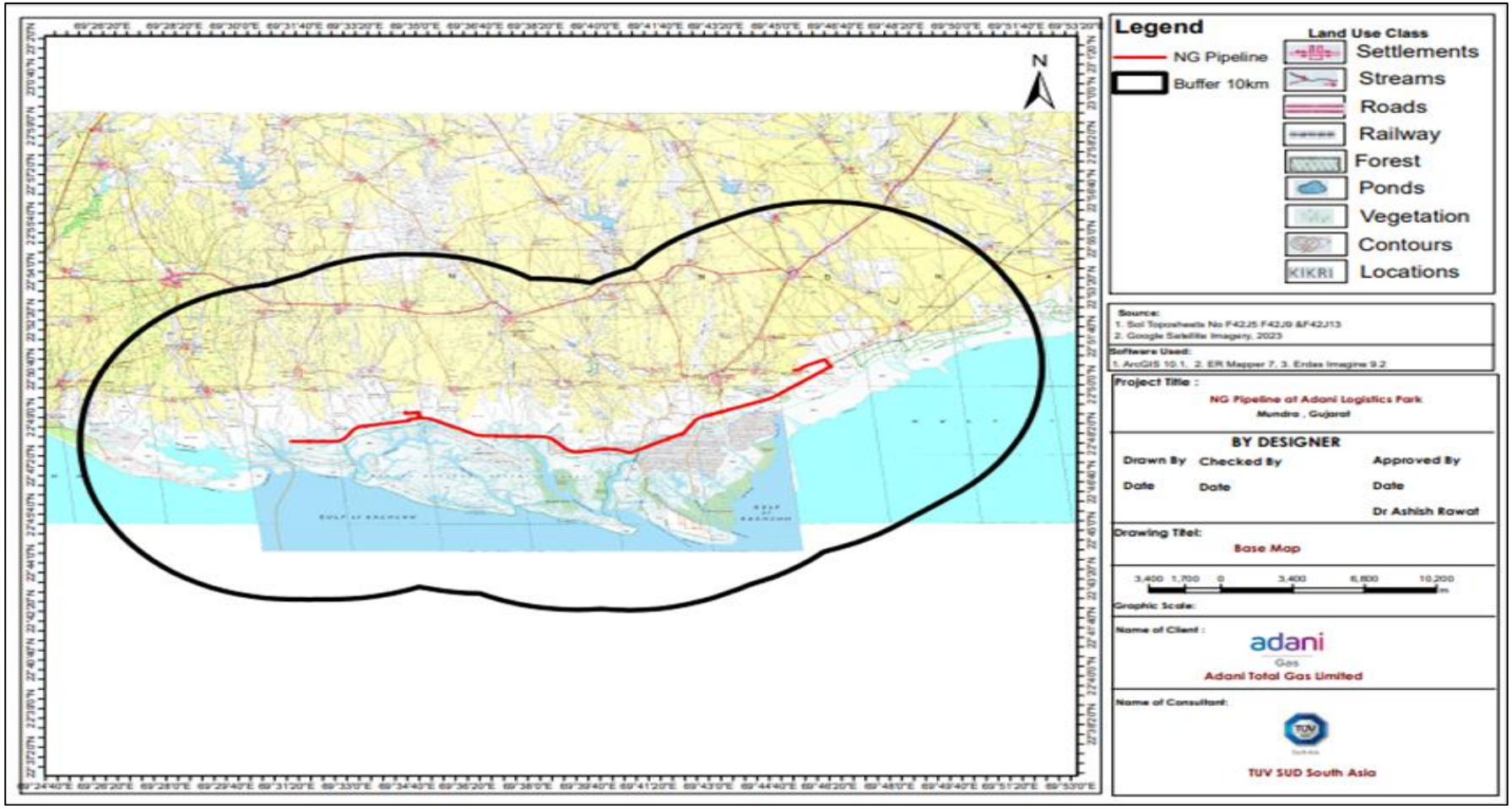
Fugitive dust shall be the main air pollutant, from the small diesel engines used for the construction works & movement of vehicles for which dust suppression system will be used as relevant points. No effluent will be generated during operation of the proposed project.

3 ENVIRONMENTAL DESCRIPTION

Baseline data generation forms an integral part of the EIA 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.

3.1 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 **4th- 5th April 2024**.



(Source: TUVSUD GIS Mapping)

Figure 3-1: Project Study Area superimposed on Toposheet

3.2 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 NG pipeline runs underground starting from the GSPL PSS and extends all the way to the required industries inside Adani port area.

3.3 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 3-1.**

Table 3-1: 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	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	Surface Water Bodies (within 5 km of the project foot-print area)	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	5.00 Km	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.
5.	Land Environment	500 m	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	500 m-10.00 Km	Area of Influence has been considered as 10.00 km around

Sl. No.	Environmental & Social issues	Area of Influence (AoI)	Justification
	Ecology		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	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.

3.4 METHODOLOGY 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 **4th and 5th April 2024** 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 team from the "**Evergreen Enviro Testing LLP**" Laboratory to undertake the summer season monitoring for the period of **April,2024** 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 3-2: 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.
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 Goresema Village, Mundra Block, Kachchh District, Gujarat 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 3-3.**

Table 3-3: Environmental and Social Attributes studied

Sl. No.	Attributes	Parameters	Source & Frequency
1.	Ambient Air Quality	SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO	Twice a week for 1 month
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

3.5 PRIMARY DATA COLLECTION BY ESTABLISHING MONITORING STATIONS AT SITE

The environmental monitoring stations were selected for ambient Air Quality, Ambient Noise Quality, Surface Water Quality, Ground Water Quality and sediment Quality, Soil Quality NABL accredited & MoEF&CC approved laboratory, **M/s Evergreen Enviro Testing LLP**, Noida, Uttar Pradesh has been entrusted by **TÜV SÜD** for conducting environment baseline monitoring at project study area, under supervision of **TÜV SÜD** representative. In accordance with the Scope of Work, the baseline environmental monitoring has been carried in the project footprint and study area during the April 2024.

3.6 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.

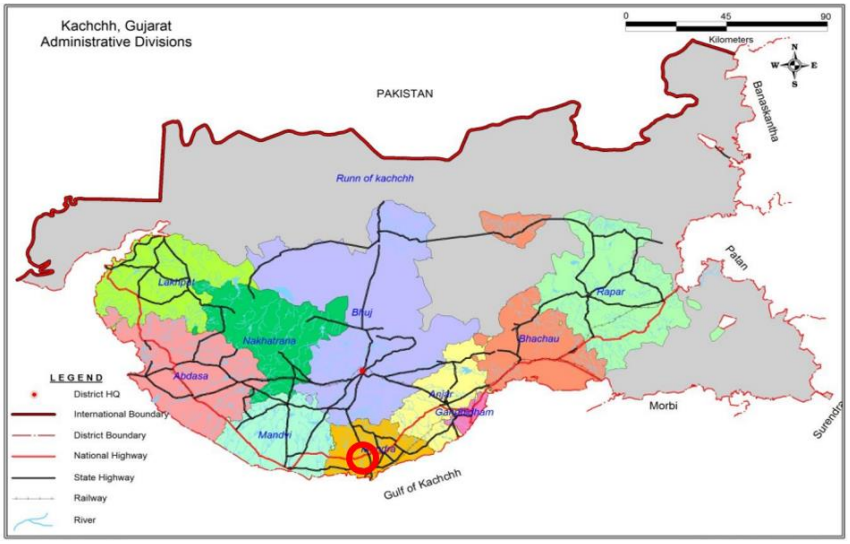
The components of physio-chemical environment discussed in this section include:

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

3.6.1 Physiography and Topography

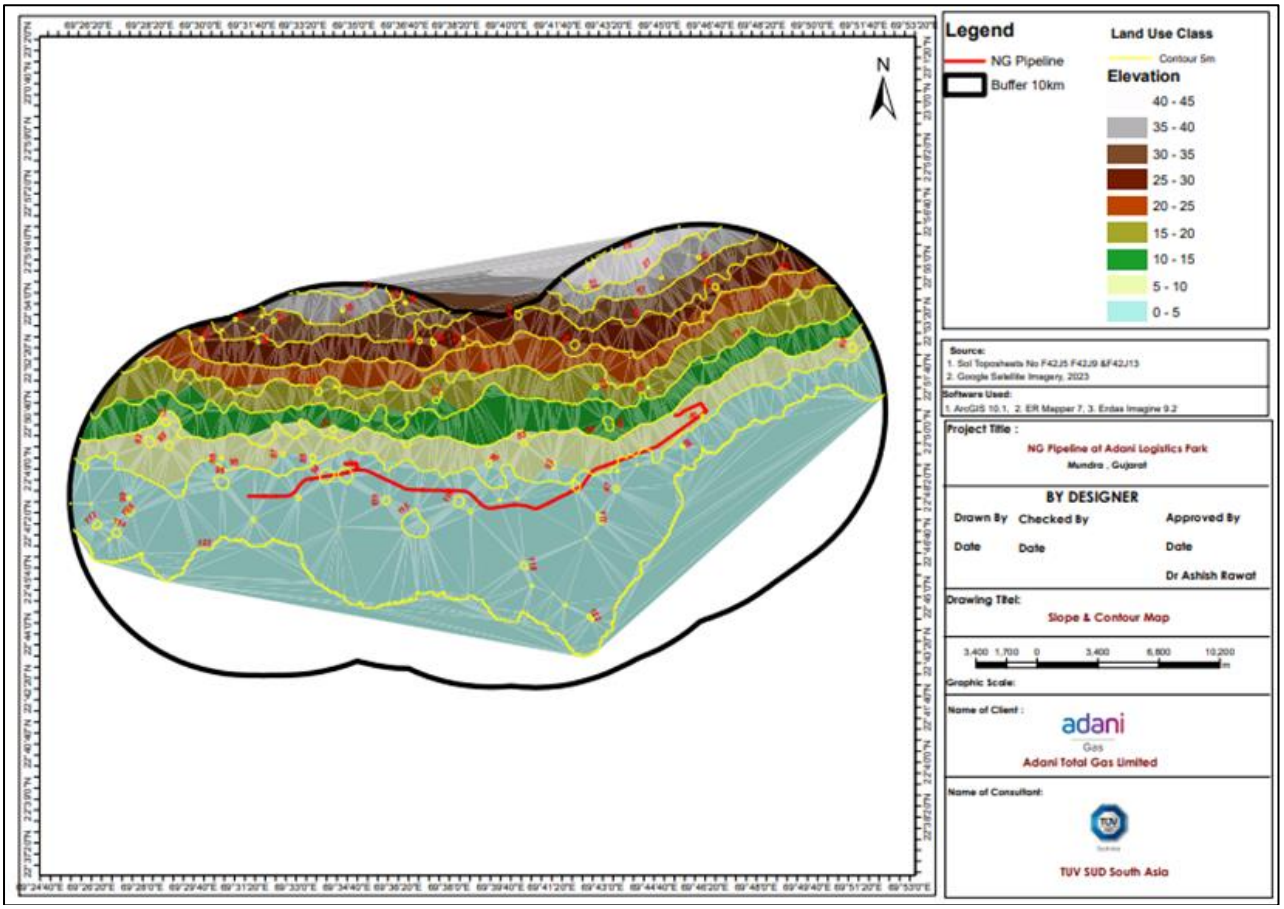
The underground NG pipeline project spans across the Adani Port and Special Economic Zone located in Goresema Village, Mundra Block, Kachchh District, Gujarat.

Kachchh district, located on the westernmost tip of India is the largest district of Gujarat lies in the extreme western part of the state. The district is bounded on the north and northwest by the Sindh Province of Pakistan and on the northeast by Rajasthan state. The southern boundary of the district is marked by the Gulf of Kachchh and towards west and southwest by the Arabian Sea. Administrative Map of the district has been depicted as **Figure 3-2**. The Kachchh Peninsula is divided into nine sub-micro regions, namely, Rann of Kachchh, Dungar Upland, Khadir Island, Banni Lowland, Rapar Stony Waste, Sathsaida Bet, Coastal Plain, Bhuj Upland and Creek Zone based on topography, climate, geology, soils, and natural vegetation. The district is characterized by treeless and barren Rann, rocky hills, and low-lying plains. The Rann of Kachchh is vast salt desert spread over the entire northern and south-eastern parts of the district which is about three-fourth area of the district. The Contour Map (**Figure 3-3**) of the project AOI is shown below.



(Source: Aquifer Map and Management Plan- Kachchh District)

Figure 3-2: District Administrative Map (Red Circle: Project AOI)

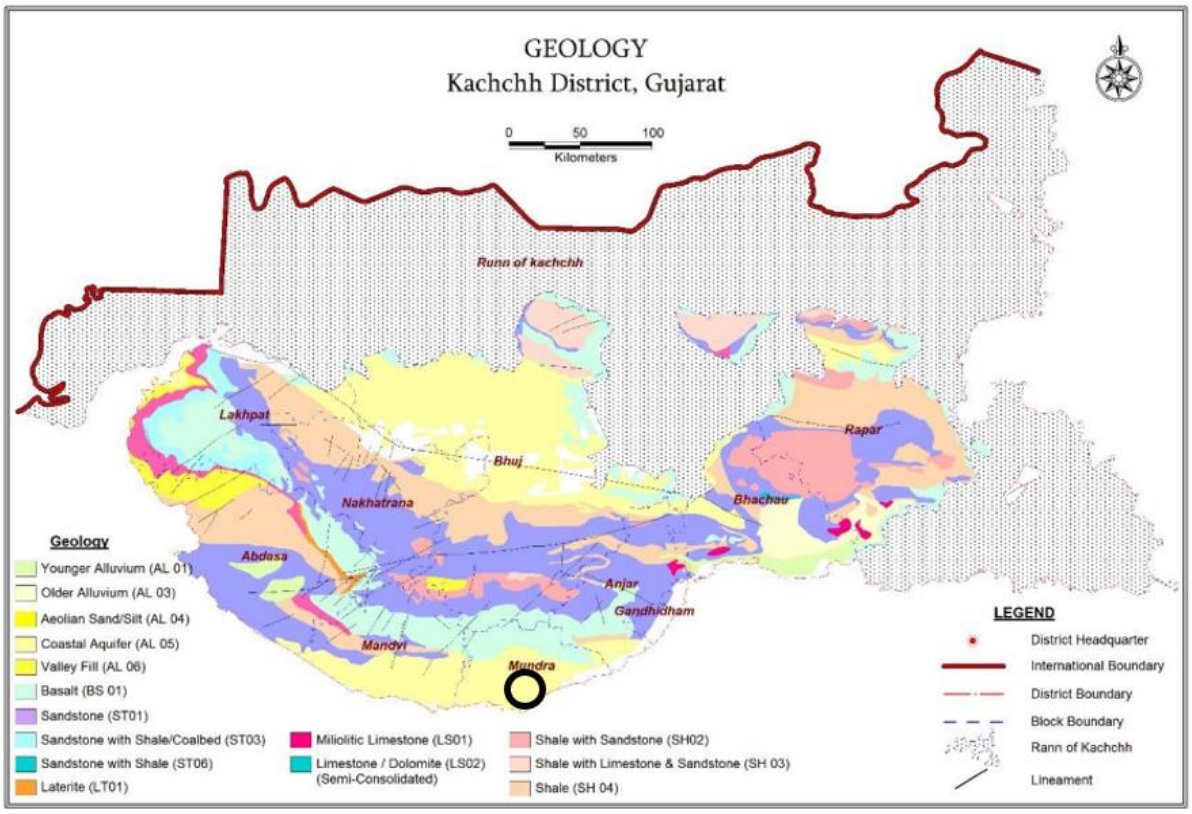


**Source: TUV SUD GIS Mapping Study (Toposheet No F42J5 F42J9 &F42J13)*

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

3.6.2 Geology

Geologically, Kachchh basin is situated in the southern end of Indus shelf, covered by alluvium, and Thar Desert, which consist of a thick blanket of sand in the north and the Cretaceous age Saurashtra Deccan traps & tertiary sedimentary rocks in the south, the eastern part of the basin is covered by vast quaternary alluvium and Arabian Sea in the west. Also, Tropic of Cancer passes through the Kachchh district. Geological map of the district has been shown below as **Figure 3-4.**



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

Figure 3-4: Geological Map of Kachchh District (Project Study Area demarcated with "Black Circle")

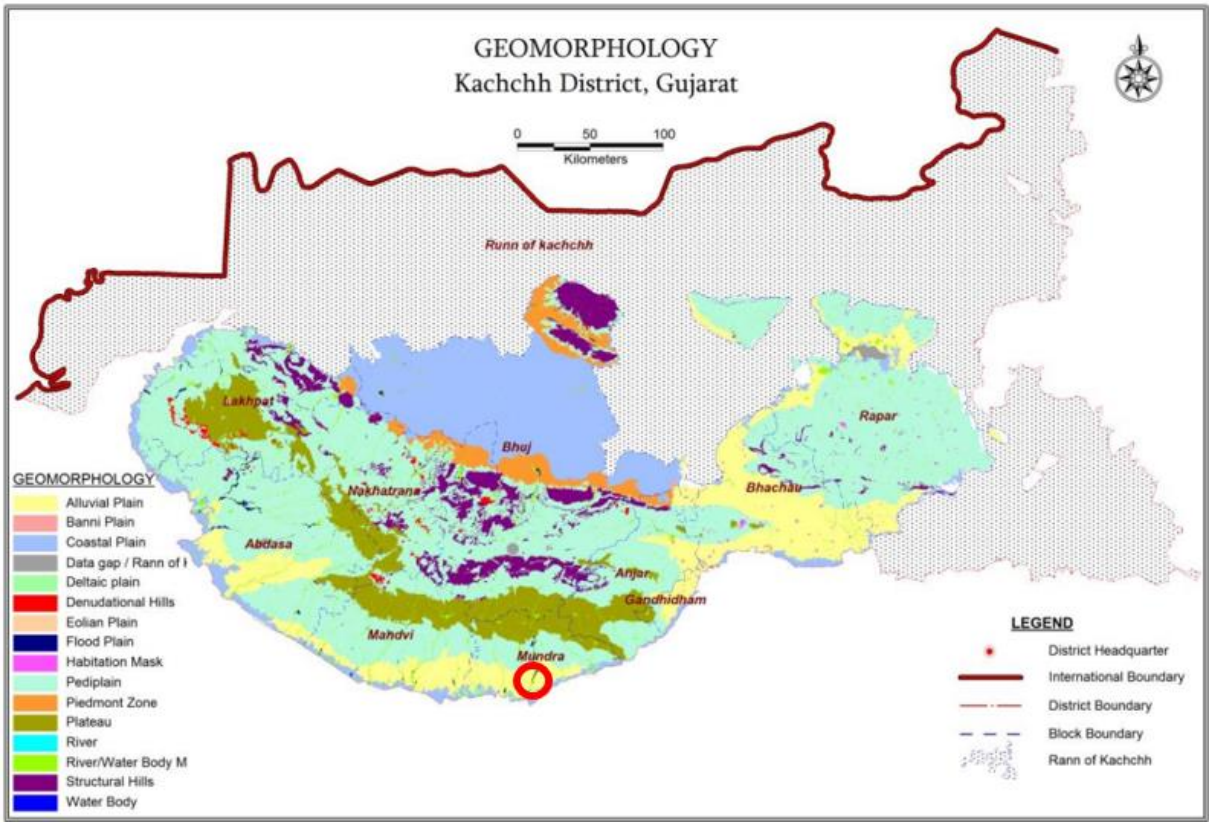
As indicated in **Figure 3-4**, the project study area is in "*Coastal Aquifer*".

3.6.3 Geomorphology and Drainage

3.6.3.1 Geomorphology

Kachchh landmass itself is an island surrounded by low-lying Ranns in north and east, the Sidhu River Delta zones in north-western parts and Gulf of Kachchh in south. The Kachchh mainland is a central high land with a core plateau zone, which is dissected in the north, west and east and associated with coastal plain in south. All these physiographic features, comprising unique saline wasteland forms of Ranns and associated plains, hill ranges, gently sloping peripheral coastal tract, dissected coastal erosional plain fringed successively by younger deltaic plains, tidal flats, spits and marginal accretionary zones etc., can broadly be divided into four characteristic units:

a) Central High land and the Upland in the Rann Area.
b) Central Plain in the southern part
c) Little and Great Rann areas, and the
d) Banni plains.



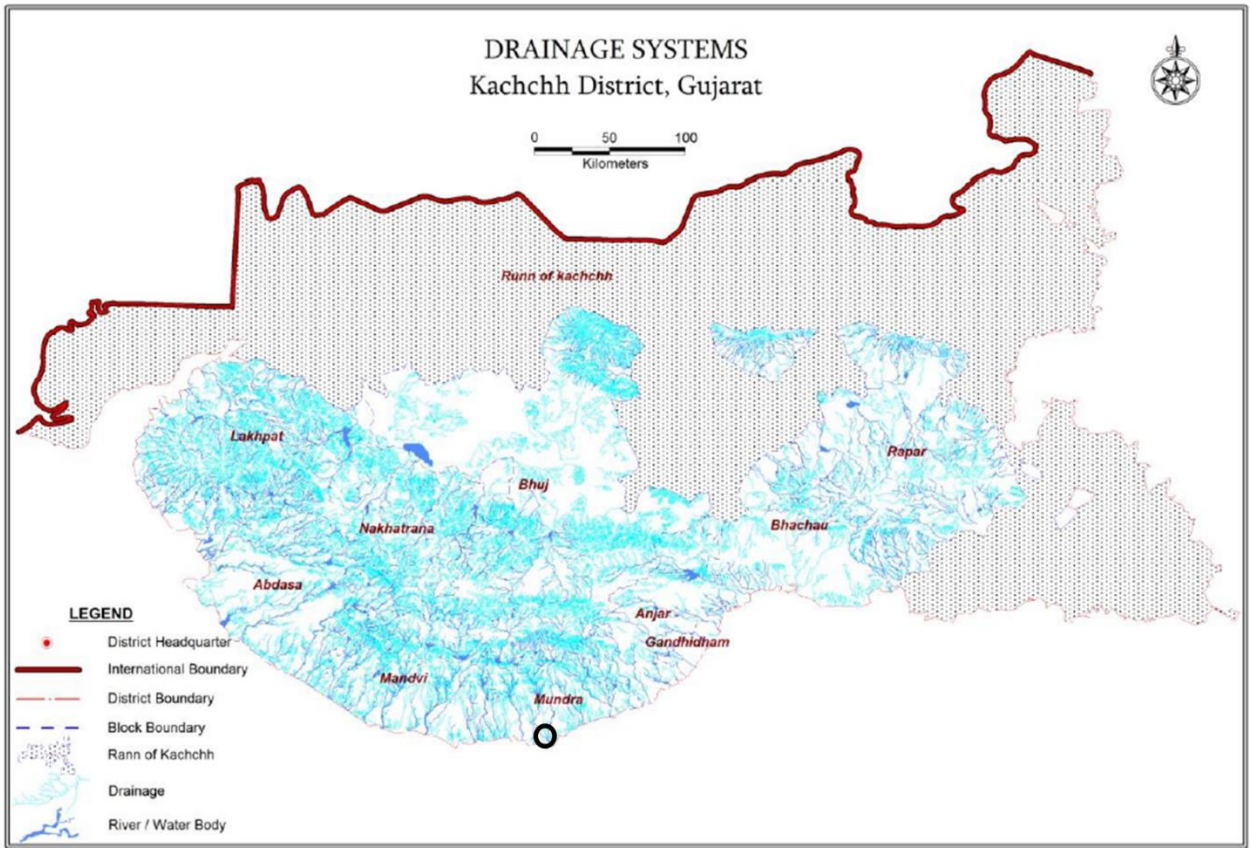
Source: Aquifer Map and Management Plan- Kachchh District

Figure 3-5: Geomorphological Map of Kachchh District (Red Circle: Project AOI)

As indicated in **Figure 3-5** above, the project study area falls in *Coastal Plain* and *Alluvial Plain*.

3.6.3.2 Drainage

The main rivers are of district Bharud, Kali, Suri, Malan, Khari, Kunkawati, Mithi, Rukmavati and Bhukhi. All the rivers are ephemeral in nature and have steep gradients. Their flow is flashy depending upon monsoon rainfall. Drainage Map of district indicating project study area has been depicted below in **Figure 3-6**.



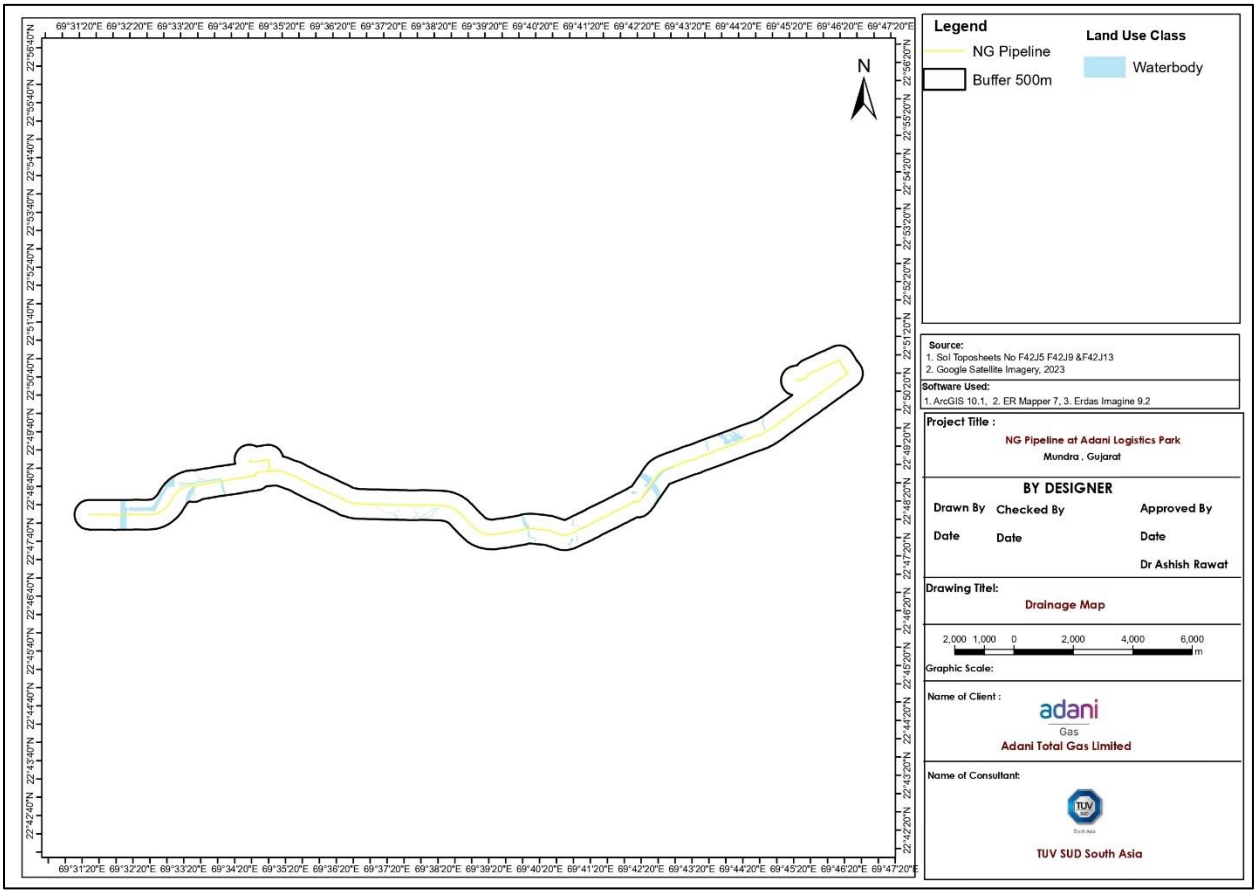
**Source: Aquifer Map and Management Plan- Kachchh District*

Figure 3-6: Drainage Map of Kachchh District (Black Circle- Project Study Area)

The pipeline crosses two water bodies in its right of way i.e., Baradi Mata Creek and Kotdi Creek. The project study area has the following drainage patterns/river systems as mentioned in **Table 3-4**:

Table 3-4: Details of Waterbodies in Project Study Area

Sl. No.	Name of Water Body	Distance (KM)	Direction
1.	Nagavanti Nadi	Adjacent	N
2.	Phot Nadi	Adjacent	N
3.	Bhukhi Nadi	Adjacent	N
4.	Gulf Of Kachchh	2.69	S



**Source: TUV SUD GIS Mapping Study (Toposheet No F42J5 F42J9 &F42J13)*

Figure 3-7: Drainage Map of Project Study Area

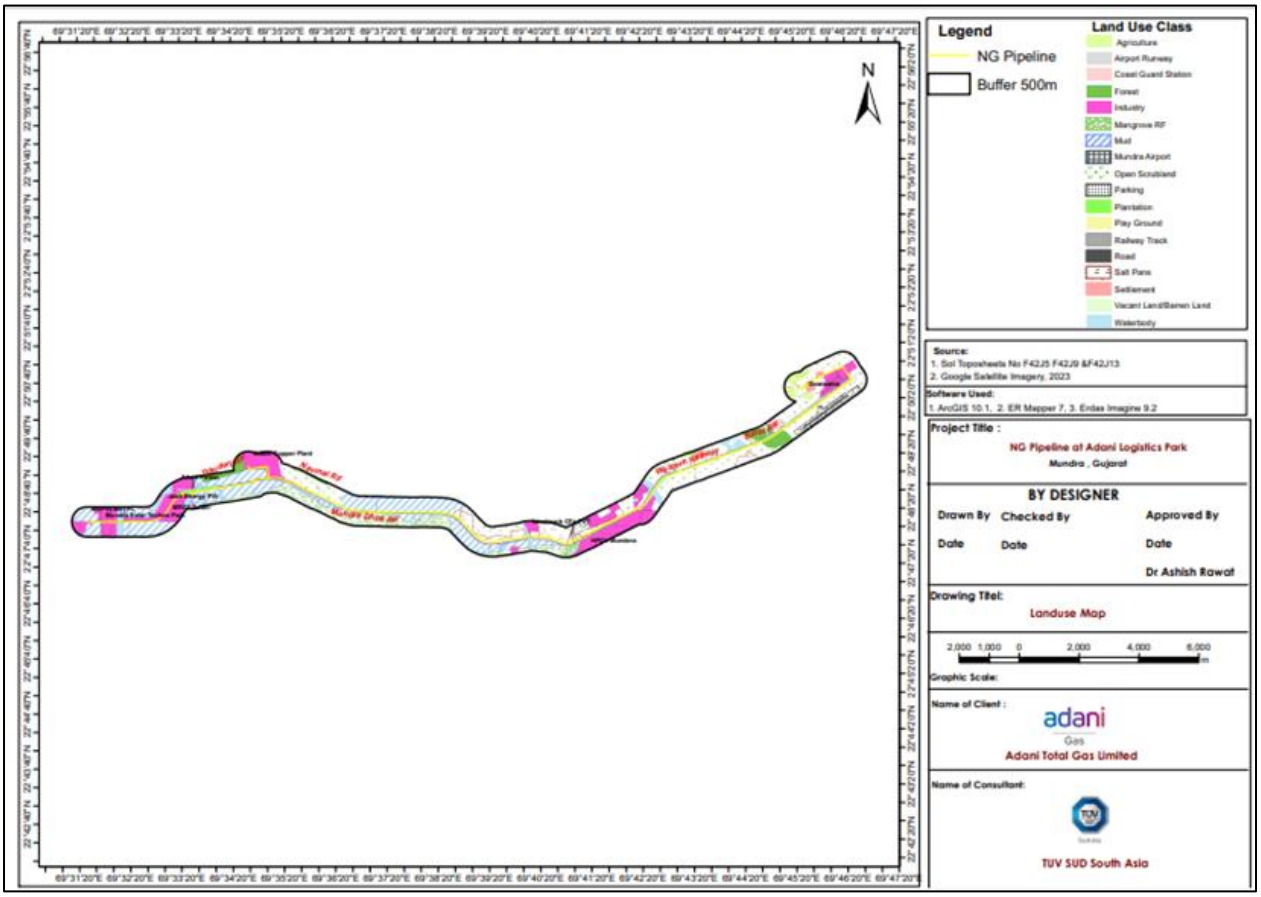
3.6.4 Land use and Land Cover

The proposed pipeline project has been identified mainly in the Special Economic Zone. The assessment of Land-use and land cover of project AOI reveals that the project study area predominantly consists of open scrubland (26.22%) followed by Mud (22.17%), Industries (16.98%), salt pans (5.55%), forest (3.86%), mangrove RF (9.92%), plantations (0.33%), agriculture (1.31%) and settlement zones (0.79%) respectively. Major settlement within the project study area is Goresema village. The detailed land-use breakup of the study area is given in **Table 3-4** as follows:

Table 3-5: Land use Details of Project Study Area

Sl. No.	Land Use	Area in Sq. Ha	Area in %
1	Agriculture	41.11	1.31
2	Airport Runway	5.21	0.17
3	Coast Guard Station	12.47	0.40
4	Forest	120.78	3.86
5	Industry	531.94	16.98
6	Mangrove RF	310.55	9.92
7	Mud	694.34	22.17

Sl. No.	Land Use	Area in Sq. Ha	Area in %
8	Mundra Airport	46.52	1.49
9	Open Scrubland	821.25	26.22
10	Parking	15.95	0.51
11	Plantation	10.40	0.33
12	Playground	2.84	0.09
13	Railway Track	36.54	1.17
14	Road	77.70	2.48
15	Salt Pans	173.78	5.55
16	Settlement	24.66	0.79
17	Vacant Land/Barren Land	58.14	1.86
18	Waterlogging	147.70	4.72
Study Area		**3131.88**	**100.00**



**Source: TUV SUD GIS Mapping Study (Toposheet No F42J5 F42J9 &F42J13)*

Figure 3-8: Land Use Map of Project Study Area

3.6.5 Soil Quality

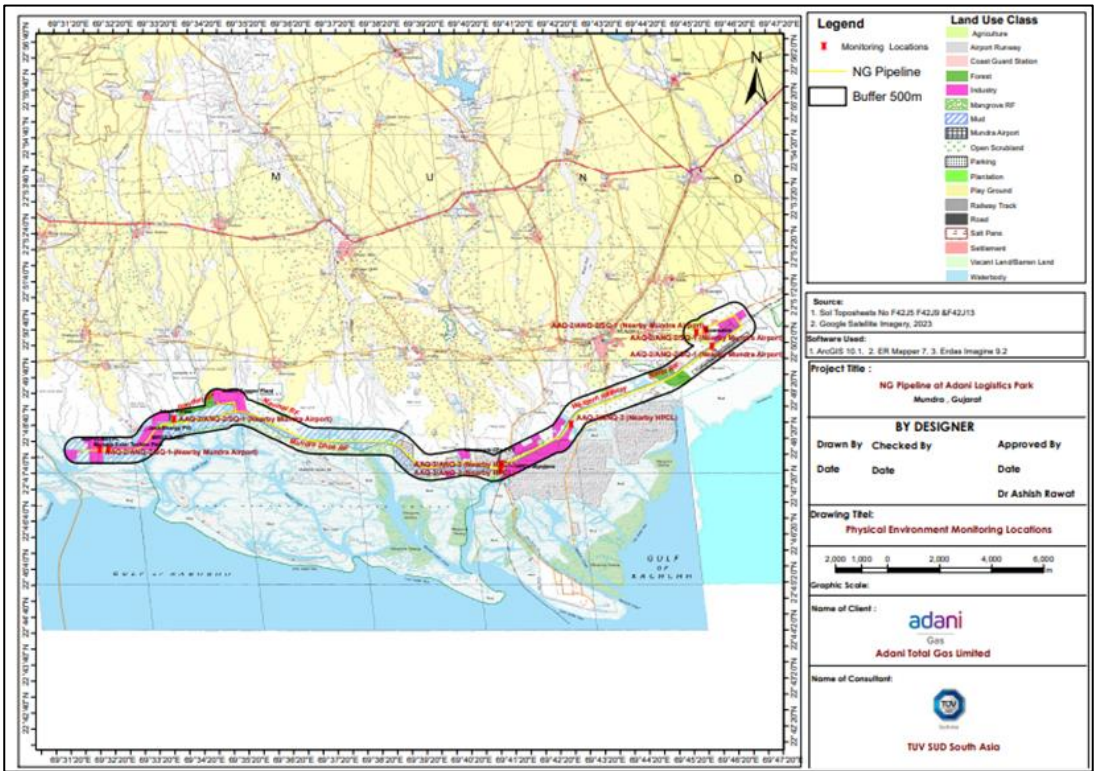
The soils found in Kachchh district can broadly be grouped into four types, i.e.,

- Shallow Black Soils
- Residual Sandy Soils
- Coastal Alluvial Soils
- Desert Soils

Coastal Alluvial soils are found all along the southern coast. These soils are sandy clay loam to clay in texture. The soil reaction varies with situation ranging from neutral to highly alkaline. These soils are normally medium in fertility. At places, these soils are saline in nature. The profile study reveals the presence of sufficient amount of gypsum throughout the profile. The soil quality monitoring locations are provided in **Table 3-5 and Figure 3-9.**

Table 3-6: Soil Quality Monitoring Locations

Sl. No.	Location code	Location name	Latitude (N)	Longitude (E)
1.	SQ-1	GSPL PSS (Starting Point)	22°50'32.28"N	69°45'25.52"E
2.	SQ-2	Nearby Mundra Airport	22°50'13.73"N	69°45'46.83"E
3.	SQ-3	Rangoli Bridge	22°47'39.75"N	69°41'0.14"E
4.	SQ-4	Nearby Adani Thermal Power Plant	22°48'45.95"N	69°33'40.01"E



**Source: TUV SUD GIS Mapping Study (Toposheets No F42J5 F42J9 &F42J13)*

Figure 3-9: Soil Quality Monitoring Locations

The samples were collected by ramming a core-cutter into the soil from three different depths viz. 30 cm, 60 cm, and 90 cm below the surface and homogenized. The homogenized samples were analyzed

for physical and chemical characteristics. The sealed samples were sent to laboratory for analysis. The soil samples were analyzed for various physical and chemical parameters of soil and the results of the soil quality analysis are given in **Table 3-7** below:

Table 3-7: Soil Quality Monitoring Results

Sl. No	Parameters	Unit	Test Method	Location			
				SQ-1	SQ-2	SQ-3	SQ-4
1.	Texture	-	IS 2720 (Part 4)	Clayey Sandy Loam	Clayey Sandy Loam	Clayey Sandy Loam	Clayey Sandy Loam
2.	Clay	%	IS 2720 (Part 4)	24.18	26.29	25.13	23.29
3.	Silt	%	IS 2720 (Part 4)	26.11	22.09	25.59	24.53
4.	Sand	%	IS 2720 (Part 4)	49.71	51.62	49.28	52.18
5	Porosity	%	EECL/STP/CHEM/55	28.7	22.47	23.86	28.19
6.	Bulk Density	g/cc	IS 2720 (Part 7)	1.39	1.51	1.47	1.59
7.	Water Holding Capacity	%	IS 14765	24.2	21.39	26.13	24.52
8.	pH	-	IS 2720 (Part 26)	7.73	7.61	7.31	7.26
9.	Specific Conductivity	µs/cm	IS 14767	582	593	407	542
10.	Moisture	%	Is 2720 (PART 2)	29.4	23.82	26.09	22.16
11.	Calcium	mg/kg	EECL/STP/CHEM/38	772	764	729	693
12.	Chlorides	mg/kg	EECL/STP/CHEM/42	307	318	327	334
13.	Sodium	mg/kg	EECL/STP/CHEM/40	372	364	152	167
14.	Potassium	mg/kg	EECL/STP/CHEM/40	174	189	26.13	241
15.	Organic Carbon	%	IS 2720 (Part 22)	0.73	0.79	0.89	0.82
16.	Organic Matter	%	IS 2720 (Part 22)	1.26	1.32	1.53	1.41
17.	Phosphorous (as P)	mg/kg	EECL/STP/CHEM/43	28.4	26.29	29.73	23.28
18.	SAR	meq	EECL/STP/CHEM/48	0.82	0.76	0.81	0.71
19.	Nitrogen (as N)	mg/kg	EECL/STP/CHEM/56	392	404	419	427
20.	Zinc as Zn	mg/kg	USEPA 3050 BY AAS FLAME	22.9	24.6	28.7	32.72
21.	Iron as Fe	mg/kg	USEPA 3050 BY AAS FLAME	64.29	61.24	54.17	59.16
22.	Selenium as Se	mg/kg	USEPA 3050 BY AAS	BDL (DL-	BDL (DL-	BDL (DL-	BDL (DL-

Sl. No	Parameters	Unit	Test Method	Location			
				SQ-1	SQ-2	SQ-3	SQ-4
			FLAME	0.1)	0.1)	0.1)	0.1)
23.	Copper as Cu	mg/kg	USEPA 3050 BY AAS FLAME	10.82	10.02	8.67	8.14
24.	Manganese as Mn	mg/kg	USEPA 3050 BY AAS FLAME	318	193	178	185.4
25.	Nickel	mg/kg	USEPA 3050 BY AAS FLAME	7.61	8.39	7.24	8.46
26.	Chromium as Cr	mg/kg	USEPA 3050 BY AAS FLAME	2.48	3.62	1.08	2.89
27.	Magnesium	mg/kg	EECL/STP/CHEM/39	318	322	339	324

Porosity & Water Holding Capacity

Porosity of the soil in study area ranges between 22.47-28.7%, whereas water holding capacity varies between 21.39-26.13%. Thus, study area soil has sufficient space between soil particles with right/moderate level of water holding capacity and soil textured as mainly Clayey Sandy Loam with sand percentage varies above 49.28-52.18% and clay percentage varies above 23.29-26.29%.

Organic Carbon & Organic Matter

Organic carbon content varies between 0.73-0.89% in the collected samples of the 2 Soil monitoring locations, whereas organic matter ranges between 1.26-1.53%.

N-P-K & and soil fertility

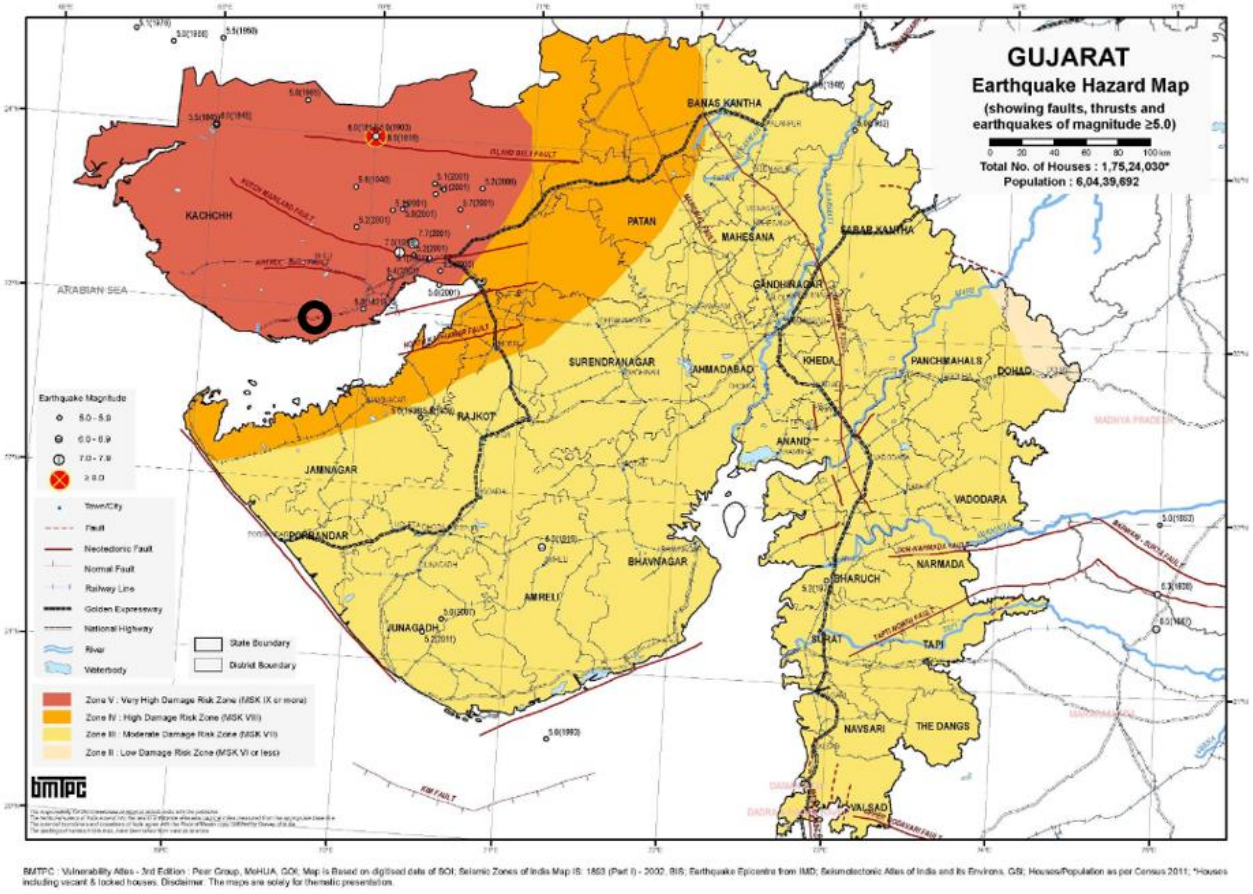
The Nitrogen content in the soil samples were found between 392 mg/kg to 427 mg/kg which is considered as High. Potassium content found with a range between 26.13 mg/kg to 241 mg/kg, which can be ranges from “Low to Medium’ concentration. Phosphorus content ranged between 23.28 mg/kg. to 29.73 mg/kg i.e., between low to medium range. Thus, ‘NPK’ concentration of the study area soil can be considered as “Medium to High”.

3.6.6 Natural Hazards

Natural hazards are naturally occurring 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 developments; hence assessment of the natural hazards in the area is important for any proposed development.

3.6.6.1 Seismicity

The study area falls in ***Zone V: Very High Damage Risk Zone (MSK IX or more)*** in accordance with the Earthquake Hazard map of Gujarat, Vulnerability Atlas of 3rd edition, 2019 prepared by BMTPC. Hence, the threat of damage due to an earthquake is of very high intensity. The seismic map is shown in **Figure 3-10**.

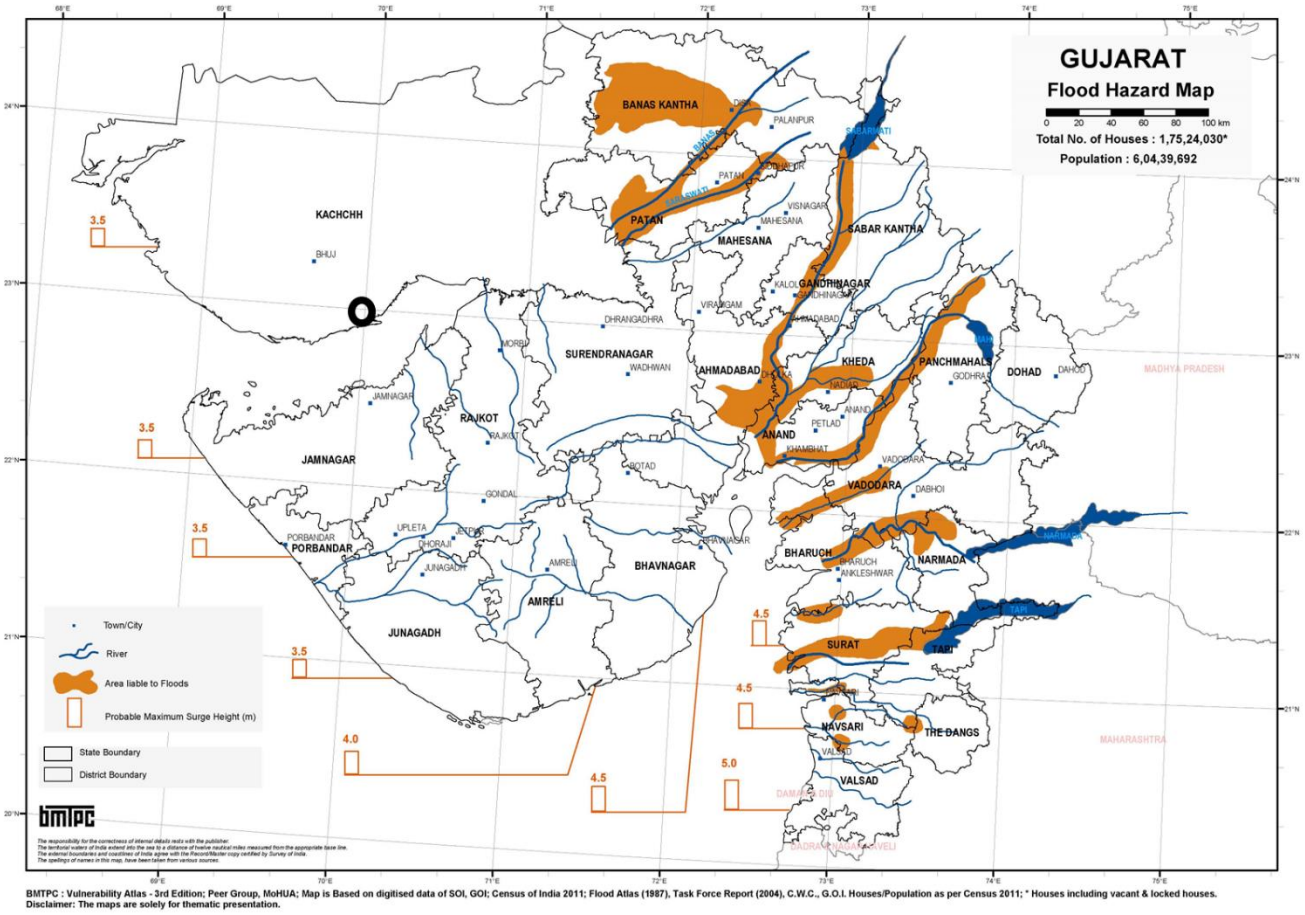


** BMTPC Vulnerability Atlas*

Figure 3-10: Earthquake Hazard Map of Gujarat (Black Circle-Project Study Area)

3.6.6.2 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 3-11.**

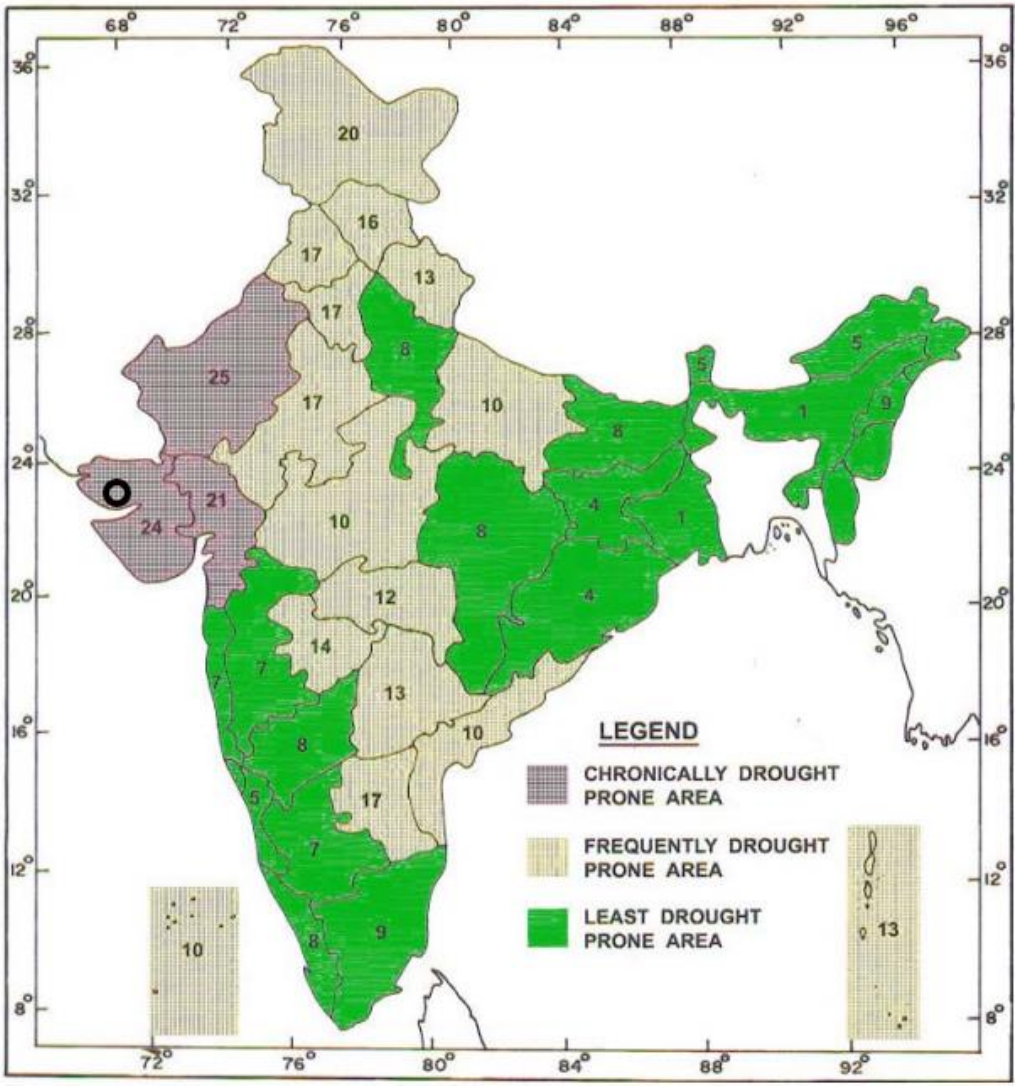


Source-BMTPC Vulnerability Atlas

Figure 3-11: Flood Hazard Map (Project Area identified with "Black Circle")

3.6.6.3 Drought

Frequent drought is one of the major problems of the district along with other problems of salinity and water logging. Kachchh district receives least amount of rainfall in entire Gujarat, therefore erratic rainfall results in declination of ground water. The continuous fall in water table has resulted into several problems like increasing salinity, problem of fluorides, reduction in bore yields and high failure rate of bores. Perpetually falling water table in mainland, sea water ingress from the gulf in and Rann ingression from the north seem to be "squeezing" Kachchh district of its freshwater resources. The prolonged use of saline ground water for irrigation has led to decline in agricultural and horticulture productivity and soil fertility in these regions.

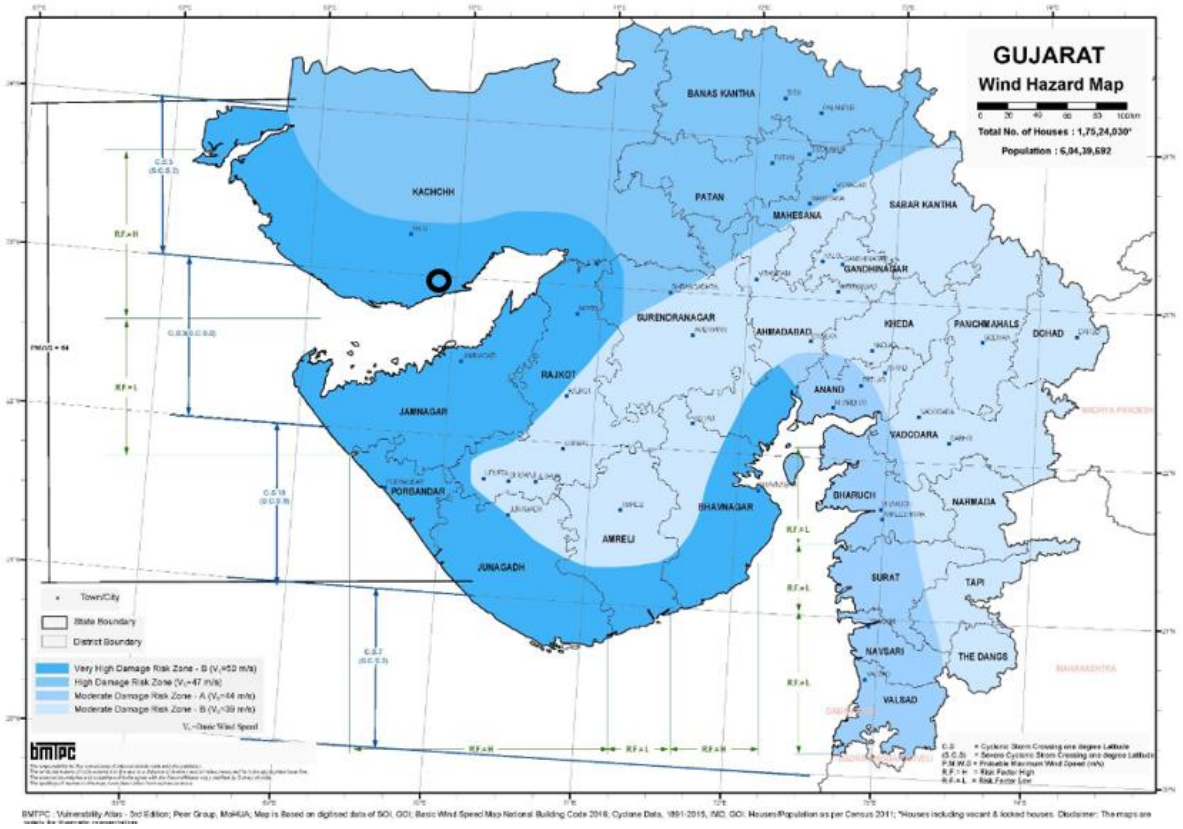


**Source: India Meteorological Department, Pune- Drought and Climatology Map*

Figure 3-12: Drought Prone Map of India (Black Circle indicating Project Area)

3.6.6.4 Wind Hazard

The project study area has been identified in Very High Damage Risk Zone - B (Vb=50 m/s) according to the Wind Hazard map of Gujarat, Vulnerability Atlas of 3rd edition, 2019 prepared by BMTPC. Wind Hazard Map of Gujarat indicating project study area has been depicted in **Figure 3-13**.



**BMTPC Vulnerability Atlas*

Figure 3-13: Wind Hazard Map, Gujarat (Project Area identified with "Black Circle")

3.6.7 Climate and Meteorology

In accordance with [2]Köppen–Geiger Climate Classification system (**Figure 3-14)** the climate zone of project area is considered as to be [3]BWh, i.e., hot desert climate.

[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.

[3]The first letter 'B' indicates that the area has arid climate i.e., *receives less than 25.4 cm of rainfall per year, with rainfall being highly* variable. The second letter 'W' denotes *that the region receives fewer than 25 centimeters (10 inches) of precipitation* a year. The third letter 'h' indicates that the region receives less than 50 cm of annual precipitation and the monthly average outdoor temperature remain above 45°F (7°C) throughout the year.
Therefore, BWh indicates hot desert climate.

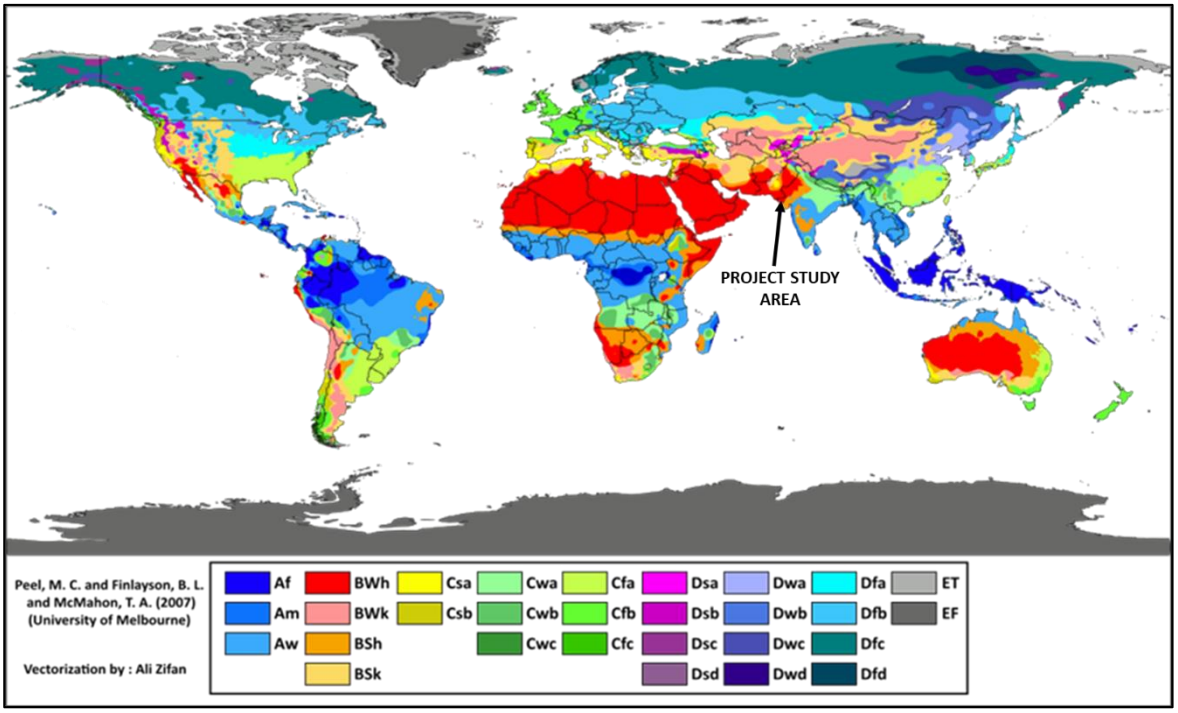
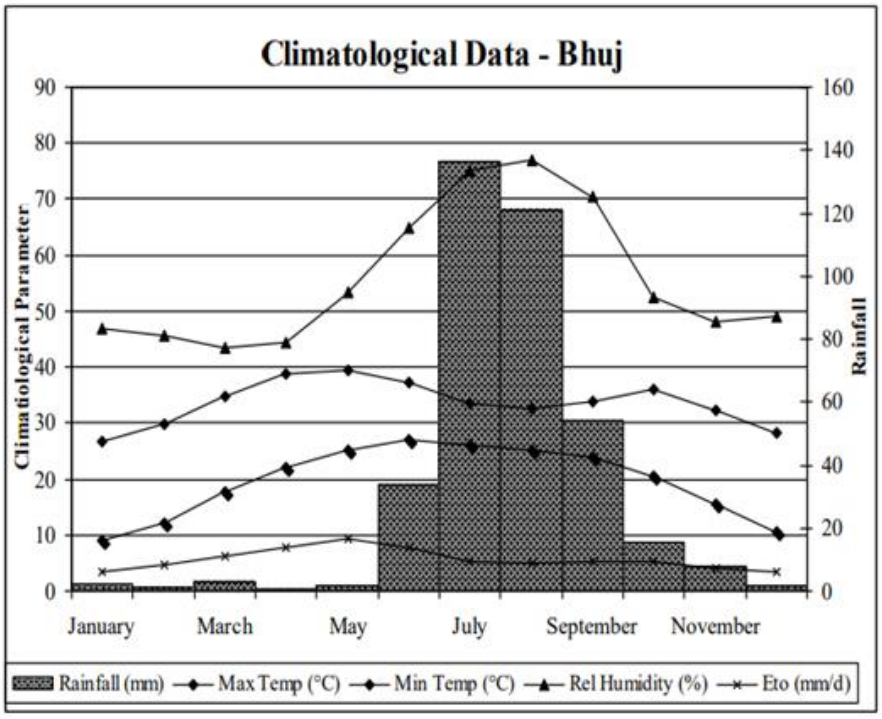


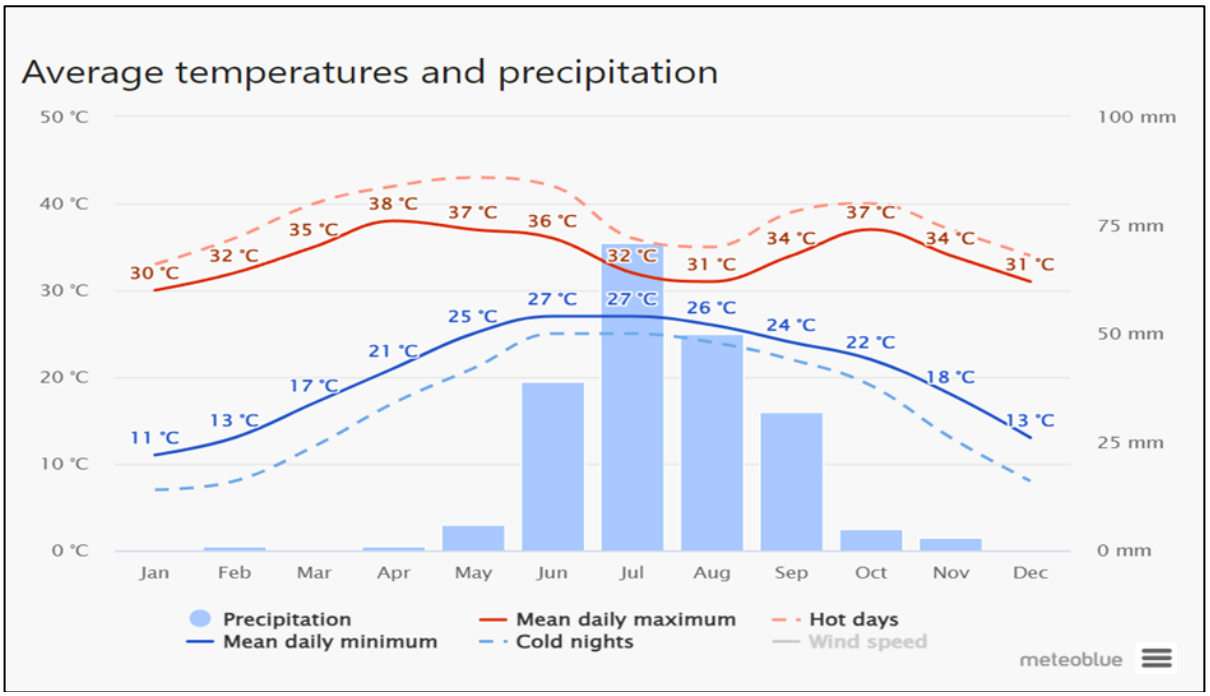
Figure 3-14: World Map of Köppen–Geiger Climate Classification

Kachchh district area, in general, being located on Tropic of Cancer has arid type of climate and accounts for 60% of the semi-arid tract of Gujarat state. The climate of the district, in general is characterized by hot summers and cool winters. The various seasons of the year are (a) monsoon - middle of June to October, (b) winter - November to February, and (c) summer – March to June. The distribution of rainfall is highly erratic with very high drought frequency. Kachchh is a chronic drought prone district. Temperatures vary considerable from season to season. The summers are generally hot, and winters are cool. Mean maximum temperature ranges between 26.7°C during January to about 39.5°C during June and the mean minimum temperatures vary between 9°C during January and 27°C during June. The relative humidity in Kachchh varies between 43.5% during March and 77% during August. The wind velocity in the district varies from about 124 km/d during November and 375 km/d during June. The potential evapotranspiration calculated using Penman's Method varies between 3.4 mm/d during December and 9.2 mm/d during May. Long-term average annual rainfall for Bhuj IMD station is 378.2 mm. Most of the rainfall (about 345 mm) is received during south-west monsoon between June and September.



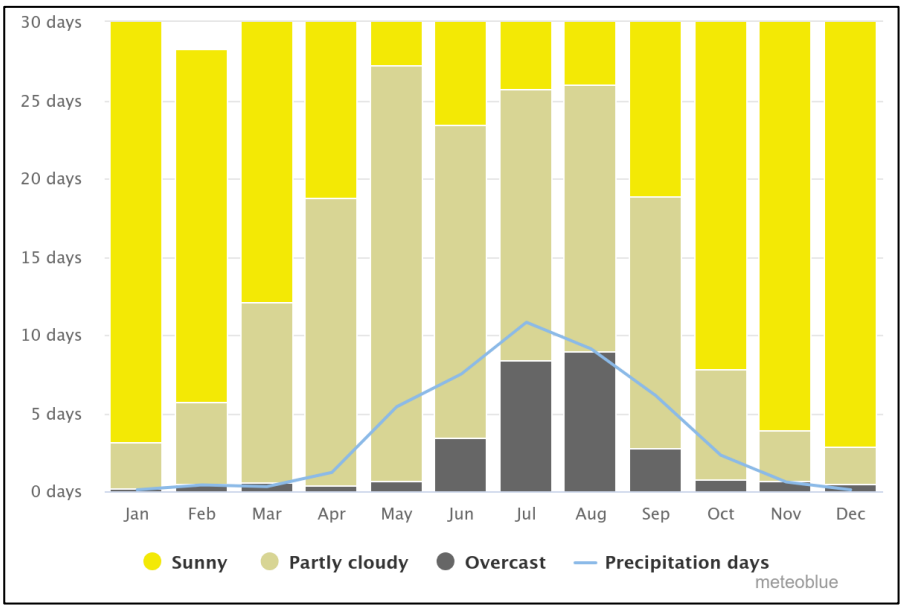
Source: Aquifer Map and Management Plan, Kachchh District October 2022)

Figure 3-15: Climatological Data of Bhuj IMD Station



Source: Meteoblue.com

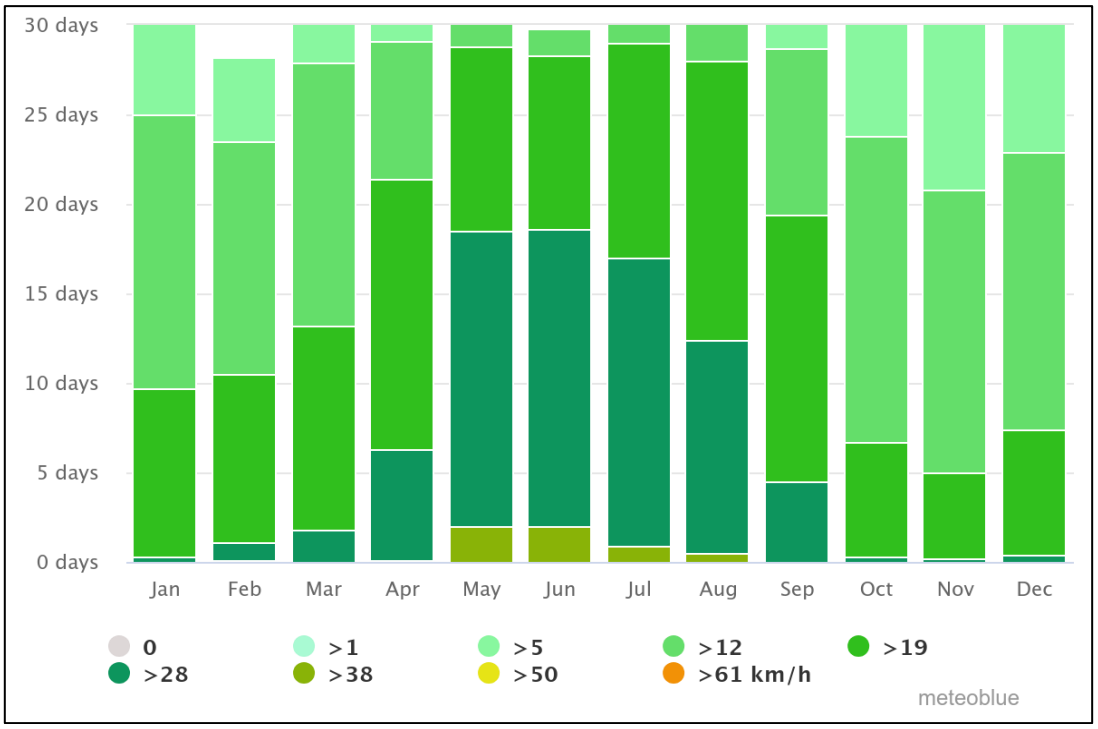
Figure 3-16: Climatological Trend in Study Area (Last 30 years)



Source: Meteoblue.com

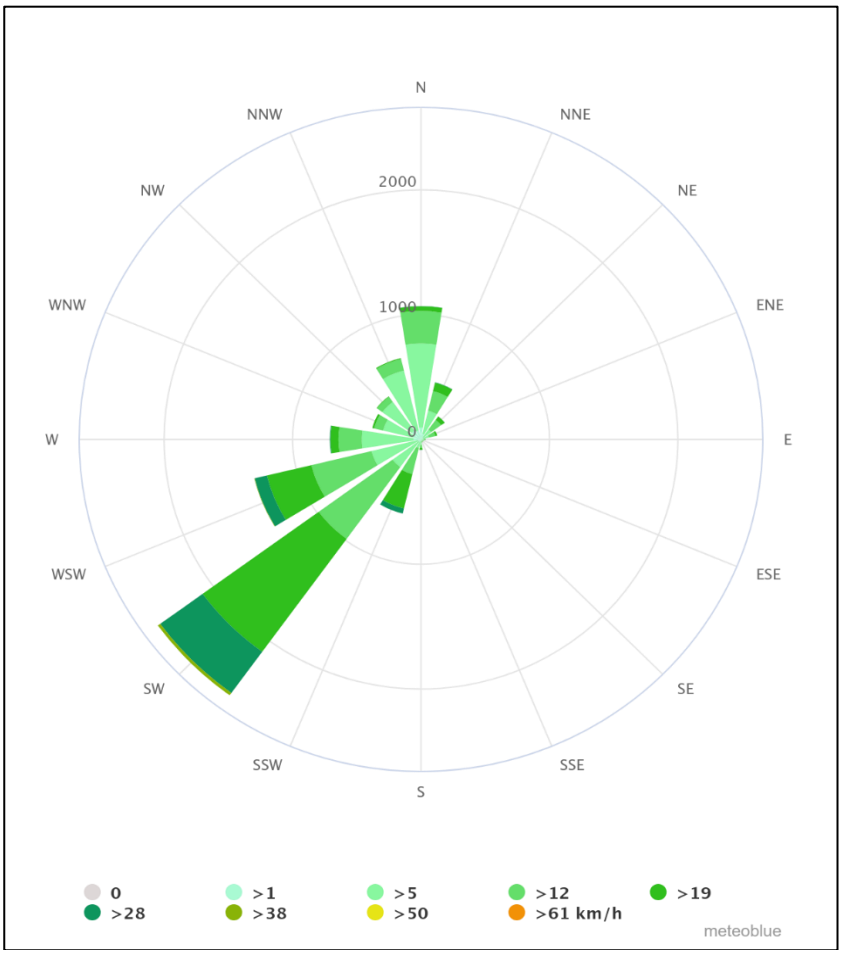
Figure 3-17: Precipitation Graph of Study Area

The predominant wind direction in the study area is primarily from the South-Western region. The wind intensity analysis and wind-rose diagram for study area is given in **Figure 3-16** and **3-17** respectively.



Source: Meteoblue.com

Figure 3-18: Wind Intensity of Study Area



Source: Meteoblue.com

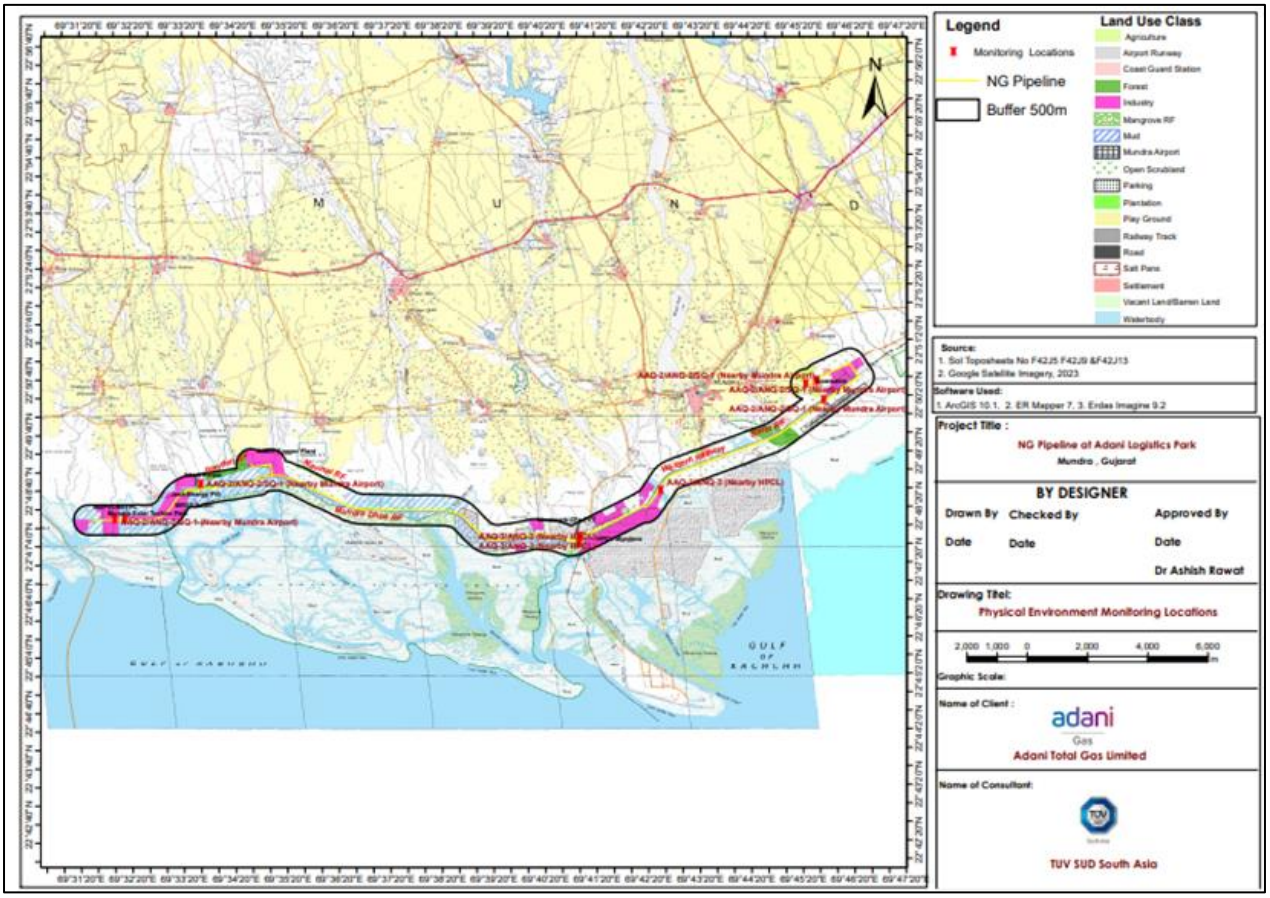
Figure 3-19: Windrose Diagram of Project Study Area

3.6.8 Ambient Air Quality

The ambient air quality monitoring was carried out at five (5) locations. The sampling locations for air and noise quality is 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.

Table 3-8: Ambient Air Quality Monitoring Locations

Sl. No.	Location code	Location name	Latitude (N)	Longitude (E)
1.	AAQ-1	GSPL PSS (Starting Point)	22°50'32.28"N	69°45'25.52"E
2.	AAQ-2	Nearby Mundra Airport	22°50'13.73"N	69°45'46.83"E
3.	AAQ-3	Nearby HPCL	22°47'47.04"N	69°41'1.68"E
4.	AAQ-4	Nearby Adani Thermal Power Plant	22°48'45.95"N	69°33'40.01"E
5.	AAQ-5	MSTPL Entry Gate-Nearby Terminal Point	22°48'8.50"N	69°32'0.08"E



**Source: TUV SUD GIS Mapping Study (Toposheets No F42J5 F42J9 &F42J13)*

Figure 3-20: Ambient Air and Noise Monitoring Locations within Project AOI

Table 3-9: Ambient Air Quality Results

S. No.	Parameters	Unit	(AAQ-1)	(AAQ-2)	(AAQ-3)	(AAQ-4)	(AAQ-5)	NAAQ Standards
1.	Particulate Matter (PM_{10})	[µg/m^3]	159	169	174	182	174	**100**
2.	Particulate Matter ($PM_{2.5}$)	[µg/m^3]	88	96	97	99	94	**60**
3.	Sulphur Dioxide (as SO_2)	[µg/m^3]	34.26	35.46	36.92	40.17	37.2	**80**
4.	Nitrogen Dioxide (as NO_2)	[µg/m^3]	52.53	55.84	55.26	60.65	59.24	**80**
5.	Ammonia (NH_3)	[µg/m^3]	BDL	BDL	BDL	BDL	BDL	**400**
6.	Ozone (O_3)	[µg/m^3]	56.1	54.53	62.05	61.88	62.08	**180**
7.	Carbon Monoxide (CO)	[mg/m^3]	1.25	1.43	1.31	1.47	1.36	**2.0**
8.	Lead (Pb)	[µg/m^3]	BDL	BDL	BDL	BDL	BDL	**1.0**
9.	Arsenic (As)	[ng/m^3]	BDL	BDL	BDL	BDL	BDL	**6**
10	Nickel (Ni)	[ng/m^3]	BDL	BDL	BDL	BDL	BDL	**20**
AQI of the locations			**193**	**220**	**223**	**230**	**213**	

S. No.	Parameters	Unit	(AAQ-1)	(AAQ-2)	(AAQ-3)	(AAQ-4)	(AAQ-5)	NAAQ Standards
			(Moderate)	(Poor)	(Poor)	(Poor)	(Poor)	

**Source: Laboratory Analysis Results*

The ambient air quality monitoring at the project study area indicates that air quality of the Starting Point of the project (GSPL PSS) is 'Moderate' (between 101-200) and other locations are indicated as 'Poor' (between 201-300) in terms of AQI index. Particulate matter concentration was observed to be exceeding the NAAQS limits (PM10:100 µg/m^3 & PM2.5- 60 µg/m^3). Increased levels of PM can be justified due to industrial activities, transportation of coal and vehicular activities within the industrial area.

3.6.9 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 was carried out at Four (04) locations to identify the baseline noise level of the project 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 3-10.**

Table 3-10: Ambient Noise Quality Monitoring Stations

Sl. No.	Location Code	Location Name	Latitude (N)	Longitude (E)
1.	ANQ-1	GSPL PSS (Starting Point)	22°50'32.28"N	69°45'25.52"E
2.	ANQ-2	Nearby Mundra Airport	22°50'13.73"N	69°45'46.83"E
3.	ANQ-3	Nearby HPCL	22°47'47.04"N	69°41'1.68"E
4.	ANQ-4	MSTPL Entry Gate-Nearby Terminal Point	22°48'8.50"N	69°32'0.08"E

Noise quality monitoring was conducted in areas close to the proposed project. At each location, noise monitoring has been 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 a.m. - 10.00 p.m. and night-time Leq from the hourly Leq values between 10.00 p.m. - 6.00 a.m. The results are presented in **Table 3-11.**

Table 3-11: Ambient Noise Quality Monitoring Results

S. No.	Locations	Location Name & Code	Results in Db(A) Leq		Limits in Db(A) Leq Noise Regulation, 2000	
			Average Day Noise Level	Average Night Noise Level	Day Time	Night-Time
1	Nearby Mundra Airport	NAQ-1	66	52.4	75	70
2	Nearby HPCL	NAQ-2	59.4	46.7	75	70
3	Nearby Adani Thermal Power Plant	NAQ-3	56.2	44.8	75	70
4	GSPL PSS -Starting Point	NAQ-4	64.2	53.6	75	70

It has been observed that in all the locations, where ambient noise quality was monitored during baseline survey, are having ambient noise level around 56.2 to 66 Db(A) during daytime and 44.8 to 53.6 Db(A) during night-time. It is found that daytime and night-time noise levels are well within CPCB limits specified for Industrial area as per Noise Pollution (Regulation and Control) Rules, 2000.

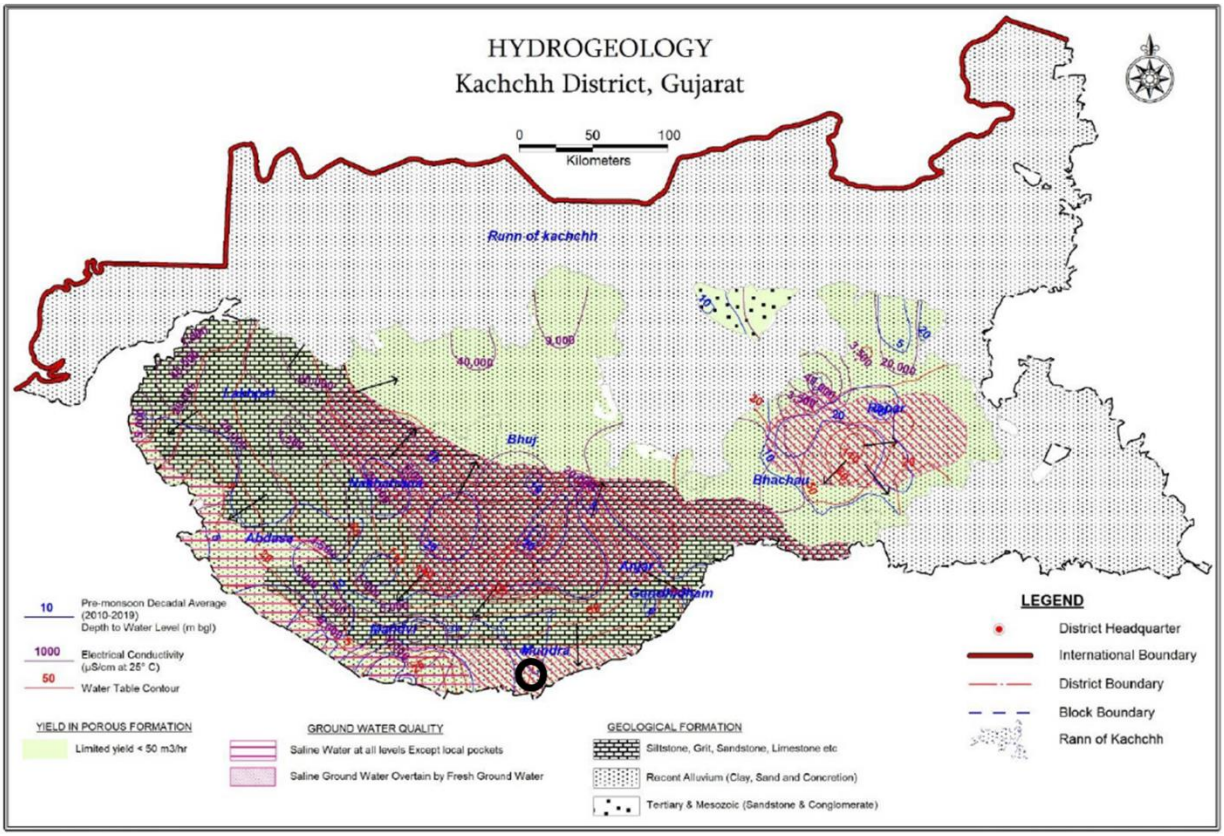
3.6.10 Hydrogeology and Ground Water Quality

3.6.10.1 Hydrogeology

The main hydrogeological groups (as aquifer system) in Kachchh district are:

i) Mesozoic formations,
ii) Deccan trap (Hard rock),
iii) Tertiary formations
iv) Quaternary sediments

Hydrogeological Map of district indicating project study area has been depicted in **Figure 3-21**.



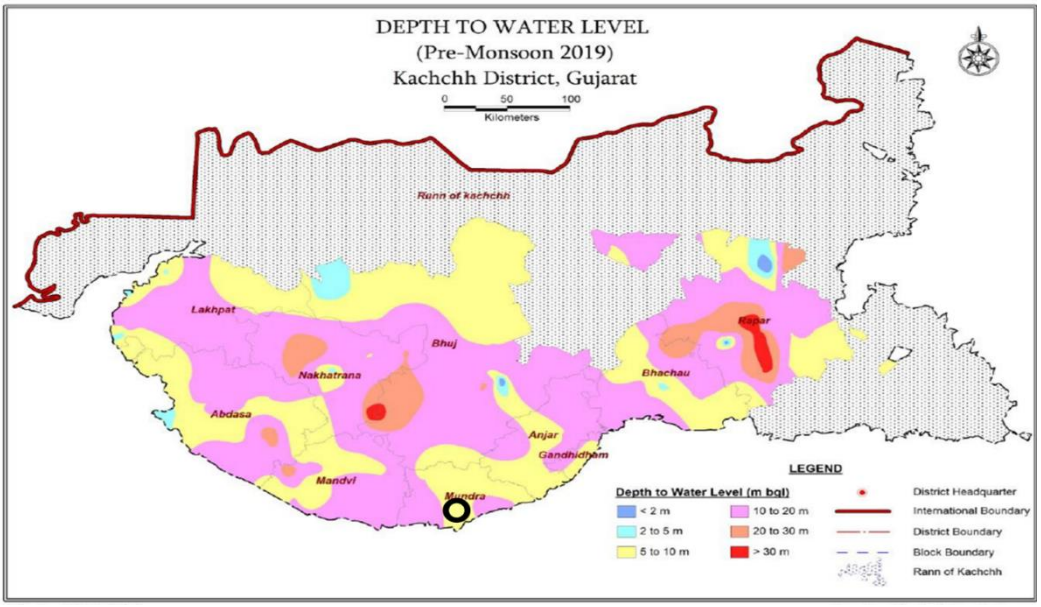
**Source: Aquifer Map and Management Plan, Kachchh District*

Figure 3-21: Hydrogeological Map of Kachchh District (Black Circle- Project Study Area)

As depicted in **Figure 3-21**, the project study area falls in "*Recent Alluvium (Clay, Sand and Concretion)*" with" *Saline Water at all levels except local pockets*" with limited yield of <50 m^3/hr.

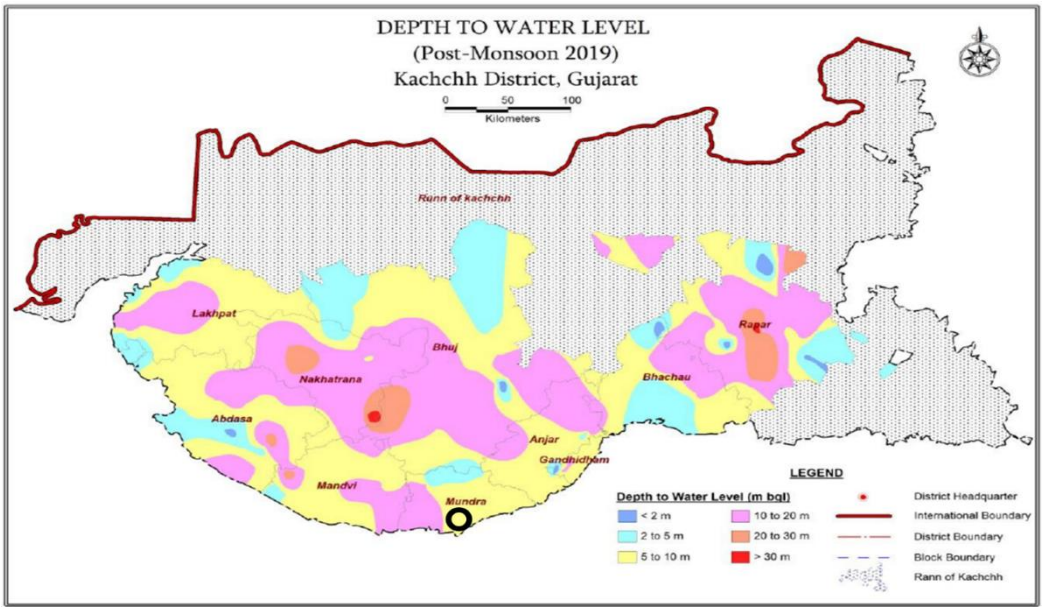
DEPTH TO WATER LEVEL

The depth to water level in the district ranges between 5-10 m bgl during pre-monsoon and post-monsoon. Maps indicating depth to water level during pre-monsoon & post-monsoon have been depicted in **Figure 3-22 & 3-23**:



Source: Aquifer Map and Management Plan, Kachchh District

Figure 3-22: Pre-Monsoon Water Level, Kachchh District (Project Study Area demarcated with "Black Circle")



Source: Aquifer Map and Management Plan, Kachchh District

Figure 3-23: Pre-Monsoon Water Level, Kachchh District (Project Study Area demarcated with "Black Circle")

GROUND WATER RESOURCES

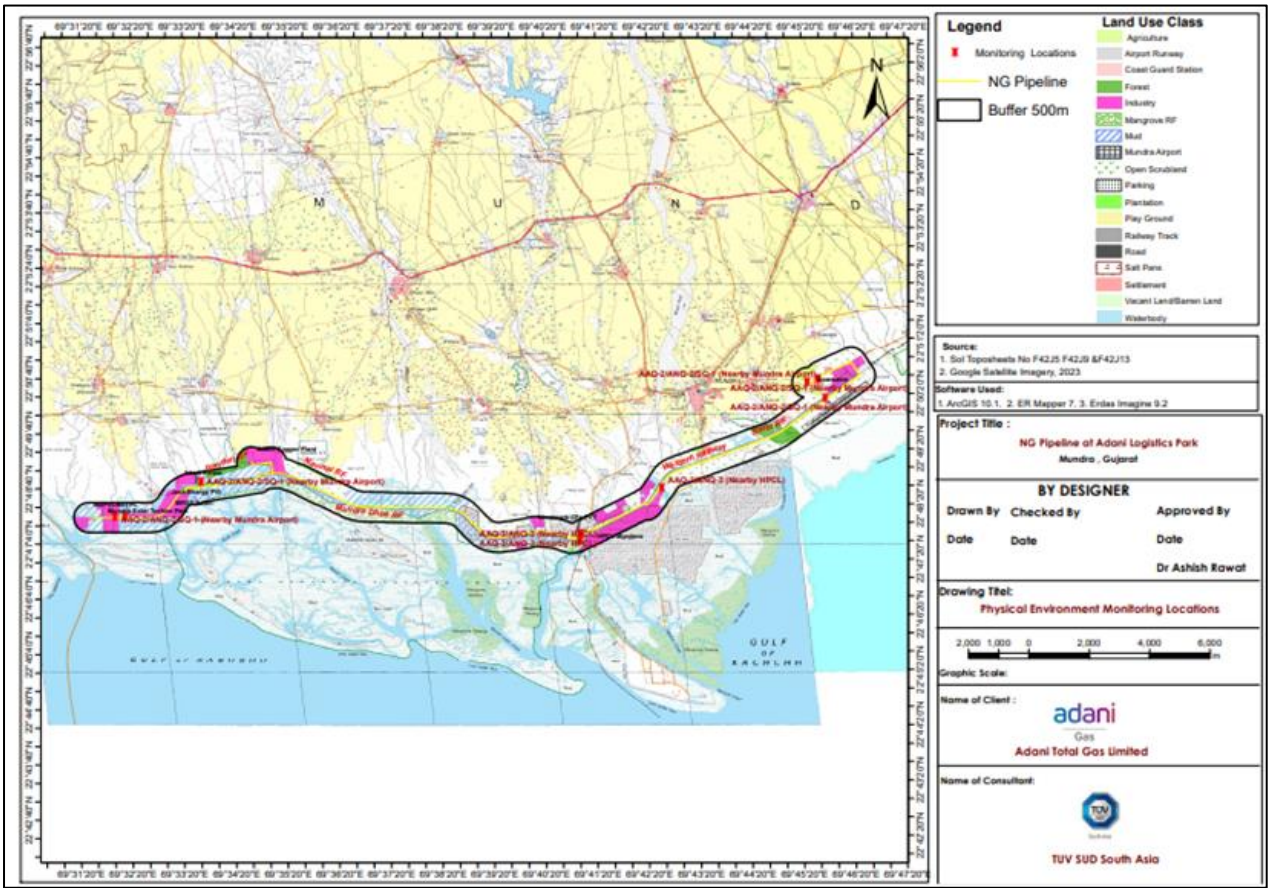
With approx. 54.05% of ground water extraction, the district falls in **"Safe"** category. [4]

3.6.10.2 Ground Water Quality

The ground water monitoring conducted in project study area is elaborated below. The ground water quality and ground water situation of the area is studied during baseline monitoring and site visit to the project study area. There is one sample collected from bore/tube well from nearby village. The details of monitoring locations are provided below in **Table 3-12**.

Table 3-12: Ground Water Quality Monitoring Locations

Sl. No.	Location Code	Location Name	Latitude (N)	Longitude (E)
1	GWQ-1	Goresema	22°50'35.09"N	69°45'38.15"E



**Source: TUV SUD GIS Mapping Study (Toposheets No F42J5 F42J9 &F42J13)*

Figure 3-24: Surface and Groundwater Quality Monitoring Locations

[4] *National Compilation on Dynamic Ground Water Resources of India, 2023 by CGWB.*

Table 3-13: Groundwater Quality Results

Sl. No.	Parameter	Unit	GW1	Limits (as per IS:10500-2012)	
			Results	Desirable Limit	Permissible Limit
1.	pH	-	7.74	6.5-8.5	No relaxation
2.	Colour	CU	<1	5	15
3.	Odour	-	Agreeable	Agreeable	Agreeable
4.	Taste	-	Agreeable	Agreeable	Agreeable
5.	Turbidity	NTU	<1	1	5
6.	Total Dissolved Solids (TDS)	mg/l	672	500	2000
7.	Temperature	°C	25.2	-	-
8.	Specific Conductivity	us/cm	1023	-	-
9.	Total Hardness as CaCO3	mg/l	383.4	200	600
10.	Alkalinity as CaCO3 (Total& Phenolphthalein)	mg/l	348	200	600
11.	Cyanide (as CN)	mg/l	BDL (DL0.05)	0.05	No relaxation
12.	Chloride as Cl	mg/l	86.7	250	1000
13.	Sulphate as SO4	mg/l	26.4	200	400
14.	Sulphide	mg/l	BDL (DL-0.05)	0.05	No relaxation
15.	Chloramine	mg/l	BDL	-	-
16.	Phenolic Compounds as C6H5OH	mg/l	BDL (DL-0.001)	0.001	0.002
17.	Fluoride as F	mg/l	(DL-0.01)	1.0	1.5
18.	Nitrite as NO2	mg/l	BDL (DL-0.01)	No relaxation	No relaxation
19.	Anionic Surfactant as MBAS	mg/l	BDL (DL0.05)	0.2	1.0
20.	Hexavalent Chromium (as Cr+6)	mg/l	BDL (DL0.02)	0.05	No relaxation
21.	Nitrate as NO3	mg/l	8.9	45	-
22.	Sodium	mg/l	18	-	-
23.	Potassium	mg/l	3.4	-	-
24.	Calcium as Ca	mg/l	89.78	75	200
25.	Magnesium as Mg	mg/l	38.63	30	100
26.	Iron (as Fe)	mg/l	0.08	0.3	No relaxation
27.	Manganese (as Mn)	mg/l	BDL (DL-0.02)	0.1	0.3
28.	Zinc (as Zn)	mg/l	0.22	5.0	15
29.	Mercury (as Hg	mg/l	BDL (DL-0.001)	0.001	No relaxation
30.	Selenium (as Se)	mg/l	BDL (DL-0.01)	0.01	No relaxation
31.	Aluminium (as Al)	mg/l	BDL (DL-0.01)	0.03	0.2
32.	Lead (as Pb)	mg/l	BDL (DL-0.01)	0.01	No relaxation
33.	Total Arsenic (as As)	mg/l	BDL (DL-0.005)	0.01	0.05
34.	Total Chromium (as Cr)	mg/l	BDL (DL-0.02)	0.05	No relaxation
35.	Bicarbonate	mg/l	118	-	-
36.	Boron (as B)	mg/l	BDL (DL-0.1)	0.5	1.0
37.	Cadmium (as Cd)	mg/l	BDL (DL-0.002)	0.003	No relaxation
38.	Total Suspended solids	mg/l	<1.0	-	-

Sl. No.	Parameter	Unit	GW1	Limits (as per IS:10500-2012)	
			Results	Desirable Limit	Permissible Limit
39.	Oil & grease	mg/l	<2.0	-	-
40.	Phosphate	mg/l	BDL(DL-2.0)	-	-
41.	Dissolved Oxygen	Mg/l	3.4	-	-
42.	Fecal Coliform	<2	MPN/100ml	<2 MPN/100ml	No Relaxation

Ground water quality monitoring revealed that project study area comprises of having concentration of Total Hardness of 383.4 mg/l. Total Dissolved Solid concentration was found to be 672 mg/l. Alkalinity concentration was found to be 348 mg/l. pH of the groundwater sample was recorded to be 7.74. All the other major parameters were found within the desirable limits for drinking use. However, controlled, and restricted use of ground water is highly advisable.

3.6.11 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 3-14.**

Table 3-14: Surface Water Quality Monitoring Locations

Sl. No.	Location code	Location name	Latitude (N)	Longitude (E)
1.	SWQ-1	Water body nearby Terram Geosynthetics	22°48'37.33"N	69°42'36.29"E
2.	SWQ-2	Pond nearby Rangoli Bridge	22°47'39.75"N	69°41'0.14"E
3.	SWQ-3	Creek nearby MSTPL	22°48'8.63"N	69°32'11.59"E

Analysis of the samples was 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). The analysis results are provided below in **Table 3-15**:

Table 3-15: Surface Water Quality Monitoring Results

S. No.	Parameter	Unit	Results		
			(SWQ-1)	(SWQ-2)	(SWQ-3)
1.	pH	-	7.21	6.89	7.13
2.	Turbidity	NTU	3.6	2.8	2.9
3.	Total Dissolved Solids (TDS)	mg/l	1742	1709	1824
4.	Specific Conductivity	µS/cm	2661	2652	2817
5.	Total Suspended solids	mg/l	4.0	3.4	5.2
6.	Alkalinity as CaCO3 (Total & Phenolphthalein)	mg/l	842	672	774
7.	Cyanide (as CN)	mg/l	BDL (DL-0.05)	BDL (DL-0.05)	BDL (DL-0.05)
8.	Chloride as Cl	mg/l	227	193.4	164
9.	Total Hardness as CaCO3	mg/l	918.4	713	819
10.	Sulphate as SO4	mg/l	98.4	89.6	78.6

S. No.	Parameter	Unit	Results		
			(SWQ-1)	(SWQ-2)	(SWQ-3)
11.	Fluoride as F	mg/l	BDL (DL-0.1)	BDL (DL-0.1)	BDL (DL-0.1)
12.	Nitrate as NO3	mg/l	10.4	12.68	14.42
13.	Sodium	mg/l	29	27.68	34.8
14.	Potassium	mg/l	12	14.23	18.2
15.	Dissolved Oxygen	mg/l	5.2	5.8	4.9
16.	Chemical Oxygen Demand	mg/l	26.4	20	28
17.	Biochemical Oxygen Demand	mg/l	4.0	5.0	6.0
18	Calcium as Ca	mg/l	218	188.4	198.7
19.	Magnesium as Mg	mg/l	64.7	59.2	78.7
20.	Zinc (as Zn)	mg/l	0.64	0.78	0.82
21.	Mercury (as Hg)	mg/l	BDL (DL-0.001)	BDL (DL-0.001)	BDL (DL-0.001)
22.	Selenium (as Se)	mg/l	BDL (DL-0.01)	BDL (DL-0.01)	BDL (DL-0.01)
23.	Lead (as Pb)	mg/l	BDL (DL-0.05)	BDL (DL-0.05)	BDL (DL-0.05)
24.	Total Arsenic (as As)	mg/l	BDL (DL-0.005)	BDL (DL-0.005)	BDL (DL-0.005)
25.	Total Chromium (as Cr)	mg/l	BDL (DL-0.02)	BDL (DL-0.02)	BDL (DL-0.02)
26.	Cadmium (as Cd)	mg/l	BDL (DL-0.002)	BDL (DL-0.002)	BDL (DL-0.002)
27.	Oil & grease	mg/l	<2	<2	<2
28.	Fecal Coliform	MPN/100ml	11	13	21

The surface water monitoring of the project study area reveals that COD concentration is ranges between 20-28 mg/l, whereas BOD concentration found between 4-6 mg/l. Dissolved Oxygen level found between 4.9-5.8. Thus, overall, the surface water quality of the area is well below the desired limit of surface water and wastewater parameters' standards.

3.7 BIOLOGICAL ENVIRONMENT

Ecological studies are one of the important aspects of Environmental Impact Assessment (EIA) with a view to conserve 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 safety of flora and fauna. The biological environment includes terrestrial and aquatic ecosystems.

The observations and assessment 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 better understanding of the situation and overall ecological importance of the area. This baseline information viewed against industrial activities help in predicting their impacts on the wildlife and their habitats in the region.

This section of 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.

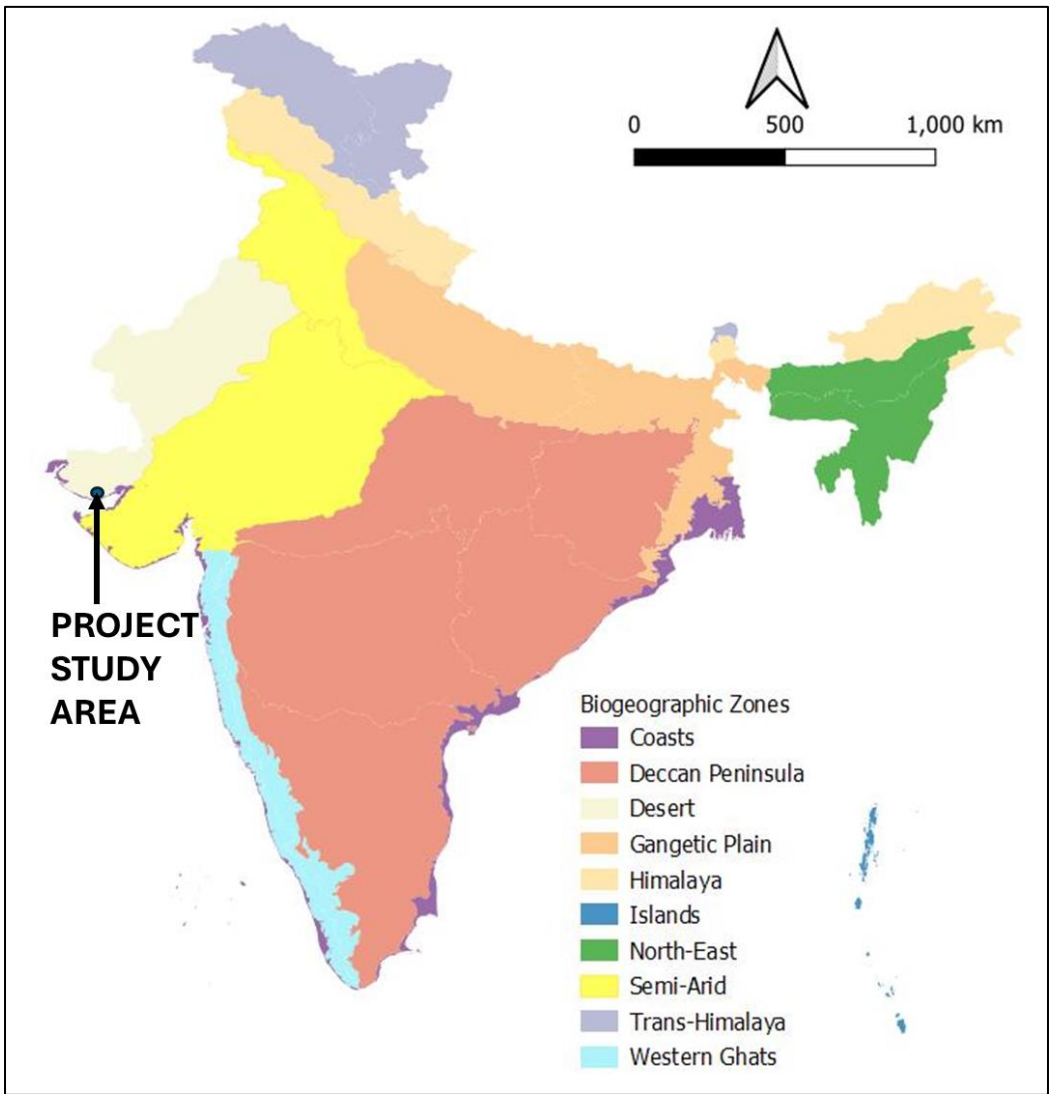
3.7.1 Scope and Objectives

The ecology & biodiversity study carried out at the project study area i.e., includes 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, 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.

3.7.2 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 3-25**).



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

Figure 3-25: Biogeographic Regions of India

3.7.3 Methodology for Ecological Survey

3.7.3.1 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 of 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 EIA process. The core and buffer zone are as follows:

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

3.7.3.2 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.

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.

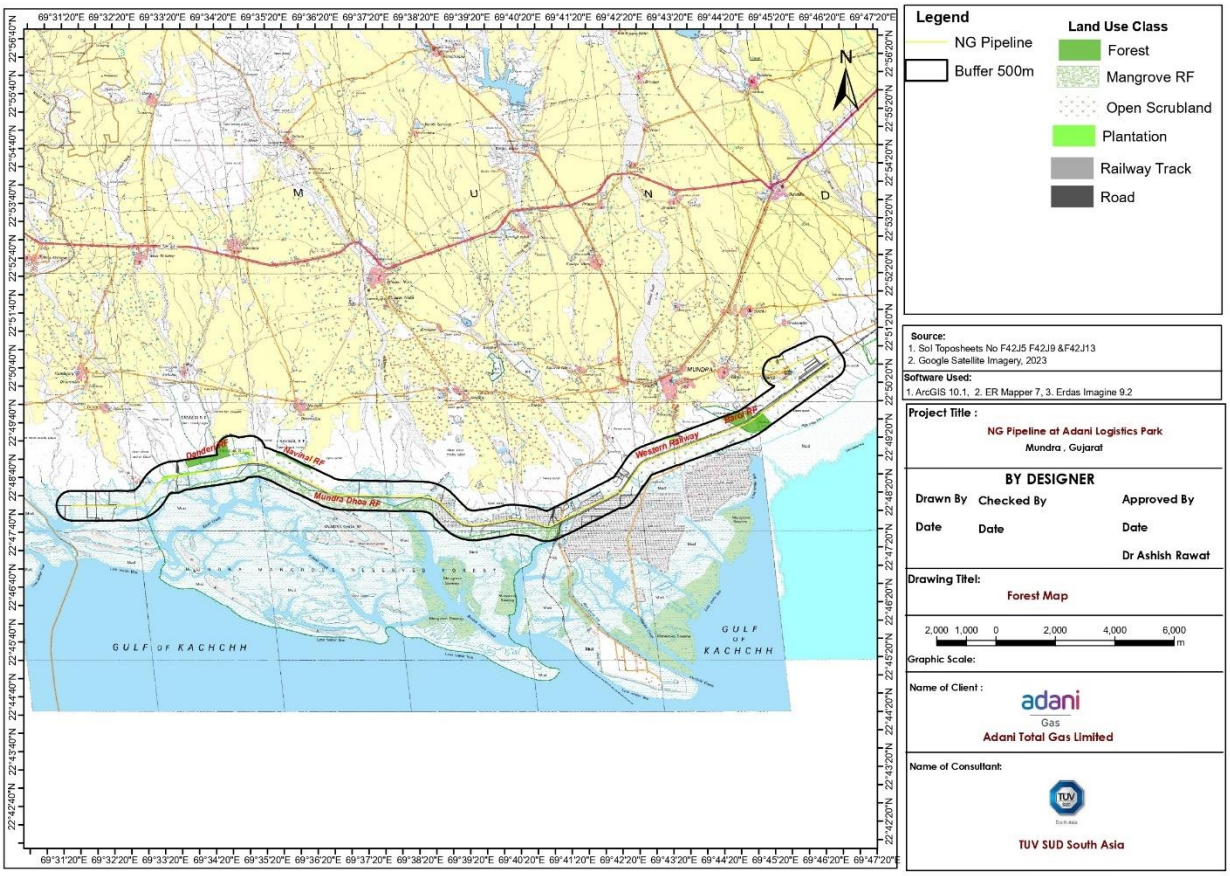
3.7.3.3 Study of Ecological Habitat

3.7.3.3.1 Forests

According to the Champion and Seth Classification of Indian Forests, the natural vegetation of the survey area represents the "***Tropical Dry Deciduous Forest***". These types of forests occur in the region with less than 600 mm rainfall. These forests contain spare and stunted growth of species like Acacia and thorn bushes etc. **Table. 3-16** shows the forest blocks in 10 km radius map of the project area.

Table 3-16: Details of reserve forest identified in project study area

Sl. No.	Forest	Distance (KM)	Direction
1.	Baroi RF	Adjacent	--
2.	Luni RF	1.29	E
3.	Bhadeshwar RF	9.01	E
4.	Mundra Dhoa RF	Adjacent	S
5.	Navinal RF	0.44	N
6.	Danderi RF	Adjacent	--



**Source: TUV SUD GIS Mapping Study (Toposheets No F42J5 F42J9 &F42J13)*

Figure 3-26: Forest Map of Project Study Area

3.7.3.3.2 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.

3.7.3.3.3 Cropping Pattern of Study Area

The principal crops of the district are Cotton, Wheat, Castor, Jowar, Bajri and Pulses, Groundnut, Tal and Castor are main oil seed crops in the district.

3.7.3.3.4 Water Bodies

Being located at the port side, there are a several water bodies located within the vicinity of the project. However, there are no water bodies observed within the project footprint area. Following Table depicts the details of water bodies located in buffer zone of the project site. The details of water bodies located in 10 km radius project study area has been provided in **Table 3-17**.

Table 3-17: Major water bodies in the Study Area

Sl. No.	Name of Water Body	Distance (KM)	Direction
1.	Nagavanti Nadi	Adjacent	N
2.	Phot Nadi	Adjacent	N
3.	Bhukhi Nadi	Adjacent	N
4.	Gulf Of Kachchh	2.69	S

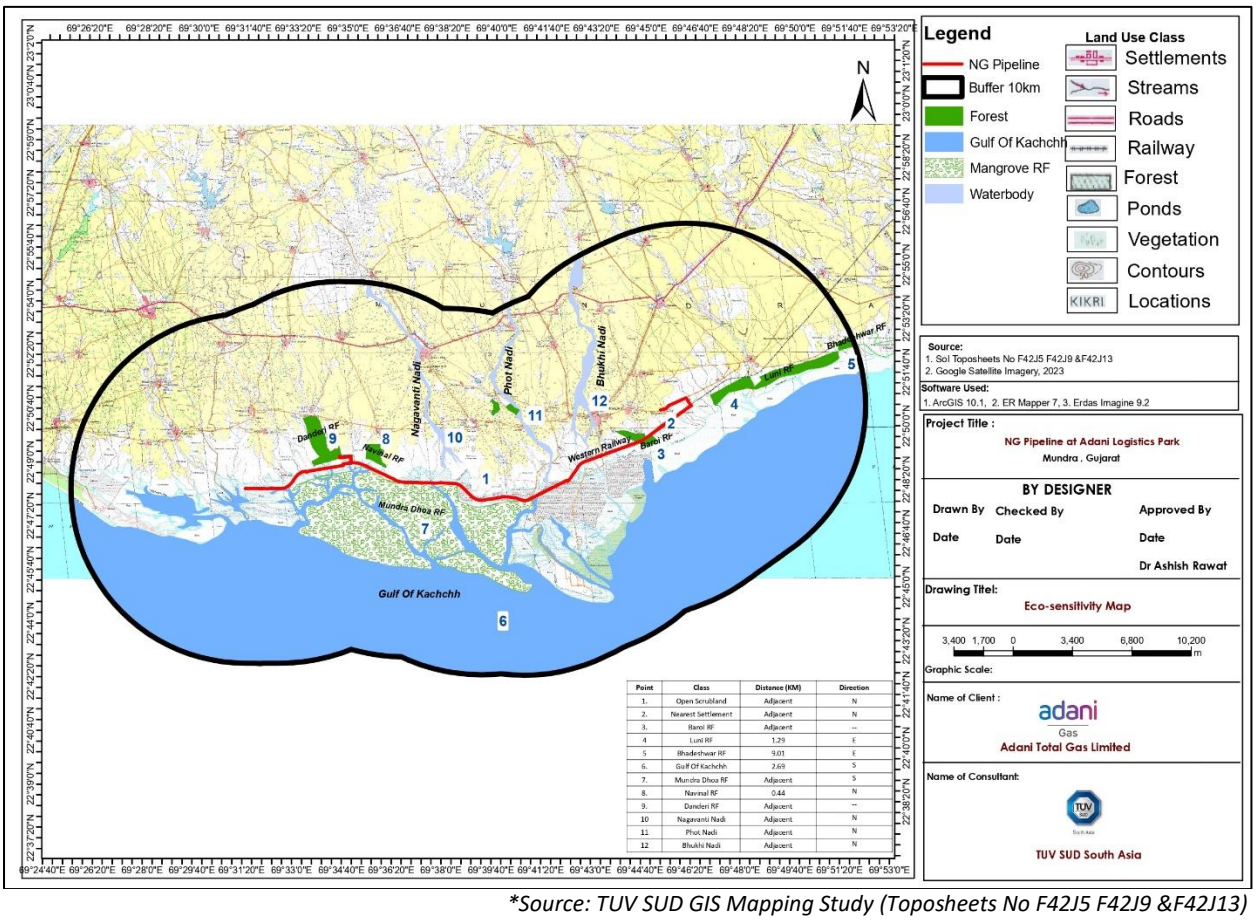
3.7.3.3.5 Protected Area and Eco-sensitive Areas

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 the Birdlife International and Bombay Natural History Society etc. Data collected and information gathered from primary and secondary sources on flora, fauna, protected area, natural habitats, wildlife species etc., were analyzed and results are presented below in **Table 3-18**.

Table 3-18: 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 10 km radius Study Area • Gulf of Kachchh National Park (35.33 km, SE) • Khijadiya Bird Sanctuary (53.28 km, SE) • Marine (Gulf of Kachchh) Wildlife Sanctuary (35.3 km, SE) • Lala Great Indian Bustard Sanctuary (90.4 km, NW)
Important Bird Areas (IBAs)	None within 10 km radius study area The nearest Important Bird Area (IBA) is Khijadiya Bird Sanctuary (53.28 km, SE)
Ramsar Wetland Site	None within 10 km radius study area Khijadiya Bird Sanctuary (53.28 km, SE)
Wildlife Corridors & Routes	Nil
Breeding/nesting areas of endangered species	Nil
Mangroves	Adjacent

**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



**Source: TUV SUD GIS Mapping Study (Toposheets No F42J5 F42J9 &F42J13)*

Figure 3-27: Eco-sensitivity Map of Project Study Area

Source: TUVSUD GIS Survey

Figure 3-28: Distance between Project Site and nearest Protected Areas

3.7.3.3.6 Migratory Birds and Migratory Pathway

No Important Bird Area (IBA) is located within 10 km radius of the project site. 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 Khijadiya Bird Sanctuary (53.28 km, SE).

3.7.4 Floral Diversity

The present study revealed that 11 tree species, 27 shrub species, 33 herb species, 21 grass species and 8 climber species were present in both core zone and buffer zone area up to 10 km radius of study area. Secondary data was also considered while listing the species for validation. Since open bare lands and Agri ecosystem is predominant in study area, 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 spp*., *Prosopis juliflora*, *Azadirachta indic*a and other xerophytic species. Jatropha and Calotropis are observed growing along roadsides. The vegetation of the salt pans consists of small, isolated patches of halophytic herbs. The banks of the creeks and mud flats are vegetated by mangroves. Tabulated details of flora recorded in study area have been provided below in **Table 3-19** below:

Table 3-19: 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.	*Acacia Senegal*	Kher, Kherio, Garad	Mimosaceae
4.	*Acacia fortalis*	Israil Baval	Mimosaceae
5.	*Azadirachta indica*	Neem	Meliaceae
6.	*Commiphora wightii*	Gugar	Burseraceae
7.	*Cordia gharaf*	Liyar, Desi gunda	Ehretiaceae
8.	*Cordia perrottetii*	Jangli Gundi	Ehretiaceae
9.	*Maytenus emarginata*	Vigo	Celastraceae
10.	*Prosopis cineara*	Kandhi	Mimosaceae
11.	*Rhizophora mucronata*	-	Rhizophoraceae
		SHRUBS	
1.	*Abutilon fruticosum*	Saneri dabariar	Malvaceae
2.	*Abutilon indicum*	Khapato, Dabaliar	Malvaceae
3.	*Asparagus dumosus*	-	Liliaceae
4.	*Avicennia marina*	Cheria	Avicenniaceae
5.	*Cadaba fruticosa*	Karo-pijaro	Capparaceae
6.	*Calotropis gigantean*	Akado	Asclepiadaceae
7.	*Capparis deciduas*	Kar jo zad	Capparaceae
8.	*Cassia angustifolia*	Son makai	Caesalpiniaceae
9.	*Cassia auriculata*	Avar	Caesalpiniaceae
10.	*Ceriops tagal*		Rhizophoraceae
11.	*Cocculus hirsutus*	Vagval, Asipal	Menispermaceae
12.	*Euphorbia caducifolia*	Thar	Euphorbiaceae
13.	*Gossypium herbaceum*	Vagdau	Malvaceae
14.	*Grewia tenax*	Gangiu	Tiliaceae
15.	*Grewia villosa*	Luo	Tiliaceae
16.	*Hibiscus ovalifolius*	Kurad val	Malvaceae
17.	*Indigofera obligifolia*	Zeel	Fabaceae
18.	*Jatropha curcas*	Ratanjyot	Euphorbiaceae
19.	*Leptadenia pyrotechnica*	Khip	Asclepiadaceae
20.	*Lycium barbatum*	Garothi	Solanaceae
21.	*Periploca aphylla*	Ratikhip	Periplocaceae
22.	*Premna resinosa*	Nidhi Kundher	Verbenaceae
23.	*Prosopis juliflora*	Gando baval	Mimosaceae
24.	*Pupalia lappacea*	Ridha bhurat	Amaranthaceae
25.	*Salvadora persica*	Khari Zar	Salvadoraceae
26.	*Saueda spp.*	-	Chenopodiaceae
27.	*Sesbania sesban*	Ekad	Fabaceae

Sl. No.	Scientific Name	Local Name	Family
HERBS			
1.	*Aclypha ciliate*	Char dadar jo zad	Euphorbiaceae
2.	*Achyranthes aspera*	Agado, Kandhero	Amaranthaceae
3.	*Aerva persica*	Bou, Bour	Amaranthaceae
4.	*Aerva pseudotomentosa*	Sane panjo bur	Amaranthaceae
5.	*Blainvillea acmella*	Tal Bhangro	Asteraceae
6.	*Belapharis maderaspatensis*	Uti gan	Acanthaceae
7.	*Belapharis repens*	Sane panjo kandho	Acanthaceae
8.	*Belapharis indica*	Ubhero kandho	Acanthaceae
9.	*Blumea lacera*	Piro fulavo	Asteraceae
10.	*Boerhavia diffusa*	Rati, Satodi	Nyctaginaceae
11.	*Cardiospermum halicacabum*	Tridharival, Popti	Sapindaceae
12.	*Cassia italic*	Mindhiavar	Caesalpiniaceae
13.	*Cleome viscose*	Beddhro	Capparaceae
14.	*Commicarpus verticillatus*	Dhokariyar	Nyctaginaceae
15.	*Convolvulus arvensis*	Neri val	Convolvulaceae
16.	*Convolvulus microphyllus*	Mankhani	Convolvulaceae
17.	*Corchorus depressus*	Mundheri	Tiliaceae
18.	*Chorchorus tridens*	-	Tiliaceae
19.	*Cressa cretica*	Oin, Bukan	Convolvulaceae
20.	*Enicostema axillare*	Mamej	Gentinaceae
21.	*Fagonia bruguieri*	Dhramau	Zygophyllaceae
22.	*Fagonia schweienfurthii*	Hamaso	Zygophyllaceae
23.	*Goniogyna hirta*	Undrakani	Fabaceae
24.	*Heliotropium bacciferum*	-	Boraginaceae
25.	*Heliotropium rariflorum*	-	Boraginaceae
26.	*Indigofera cordifolia*	Gadar gari	Fabaceae
27.	*Ipomea nil*	Kari Patiyar	Convolvulaceae
28.	*Leucas aspera*	Gumu	Lamiaceae
29.	*Leucas lavandulaefolia*	Sanepanjo gumu	Lamiaceae
30.	*Peristrophe bicalyculata*	Kari adhedi	Acanthaceae
31.	*Phyla nodiflora*	Ratval	Verbenaceae
32.	*Pulicaria wightiana*	San fuladi	Asteraceae
33.	*Salicornia brachaiata*	-	Chenopodiaceae
GRASSES			
1.	*Aelurops lagopides*	Kharoga	Poaceae
2.	*Apluda mutica*	Fulariga	Poaceae
3.	*Aristida adscensionis*	Jandhar lambhaga	Poaceae
4.	*Aristida funiculate*	Laso lambh	Poaceae
5.	*Cenchus biflorus*	Dhamangha	Poaceae
6.	*Cenchus setigerus*	Anjaniyo	Poaceae

Sl. No.	Scientific Name	Local Name	Family
7.	*Chloris barbata*	Rusadgha	Poaceae
8.	*Chloris variegata*	Punjaniuga	Poaceae
9.	*Cymbopogon jwarancusa*	-	Poaceae
10.	*Cymbopogon martini*	Roshagha	Poaceae
11.	*Cyperus alopecuroides*	-	Cyperaceae
12.	*Cyperus atkinsonii*	-	Cyperaceae
13.	*Dactyloctenium aegypticum*	Kagatangogha	Poaceae
14.	*Dactyloctenium indicum*	Chundgha	Poaceae
15.	*Desmostachya bipinnata*	Darabgha	Poaceae
16.	*Digitaria pennata*	-	Poaceae
17.	*Echinchloa colonum*	Samu	Poaceae
18.	*Elusine compressa*	Gandhirogha	Poaceae
19.	*Elusine indica*	Adbau madanu	Poaceae
20.	*Eragrostis ciliare*	Fuliyugha	Poaceae
21.	*Panicum antidotale*	Gumgha	Poaceae
CLIMBERS			
1.	*Cayratia carnosa*	Khatumvadi jival	Vitaceae
2.	*Citrullus colocynthis*	Tru val, Tru deda	Cucurbitaceae
3.	*Coccinia grandis*	Tindora	Cucurbitaceae
4.	*Convolvulus auricomus*	Rushad nerival	Convolvulaceae
5.	*Ctenolepis cerasiformis*	Dad vel	Cucurbitaceae
6.	*Cucumis callosus*	Kotimbiyal	Cucurbitaceae
7.	*Dactyliandra welwitschii*	Dad val	Cucurbitaceae
8.	*Dalechampia scandens*	Char val	Euphorbiaceae

3.7.5 Faunal Diversity

Diversity of faunal distribution shows the health of ecosystem. In this study area a total of 64 types of faunal species were observed or reported in which 8 species of mammals, 51 birds, 5 reptiles were recorded.

3.7.5.1 Mammals

The mammals are occupying higher tropic levels in many ecosystems and respond quickly to the changes in their habitats, therefore, serves 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. Following list of mammal species as presented in **Table 3-20** were recorded in the project study area.

Table 3-20: 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	LC
2.	Jackal	*Canis aureus*	I	LC
3.	Indian Fox	*Vulpes bengalensis*	I	LC
4.	Common House rat	*Rattus rattus*	II	LC
5	Nilgai	*Boselaphus tragocamelus*	II	LC
6	Squirrel	*Funambulus pennanti*	II	LC
7	Wild Pig	*Sus scrofa*	II	LC
8	Fulvous fruit bat	*Rousettus leschnaulti*	II	LC

**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

3.7.5.2 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 richness of ecosystem. They are omnivorous in feeding habit. The following species of herpetofauna were observed in the study area.

Table 3-21: Herpetofaunal Species recorded in Project Study Area

Sl. No.	Common Name	Scientific Name	Schedule as per WPA,2022	IUCN Status
1.	Wall Lizard	*Hemidactylus spp.*	-	
2.	Cobra	*Naja naja*	I	LC
3.	Yellow Rat Snake	*Ptyas mucosus*	II	
4.	Common Skink	*Mabuya carinata*	II	LC
5	Garden Lizard	*Calotes versicolor*	-	

**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

3.7.5.3 Avifauna

A total of 51 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. Shikra, Steppe Eagle & River Tern 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 3-22**.

Table 3-22: List of Avifaunal species in Project Study Area

Sl. No.	Common Name	Scientific Name	Schedule as per WPA,2022	IUCN Status
1	Pariah Kite	*Milvus migrans*	II	LC
2	Common Crow	*Corvus splendens*	-	LC
3	Grey Partridge	*Francolinus pondicerianus*	II	LC
4	House Sparrow	*Passer domesticus*	-	LC
5	White Wagtail	*Motacilla alba*	II	LC
6	Grey Wagtail	*Motacilla cineara*	II	-
7	Common Tailorbird	*Orthotomus sutorius*	II	LC
8	Drongo	*Dicrurus adsimilis*	-	LC
9	Crow Pheasant	*Centropus sinensis*	II	LC
10	Blue Jay / Indian Roller	*Coracias benghalensis*	II	LC
11	White eared Bulbul	*Pycnonotus leucotis*	II	LC
12	Koel	*Eudynamis scolopacea*	-	-
13	Pigeon	*Columba livia*	-	LC
14	Indian Ring Dove	*Streptopelia decacto*	II	-
15	Common Babbler	*Turdoides caudatus*	-	LC
16	Hoopoe	*Upupa epops*	II	LC
17	White Throated Munia	*Lonchura malabarica*	-	LC
18	Indian Robin	*Saxicoloides fulicata*	-	LC
19	**Shikra**	***Accipiter badius***	**I**	**LC**
20	House Swift	*Apus affinis*	II	LC
21	**Steppe Eagle**	***Aquila nipalensis***	**I**	**EN**
22	Grey Shrike	*Lanius excubitor*	II	LC
23	Bay-backed Shrike	*Lanius vittatus*	II	LC
24	Magpie Robin	*Copsychus saularis*	II	LC
25	Desert Wheat-eater	*Oenanthe deserti*	II	LC
26	Barn Swallow	*Hirundo rustica*	-	-
27	Wire Tailed Swallow	*Hirundo smithii*	-	LC
28	Northern House Martin	*Delichon urbica*	II	-
29	Green Bee-eater	*Merops orientalis*	II	LC
30	Booted Warbler	*Hippolais caligata*	-	LC
31	Paddyfield warbler	*Acrocephala agricola*	-	-
32	Crested Lark	*Galerida cristata*	II	-
33	Red Wattled Lapwing	*Vannelus indica*	-	-
34	Black Winged Stilt	*Himantopus himantopus*	II	LC
35	White Breasted Kingfisher	*Halcyon smyrnensis*	II	LC
36	Cattle Egret	*Bubulcus ibis*	II	LC
37	Little Egret	*Egretta garzetta*	II	LC
38	Pond Heron	*Ardeola grayii*	II	LC
39	Small Indian Cormorant	*Phalacrocorax niger*	II	LC

Sl. No.	Common Name	Scientific Name	Schedule as per WPA,2022	IUCN Status
40	Whimbrel	*Numenius phaeopus*	II	LC
41	Common Sandpiper	*Tringa hypoleucos*	-	LC
42	Stone Curlew	*Burhinus oedicnemus*	-	LC
43	Black Ibis	*Pseudibis papillosa*	II	LC
44	White Ibis	*Theskiornis aethiopica*	-	LC
45	Spoonbill	*Palatea leucocordia*	-	-
46	Grey Heron	*Ardea cinerea*	II	LC
47	Painted Stork	*Mycteria leucocephala*	II	LC
48	**River Tern**	***Sterna aurantia***	**I**	**VU**
49	Little Tern	*Sterna albifrons*	II	LC
50	Common Tern	*Sterna hindo*	-	-
51	Caspian tern	*Hydroprogne caspia*	II	LC

**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

3.7.5.4 Aquatic Ecology

PHYTOPLANKTONS: On secondary data analysis of the study area, the following phytoplankton species have been recorded:

Table 3-23: Details of Phytoplankton Species recorded in Study Area

Sl. No.	Phytoplankton Species
1.	Anabaena
2.	Ankistrodesmus
3.	Cladophora
4.	Coelospharium
5.	Diatoms
6.	Gonatozygon
7.	Melosira
8.	Micrasterias
9.	Nitschia
10.	Nostoc
11.	Pediastrum
12.	Phormidium
13.	Scenedesmus
14.	Spirulina
15.	Stauroneis
16.	Stephanodiscus
17.	Synedra

ZOOPLANKTONS: Copepods and amphipods are the most common group of zooplanktons observed in the study area.

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

Table 3-24: Details of Fish Species recorded in Study Area

Sl. No.	Scientific Name	Common Name/English Name
FISH SPECIES		
1	*Anodondontostoma chacunda*	Chacunda Gizzard Shad
2	*Arius caelatus*	Engraved Sea Catfish
3	*Caranx para*	Kingfishes
4	*Coilia dussumieri*	Gold spotted Grenadier Anchovy
5	*Elops machnata*	Tenpounder
6	*Harpodon nehereus*	Bombay Duck
7	*Hilsa kelee*	Kelee Shad
8	*Johnius glacus*	Pale Spot fin Croaker
9	*Lepturacanthus savala*	Savalai Hairtail
10	*Liza carinata*	Keeled Mullet
11	*Liza tade*	Rock Mullet
12	*Lutjanus sp.*	Bigeye Snapper
13	*Nematolosa nasus*	Bloch's Gizzard Shad
14	*Opisthiotrerus tardoore*	Long-Finned Herring
15	*Otolithoides biauritus*	Bronze Croaker
16	*Pampus argentatus*	Silver Pomfret
17	*Pellona ditchela*	Indian Pellona
18	*Pomadasys maculatum*	Saddle Grunt
19	*Rogadius asper*	Olive-Tail Flathead
20	*Saparidentex hasta*	Sobaity Seabream
21	*Scoliodon laticaudatus*	Indian Dogfish
22	*Scomberomorus guttatus*	Indo-Pacific King Mackerel
23	*Secutor insidiator*	Kampi
24	*Sillago sihama*	Silver Sillago
25	*Thryssa mystax*	The Moustached Thryssa Or Gangetic Anchovy
26	*Thryssa vitriostris*	Ray Finned Fish
27	*Trichurus lepturus*	Atlantic Cutlassfish
28	*Valamugil seheli*	Blue spot Mullet
29	*Coilia dussumieri*	Gold spotted Grenadier Anchovy
30	*Gerrus lucidus*	Saddleback Silver-Biddy
PRAWNS		
1	*Exhippolysmata ensirostris*	Hunter Shrimp
2	*Exopalaemon stysliferus*	Roshna Prawn
3	*Metapenaeus sp.*	Jhinga Shrimp
4	*Parapenaeopsis sculptilis*	Rainbow Shrimp
5	*Penaeus indicus*	Indian White Prawn
6	*Solenocera crassicornis*	Costal Mud Shrimp
OTHERS		
1	*Charybdis cruciata*	Crucifix Crab
2	*Loligo spp.*	Squid
3	*Matuta planipes*	Flower Moon Crab
4	*Neptunus pelagicus*	Flower Crab,
5	*Sepia spp.*	Cuttlefish

Sl. No.	Scientific Name	Common Name/English Name
6	*Squilla sp.*	Spot tail Mantis Shrimp
7	*Charybdis annulata*	Banded Leg Swimming Crab

3.8 SOCIO-ECONOMIC ENVIRONMENT

The primary objective of socio-economic study is to assess the current socio-economic status of the village(s) and community 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 to present the socio-economic baseline of the project footprint area along with the synopsis of the stakeholder consultations conducted on the site.

3.8.1 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 primary and secondary data. While primary data has been collected through reconnaissance survey within the villages/towns/district headquarters falling on the proposed project alignment, secondary data has been collected from the Census of India 2011 and district statistical handbook, state and district portal. The details regarding population composition, number of literates, working population and access to basic facilities and others have been collected from secondary sources and analyzed. Goresema village is identified as the Project Impact Area to address the qualitative aspects of the study.

3.8.2 Concept and Definition of Terms Used

a) **Household:** A group of persons who normally live together and take their meals from a common kitchen are called a household. Persons living in a household may be related or unrelated or a mix of both. However, if a group of related or unrelated persons live in a house but do not take their meals from the common kitchen, then they are not part of a common household. Each such 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.

3.9 State Profile-Gujarat

Gujarat is the fifth largest state of India, with an area of about 1,96,024 square kilometers, occupying approximately 6.19% of the total geographical area of the country. Gujarat is located on the country's western coast, on the Arabian Sea. It encompasses the entire Kathiawar Peninsula (Saurashtra) as well as the surrounding area on the mainland. The state is bounded by Pakistan to the north and northwest and by the Indian states of Rajasthan to the northeast, Madhya Pradesh to the east, and Maharashtra to the southeast. The state is also surrounded by the Arabian Sea to its west and southwest. Gujarat also shares a small segment of its southeastern border with the Indian union territory of Daman and Diu and Dadra and Nagar Haveli.

With a population of 6,04,39,692 persons as specified in the Census of India 2011, the state of Gujarat is the tenth most populated state of the country. Gujarat is divided into 33 districts, which is subdivided into 251 talukas at present for smoother administration. The state is further grouped into five divisions, which also acts as administrative divisions. According to Census of India 2011, Gujarat has 17843 inhabited villages and 348 towns. The sex ratio of the state has been recorded as 919 against the national figure of 943. The proportion of Scheduled Caste population has been recorded as 40,74,447 lakhs of people as per 2011 Census, while the Schedule Tribe population constitutes of 89,17,174 lakhs of people. As per Census 2011, Hinduism was the most followed religion in the state with 88.57 percent population followed by Islam accounting for 9.67 percent and minor proportions of Christians, Sikhs, Jains, Buddhists and others.

3.9.1 District Profile (Kachchh)

Kachchh lies between the parallels of latitude 22° 44' to 24° 42' and the meridians of longitude 68° 10' to 71° 55', covering an area of 45,674 km². It is largest district in terms of area and consists of the longest coastline of Gujarat, of about 406 km. Kachchh is bound on north and northwest by Pakistan, on the northeast by the state of Rajasthan, on the east by Banas Kantha and Patan districts, on the southeast by Surendra Nagar district, on the south by the Gulf of Kachchh and Rajkot district and on the southwest by the Arabian Sea. The district occupies about 23.27 percent of the total geographical area of the State and accounts for 3.5 percent of the total population, holding the fourteenth rank in the State with respect to population. The district has six subdivisions. Further for smoother administration, the district is divided into 10 talukas viz, Lakhpat, Rapar, Bhachau, Anjar, Bhuj, Nakhatrana, Abdasa, Mandvi, Mundra and Gandhidham.

There are a total of 632 Gram Panchayats covering 924 villages in the district at present. As per 2011 Census, the total population of the district has been recorded as 20,92,371 of which approximately 65.2 percent of the population resides in rural areas and 34.8 percent resides in urban areas. The sex ratio of the district was recorded as 911 in rural areas and 901 in urban areas which collectively counts as 908, whereas the population density was recorded as 46 persons per Sq. km. The average literacy rate of the district has been recorded as 70.6 percent, where literacy rates amongst males and females was recorded as 79.4 percent and 60.9 percent respectively. The Schedule Caste and Schedule Tribe population were recorded.

3.9.2 Block Profile

The land identified for the proposed project is a continuous stretch of land spanning within the Special Economic Zone (SEZ) of Mundra. The block has been discussed in total, comprising of both rural and urban areas, as suggested by the Census 2011 data. Mundra has 1 town and 62 villages, 1,53,219 people and 35,192 households as per Census of India, 2011. The salient characteristics of the block have been elucidated in the next sections.

3.9.3 Demography

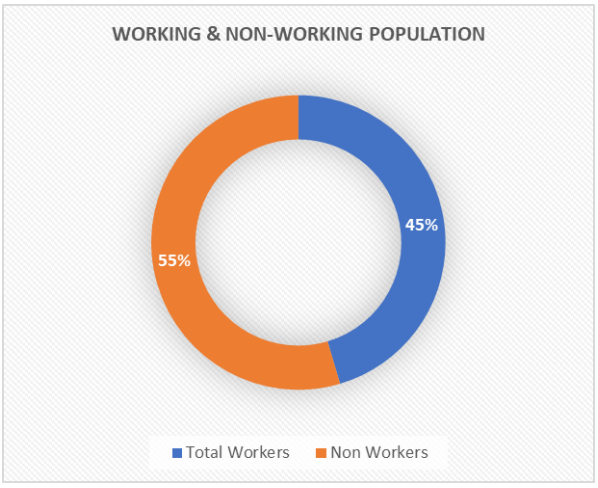
Table 3-25 provides details of the area and demography of Mundra. As per the Census 2011 data, Mundra has the highest population with about 1,53,219 people and 35,192 households, of which males and females accounted for about 58.66 percent and 41.34 percent of the total population. Both Schedule Caste and Schedule Tribe population were recorded in smaller proportions contributing to only about 13.26 percent and 1.29 percent respectively. The sex ratio of Mundra is recorded as 705, and the literacy rates stood at 66.44 percent.

Table 3-25: Demographic Details

Block	Area (in Sq. Km)	No. of HH	Pop	Male	Female	SC Population	ST Population	Literacy Rate
Mundra	888.15	35,192	153,219	58.66 %	41.34 %	13.26%	1.29%	66.44%

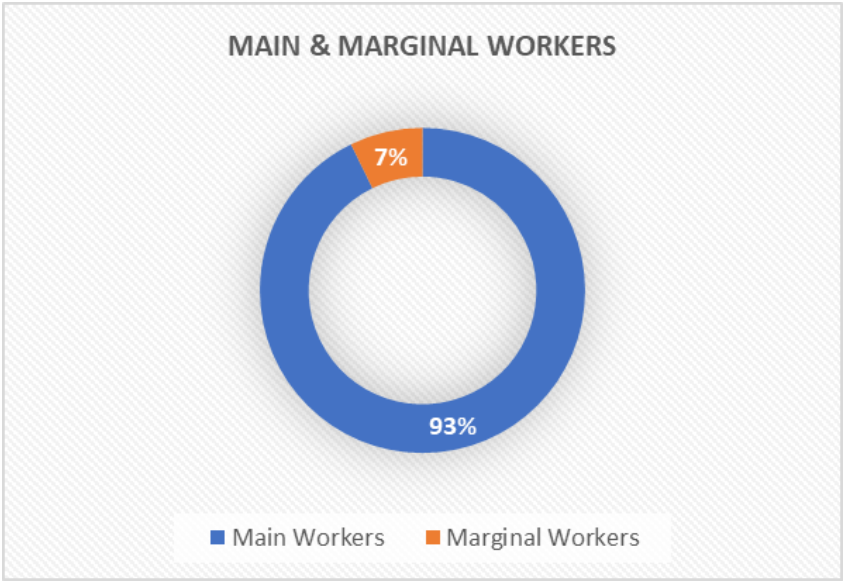
3.9.4 Working Population

As per the Census 2011, Mundra has a working population of 45.43 percent and a non-working population of 54.57 percent. Figure 1 provides details of the working and non- working population of Mundra. Main workers constituted more in the working population than marginal workers, as depicted in **Figure 3-29**.



**Source: Census,2011*

Figure 3-29: Segregation of Workers and Non-Workers

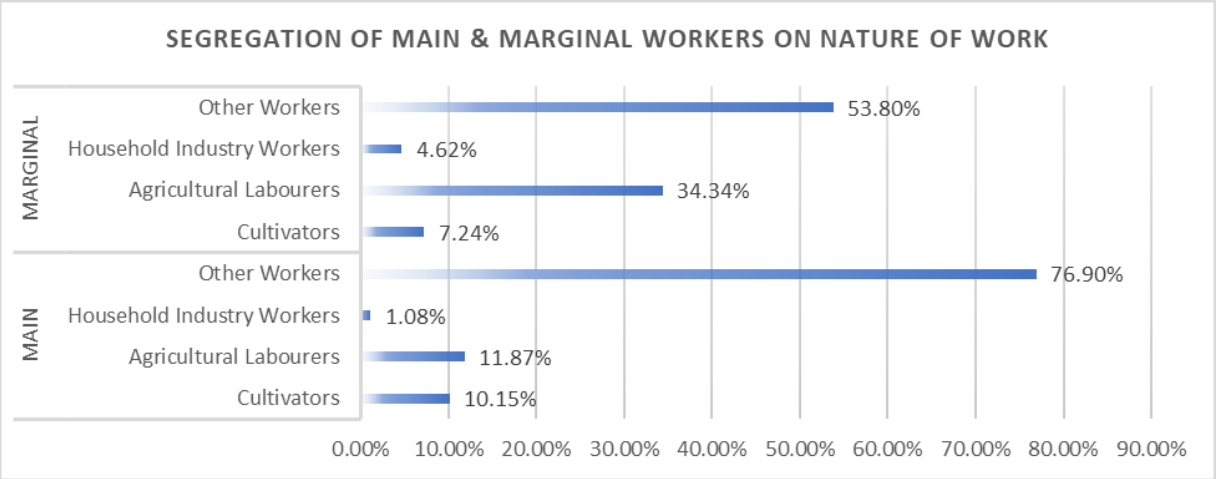


**Source: Census,2011*

Figure 3-30: 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 3-31** 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. A higher proportion of main and marginal workers are engaged in activities other than agriculture, where the proportion of workers engaged in activities other than agriculture in main worker category was higher than those in marginal working category. However, the proportion of agriculture workers were observed to be more amongst marginal workers.



Source: Census,2011

Figure 3-31: Segregation of Main Working Population by Nature of Work

3.10 Project Impact Area

As per the data shared by the project proponent, Goresema is the village where the project area is located.

3.10.1 Demography

Table 3-26 provides details of the demographic profile of the villages within the project impact area. As per Census 2011, Goresema was recorded with a geographical area of 599.48 Hectares and a total population of 989 people. The average proportion of males and females were recorded as 51.57 percent and 48.43 percent respectively in the area. Goresema has an SC population of 19.72 percent. The village does not have an ST population according to Census 2011. The literacy rate of Goresema has been recorded as 55.61 percent.

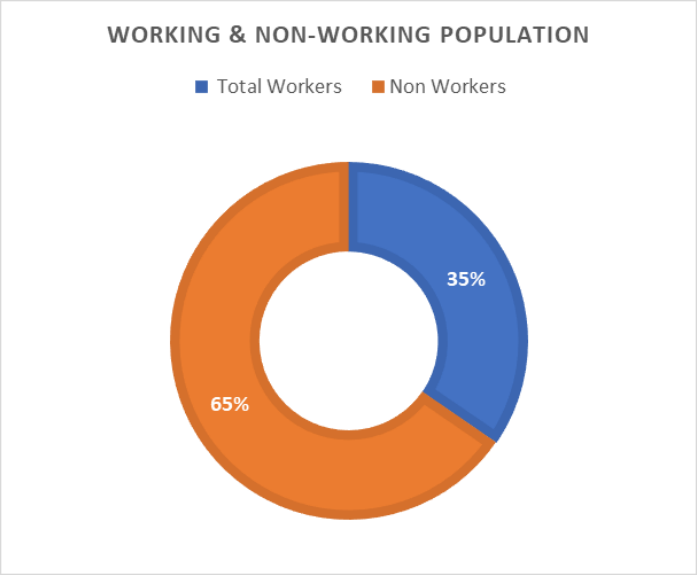
Table 3-26: Demography- Project Impact Area

Name of village	Total Geographical area (in Ha)	No of HH	Total Population	Percent Male	Percent Female	Percent SC	Percent ST	Percent Literate
Goresema	599.48	195	989	51.57%	48.43%	19.72%	0.00%	55.61%

Source: Census,2011

3.10.2 Working Population

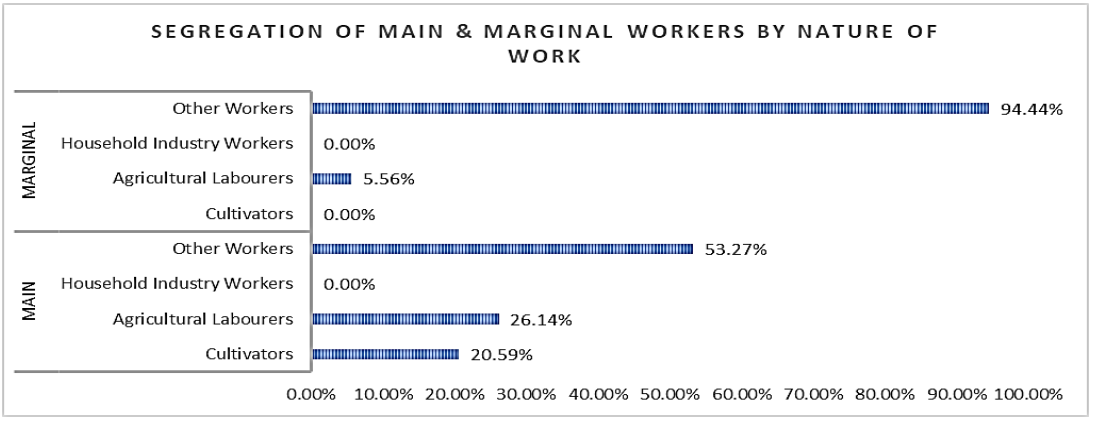
Figure 3-32 provides details of the proportion of Working and Non-Working population in the villages within the project impact area. Goresema records a working population constituting 34.58 percent, and 65.42 percent constituting as the non-working population as per Census 2011.



Source: Census,2011

Figure 3-32: Segregation of Working and Non-working Population

Further segregation of Working population suggests high proportion of main workers to marginal workers in Goresema village. A high proportion of workers other than agriculture can be seen constituting about 53.27 percent in main worker category and 94.47 percent of marginal worker category of the working population. **Figure 3-33** provides further analysis of the basis of segregation of the working population w.r.t the type of occupational activities. Analysis of data suggests less proportion of cultivators in both main and marginal worker category.



Source: Census,2011

Figure 3-33: Segregation of Main & Marginal Workers by Nature of Work

3.10.3 Education Facilities

Table 3-27 provides details of the educational facilities present in the village.

Table 3-27: Educational Facilities- Project Impact Area

Village Name	Pre-primary	Primary	Middle	Secondary	Senior Secondary
Goresema	<5 km	2	Not Available	<5 km	<5 km

Source: Census,2011

3.10.4 Drinking Water Facilities

Table 3-28 provides details of the drinking water facilities available in the village based on the data from Census 2011.

Table 3-28: Drinking Water Facilities- Project Impact Area

Village Name	Tap Water	Well Water	Hand Pump	Spring	River
Goresema	Yes	No	No	No	No

Source: Census,2011

3.10.5 Communication Facilities

Public and Private Transport facilities are also available in the village with a proper access to State Highways (SHs), National Highways (NHs) and Major District Roads.

Table 3-29: Communication Facilities- Project Impact Area

Village Name	Bus Service	Railway Station	Connected to National Highway (NH)	Connected to State Highway (SH)
Goresema	Yes	<5 km	5-10 km	Yes

Source: Census,2011

4 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.1 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, discussions with local community 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 and area drainage, air quality degradation, noise impacts, impact on ecological environment, impact on agriculture, land use changes, impact on health and safety, impact on socio-economic features, impact on community activities, impact on cultural heritage 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.

4.2 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 local community and representatives 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 4-1** below:

Table 4-1: Impact Identificationa Matrix for NG Pipeline Route

Components	Physical				Biological		Socio-Economic		
	Ambient Air Quality	Ground/Surface Water (Quantity/Quali	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	•	•	•	•	•	•	•	•	•

Components	Physical				Biological		Socio-Economic		
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	•			•					

4.3 PRE-CONSTRUCTION PHASE IMPACTS

4.3.1 Impact on Land Procurement

IMPACTS

ATGL has identified the 30.786 kms Natural Gas Pipeline spanning across APSEZ premises, wherein 1.64 kms of pipeline will be laid in right of way of Mundra-Gandhidham Road. Permission for laying of NG pipeline within the APSEZ and Goresema Village has been taken from Adani Ports and Special Economic Zone Limited and Road and Building Department respectively. The significance of this impact has been evaluated to be **Nil** as land acquisition process has been conducted by taking prior permission from concerned departments i.e., APSEZ and Road & Building Department.

4.4 IMPACTS DURING CONSTRUCTION PHASE

4.4.1 Topography, Land use and Drainage

IMPACTS

The proposed natural gas pipeline project is mainly identified within land designated for “Industrial Use/Special Economic Zone” by Adani Ports and Special Economic Zone Limited. The entire stretch of pipeline is majorly flat with minor undulations in its right of way. Although, the pipeline crosses two water bodies in its right of way. Laying of natural gas pipeline will be done within depth of 1.5 m in land

while NG pipeline will be laid as per standard protocols and procedures. There will be limited change in topographic characteristics of project footprint area. The alteration in surface drainage pattern of the area due to construction activities will be limited to smaller areas located in project footprint. The natural flow of storm water will not be altered on contiguous larger area. Intensity of the effect also can be considered as low, and duration of the effect would be short in nature.

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.

4.4.2 Water Resources and Availability

IMPACTS

During construction phase, water will be primarily required for domestic activities by staff. Additionally, the pipeline is crossing at two water bodies in its right of way. Freshwater will be sourced from private tankers/SEZ Department. There will be generation of sewage by construction workers. The deterioration of water quality during construction phase is expected due to wastewater disposal from the workers camp and sludge generated from construction sites. Inappropriate disposal of fuel & lubricants could also lead to water contamination. Additionally, there is a possibility of contamination of water bodies during laying of NG pipeline in the creeks coming within ROW of the pipeline.

MITIGATION MEASURES

- Quality of construction wastewater emanating from the construction site will be controlled through suitable drainage system with sediment traps (silting basin as water intercepting ditch) for arresting the silt / sediment load before its disposal into the main natural drainage system around the site.
- 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.
- All the construction and preparatory activities to be conducted during dry seasons only.
- 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.

4.4.3 Ambient Air Quality

IMPACTS

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. However, this will not lead to any tangible effect, as the additional traffic volume related to construction activities will be low.

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 in order 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.

4.4.4 Ambient Noise Quality

IMPACTS

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 also 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.

MITIGATION MEASURES

- 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.

4.4.5 Land and Soil Environment

IMPACTS

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.

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.

4.4.6 Ecology and Biodiversity

IMPACTS

The construction works of the NG pipeline route involves clearance of land, but it does not include uprooting of trees. Few shrubs and herbs will be cleared. The area has already been converted into industrial area/SEZ Area. Therefore, no significant impact on the ecological environment is envisaged due to the construction activity of the proposed pipeline project.

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.

4.4.7 Socio-economic Environment

IMPACTS

The project will provide either direct or indirect job opportunities to the local population as far as possible. There will be some migration of skilled labour force from outside the project area during construction phase, which may put some pressure on the local settlements and resources. Local skilled employees will be preferred. There will be short term increments in traffic of nearby roads outside APSEZ & within the premises for transportation of raw materials and construction machineries that may cause public inconvenience. This will have minimal affect considering the size and nature of the project.

MITIGATION MEASURES

- Transport of construction materials and machineries shall be carried out during lean traffic period of the day or during night.
- Hygiene conditions shall be maintained at site.
- PPE shall be given to all labour working in noisy and risky area.
- The construction impacts are likely to be for short duration and confined locally to the construction site itself.
- During the movement of earth moving equipment the operator should blow horn to caution the people around.
- Protection screen to be placed around the pipe during coating.

4.5 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.

4.5.1 Air Environment

The pipeline will be 1.5 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.

4.5.2 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.

4.5.3 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.

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.

4.5.4 Environment, Health, and Safety

There could be impacts on environment, health, and safety due to leakage from pipelines from likely external physical forces (Floods & Cyclones). Natural Gas being inflammable in nature could lead to fire hazards. Being located within a Multi-Product SEZ that includes, thermal power plant, coal transportation system and several other activities, stringent measures are required to be adapted to avoid any hazard due to leakage of natural gas pipeline.

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.

5 ADDITIONAL STUDIES

5.1 Quantitative Risk Assessment

Quantitative Risk Assessment (QRA) study should be undertaken for the proposed 12" 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.

5.2 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.

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 following alignments were preliminary selected for the proposed natural gas pipeline.

1. Existing GSPC Switching Station as Shekhadiya Village.
2. Existing GSPC LNG Pipeline within APSEZ premises.
3. From GSPC LNG Terminal located within APSEZ premises.

Figure 6-1 depicts the analyzed routes for laying of NG pipeline.

Figure 6-1: Alignment Routes for laying of NG Pipeline

Based on detailed analysis for above-mentioned route alignments for the project, it was concluded that **Option-1 i.e., Existing GSPC Switching Station as Shekhadiya Village** would be the most feasible location for the proposed project. The analysis was done on basis of the following rationales:

1. In Option 2 i.e., the alignment (ROW) made for tapping off of LNG Pipeline from existing GSPC pipeline was coming within reserve forest i.e., Mundra Dhoa Reserve Forest. Selecting this alignment would require Forest Clearance from MoEF&CC that could lead to delay in the project. Therefore, this route was not selected.
2. Option 3 i.e., direct sourcing from LNG terminal was avoided due to safety and administrative reasons.

7 PROJECT BENEFITS

7.1 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.

7.2 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. During the last five years the oil import has reduced by 8 %. 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.

7.3 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 local 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.

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8 ENVIRONMENTAL MANAGEMENT AND MONITORING PROGRAM

8.1 INTRODUCTION

The Environmental Management Plan (EMP) provides an essential link between predicted impacts and mitigation measures during implementation and operational activities. EMP 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 EMP lists all the requirements to ensure effective mitigation of every potential biophysical and socio-economic impact identified in the EIA. 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 EMP 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.

8.2 ENVIRONMENT MANAGEMENT PLAN

Table 8-1: Environment Management Plan

Aspect	Impacts	Mitigation Procedure	Monitoring Action	Responsibility	Timing
Air Pollution	Dust generation	• Access limited to demarcated ROW and specified access roads. Strict enforcement of project speed limits. • Damping down of ROW · • Identification of areas of particularly sensitive receptors (e.g., villages or crops).	• Review and approval of contractors for Transport Management Plan, Pollution Prevention Management Plan, Detailed Construction Method Statements	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance	ATGL	Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites	ATGL	Pre-construction
	Metal Vapour Emissions	Ensure adequate ventilation and dispersion of vapour. Ensure welding is undertaken by appropriately trained personnel.	• Review and approval of the contractors. Employment and Training Management Plan and detailed construction method statements	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance	ATGL	Throughout Construction Period

Aspect	Impacts	Mitigation Procedure	Monitoring Action	Responsibility	Timing
	Combustion gases (CO_2, CO, NO_2, NO, SO_2, PM, CH_4, VOCs)	• Maintenance of all vehicles and plant to meet relevant international standards and manufacturer's recommendations. • Monitoring of vehicle and plant emissions. • Optimization of plant running time (where appropriate).	• Review and approval of the contractors Transport management plan, Pollution Prevention Management Plan, Construction Camp Management Plan, and detailed construction method statements.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance. • Routine review of discharge monitoring data.	ATGL	Throughout Construction Period
	Vehicle movements	• Selection of appropriate routes for vehicles using public road network and project access roads. • Provision of environmental training for vehicle drivers and equipment operators. • Control of operational speeds and operating times. • Maintenance of vehicles and plant.	• Review and approval of the contractors Transport Management Plan, Infrastructure and Services Management Plan and Employment and Training Management Plan.	ATGL	Pre-construction
			• Routine monitoring, documentation and review of traffic management and training processes.	Contractor	Throughout Construction Period
			• Collection and review of incident and near miss data.	Contractor	Throughout Construction Period
			• Spot checks on procurement and waste management processes Routine review of incident and near miss reports.	ATGL	Throughout Construction Period

Aspect	Impacts	Mitigation Procedure	Monitoring Action	Responsibility	Timing
Noise Pollution	Noise emissions	• Control of vehicle and plant noise generation. • Control of operating hours. • Appropriate selection and maintenance of plant, vehicles, and access routes. • Appropriate selection of construction techniques. • Ensure environmental considerations are incorporated into the siting and design of camps. • Implement workforce education with respect to minimizing disruptive activities. • Incorporate into the project induction training. • Implementation of camp rules including restrictions on noisy activities.	• Review and approval of the contractors Transport Management Plan, Pollution Prevention Management Plan, Infrastructure and Services Management Plan, Procurement and Supply Management Plan and detailed construction method statements.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance.	ATGL	Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites.	ATGL	Pre-monitoring
Water Pollution	Disposal of liquid wastes/water (Hydro test Specific Measures)	• Risk assessment to be undertaken before any chemical additives are used in hydro test water. • Controlled discharge of water to reduce soil erosion Testing	• Review and approval of the contractors Pollution Prevention Management Plan, Procurement and Supply Management Plan, Waste Management Plan, Infrastructure and Services Management Plan and detailed construction method statements	ATGL	Pre-construction

Aspect	Impacts	Mitigation Procedure	Monitoring Action	Responsibility	Timing
		and treatment of water before discharge. • Responsible disposal of wastewater; no disposal of incompatible water in areas of groundwater or surface water vulnerability.	• Routine monitoring, documentation, and review of application of mitigation measures	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance	ATGL	Throughout Construction Period
	Disruption of drainage / irrigation channels	• Undertake pre-construction surveys of irrigation and drainage systems as necessary to identify existing systems and devise temporary replacement measures if required, · • Undertake liaison with landowners/land occupiers/land users · • Include provisions for drainage/irrigation management	• Review and approval of the contractors Infrastructure and Services Management Plan, and Detailed Construction Method Statements.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance.	ATGL	Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites.	ATGL	Pre-construction
	Increased flood risk	• Ensure that gaps are left in topsoil stacks to allow floodwater through. • Ensure the continued viability of pre-existing drainage and irrigation systems throughout the project.	• Review and approval of the contractors Infrastructure and Services Management Plan, and detailed construction method statements.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance.	ATGL	Throughout Construction Period

Aspect	Impacts	Mitigation Procedure	Monitoring Action	Responsibility	Timing
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites.	ATGL	Pre-construction
	Disposal of trench-water	• Ensure that trench-water disposal is undertaken in an appropriate manner.	• Review and approval of the contractors Pollution Prevention Management Plan, Waste Management Plan, and detailed construction method statements.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance.	ATGL	Throughout Construction Period
	Sediment release	• Avoid open cut river crossings during monsoon season. • Include environmental considerations in the selection of crossing design and choice of methodology.	• Review and approval of the contractors Pollution Prevention Management Plan, Emergency Response Plan, and detailed construction method statements.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance.	ATGL	Throughout Construction Period
			• Review and approval of the contractors Infrastructure and Services Management Plan, and detailed construction method statements.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout Construction Period

Aspect	Impacts	Mitigation Procedure	Monitoring Action	Responsibility	Timing
			• Spot checks on the contractor's performance.	ATGL	Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites.	ATGL	Pre-construction
Land & Soil	Use of raw materials & natural resources	• Development and implementation of procurement, supply, and waste management procedures.	• Review and approval of the contractors Procurement and Supply Management Plan and Waste Management Plan.	ATGL	Pre-construction
			• Routine monitoring, documentation and review of procurement and waste management processes.	Contractor	Throughout Construction Period
			• Spot checks on procurement and waste management processes.	ATGL	Throughout Construction Period
	Railway Crossing	• Mitigation measures to be formulated in conjunction with local railway department.	• Review and approval of the contractors Transport management plan, Infrastructure and Services Management Plan, Community Safety Management Plan and Procurement and Supply Management Plan.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance.	ATGL	Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites.	ATGL	Throughout Construction Period

Aspect	Impacts	Mitigation Procedure	Monitoring Action	Responsibility	Timing
	Potential for accidental spillage of hazardous materials (e.g. lubrication fluids, oils, paints, diesel etc.).	• Development and implementation of specific procedures for hazardous materials management. • Minimization of acquisition and storage of hazardous materials Training of personnel in safe use & handling of hazardous materials. • Provision of appropriate spill response equipment and spill response training Rapid response in event of spillage.	• Review and approval of the contractors Pollution Prevention Management Plan, Employment and Training Management Plan, Transport Management Plan, Procurement and Supply Management Plan, Waste Management Plan, Emergency Response plan, and construction method statements.	ATGL	Pre-construction
			• Recording and regular review of incidents and near misses.	Contractor	Throughout Construction Period
			• Routine monitoring, documentation and review of training, procurement, storage, and waste management processes.	Contractor	Throughout Construction Period
			• Spot checks on contractor performance and record keeping Routine review of incident and near miss data.	ATGL	Throughout Construction Period
	Disturbance of land surface & vegetation	• Vehicle movements confined to defined access routes. • Provision of training to drivers and plant operators.	• Review and approval of the contractors Transport Management Plan, Infrastructure and Services Management Plan, Community Safety Management Plan	Contractor	Throughout Construction Period
			• Routine monitoring, documentation and review of traffic management processes.	Contractor	Throughout Construction Period

Aspect	Impacts	Mitigation Procedure	Monitoring Action	Responsibility	Timing
			• Spot checks on traffic management, training. • Routine review of access route condition and adherence to defined access routes.	ATGL	Throughout Construction Period
	Soil compaction	• Protection of soil storage areas from vehicle movements. • Protection of soil surface in areas of soft ground. • Provision of appropriate drainage and regular regrading.	• Review and approval of the contractor's management plans, detailed construction method statements.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance.	ATGL	Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites.	ATGL	Pre-construction
	Soil erosion	• Implementation of erosion control measures. • Compaction of soil stack surface to minimize erosion. • Preparation & implementation of approved crossing methods.	• Review and approval of the contractors Pollution Prevention Management Plan, and detailed construction method statements (with specific attention to those concerning river crossings)	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance.	ATGL	Throughout Construction Period

Aspect	Impacts	Mitigation Procedure	Monitoring Action	Responsibility	Timing
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites.	ATGL	Pre-construction
	Loss of soil structure and fertility	• Ensure appropriate segregation, storage, management, and reinstatement of stripped soil	• Review and approval of the contractor's management plans, detailed construction method statements.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance	ATGL	Throughout Construction Period
	Modified topography	• Ensure that reinstatement is sympathetic to existing contours.	• Review and approval of the contractors for detailed construction method statements.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance.	ATGL	Throughout Construction Period
	Disposal of surplus subsoil	• Ensure that the generation of surplus soil is minimized, and that disposal is conducted appropriately. • Ensure that any potential subsoil disposal sites and disposal plans are subject to an environmental review prior	• Review and approval of the contractors Waste Management Plan, and detailed construction method statements.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance.	ATGL	Throughout Construction Period

Aspect	Impacts	Mitigation Procedure	Monitoring Action	Responsibility	Timing
		to their adoption	• Spot checks on completion of all necessary additional assessments and development of appropriate mitigation actions.	ATGL	Pre-construction
	Disturbance of known/unknown contaminated land	• Avoid construction in areas of known or suspected contamination as far as is practical · • Ensure that where contaminated land is encountered it is effectively managed.	• Review and approval of the contractors Pollution Prevention Management Plan, Waste Management Plan, and detailed construction method statements.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance.	ATGL	Throughout Construction Period
			• Spot checks on completion of all necessary additional assessments and development of appropriate mitigation action.	ATGL	Pre-construction
	Potential for drilling fluid breakout/spillage (During HDD)	• Adequate geotechnical survey work conducted during design. • Risk assessment to be undertaken before drilling in vicinity of sensitive surface waters. • Storage of drilling muds in bunded area. • Avoid use of toxic chemicals in	• Review and approval of the contractors Pollution Prevention Management Plan, Emergency Response Plan, Waste Management Plan, and detailed construction method statements.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance.	ATGL	Throughout Construction Period

Aspect	Impacts	Mitigation Procedure	Monitoring Action	Responsibility	Timing
		drilling fluid	• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites.	ATGL	Pre-construction
Ecology	Loss of habitat	• Environmental management plans· • Construction method statements (including clearance) • Transport Management (including route selection)	• Review and approval of the contractor's management plans, detailed construction method statements.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout Construction Period
			• Spot checks on the contractor's performance.	ATGL	Throughout Construction Period
			• Spot checks on completion of all necessary pre-construction assessments and development of mitigation actions for sensitive sites.	ATGL	Pre-construction
	Public & animal safety	• Erection of warning barriers where significant risk to public and livestock exists. • Installation of soft plugs in ditch with sloped edges to allow animal egress.	• Review and approval of the contractors Community Safety Management Plan, Infrastructure and Services Management Plan, and detailed construction method statements.	ATGL	Pre-construction
			• Routine monitoring, documentation, and review of application of mitigation measures.	Contractor	Throughout construction period
			• Spot checks on the contractor's performance.	ATGL	Throughout construction period

Aspect	Impacts	Mitigation Procedure	Monitoring Action	Responsibility	Timing
Social	Vehicle Movements	• Selection of appropriate routes for vehicles using public road network and project access roads. • Provision of training for vehicle drivers and equipment operators. • Control of operational speeds and operating times. • Maintenance of vehicles and plant.	• Review and approval of the contractors Transport Management Plan, Infrastructure and Services Management Plan and Employment and Training Management Plan.	ATGL	Pre-construction
			• Routine monitoring, documentation and review of traffic management and training processes.	Contractor	Throughout construction period
			• Collection and review of incident and near miss data.	Contractor	Throughout construction period
			• Spot checks on procurement and waste management processes Routine review of incident and near miss reports.	ATGL	Throughout construction period
	Partial road closure	• Use non-open trench crossing techniques for major roads. • Minimize duration of closure of roads and provide temporary access where necessary. • Use steel plates across trench to maintain access. • Institute temporary traffic control, where necessary. • Undertake community consultation	• Review and approval of the contractors Transport Management Plan, Infrastructure and Services Management Plan, Community Safety Management Plan, and detailed construction method statements.	ATGL	Pre-construction
			• Routine monitoring, documentation and review of application of mitigation measures.	Contractor	Throughout construction period
			• Spot checks on the contractor's performance.	ATGL	Throughout construction period
	Grievance Redressal Mechanism	Community Grievance Process	• Spot follow up of complaints recorded in complaints register to assess whether process has been carried out correctly.	ATGL	Monthly during Construction period

Aspect	Impacts	Mitigation Procedure	Monitoring Action	Responsibility	Timing
		Implementation of general construction mitigation measures	Spot checks at ROW, construction sites and affected communities to ensure mitigation measures are being implemented. This will look specifically at: · • Implementation of measures to avoid disruption to infrastructural services such as telecoms, electricity, gas, and water. · • Implementation of community safety measures (fencing near residential areas, fencing on public trench crossings, warning lights and warning signs at open areas of trench). • Suitable diversions are in place where necessary · • Dust and noise mitigation measures are in place · • Alternative water sources are provided as appropriate	ATGL	Monthly for first 3 months. If implementation of mitigation measures is proceeding appropriately, reduce monitoring to bi-monthly with review of written activity reports submitted on a weekly basis.

Aspect	Impacts	Mitigation Procedure	Monitoring Action	Responsibility	Timing
Health and Safety	Public health and Safety	Community Safety	• Spot monitoring of health and safety incidence rates for community members and full review of any serious incidents. • Spot monitoring of community traffic safety meetings	ATGL	Monthly Two to three times in first four months and if training is seen as acceptable, revert to once every six months. If training is not of sufficient quality, then continue at two to three every four months.
		General Safety Measures	Spot monitoring of implementation of safety measures during construction as outlined in 'Implementation of general construction mitigation measures', General Construction Impacts section above.	ATGL	Monthly for first three months. If implementation of mitigation measures is proceeding appropriately, reduce monitoring to bimonthly with review of written activity reports submitted on a weekly basis
		Health and Safety Training	Monitor HR records to ensure training is provided to all workers and spot monitor all courses (general health and safety, safe driving training, job specific health and safety) provided to ensure training is adequate.	ATGL	

8.3 MONITORING SCHEDULE

The objectives of monitoring are:

- To check effectiveness of mitigation measures
- To evaluate the adequacy of Environmental Impact Assessment
- To assess status of compliance to legal requirements
- To assess if the Environmental Management Plan needs revisions/ updating.

The proposed environmental monitoring program during both construction and operation phases of the project are given in **Table 8-2** below:

Table 8-2: Environment Monitoring Program- Construction & Operation Phase

Sl. No.	Component	Location	Parameters	Frequency
Construction Phase				
1	Stack emission characteristics	Stacks attached to emission sources (e.g. DG set)	Stack monitoring for PM, SOx, NOx and HC	Once in a month
2	Ambient air quality	Nearest Residential Areas, and busy commercial locations	Ambient air quality parameters as per NAAQS viz. PM10, PM2.5, SOx, NOx, CO	Once in a month
3	Ground water quality (used as source of domestic water)	Point used for drinking water	Parameters listed in ISO:10500	Once in a month
4	Effluent quality	Discharge header of hydrotested pipeline/ tank	According to general discharge standards	As per requirement
5	Waste (including hazardous)	Construction sites and camps	Quantity/ volume generated and disposed	Once in a day
6	Equipment noise levels	1 m from DG set	dB(A)	Once in a month
7	Ambient noise levels	Nearest residential areas/ Silent zones etc.	Ambient noise levels (Leq Day & Leq Night)	Once in a month
Operation Phase				
8	Greenbelt development	Along the ROW of pipeline	Plant density, health, growth, and survival rate	Once in 6 months
9	Waste (including hazardous)	Along the ROW of pipeline	Quantity/ volume generated and disposed of.	Once in a month
10	Effluent quality	Along the ROW of pipeline	According to general discharge standards	Once in 6 months

9 SUMMARY AND CONCLUSION

9.1 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.

9.2 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
- Minimum impact to reserve forests and other sensitive areas.
- Minimum number of water crossings.
- Minimum impact to the environment.
- Easy access to the route during construction, operation, and maintenance of the pipeline.

9.3 IMPACTS DUE TO CONSTRUCTION OF PIPELINE

- The land identified for the proposed pipeline project is located mostly within Adani Ports and Special Economic Zone Limited (APSEZ) premises. Only 1.64 kms of pipeline will be laid outside the premises in right of way of Mundra-Gandhidham Road. Permission for laying of NG pipeline within the APSEZ and Goresema Village has been obtained from Adani Ports and Special Economic Zone Limited and Road and Building 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 SEZ department/private tankers. Domestic sewage will be disposed of to 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. The pipeline laying work would be done in night only as there is lots of traffic in daytime and creates disturbance to the locals.
- 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.

9.4 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 1.5 m at major crossings.

9.5 MITIGATION AND ENVIRONMENTAL MANAGEMENT PLAN

9.5.1 General

The mitigation measures to reduce environmental impacts, described in this EIA, 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 in the course of the proposed activities.
- Mock Drills shall be conducted at regular intervals in line with Emergency Response and Disaster Management Plan.

9.5.2 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 so as 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

9.6 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.

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ANNNEXURES

ANNEXURE 1: ENVIRONMENTAL CLEARANCE FOR MULTI-SEZ PROJECT (ADANI PORT AND SEZ LIMITED) CONVERING GAS LINE NETWORK WITHIN THE PREMIES

F. No. 10-138/2008-IA.III
Government of India
Ministry of Environment & Forests

Paryavaran Bhawan,
CGO Complex, Lodhi Road,
New Delhi - 110 003.

Dated: July 15, 2014

To
M/s Adani Port and SEZ Ltd
Adani House, Near Mithakhali Six Roads,
Navarangpura, Ahmedabad,
Gujarat- 380 009.

Subject: EC for proposed Multi- Product SEZ and CRZ clearance for Desalination, sea water intake, outfall facility and pipeline, at Mundra by M/s Adani Port and SEZ Ltd. – Reg.

This has reference to letter No. ENV-10-2010-1601-E dated 27.03.2012 of the Director (Environment) & Additional Secretary, Govt. of Gujarat and your subsequent letters dated 10.05.2012, 14.05.2012, 26.05.2012 and 29.04.2013 seeking prior Environmental and CRZ Clearance for the above project under the EIA Notification, 2006 and Coastal Regulation Zone Notification, 2011. The proposal has been appraised as per prescribed procedure in the light of provisions under the EIA Notification, 2006 and the Coastal Regulation Zone Notification, 2011 on the basis of the mandatory documents enclosed with the application viz., the Questionnaire, EIA, EMP, recommendations of the State Coastal Zone Management Authority and the additional clarifications furnished in response to the observations of the Expert Appraisal Committee constituted by the competent authority in its meetings held on 16th –17th April, 2012, 4th –5th June, 2012 and 9th -10th July, 2012.

2. It is, interalia, noted that the project involves development of multi product SEZ on a plot area of 18,000 ha. of which 6641.2784 ha. is presently notified under Special Economic Zone (SEZ). As per the proponent, the Multi product SEZ at Mundra comprising of various processing zones, non-processing zones, warehousing zones, Road Network (trunk as well as internal), Bridges or culverts over natural drains, Rail Network, IT-Telecommunication network, Electrical Network, Water supply, conservation & drainage Network, Effluent collection network, Desalination Plant with proposed intake & outfall locations, Common Effluent Treatment Plants & Sewage Treatment Plants, Natural Gas line network, Social Infrastructure, Existing Airstrip, Municipal Solid Waste Disposal site, utilities & supporting infrastructure etc. For the first phase of development total water requirement will be 150 MLD. Power requirement will be approx. 360 MW. Desalination plant of 150 MLD output capacity is proposed. 11 MLD water will be sourced through Narmada water pipeline. Two CETP each of capacity 50 MLD and 17 MLD as well as STP of 62 MLD is proposed. This will require 375 MLD of seawater intake and 241 MLD of treated waste water outfall into the sea. For final phase of development total water requirement will be 450 MLD and power requirement will be approx. 1000 MW.

3. A suitable seawater intake point has been identified on the eastern end of the approved East Port Basin at Latitude 22°48'30.76"N; Longitude 69°46'34.06"E where a depth of 6 m below CD would be available after the port development. As per modelling study the combined discharge of 241MLD which includes 16MLD from CETP and 225 MLD from desalination plant as RO reject is expected having 57.57ppt of salinity, 14.41 mg / l of BOD and 94.39 mg/l of COD. After careful consideration of many aspects a suitable outfall location is identified on the west of the Eastern basin at Latitude 22°46'44.04"N; Longitude 69°45'5.51"E taking advantage of the expected 7.5m below CD basin depth. The outfall pipe line length is approximately 5.7 km and diffuser designed to attain a minimum dilution of 40-50 times.

4. The Centre for Earth Science Studies demarcated HTL, LTL and CRZ area. As per the CESS report and GCZMA, out of 6641.2784 ha of SEZ area, 1473.39 ha area falls within CRZ area. No SEZ industrial activity is proposed in the CRZ area. Only the Desalination plant pipeline for intake and outfall is proposed in CRZ areas. The Gujarat SCZMA in their 14th meeting held on 27-02-2012 considered the proposal of intake, outfall facilities, Desalination plant and laying pipeline and recommended the same vide their letter no.ENV-10-2010-1601-E dated 27th March 2012. Gujarat Pollution Control Board has granted Consent to Establishment of Marine outfall (NOC) vide letter dated 10.11.2011. The length of the intake will be approximately 5 Kms. As the sea water intake demand is 15000m3/h, drawal by pipe system is suitable by incorporating a wet well structure at the location. The intake point proposed is within the proposed East Port basin with a depth of 6 m below CD. The projected quantity of water can be transported through a single pipe of 1.3 m dia with a flow velocity of 3 m/ s or with a 1.6 m pipe with flow velocity of 2m/s.

5. The Expert Appraisal Committee, after due consideration of the relevant documents submitted by the project proponent and additional clarifications furnished in response to its observations, have recommended for the grant of Environment and CRZ Clearance for the SEZ in an area of 8481.2784 ha. However, SEZ for 1840 ha has been approved in principle by Ministry of Commerce and Industries.

6. Hon'ble High Court of Gujarat in WP No. 21 of 2013 vide order dated 13.01.2014 has directed that the Ministry to take a decision of its own so far as the issue of grant of environmental clearance is concerned considering the position prevailing as on date and also the aspects which have been highlighted by us in this judgment, within a period of thirty days from the date of this judgment without fail. Further, vide order dated 27.01.2014 Hon'ble Supreme Court in SLP No. 1526 of 2014 which was filed against the Order of High Court by the Respondent-1 has passed order that in case, the MOEF is unable to complete the process within the time stipulated by the High Court, it will be open for them to approach this Court for extension of time. Accordingly, Ministry has filed a petition before the Hon'ble Supreme Court seeking extension of two months time.

7. It is noted from the Judgement dated 13.01.2014 of Hon'ble High Court of Gujarat in PIL 21 of 2013 the Hon'ble Court has construed the grant of lease to units prior to

obtaining EC by M/s APSEZL as violation of EIA, Notification, 2006. Therefore, according to the OMs dated 12.12.2012 and 27.06.2013, PP was addressed for Board Resolution and the State Government was addressed to take credible action against the PP for the violation. Direction under Section 5 of E(P)Act, 1986 was also issued to APSEZ not to take up and allow any further construction activity within SEZ till the grant of clearance.

8. Further, Hon'ble Supreme Court video order dated 02.05.2014 in SLP 1526 of 2013 had ordered for stay of Ministry's letter dated 3.04.2014 addressed to Government of Gujarat to initiate legal action for the violation, also directed that the Ministry to complete the process of EC within eight weeks.

9. M/s APSEZ Ltd. has stated that the Board resolved that since the matter is sub-judice before the Hon'ble Supreme Court of India, will fully abide by the out come of the decision of the Hon'ble Supreme Court.

10. In view of the above and to comply with the orders of Hon'ble Courts, Ministry hereby accords necessary Environment Clearance for proposed Multi- Product SEZ in an area of 6641.2784 ha and CRZ clearance for desalination, seawater intake, outfall facility and pipeline for as per the provisions of Environmental Impact Assessment Notification – 2006 and its subsequent amendments and Coastal Regulation Zone Notification, 2011, subject to strict compliance of the terms and conditions as follows:

11. PART A - SPECIFIC CONDITIONS

(i) *PP shall abide by the final order/decision of Hon'ble Supreme Court in SLP (Civil) no. 1526/2014 and connected matters.*

(ii) *Properly conserve the creeks, river and the mangroves area in the area.*

(iii) *Ensure that mouths of all the creeks are kept open to ensure flushing of the creeks.*

(iv) *Bring the creeks to the condition as was seen in the satellite map of 2005 which will be a "reference" satellite map and a copy of which shall be sent to you separately.*

(v) *Submit once in a year latest satellite map which can be compared with the reference satellite map of 2005 to ensure that no modification in the creeks, rivers, mangroves and mouth of creeks have taken place.*

(vi) *Any direction issued by the MoEF with respect to the report submitted by Ms Sunita Narain Committee shall be complied with by the Proponent as applicable.*

(vii) *At its cost get Inspection study done once in a year by the organizations like NEERI or any organization approved by this Ministry to - (i) ensure compliance of all the EC conditions (ii) development of SEZ meeting of the environment norms, and (iii) advise any mid-term correction that can be introduced depending on the recommendation of the independent Third Party.*

(viii) "Consent for Establishment" for the SEZ shall be obtained from Gujarat Pollution Control Board under Air and Water Act and a copy shall be submitted to the Ministry before start of any construction work at the site.

(ix) PP shall get detailed bathymetry done for all the creeks and rivers within Port and SEZ areas along with mapping of co-ordinates, running length, HTL, CRZ boundary, mangrove areas including buffer zone through NCSCM / NIOT. PP shall also get prepared a detailed action plan for conservation and protection of creeks/ mangrove area etc through NCSCM / NIOT and submit the same to GCZMA for their examination and recommendation. GCZMA will submit its recommendations to MoEF for approval.

(x) PP shall demarcate the CRZ area on land with GPS coordinates in consultation with GCZMA/ the agency which has done the HTL/LTL demarcation for the area. There shall be no allotment of plot/s in CRZ area to industries. No industrial activity within CRZ area except the port and harbor & the foreshore facilities shall be allowed as committed

(xi) Till the approval of action plan for conservation and protection of creeks/ mangrove area, the CRZ area within SEZ shall be demarcated as "No Development Zone". PP shall not allow/ undertake any development in CRZ area of SEZ.

(xii) The implementation of action plan approved by the MoEF shall be monitored by the NCSCM/ NIOT. Compliance with action plan shall be submitted to GCZMA and to MoEF, RO. at Bhopal along with six monthly monitoring report.

(xiii) PP shall earmark separate budget for the implementation of the above action plan. The details of the expenditure shall be submitted to GCZMA and to MoEF, RO. at Bhopal along with six monthly monitoring report.

(xiv) All the industry in SEZ shall be connected through impervious drainage lines to the STP/ CETP for the discharge of their sewage or industrial effluent. There shall not be any discharge to creeks / rivers. PP shall be accountable for implementing this condition and necessary clause shall be incorporated in the MoU while allotting the plot to the individual industries

(xv) PP shall not carry out any river course modification.

(xvi) The individual industrial units shall obtain prior EC under EIA Notification, 2006 as applicable.

(xvii) Proponent shall identify 200 ha of land for mangrove plantation as per the condition laid by SEAC.

(xviii) 50 meter buffer from the existing mangrove area should be provided for any developmental activity,

(xix) *Proponent shell develop the green belt with 3 layers of canopy all along the periphery.*

(xx) *All the recommendation of the EMP shall be complied with in letter and spirit. All the mitigation measures submitted in the EIA report shall be prepared in a matrix format and the compliance for each mitigation plan shall be submitted to MoEF along with half yearly compliance report to MoEF-RO.*

(xxi) *There shall be no disturbance to the sand dunes. The pipelines shall be laid using advanced method viz. Horizontal Directional Drilling (HDD) so as to avoid disturbance to the sand dunes/ creeks/ mangroves.*

PART – B. GENERAL CONDITIONS

Construction Phase.

(i) *Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.*

(ii) *A First Aid Room will be provided in the project both during construction and operation of the project.*

(iii) *All the topsoil excavated during construction activities should be stored for use in horticulture/landscape development within the project site.*

(iv) *Disposal of muck during construction phase should not create any adverse effect on the neighbouring communities and be disposed, taking the necessary precautions for general safety and health aspects of people, only in approved sites with the approval of competent authority.*

(v) *Soil and ground water samples will be tested to ascertain that there is no threat to ground water quality by leaching of heavy metals and other toxic contaminants.*

(vi) *Construction spoils, including bituminous material and other hazardous materials, must not be allowed to contaminate watercourses and the dump sites for such material must be secured so that they should not leach into the ground water.*

(vii) *Any hazardous waste generated during construction phase should be disposed off as per applicable rules and norms with necessary approvals of the Gujarat Pollution Control Board.*

(viii) *The diesel generator sets to be used during construction phase should be low sulphur diesel type and should conform to Environment (Protection) Rules prescribed for air and noise emission standards.*

(ix) *The diesel required for operating DG sets shall be stored in underground tanks and if required, clearance from Chief Controller of Explosives shall be taken.*

(x) *Vehicles hired for bringing construction material to the site should be in good condition and should have a pollution check certificate and should conform to applicable air and noise emission standards and should be operated only during non-peak hours.*

(xi) *Ambient noise levels should conform to residential standards both during day and night. Incremental pollution loads on the ambient air and noise quality should be closely monitored during construction phase. Adequate measures should be made to reduce ambient air and noise level during construction phase, so as to conform to the stipulated standards by CPCB/GPCB.*

(xii) *Fly ash should be used as building material in the construction as per the provisions of Fly Ash Notification of September, 1999 and amended as on 27th August, 2003. (The above condition is applicable only if the project site is located within 100 Kms of Thermal Power Stations).*

(xiii) *Ready mixed concrete must be used in building construction.*

(xiv) *Storm water control and its re-use should be regulated as per CGWB and BIS standards for various applications.*

(xv) *Water demand during construction should be reduced by use of pre-mixed concrete, curing agents and other referred best practices.*

(xvi) *Permission to draw ground water shall be obtained from the competent Authority prior to construction/operation of the project.*

(xvii) *Separation of grey and black water should be done by the use of dual plumbing line for separation of grey and black water.*

(xviii) *Fixtures for showers, toilet flushing and drinking should be of low flow either by use of aerators or pressure reducing devices or sensor based control.*

(xix) *Use of glass may be reduced by upto 40% to reduce the electricity consumption and load on air-conditioning. If necessary, use high quality double glass with special reflective coating in windows.*

(xx) *Roof should meet prescriptive requirements as per Energy Conservation Building Code by using appropriate thermal insulation material to fulfill requirements.*

(xxi) *Opaque wall should meet prescriptive requirement as per Energy Conservation Building Code which is proposed to be mandatory for all airconditioned spaces while it is aspirational for non-airconditioned spaces by use of appropriate thermal insulation material to fulfil these requirement.*

(xxii) *The approval of the competent authority shall be obtained for structural safety of the buildings due to earthquake, adequacy of fire fighting equipments, etc. as per National Building Code including protection measures from lightning etc.*

(xxiii) *Regular supervision of the above and other measures for monitoring should be in place all through the construction phase, so as to avoid disturbance to the surroundings.*

(xxiv) *Under the provisions of Environment (Protection) Act, 1986, legal action shall be initiated against the project proponent if it is found that construction of the project has been started without obtaining environmental clearance.*

Operation Phase

(i) *The PP while issuing the allotment letter to individual member units shall specifically mention the allowable maximum quantity of water usage and effluent generated by each member unit.*

(ii) *The PP shall establish an environmental monitoring cell with all the potential polluting units as members to review the environmental monitoring data and suggest improvements.*

(iii) *Treated affluent emanating from STP shall be recycled/reused to the maximum extent possible. Treatment of 100% grey water by decentralised treatment should be done. Discharge of unused treated affluent shall conform to the norms and standards of the Pollution Control Board. Necessary measures should be made to mitigate the odour problem from STP.*

(iv) *The solid waste generated should be properly collected and segregated. Wet garbage should be composted and dry / inert solid waste should be disposed off to the approved sites for land filling after recovering recyclable material.*

(v) *Diesel power generating sets proposed as source of back up power for elevators and common area illumination during operational phase should be of enclosed type and conform to rules made under the Environment (Protection) Act, 1986. The height of stack of DG sets should be equal to the height needed for the combined capacity of all proposed DG sets. Low sulphur diesel should be used. The location of the DG sets may be decided in consultation with the Gujarat Pollution Control Board.*

(vi) *Noise should be controlled to ensure that it does not exceed the prescribed standards. During night time the noise levels measured at the boundary of the building shall be restricted to the permissible levels to comply with the prevalent regulations.*

(vii) *Green belt of adequate width and density preferably with local species along the periphery of the plot shall be raised so as to provide protection against particulates and noise.*

(viii) *Weep holes in the compound walls shall be provided to ensure natural drainage of rain water in the catchment area during the monsoon period.*

(ix) *Rain water harvesting for roof run- off and surface run- off, as plan submitted should be implemented.*

(x) *The ground water level and its quality should be monitored regularly in consultation with Central Ground Water Authority.*

(xi) *Traffic congestion near the entry and exit points from the roads adjoining the proposed project site must be avoided. Parking should be fully internalized and no public space should be utilized.*

(xii) *A Report on the energy conservation measures conforming to energy conservation norms finalised by Bureau of Energy Efficiency should be prepared incorporating details about building materials & technology, R & D Factors etc and submitted to the Ministry along with six monthly monitoring report.*

(xiii) *Energy conservation measures like installation of CFLs/TFLs for the lighting the areas outside the building should be an integral part of the project design and should be in place before project commissioning. Used CFLs and TFLs should be properly collected and disposed off/sent for recycling as per the prevailing guidelines/ rules of the regulatory authority to avoid mercury contamination. Solar panels may be used to the extent possible.*

(xiv) *Adequate measures should be taken to prevent odour problems from solid waste processing plant and STP.*

(xv) *The buildings should have adequate distance between them to allow movement of fresh air and passage of natural light, air and ventilation.*

(xvi) *The environmental safeguards contained in the EIA Report should be implemented in letter and spirit.*

(xvii) *Adequate drinking water facility be provided.*

(xviii) *Incremental pollution loads on the ambient air quality, noise and water quality should be periodically monitored after commissioning of the project.*

(xix) *Application of solar energy should be incorporated for illumination of common areas, lighting for gardens and street lighting in addition to provision for solar water heating. A hybrid system or fully solar system for portion of the apartments should be provided.*

(xx) *Ozone depleting substance (Regulation & Control) Rules should be followed while designing the air conditioning system of the project.*

12. Officials from the Regional Office of MOEF, Bhopal who would be monitoring the implementation of environmental safeguards should be given full cooperation, facilities and documents / data by the project proponents during their inspection. A complete set of all the

documents submitted to MoEF should be forwarded to the CCF, Regional office of MOEF, Bhopal

13. In the case of any change(s) in the scope of the project, the project would require a fresh appraisal by this Ministry.

14. The Ministry reserves the right to add additional safeguard measures subsequently, if found necessary, and to take action including revoking of the environment clearance under the provisions of the Environmental (Protection) Act, 1986, to ensure effective implementation of the suggested safeguard measures in a time bound and satisfactory manner.

15. All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponents from the respective competent authorities.

16. These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and control of Pollution) act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification, 2006.

17. The project proponent should advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded Clearance and copies of clearance letters are available with the Gujarat Pollution Control Board and may also be seen on the website of the Ministry of Environment and Forests at http://www.envfor.nic.in. The advertisement should be made within 10 days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the Regional office of this Ministry at Bhopal.

18. Clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.

19. "Any appeal against this clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010".

20. A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zilla Parisad/Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/ representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.

21. The proponent shall upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.

22. The project proponent shall also submit six monthly reports on the status of compliance of the stipulated EC conditions including results of monitored data (both in hard copies as well as by e-mail) to the respective Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.

23. The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of EC conditions and shall also be sent to the respective Regional Offices of MoEF by e-mail.

(Lalit Kapur)
Director (IA-III)

Copy to:

1. The Principal Secretary, Forest and Environment Department, Block no. 14/ 8 floor Sachivalaya, Gandhinagar – 382 010 Gujarat.
2. The Chairman, Central Pollution Control Board, Parivesh Bhavan, CBD-cum-Office Complex, East Arjun Nagar, Delhi – 110 032.
3. The Member Secretary, Gujarat Coastal Zone Management Authority & Director,(Environment) Forests & Environment Department, Block No. 14, 8th Floor, Sachivalaya, GandhiNagar-382.
4. The Chief Conservator of Forests, Ministry of Environment and Forests, Regional Office, Western Region, Kendriya Paryavaran Bhavan, Link Road No. 3, Ravishankar Nagar, Bhopal – 462016 (M.P.)
5. The Member Secretary, Gujarat State Pollution Control Board, Paryavaran Bhawan , Sector 10-A, Gandhi Nagar 382043, Gujarat
6. Director (EI), Ministry of Environment and Forests.
7. Guard File.
8. Monitoring File.

(Lalit Kapur)
Director (IA-III)

ANNEXURE 2: PERMISSION FROM ROAD & BUILDING DEPARTMENT FOR LAYING OF PIPELINE OUTSIDE ADANI PORT & SEZ PREMISES

જા.નં.સીબી/ ૩૧૬૮/૨૦૨૩

કાર્યપાલક ઈજનેરશ્રીની કચેરી,
માર્ગ અને મકાન વિભાગ(રાજય)
સ્મીથ બંગલો,ઓફીસર્સ કલબની સામે,
કોલેજ રોડ,ભુજ(કચ્છ).
☎ (૦૨૮૩૨)૨૫૧૪૫૦ / (ફેકસ)૨૫૦૪૨૪
E-mail: rnb.kut@gmail.com
તા. ૬૬ / ૦૭ /૨૦૨૩

પ્રતિ,
અદાણી ટોટલ ગેસ પ્રાઈવેટ લીમીટેડ,
બીજા માળે, અદાણી કોર્પોરેટ હાઉસ,
મુદરા–કચ્છ, ગુજરાત–૩૭૦૪૨૧.

વિષય :– ગેસ પાઈપ લાઈનની પરવાનગી આપવા બાબત.

સંદર્ભ:– (૧)આપશ્રીના પત્ર તા.૦૬/૦૨/૨૦૨૩
(૨)નાયબ કાર્યપાલક ઈજનેરશ્રી, માર્ગ અને મકાન પેટા વિભાગ, અંજાર–કચ્છના પત્ર જા.નં. સીબી/અંજાર/૩૭૮/ સને ૨૦૨૩, તા.૧૫/૦૩/૨૦૨૩.
(૩)આ વિભાગના જા.નં.સીબી/૧૪૬૨/૨૦૨૩, તા.૨૧/૦૩/૨૦૨૩.
(૪)આપશ્રીના પત્ર તા.૧૦/૦૫/૨૦૨૩.

ઉપરોકત વિષયે અને સંદર્ભિત પત્ર અન્વયે જણાવવાનું કે, ગેસ પાઈપ લાઈન પ્રોજેકટ અંતર્ગત સમાંતર અને ક્રોસીંગની પાઈપ લાઈન નાખવા માટે અરજદારશ્રી અદાણી ટોટલ ગેસ પ્રાઈવેટ લીમીટેડ, મુદરા–કચ્છ દ્વારા સંદર્ભિત પત્ર નં. ૧ વાળાથી પરવાનગી માંગેલ છે. જે સંદર્ભિત પત્ર નં. ૨ વાળામાં જણાવ્યા મુજબ અત્રેની કચેરીના સંદર્ભિત પત્ર નં. ૩ વાળાથી નીચે જણાવેલ રકમ તેમજ એગ્રીમેન્ટ અત્રેની કચેરીએ મોકલી આપવા જણાવેલ. જે આપશ્રીના સંદર્ભિત પત્ર નં. ૪ વાળાથી જમા કરાવેલ હોઈ, વિગતવાર સરકારશ્રીના નિયમનુસાર અને શરતોને આધીન રહીને પરવાનગી આપવામાં આવે છે.

ક્રમ	રસ્તાનું નામ	રસ્તાની લંબાઈ મીટર	રસ્તાના પેરેલલ લાઈનની ડીપોઝીટ રૂા. (રીફંડેબલ)(બેંક ગેરંટી)	વાર્ષિક રૂા.૧૦ મી. ભાડું(૨૫ વર્ષ) રૂા. (નોન રીફંડેબલ)
૧	મુંદરા–વડાલા રોડ (ચે.કી.મી.૩/૫૦૦ થી કી.મી.૫/૧૫૦)	૧૬૫૦	૪૧,૨૫૦/–	૧૬૫૦×૧૦×૨૫= રૂા.૪,૧૨,૫૦૦/–
રસ્તાને ક્રોસીંગ માટે				
૧	મુંદરા–વડાલા રોડ (ચે.કી.મી.૩/૫૦૦)	૧	૫૦,૦૦૦/–	રૂા.૧૮,૦૦૦/–
	કુલ્લ રકમ રૂા.	**૧૬૫૦**	**રૂા.૯૧,૨૫૦/–**	**રૂા.૪,૩૦,૫૦૦/–**

શરતો :–

(૧) સુચિત ગેસ પાઈપ લાઈન રસ્તાને સમાંતર/ક્રોસીંગ ૧૬૫૦.૦૦ મીટર નાખવાની થતો હોઈ નીચેની વિગતે જમા કરાવેલ છે.

ક્રમ	વિગત	ડી.ડી.નંબર/તારીખ	કુલ મળેલ રકમ
૧	વાર્ષિક રૂા.૧૦ મી. ભાડું(૨૫ વર્ષ) રૂા. (નોન રીફંડેબલ)	ICICI Bank, ડી.ડી. નં. ૫૦૬૭૦૨, તા.૦૫/૦૫/૨૦૨૩, ડી.આર. નં.૬૧૬૬, તા. ૦૪/૦૬/૨૦૨૩	રૂા.૪,૩૦,૦૦૦/–
૨	રસ્તાના પેરેલલ લાઈનની ડીપોઝીટ રૂા. (રીફંડેબલ) (બેંક ગેરંટી)	ICICI Bank, બીજી નં. ૦૦૨૪NDLG૦૦૦૧૭૯૨૪, તા.૧૮/૦૪/૨૦૨૩	રૂા.૯૧,૨૫૦/–
કુલ રકમ			રૂા.૫,૨૧,૭૫૦/–

તેમજ બેંક ગેરંટી નં. ૦૦૨૪NDLG૦૦૦૧૭૯૨૪, તા.૧૮/૦૪/૨૦૨૩, ICICI Bank ની આ વિભાગમાં અગાઉથી જમા કરાવેલ છે.

(૨) રૂા.૩૦૦.૦૦ ના સ્ટેમ્પ ઉપર કરારખત કરેલ છે.

(૩) સદરહુ અન્ડર ગ્રાઉન્ડ ગેસ લાઈન રસ્તાના મધ્યરેખાથી ૧૪.૦૦ થી ૧૫.૦૦ મીટર દુર પહોળાઈવાળા પટ્ટામાં ૧.૫૦ મીટર ઉંડાઈ ગેસ લાઈન સંપુર્ણ સલામતનાં ધોરણે નાખવાની રહેશે તેમજ આ કામગીરી શરૂ કરતા પહેલાં સબંધિત નાયબ કાર્યપાલક ઈજનેરશ્રી, માર્ગ અને મકાન પેટા વિભાગ, અંજાર–કચ્છના સેકશન અધિકારીશ્રી સાથે ચર્ચા કર્યા બાદ સ્થળ ઉપર સુચના અનુસાર કામગીરી કરવાની રહેશે.

(૪) સુચિત ગેસ પાઈપ લાઈનનું ખોદાણ ૧.૬૫ મીટર ઉંડાઈએ અને રસ્તાના મધ્યબિંદુથી ૧૪ મીટરથી ૧૫ મીટર વચ્ચે નાખવાનું રહેશે. "૧૨ એમ.એમ." એચ.ડી.પી.ઈ. પાઈપમાં પસાર કરીને ૪૫ સે.મી. પહોળાઈમાં નાખવાની રહેશે. ગેસ પાઈપ લાઈન નાખતી વખતે રસ્તાના કોઈપણ ભાગ સ્ટ્રકચર કે રસ્તાની અંદર ગ્રાઉન્ડમાંથી પસાર થતી અન્ય આવશ્યક સેવા માટેની ચીજ વસ્તુને નુકસાન ન થાય તે રીતે કામગીરી હાથ ધરવાની રહેશે તેમજ કામગીરી પુર્ણ થયે તુરંત જ ટ્રેન્ચીઝ ભરીને રસ્તાને મુળ સ્થિતિમાં કંપનીએ તેઓના પોતાના ખર્ચે કરી આપવાની રહેશે.

(૫) પત્રક મુજબના રોડ(જંકશન પાસે) રાજયધોરી માર્ગને ક્રોસીંગ માટે અન્ડર ગ્રાઉન્ડ ગેસ લાઈન ટ્રાફીકને અડચણરૂપ ન થાય તે રીતે નાખવાની રહેશે. સદર કામગીરી સમયે સાવચેતી માટે ફ્રેન્ચીંગ તથા રાત્રે લાલ લાઈટ મુકવાની રહેશે તેમજ ચેતવણી દર્શક રીફલેકટીવ પ્રકારના બોર્ડ મુકવાના રહેશે. જરૂર જણાય તો કામગીરી પુર્ણ થાય ત્યાં સુધી અકસ્માત ન થાય તે હેતુને ધ્યાનમાં લઈ ચોકીદારની વ્યવસ્થા કરવાની રહેશે.

(૬) સદર કામગીરી પુર્ણ થયા બાદ રસ્તાની સપાટી તથા અન્ડર ગ્રાઉન્ડ ગેસ લાઈન માટે ખોદાણ કરવા કરવામાં આવે તે તેની સપાટી મુળ સ્થિતિ અદાણી ટોટલ ગેસ પ્રાઈવેટ લીમીટેડ સ્વખર્ચે તાત્કાલિક પુરી દેવાની રહેશે.

(૭) કરારખત અમલમાં હોય ત્યાં સુધી અદાણી ટોટલ ગેસ પ્રાઈવેટ લીમીટેડનો પ્રશ્ન તળેની ગેસ લાઈન ફકત મરામત કરવાના કામ સિવાય રસ્તાનો કોઈ પણ જાતનો હકક હિસ્સો રહેશે નહિ.

(૮) રસ્તામાં આવેલ પુલ તેમજ નાળાં રસ્તાની સપાટીને નુકશાન ન થાય તે રીતે અન્ડર ગ્રાઉન્ડ ગેસ લાઈન નાખવાનું કામ કરવાનું રહેશે તેમજ રસ્તાની જમીનને મુળ સ્થિતિમાં લાવવા અદાણી ટોટલ ગેસ પ્રાઈવેટ લીમીટેડ તેના સ્વખર્ચે કામગીરી કરવાની રહેશે. આશરે ૨.૫૦ થી ૩.૦ મીટર મુળ જમીન લેવલથી નીચું ઉંચાઈનાં સ્તરે કરવાનું રહેશે.

(૯) સદરહુ કામ દરમ્યાન વાહન વ્યવહારને નડતરરૂપ ન થાય તે રીતે વ્યવસ્થા અદાણી ટોટલ ગેસ પ્રાઈવેટ લીમીટેડ એ ગોઠવવાની રહેશે તથા અકસ્માત ન થાય તે રીતે સાવચેતીની તકેદારી રાખવાની રહેશે. સુચિત કામગીરી દરમ્યાન કોઈ અકસ્માતની જવાબદારી આ વિભાગની રહેશે નહી.

(૧૦) અન્ડર ગ્રાઉન્ડ ગેસ લાઈનનું કામ પુર્ણ થયા બાદ રસ્તાને મુળ સ્થિતિમાં લાવવા માટીકામ તથા અન્ય થતી જરૂરી કામગીરી આ વિભાગના ધારા ધોરણથી હાથ ધરવાની રહેશે. જો આ કામગીરી અદાણી ટોટલ ગેસ પ્રાઈવેટ લીમીટેડ તરફથી હાથ ધરવામાં નહી આવે તો આ કામ આ વિભાગ દ્વારા ડીપોઝીટની રકમમાંથી કામગીરી કરાવી નાખવામાં આવશે.

(૧૧) કામગીરી કરારનામાની શરતોને આધિન કરવાની રહેશે. ભવિષ્યમાં સરકારશ્રીને સદરહુ જમીનની કોઈ જરૂર પડે તો કોઈપણ પ્રકારની અનાકાની કે શરત વગર આ ગેસ લાઈન અદાણી ટોટલ ગેસ પ્રાઈવેટ લીમીટેડ એ તેના સ્વખર્ચે અને જોખમે ખસેડી લેવાની રહેશે. અથવા રાજય સરકારશ્રીની સુચના મુજબ ફેરફાર કરી આપવાની રહેશે.

(૧૨) સુચિત અન્ડર ગ્રાઉન્ડ ગેસ લાઈન લાઈન નાખવાની કામગીરી નાયબ કાર્યપાલક ઈજનેરશ્રી, માર્ગ અને મકાન પેટા વિભાગ, અંજાર–કચ્છ ની દેખરેખ હેઠળ હાથ ધરવાની રહેશે.

(૧૩) સુચિત અન્ડર ગ્રાઉન્ડ ગેસ લાઈન રસ્તાની બાજુમાં અકસ્માત ન થાય તેની કાળજી લેવાની રહેશે અને તે અંગેની ટેકનીકલી કામગીરી કરી આપવાની રહેશે. તેમજ અકસ્માત થાય તો અદાણી ટોટલ ગેસ પ્રાઈવેટ લીમીટેડ દ્વારા સમારકામ સ્વખર્ચે સત્વરે કરી આપવાનું રહેશે.

(૧૪) સુચિત અન્ડર ગ્રાઉન્ડ ગેસ લાઈનની કામગીરી પુર્ણ થયે આ વિભાગનું કમ્પલીશન સર્ટીફીકેટ મેળવવાનું રહેશે તેમજ સદરહુ કામગીરી દર્શાવ્યા મુજબના સુચિત સ્થળે બે માસની સમયમર્યાદામાં પુર્ણ કરવાની રહેશે.

(૧૫) જે ભાગમાં આ વિભાગ હસ્તકનો રસ્તો ક્રોસ કરવાની થાય ત્યાં રસ્તાનું ખોદાણ કામ કરવાને બદલે રસ્તામાં અત્રેના કચેરીનાં ઈજનેરની સુચના મુજબ રસ્તાની આરપાર ડ્રીલીંગ થી હોલ પાડી લાઈન નાખવાની રહેશે. લાઈન નાખ્યા બાદ રસ્તાની મુળ સ્થિતિએ લાવવાની જવાબદારી અદાણી ટોટલ ગેસ પ્રાઈવેટ લીમીટેડની રહેશે. જે રસ્તો ક્રોસ કરવાની

કામગીરી રસ્તાની ફીનીશ સપાટીને નુકશાન ન થાય તે રીતે હોરીઝોન્ટલ પધ્ધતિથી પસાર કરવાનું રહેશે. આશરે ૨.૫૦ થી ૩.૦ મીટર મુળ જમીન લેવલથી નીચું ઉંચાઈના સ્તરે કરવાનું રહેશે.

(૧૬) સામેલ કરારખતની તમામ શરતો યથાવત રહેશે.

(૧૭) રસ્તાની વિકાસ/ સુધારણાની કામગીરી દરમ્યાન સદરહુ ગેસ લાઈનને કોઈપણ નુકશાન થશે તો તેની કોઈ જવાબદારી અત્રેની કચેરીની રહેશે નહી. રસ્તાની સુધારણા માટે અથવા વાઈડીનીંગ કરવા ભવિષ્યમાં ગેસ લાઈન ખસેડવાની થાય તો તે કામગીરી અરજદારશ્રીએ પોતાના ખર્ચે અને જોખમે કોઈપણ જાતના વિવાદ વગર કરવાની રહેશે.

(૧૮) સદર કામગીરી સમયે અન્ડર ગ્રાઉન્ડ વિજળી, ટેલીફોન કે કોઈપણ પ્રકારની આવશ્યક સેવાઓને નુકશાન ન થાય તેનું ધ્યાન રાખવાનું રહેશે.

(૧૯) ઉપરોકત મંજુરી આપ્યા બાદ ગેસ પાઈપ લાઈન કેબલ નાખવાની કામગીરીમાં કોઈ ફેરફાર/ રદ થવાના સંજોગોમાં જમા રહેલ ડીપોઝીટ સિવાયની કોઈ રકમ પરત આપી શકાશે નહિ અને તે રકમ માટેના કોઈ હકક દાવાને ધ્યાને લેવામાં આવશે નહિ.

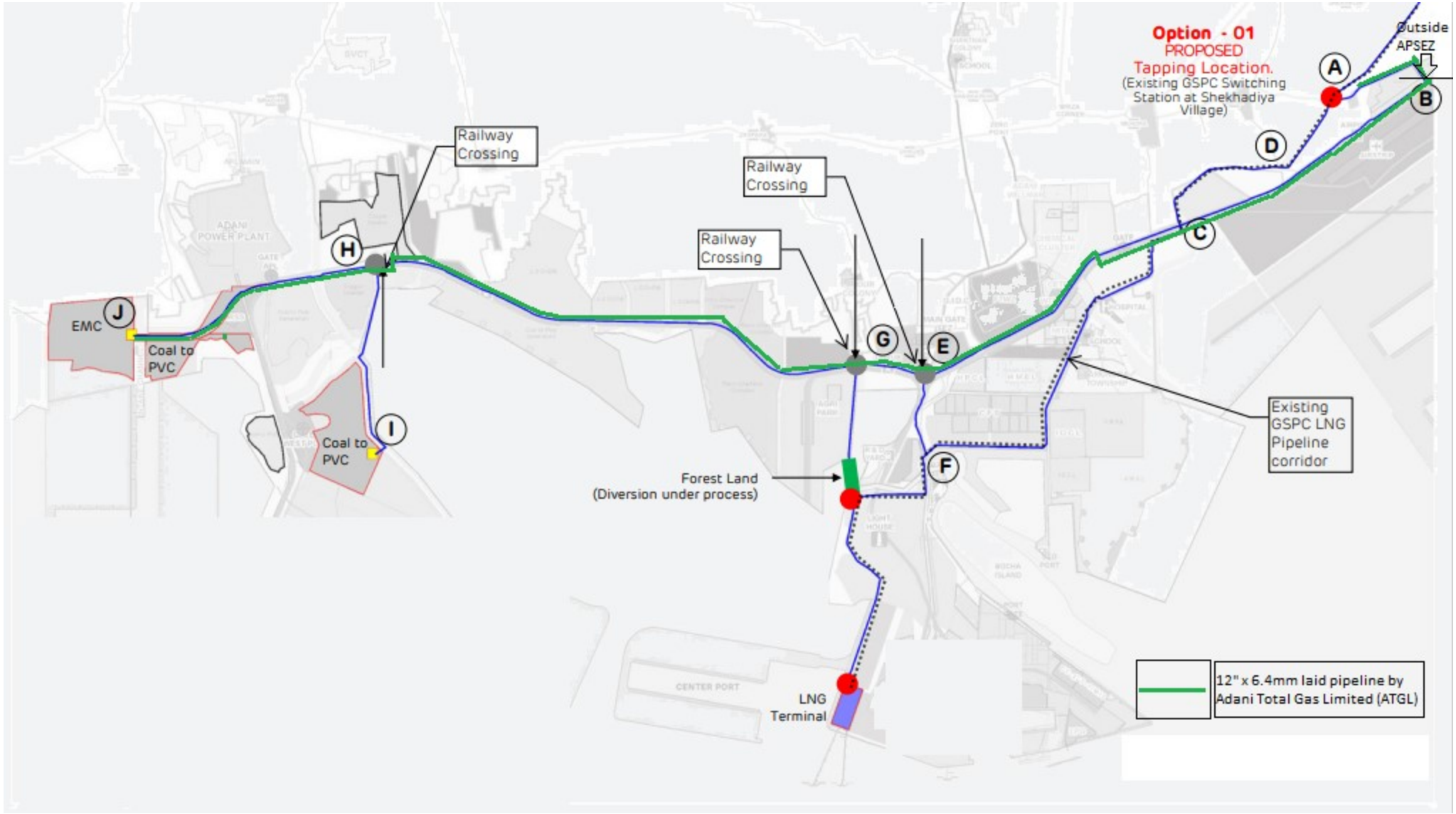
(૨૦) ઉપરોકત નિયમ ૧ થી ૧૯ માં દર્શાવેલ વિગતે મંજુરી આપવામાં આવે છે. આ ઉપરાંત **<u>શરત નં. ૪</u>** નું અરજદારશ્રીએ ચુસ્તપણે પાલન કરવાનું રહેશે. જો ઉપરોકત શરતોનું પાલન કરવામાં નહીં આવે તો મંજુરી રદ્ કરી ડીપોઝીટની રકમ જપ્ત કરવામાં આવશે. જેની નોંધ લેશો.

(૨૧) રસ્તાના વિસ્તરણ સમયે જો ગેસની લાઈન નડતરરૂપ હશે તો જાણ કર્યાના ૩૦ દિવસ બાદ બિનશરતી રીતે તોડી પાડવામાં આવશે. જેનાં વળતર વિશેની કોઈપણ રજુઆત માન્ય રહેશે નહિં.

કાર્યપાલક ઈજનેર
માર્ગ અને મકાન વિભાગ
ભુજ–કચ્છ

<u>નકલ સવિનય રવાના</u> :– પ્રતિ, નાયબ કાર્યપાલક ઈજનેરશ્રી, માર્ગ અને મકાન પેટા વિભાગ, અંજાર–કચ્છ તરફ જાણ તથા યોગ્ય થવા સારૂં. ઉપરોકત પાઈપ લાઈન નાખવાના સમયે ઉપરોકત સંસ્થા/કંપનીને જરૂરી માર્ગદર્શન પુરૂં પાડી હયાત રસ્તાના છેલ્લા ભાગમાં પાઈપ લાઈન નાખવામાં આવે તેની ખાસ કાળજી લેવા સારૂં.

ANNEXURE 3: ROUTE MAP OF PROPOSED NATURAL GAS PIPELINE NETWORK


Option - 01
PROPOSED
Tapping Location.
(Existing GSPC Switching Station at Shekhadiya Village)
Outside APSEZ
A
B
C
D
E
F
G
H
I
J
Railway Crossing
Railway Crossing
Railway Crossing
EMC
Coal to PVC
Coal to PVC
Forest Land
(Diversion under process)
Existing GSPC LNG Pipeline corridor
LNG Terminal
12" x 6.4mm laid pipeline by Adani Total Gas Limited (ATGL)

ANNEXURE 4: PERMISSION FROM ADANI PORTS & SEZ FOR LAYING OF PIPELINE

ADANI PORTS AND SPECIAL ECONOMIC ZONE LIMITED
INTEGRATED MANAGEMENT SYSTEM FORMATS MANUAL

GEN/ F/ 015 — No-Objection Certificate (NOC) Application

To Commence any Project, Upgradation, Modification, etc works at AP&SEZ - SEZ AREA - Asset & Estate Management Department

Date :- ~~18.08.2021~~ 25/02/23 (signature) Ishan

1). Name of Project Manager: Ishan jani
2). Name of Project: Steel pipeline laying, installation & commissioning at Mundra port - kutch for gas project
3). Type of Work: Civil work :
4). Approval from Concerned / User Dept.:
5). Attached : Drawing attached. Site Visit / Proposed pipeline Route (A-G-C-B-A) as ~~per~~ mentioned in attached drawing.
6). Attached : Other data if any.
7). Attached : Documents related to formalities for working in Custom Bonded / SEZ Area:
8). SECURITY AUTOMATION

SR.NO.	DEPT. NAME	NAME OF AUTHORIZED PERSON	PERMITTED / NOT PERMITTED	SIGN. WITH DATE	REMARKS
1	ES - PROJ. PLANNING	Mr. Nitin jaiswal			
2	ES - CIVIL	Mr. Manish Dahisariya	Permitted	(signature)	Take care of Existing Assets.
3	ES - ELECTRICAL	Mr. Dharmesh vasy	Permitted	(signature)	Take of LT Electrical cable.
4	FIRE & NARMADA LINE MAINT.	Mr. Arijit Roy	Permitted	(signature)	Take care while crossing water line. while work communicate representative
5	FIRE DEPT.	N.A			
6	QHSE DEPT.	Jitendra Chaudhari	Permitted	(signature)	Ensure safety at site
7	ENVIRONMENT DEPT.	Bhagwat sharma			
8	IT & TELECOM	piyus Sorathiya	permitted	(signature)	Manual Excavation near north Gate area
9	MARINE DEPT.	NA			
10	HORTICULTURE	Mr. Ravindra Gaurav	permitted.	(signature)	If irrigation system or plantation is going to be affected pl. issue the budget for restoration work.
11	MUPL -ELECTRICAL	Mr. Jayesh Patel	permitted with remark		
12	SECURITY AUTOMATION	Mr. Sanjay chaudhari	Permitted	S.P (signature)	Please Take care of [illegible]
13	AREA OR ZONAL MANAGER (i.e., DRY CARGO, LIQUID, LT MAINT. RAILWAY SERVICES, AMCT, ETC.)	Mr. Paresh palan			

* MUPL Remark:- 66kv Power cable crossing shall be HDD only. Also take care of 11kv cable showed during joint visit at of locations. (signature) 25/02/2023

Note :
1) The contractors shall be responsible for obtaining Fire & Safety Permits and liabilities due to safety violation.
2) In the event of any damages to the existing assets, responsibility to make it correct lies with requesters & contractors @ their own risk & cost.
3) Customs / SEZ working formalities to be complied by project manager and contractor.
4) Copy of NOC to be kept by requester / contractor and to produce as & when asked.
5) Contractor & Project Manager has to ensure housekeeping & site clearance till completion of work.
6) As built drawings attached / to be submitted during project closure.

Authorized By Asset & Estate Management:	Received By Project Manager:
Name :- Paresh Gohel	Name :- Ishan Jani
Sign. (signature)	Sign. (signature)
Date :- 10/3/23	Date :- 10/03/2023

Add value.
Inspire trust.

ANNEXURE 5: QUALITY, HEALTH, SAFETY AND ENVIRONMENTAL POLICY

adani
Gas

QUALITY, HEALTH, SAFETY & ENVIRONMENT POLICY

ADANI TOTAL GAS LIMITED (ATGL) is engaged in providing energy solution to the nation with efficient, environment friendly, safe & cost-effective fuel.

"Safety first in everything we do at ATGL" is an integral part of ATGL culture. Safety is not just a priority but is a **pre-condition of employment at ATGL**

ATGL firmly believes that all types of injuries, illness & HSE incidents are preventable.

ATGL is committed to ensure continuity of natural gas supply & reliability of services to the customers and also committed to demonstrate continual improvement in our Quality, Occupational Health, Safety & Environmental (QHSE) management performance by:

- Ensuring safe & healthy place to work by identifying, assessing, and reducing QHSE risks to as low as reasonably practicable (ALARP) by applying hierarchy of controls
- Assessing QHSE needs & expectations of Interested Parties and satisfying them with continual improvement effort.
- Adopting and implementing the best available technology and systems from design to the delivery of gas to customers and accessing risk from life cycle perspective
- Integrating QHSE aspects in all our business processes
- Pro-actively complying with all applicable legislation & other requirements.
- Continuously improve our QHSE Management Systems through regular audits and inspection, and ensure its implementation
- Maintaining CGD network integrity in an ongoing and auditable manner.
- Institutionalize practices for sustainable development, pollution prevention, waste avoidance and prevention of injury & ill health.
- Enhancing the competencies and commitment of employees through suitable training programs, involvement, and motivation
- Demonstrating visible leadership at all levels, leaders demonstrate their personal commitment to QHSE to promote Principle of Prevention through consideration of HSE in all decisions
- Proactively report all incidents, investigate root causes and ensure lessons learnt are shared and deployed across the Business
- Setting QHSE objective and targets, monitor progress and continually improve performance.
- Include QHSE performance in the appraisal of staff, evaluation of contractors and rewards accordingly.
- Promote consultation & participation from workers & worker representative in decision making whenever required

We shall make this policy available to all our stakeholders.

I trust each & everyone of you will share the responsibility in implementing a sound QHSE policy and lead by example at all times.

Suresh P Mangalji 04.2021

Date: 15.04.2021

Chief Executive Officer

ANNEXURE 6: LABORATORY TEST REPORTS