

EXECUTIVE SUMMARY

for

EXPANSION OF EXISTING LNG IMPORT, STORAGE AND
RE-GASIFICATION FACILITIES FROM 10 MMTPA TO 20 MMTPA
AT
DAHEJ, BHARUCH DISTRICT, GUJARAT

Project Proponent:



PETRONET
LNG
LIMITED

Petronet LNG Limited
New Delhi

Environment Consultant:



VIMTA LABS

Determining Quality

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April, 2013



1.0 EXECUTIVE SUMMARY

1.1 Introduction

Petronet LNG Limited (PLL) proposes to expand its existing LNG Import, Storage and Re-gasification facilities from 10 MMTPA to 20 MMTPA at Dahej, Bharuch District, Gujarat.

1.1.1 Classification of the project as EIA Notification

As per the Environment Impact Assessment (EIA) Notification dated 14th September 2006, the proposed expansion of LNG Re-gasification Terminal falls under 'Category-A' with project or activity type number '6(a)'. Ministry of Environment & Forests (MoEF) Expert Appraisal Committee (EAC) has prescribed the TORs for undertaking detailed EIA study vide letter F.No. 11-63/2011-IA.III dated 17th February 2012. Present EIA report has been prepared in compliance to the above ToRs and report is being presented for the public consultation process.

1.1.2 CRZ Status of the project

As per the Costal Regulation Zone (CRZ) notification 2011, the proposed project is a permitted activity within CRZ-III zone.

1.2 Importance of Project

Regasified Liquefied Natural Gas (LNG) is having considerable advantage in terms of environmental benefits when compared to fossil fuel like Methylated spirit, High speed diesel, and furnace oil etc.

Honorable Supreme Court of India, on realizing the urgency and importance of protection and improvement of the environment, has given direction to authorities to take immediate steps to tackle the vehicular pollution. On Writ petition no. 939 of 1996, Supreme Court has given judgment on 28/07/1998 for use of Compressed Natural Gas (CNG) in vehicles at New Delhi.

Advantages of CNG/LNG/NG

- 60–90% less smog-producing pollutants
- 30–40% less greenhouse gas emissions
- Less expensive than gasoline

1.3 Brief Description of the Project

The PLL Project facilities would receive and store LNG that is unloaded from ship tankers, and regassify the LNG into natural gas for delivery to a pipeline. The terminal would be expected to operate continuously, with a design capacity of 20 MMTPA.

Existing LNG terminal consists of the following facilities:

- A) Marine
- Jetty with unloading platform & unloading arms;
 - Trestle; and
 - Berthing & mooring dolphins LNG Jetty.



- Stand by jetty (under construction)
- B) Onshore
- Storage Tanks
 - LP & HP Pumps;
 - Vaporizers; and
 - Utilities.

Additional facilities required for expansion of LNG Terminal from 10 MMTPA to 20 MMTPA:

- A) Onshore
- Storage Tanks;
 - LP & HP Pumps;
 - Vaporizers; and
 - Utilities.

1.3.1 Cost of the Project

The estimated cost of the proposed expansion of LNG Re-gasification Terminal from 10 MMTPA to 20 MMTPA is about Rs.2950 crores (for 5 MMTPA) and estimated to be 2700 crores (for additional 5 MMTPA capacity). This estimate is inclusive of LNG storage tank facilities, re-gasification facilities, project management and project financing cost.

1.3.2 Land Requirement and Status

PLL is having about 16 hectares of land in south side of the existing plot. Additionally about 22.62 hectares of land on south side of existing plot is allocated by Forest Department to PLL and Stage-I clearance is accorded by Forest Department. PLL has also been permitted by Gujarat maritime Board to reclaim 20 hectares of land on west side of the existing plot.

1.4 **Project Location**

The index map and topographical features of the study area within 10 km radius from the proposed LNG Terminal boundary are shown in **Figure-1** and **Figure-2**.

The environmental setting of study area within 10 km radius from the proposed LNG Terminal boundary are given **Table-1.1**.

TABLE-1.1
ENVIRONMENTAL SETTING AROUND 10-KM RADIUS OF PROJECT SITE

Sr. No.	Particulars	Details		
1	LNG terminal Location			
	Town	Dahej		
	District	Bharuch		
	State	Gujarat		
2	LNG terminal Location Limits (within Sea)	Project Land Co-ordinates		
		Code	Latitude	Longitude



Sr. No.	Particulars	Details		
		A	21° 40' 17.49"	72°32' 0.05"
B	21° 40' 17.81"	72°32' 21.43"		
C	21° 39' 55.66"	72° 32' 21.80"		
D	21° 39' 53.74"	72° 32' 13.78"		
Land To Be Reclaimed Co-ordinates				
		Code	Latitude	Longitude
		1	21°40'43.20"	72°31' 50.91"
		2	21°40'43.49"	72°31' 59.60"
		3	21°40'17.49"	72°32' 0.05"
		4	21°40'17.36"	72°31' 51.36"
3	Site Elevation above MSL	12-14 m above MSL		
4	Geographical location in toposheet	Topo sheet No. 46 C/9, C/10		
5	Nearest representative IMD station	IMD Surat		
6	India Meteorological Dept. (IMD), Data	IMD-Surat Data (Annual) Predominant Wind Direction-SW Predominant Wind Speed- 1 to 11 kmph Maximum temperature-37.2°C Minimum Temperature-17.1°C Relative Humidity-32.8-36.6		
	Study Period - IMD Meteorological Data	Winter Season Predominant Wind Direction-NW Predominant Wind Speed-1 to 5 kmph Maximum Temperature- 34.6°C Minimum Temperature-16.0°C Relative Humidity-36-68% Pre Monsoon Season Predominant Wind Direction-SW Predominant Wind Speed-1 to 11 kmph Maximum Temperature- 40.3°C Minimum Temperature- 23.1°C Relative Humidity- 35-72% Post Monsoon Season Predominant Wind Direction-NW Predominant Wind Speed- 1-5kmph Maximum Temperature- 35.1°C Minimum Temperature- 20.2°C Relative Humidity- 45.7-79.2%		
7	Present land use at the site	Industrial		
8	Nearest highway	SH-206 (1.5km, N)		
9	Nearest railway station	Baruch(50-km, E)		
10	Nearest airport	Vadodara(130-km, E)		
11	Nearest rivers	Narmada (2.6 km, ESE)		
12	Nearest sea	Arabian Sea (0.3 km, W)		
13	Nearest port	Hazira (68.3 km, S)		
14	Nearest town	Baruch(50-km,E)		
15	Nearest city	Vadodara(130km,NE)		
16	Nearest major city with 2,00,000 population	Bharuch (43.7 km, E)		
17	Villages within 1 km radius	Luvara (1.5 km, E), Lakhigam (1.9 km, NE)		
18	Distance from the sea coast	0.3 km, W		

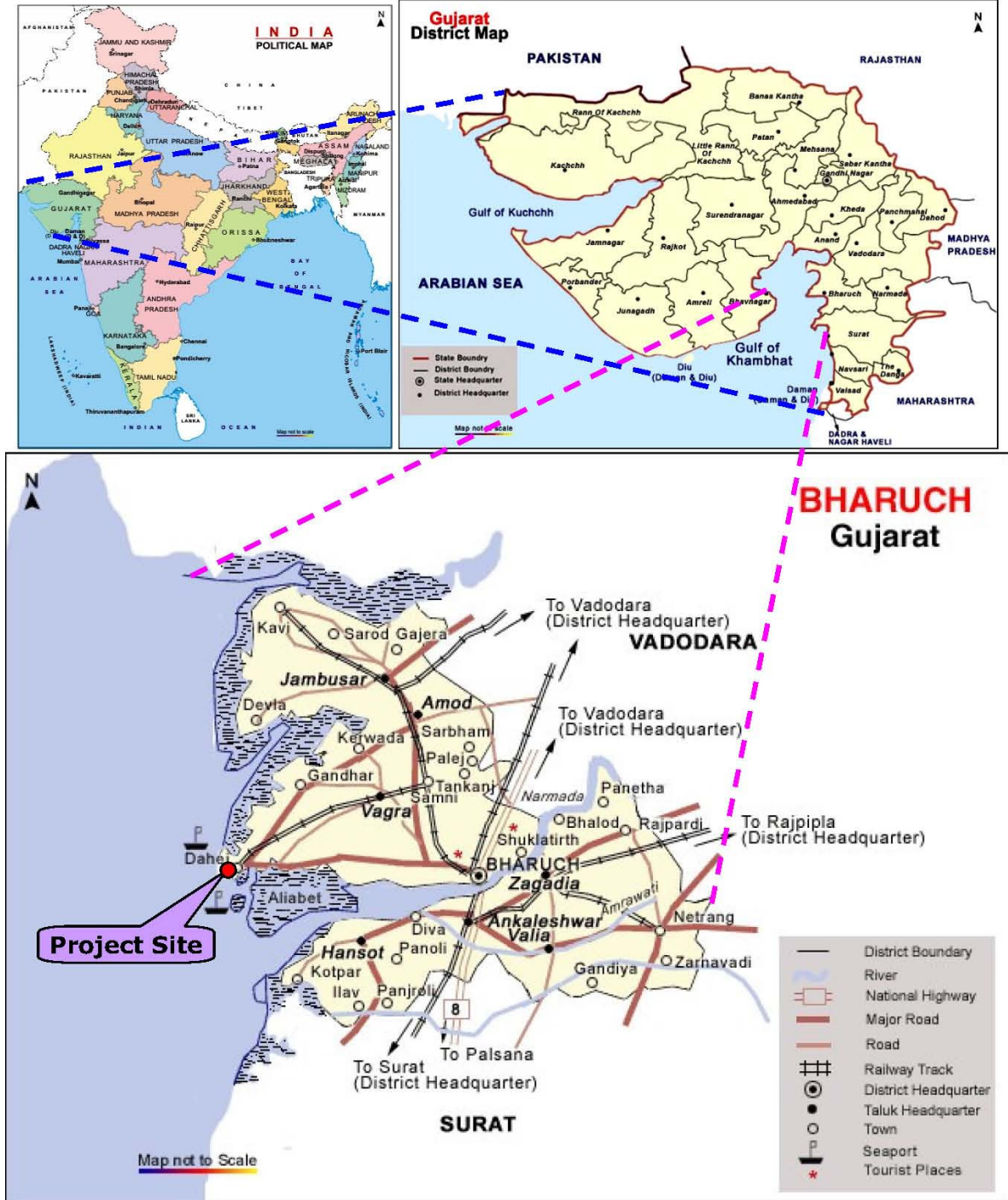


Environmental Impact Assessment Report for Expansion of existing LNG Import, Storage and Re-gasification Facilities from 10MMTPA to 20 MMTPA at Dahej, Bharuch District, Gujarat

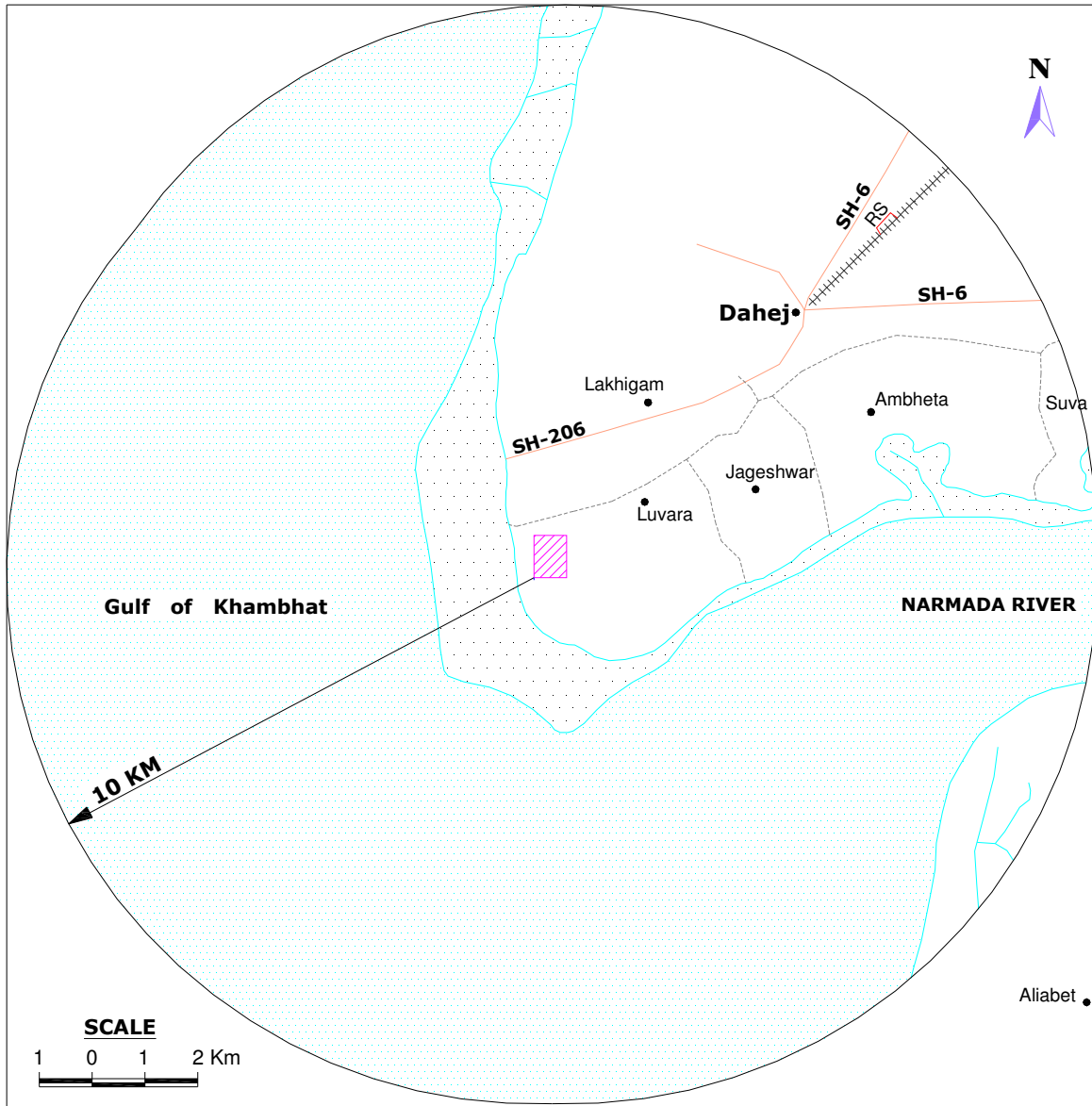
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Sr. No.	Particulars	Details
19	Hills/valleys	NIL
20	Nearest tourist place	NIL
21	Archaeologically important places	NIL
22	Protected areas as per Wildlife Protection Act, 1972 (Tiger reserve, Elephant reserve, Biospheres, National parks, Wildlife sanctuaries, community reserves and conservation reserves)	NIL
23	Reserved / Protected Forests	Adjacent to project site in southern direction
24	Seismicity	Seismic Zone III
25	Defence Installations	NIL
26	List of Industries	RIL, Birla Copper, GCPTCL

*Note: All distances mentioned above are aerial distances
Source: EIA Studies, Vimta Labs Limited, Hyderabad*



**FIGURE-1
INDEX MAP SITE**



LEGEND

- | | | | |
|--|--------------|--|------------------|
| | Project Site | | Sea/River/ Nala |
| | Railway Line | | Settlements |
| | Road | | Village Boundary |

**FIGURE-2
STUDY AREA OF THE PROJECT SITE**



1.5 Baseline Environmental Status

The existing environmental setting is considered to adjudge the baseline environmental conditions, which are described with respect to climate, hydrogeological aspects, atmospheric conditions, water quality, soil quality, vegetation pattern, ecology, land use and socioeconomic profiles of people.

The comprehensive report incorporates the baseline studies carried out for three seasons covering 2011-2012 (winter, pre-monsoon and post-monsoon) seasons in the various domains of environment. Secondary data collected from various Government and Semi-Government organizations have been also discussed in the following section.

1.5.1 Land Use Studies

The land use pattern around 10 km radius of the proposed expansion of LNG terminal has been studied by District Census Hand Books. It is observed that 5.2% of the land falls under Culturable waste. On the other hand, 19.1% of land falls under un-irrigated land. The area not available for cultivation is about 75.6 % forms the bulk of the land use.

1.5.2 Soil Quality

Eight locations within 10 km radius of the study area were selected for soil sampling. The soil quality at all locations is found to be neutral in nature with moderate to average content of NPK.

1.5.3 Meteorology

The recorded temperature at site during study period ranges between 16.0°C and 43.3°C and relative humidity ranges in between 35% to 79.2%. Predominant winds from SW, NE and NW directions were observed during study period.

1.5.4 Ambient Air Quality

Ambient Air Quality Monitoring (AAQM) stations were set up at **Eight** locations during the study period of 2011-2012 (winter, pre-monsoon and post-monsoon) seasons with due consideration to the above mentioned points.

The Ambient air quality at all locations during the study period is presented in **Table-1.2**. All the values are found to be within the limits as per gazette notification GSR 826(E), dated 16th Nov. 2009.



**TABLE-1.2
AMBIENT AIR QUALITY RESULTS**

Sr.No	Parameter	Ranges in Winter season (December 2011 to February 2012)	Ranges in Pre-monsoon season (March to May 2012)	Ranges in Post monsoon season – (October to November 2012)	NAAQS (National Ambient Air Quality Standards) 24hrs CO, O ₃ – 8hrs
1	PM ₁₀	33.5-57.9	34.7-65.1	34.1-62.3	100
2	PM _{2.5}	8.5-19.4	10.2-23.8	9.4-21.7	60
3	SO ₂	10.2-19.4	9.1-15.8	9.6-17.8	80
4	Nox	11.4-20.4	10.3-16.5	10.8-19.1	80
5	CO	143-507	132-414	136-473	02
6	O ₃	2.2-7.8	2.5-8.0	2.4-7.9	100

All values are given in µg/m³

1.5.5 Water Quality

Surface water samples were collected from **two** locations and Ground water samples were collected from **eight** locations during the study period of 2011-2012 (winter, pre-monsoon and post-monsoon) seasons.

The quality of water samples were found to be having high values of hardness. The Ground Water Quality at all locations during the study period is presented in **Table-1.3**.

**TABLE-1.3
GROUND WATER QUALITY**

Sr. No	Parameter	Units	Ranges in Winter season (December 2011 to February 2012)	Ranges in Pre-monsoon season (March to May 2012)	Ranges in monsoon season (March to May 2012)	Ranges in Post monsoon season – (October to November 2012)	IS:10500 Limits
1	pH	-	7.6-8.3	7.6-8.5	7.7-7.9	7.6-7.9	6.5 -8.5
2	Electrical conductivity	µS/cm	203-2570	214-3160	176-2980	194-3050	\$
3	Total Hardness	mg/l	90-940	85-675	73-523	84-565	300 (600)
4	TDS	mg/l	132-1720	142-1390	115-2090	126-1980	500 (2000)
5	Chloride	mg/l	7.1-319	8.2-500	10.1-475	9.7-490	250 (1000)
6	Fluoride	mg/l	0.2-0.7	0.1-0.8	0.2-0.7	0.3-0.6	1.0 (1.5)
7	Nitrate	mg/l	1.2-34.6	1.4-31.4	1.6-31.4	1.2-34.6	45 (NR)

The Surface Water Quality at all locations during the study period is presented in **Table-1.4**



**TABLE-1.4
SURFACE WATER QUALITY**

Sr. No	Parameter	Units	Ranges in Winter season (December 2011 to February 2012)	Ranges in Pre-monsoon season (March to May 2012)	Ranges in monsoon season (March to May 2012)	Ranges in Post monsoon season – (October to November 2012)	IS:2296 Class 'C' Limits
1	pH	-	7.8-7.9	7.9-8.0	7.6-7.7	7.7-7.9	6.5 to 8.5
2	DO	mg/l	6.2-6.5	6.3-6.4	3.8-4.1	4.9-5.2	4
3	Sulphates	mg/l	189.0-232.4	196-254	164-204	182-210	400
4	Fluoride	mg/l	1.1-1.2	1.1-1.2	1.2-1.3	1.2-1.3	1.5
5	Nitrate	mg/l	3.4-4.5	3.8-4.8	3.1-3.8	3.1-3.5	\$

1.5.6 Ambient Noise Levels

The Noise monitoring has been conducted for determination of noise levels at eight locations in the study area. The noise levels at each location were recorded for 24 hrs.

Seasons	Ranges of Day Time Noise Levels (L_{day})	Ranges of Night Time Noise Levels (L_{night})
Ranges in Winter season (December 2011 to February 2012)	37.1-48.1	32.5-43.6
Ranges in Pre-monsoon season (March to May 2012)	38.3-47.8	33.7-44.1
Ranges in Post monsoon season – (October to November 2012)	37.5-47.6	32.9-43.9
Standards	Day time	Night time
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone**	50	40

The noise levels are found to be within the limits as per the CPCB gazette notification dated 11th April 1994.

1.5.7 Ecological Environment

Terrestrial Environment

Detailed ecological studies were conducted during winter season in 2011-2012 to identify the floristic composition in and around project area and surrounding villages. To know the presence of any endangered/threatened/endemic plant species in proposed project area and surrounding 10 km radius.

The study area did not record the presence of any critically threatened species. The records of Botanical Survey of India and Forest department also did not indicate presence of any endangered and or vulnerable species in this area.



Avifauna: Many bird species including quails, sand grouses, bayas, sparrows, munias, crows, mynas, parakeets, kites, hawks, doves, bee-eaters, ibis, bulbuls, babblers, larks, ducks, peafowls, lapwings, pigeons, etc are recorded from the study area during the recent survey by VIMTA team. These bird species have composition of raptors, insectivorous and granivorous birds. Occurrence of bird species in good numbers is due to suitable climate and availability of food. Some of the common birds observed during recent survey by state forest departments indicate the presence of bhat titar (*Pterocles exuslus*), house crow (*Corvus splendense*), wood pecker (*Picoides nanus*), Baya (*Ploceus philippinus*), kabboter (*Columbia livia*), owl (*Bubo bubo*), house sparrow (*Passer domesticus*), parrot (*Psittacula krameri*), chil (*Falco jugger*) and eagle (*Corcatus gallicus*).

Surroundings of agricultural land and water bodies: The birds like Mynas, Crows, Sparrows, Bulbuls, Babblers and Pigeons are observed in and around villages. In agriculture fields, the grain eating herbivorous species are dominant. These species are Doves, Sparrows, Cattle egrets, Parakeets etc. Insectivorous bird species viz. Bee-eaters, Wagtails, White breasted kingfisher, Egrets, Indian Roller are found around water bodies and in low-lying vegetation areas.

Rare, Endangered and Threatened Fauna in the Study Area:

In the year 1972 Government of India made an Act to provide protection to wild animals, birds and plants and for matters connected therewith which is known as Wild life (Protection) Act, 1972. Under this act Animals are categorized in Schedules to give maximum protection to the wild animals.

No animals and birds are found to be threatened in the study area. However with increasing anthropogenic activities like expansion of agricultural fields and industries there is limited impact on the fauna.

Surface water samples were collected for biological analysis from lentic and lotic water bodies during study period. Biological samples were analysed and estimated diversity index. Plankton diversity Index for phytoplankton and zooplankton varies from 2.56 to 3.14 and 2.45 and 2.84. Physico-chemical, biological parameters and diversity index reveals that the studied water bodies are slightly Oligotrophic in nature.

1.5.9 Socio-Economic Environment

The information on socio-economic aspects of the study area has been compiled from secondary sources, which mainly include census data of 2001.

The total population of the study area is about 14391. The Sex ratio is 812.5. About 64.4% of people are literates. The study area contains about 38.3 % of main workers, 2.6% of marginal workers and 59.1% of non-workers. In the study area about 20.1% population belong to Scheduled Tribes (ST) and 4.5 % Scheduled Castes (SC), thus indicating that there has been no significant change in weaker sections over previous years.

1.6 **Impact Assessment**

The identification and assessment of impacts over the various environmental attributes in the region due to the proposed expansion of LNG Terminal activities



are discussed in the following sections. Suitable mitigative measures and environmental management plan for the potential impacts have also been presented.

1.6.1 Impact on Land Use

The proposed expansion of LNG Re-gasification Terminal will be carried out with in existing LNG terminal at Dahej. PLL is having about 16 hectares of land in south side of the existing plot. Additionally about 22.62 hectares of land on south side of existing plot is allocated to PLL by Forest Department. PLL has also been permitted by Gujarat Maritime Board to reclaim 20 hectares of land on west side of the existing plot.

1.6.2 Impact on Soil

The impact on soil due to project activity is expected on account of changes in soil quality and also due to soil erosion from the project areas. Considering that the proposed project will be implemented within the existing LNG terminal premises and operation causing change in soil quality is not envisaged, the impact of the project on soil quality will be less than significant.

Greenbelt will be developed in phased manner from construction stage onwards. Apart from localized construction impacts at the plant site, no adverse impacts on soil in the surrounding area are anticipated.

1.6.3 Impact on Topography

The proposed project premise is a generally plain land with a general elevation of about 12~13 m above MSL. Most of the buffer zone of the project is undulated land.

It is proposed to level the project area and to use the dredge sand. There will be no tall structures except stacks and storage tanks. Also, the contours of natural drainage will not be disturbed. In view of the above, there will be no major adverse impact on topography of the project site.

1.6.4 Impact on Air Quality

LNG regasification and storage is a clean process and essentially there is no emission from this process. The only sources of pollution in the proposed project are the operation of GTGs and flare. The GTGs are run by the natural gas only and hence the emissions of SO₂ and SPM are negligible as LNG don't contain sulphur. NO_x is the only pollutant emitted from GTGs with a guarantee of NO_x emissions less than 50 ppm.

Emissions from the flare shall mostly occur at the time of plant upset condition and the emissions will be insignificant under normal condition In the proposed LNG terminal, three (03) No of GTGs are proposed for 15 MMTPA and further two (02) additional GTG for 20 MMTPA terminal operations.



1.6.5 Impact on Surface Water and Groundwater Quality

There is no generation of any liquid effluent from the process area. Existing facilities are adequate to handle additional domestic waste water.

1.6.6 Impact on Noise Levels

The proposed LNG terminal would generate noise due to pumps and compressors. A quantitative prediction was carried out to estimate the cumulative noise levels due to operation of all noise generating source of LNG terminal and found to be within the permissible limits.

1.6.7 Impact on Terrestrial Ecology

The initial construction works at the LNG terminal involves land clearance and reclamation. Greenbelt will be developed in phased manner during construction to improve the aesthetic value in the area and to screen out the fugitive dust generated during construction.

The existing trees will be preserved to the extent possible. Thus, no major adverse impacts are envisaged on terrestrial ecology.

1.7 Environment Management Plan

1.7.1 Environment Management Plan during Construction Phase

Air Quality Management

The activities like site development, grading and vehicular traffic contribute to increase in PM and NO_x concentrations. The mitigation measures recommended to minimize the impacts are:

- Dust masks will be provided to construction workers, while carrying out operations that may entails potential for dust generation.
- All vehicles delivering construction materials or removing soil will be covered to prevent escape of dust.
- Water sprinkling in construction area;
- Asphaltting the main approach road;
- Proper maintenance of vehicles and construction equipment; and
- Tree plantation in the area earmarked for greenbelt development.

Water Quality Management

The mitigation measures recommended to minimize the impacts are sedimentation tank to retain the solids from run-off water; oil and grease trap at equipment maintenance centre; septic tanks to treat sanitary waste at labour camp; and utilizing the wastewater in greenbelt development.



Noise Level Management

Operation of construction equipment and vehicular traffic contribute to the increased noise level. Recommended mitigation measures are:

- Good maintenance of vehicles and construction equipment;
- Restriction of construction activities only to day time;
- Plantation of trees around the plant boundary to attenuate the noise; and
- Provision of earplugs and earmuffs to workers.

Ecological Management

Tree plantation (large size species) should be undertaken at the time of preparation of site so that they would grow to considerable size by time of commissioning of the proposed project.

Socio-economic Environment

Given that the project and related developments like construction camps will be dependent on local resources (power, water), during both construction and operations, the only likely impact on infrastructure would be on the roads. Considering the increased traffic during construction phase an effective traffic management scheme will be developed to avoid congestion on the nearby and local roads.

1.7.2 Environment Management Plan during Operations Phase

Air Quality Management

Only source of emissions in the proposed project are the GTGs. The gas generators installed at PLL Dahej site are based on "Lean-burn" technology and the NO_x emissions will be controlled below 50 ppm.

Water Quality Management

There is no generation of any liquid effluent from the process area. Existing facilities are adequate to handle additional domestic waste water.

Rainwater harvesting structures can't be built in the project area as the ground water table is very shallow.

Noise Level Management

The noise may be generated due to operation of pumps and compressors.

The recommended measures to minimize the impacts of noise generated which are as follows:

- Equipment's should be designed to conform to noise levels prescribed by regulatory authorities; i.e 85 dB(A) at 1 m from source;
- Provision of acoustic barriers or shelters in noisy workplaces;



- Provision of hoods to noise generating equipments like pumps;
- Provision of thick greenbelt to attenuate the noise levels;
- Provision of Personal Protective Equipments (PPE) such as earplugs, earmuffs to the workers working in high noise level area; and
- Implementation of greenbelt, landscaping with horticulture at power block areas to reduce noise impacts.

Ecological Management

The measures required to be undertaken to minimize the impact on the ecology are:

- The felling of trees will be kept at minimum; and
- The greenbelt having vegetation density of 2500 trees/ha will be developed in phased manner

Solid Waste Management

On a regular basis, there is no generation of any non-hazardous or inert solid waste from the proposed expansion of LNG terminal. A small quantity i.e. about 0.5 KL/year of hazardous oily waste will be generated from the proposed LNG terminal during periodic maintenance. Hazardous waste will be collected and stored at specific identified area at site. Separate authorization has been obtained under Hazardous Waste Management Rules to handling the hazardous waste generated.

1.8 Environmental Monitoring Program

Recognized agencies are engaged for carrying out the above stated monitoring works.

A centralized environmental monitoring cell has been established for monitoring of important and crucial environmental parameters which are of immense importance to assess the status of environment during LNG Terminal operation.

1.9 Risk Assessment and Disaster Management Plan

The hazard potential of LNG estimation of consequences in case of their accidental release during storage, transportation and handling has been identified and risk assessment has been carried out to quantify the extent of damage and suggest recommendations for safety improvement for the proposed expansion of LNG terminal facilities.

The Risk modelling scenarios considered for the proposed LNG terminal are

- Leakage of pipeline
- Unloading arm failure

1.9.1 Storage Tank

A Full containment LNG storage tank is designed to contain the spill from the inner tank into the containment space of the tank itself. Hence, the chance of leakage from the storage tank is ruled out.



The maximum vulnerable heat radiation will not spread beyond 346-m. Hence, human habitation will not be affected.

An effective Disaster Management Plan (DMP) to mitigate the risks involved has been prepared. This plan defines the responsibilities and resources available to respond to the different types of emergencies envisaged. Training exercises will be held to ensure that all personnel are familiar with their responsibilities and that communication links are functioning effectively.

1.10 Project Benefits

The proposed expansion of LNG Terminal will result in improvement in the social infrastructure in following manner:

- Generation of employment to unskilled people will be during construction phase and skilled people during operational phase of the LNG terminal.
- Improved standard of living;
- Revenue to Government;
- Change in the socio-economic scenario of the area;
- Direct and in direct employment during terminal construction and operation phases. Recruitment for the unskilled and semiskilled workers for the proposed project will be from the nearby villages;
- Development of the basic amenities viz. roads, transportation, electricity, drinking water, proper sanitation, educational institutions, medical facilities.
- Overall the project will change living standards of the people and improve the socio-economic conditions of the area.