

# **ENVIRONMENTAL IMPACT ASSESSMENT REPORT**

FOR

## **EXPANSION OF LPG BOTTLING PLANT PONDICHEERY (U.T)**

SUBMITTED TO



**M/s INDIAN OIL CORPORATION LIMITED**

PREPARED BY



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## EXECUTIVE SUMMARY

### 1.0 Introduction

M/s Indian Oil Corporation Ltd. proposes Augmentation of LPG storage capacity from 300 MT to 900 MT by installing 2x300 MT mounded storage unit at Puducherry LPG bottling plant. Consequent to detailed presentation before 12<sup>th</sup> Expert Appraisal Committee on 23-24 August, 2016, SEAC granted Terms of Reference (ToR) vide letter Oct 25, 2016.

In the proposed augmentation works, the LPG will be stored in pressurized mounded bullets.. There are 3 x 100MT existing mounded bullets and proposed mounded storage in 2 bullets of 300 MT each with a total capacity of 900 MT.

### 2.0 Details of Site

The site for the project is within the existing premises of the plant so no extra land has been acquired. The site is well connected for easy transportation of LPG bullets and cylinders. The Plant site is located at a distance of 10 km from the Puducherry railway station and 12 Km from Puducherry airport. The site is well connected to through NH-45A which is in nearby vicinity to the site in South direction.

### 3.0 Project details

The mounded storage will be in 2 bullets of 300 MT each with a total capacity of 900 MT. The details of existing and proposed LPG storage and bottling plant capacities are provided in table below.

**Existing And Proposed - LPG Storage**

Type of Vessel	Existing/Proposed	Nos.	Capacity	Total Capacity
Mounded Bullets	Existing	3	100 MT	300 MT
Mounded Bullets	Proposed	2	300 MT	600 MT
<b>Total</b>				<b>900 MT</b>

The details regarding description of proposed storage facility and process flow chart are presented in Chapter 2 of EIA Report

### 4.0 Utilities

The water requirements for the project have been estimated at 25 m<sup>3</sup>/d. Required water will be supplied through local authorized body.

Power requirement is estimated at 320 kVA. Puducherry Electricity Board will supply the necessary power.

The total manpower requirement for the proposed project works out to 70 persons. It is expected that a number of ancillary industries are likely to be developed near the project site which will be mutually beneficial.

## 5.0 Baseline Studies

The baseline studies as per CPCB guidelines and protocol (meteorology, Air Water and Soil Quality, Noise levels, Ecology, etc) were conducted during **January 2016 to March 2016**. Data were supplemented with interaction with government officials, NGOs, as well as gram panchayats.

### Environmental Monitoring Schedule

Sr. No.	Environmental Component	Sampling Parameters	Sampling Period	Sampling Frequency
1	Meteorology	Temperature, Wind Speed, Wind Direction	3 months	Hourly
		Rainfall	3 months	Daily
		Relative Humidity, Cloud Cover	3 months	Hourly
2	Ambient Air Quality	As per NAAQS 2009- PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>x</sub> , CO, O <sub>3</sub> , As, Ni, Pb, C <sub>6</sub> H <sub>6</sub> , BaP, NH <sub>3</sub>	Two days per week for 13 weeks	24 hourly
3	Water Quality	As per IS:10500-2012	Grab sampling	Once in study period
		Heavy metals (As, Hg, Pb, Cd, Cr <sup>-6</sup> , Total Cr, Cu, Zn, Se, Fe)	Grab sampling	Once during study period
4	Noise	L <sub>eq</sub> , L <sub>day</sub> , L <sub>night</sub> , L <sub>D/N</sub>	Hourly readings for 24 hours	Once during study period
5	Soil	Soil profile, Chemical constituents, Suitability for agricultural growth	Composite sample up to 90-cm depth	Once during study period
6	Terrestrial Ecology	Flora and fauna	Field observations	Once during study period
7	Demography and Socio-economic aspects	Demographic profile	-	-

**Air Quality:** It could be noted from the results that the air quality in the study area is within NAAQS Nov 2009 limits.

**Surface water:** In general, the samples are free from metallic and industrial pollutants, such as fluoride, copper, iron, zinc, boron, arsenic and lead. These elements were found to be below detectable levels. All the parameters were found to be within the prescribed limits.

**Ground Water:** All the parameters, including the metals like copper, iron, zinc, lead etc. were within the limits prescribed by IS 10500:2012.

**Ecology:** There will not be any direct or indirect impact on the ecology of the study area as there isn't any process or emission involved.

**Socio-Economics:** Since the set up of proposed expansion is planned within existing facility, critical issues like land acquisition, compensation, rehabilitation and resettlement do not feature in the study.

## 6.0 Pollution Control Construction Phase

**Air:** Suspended particulate matter will be the main pollutant, which would be generated due to site developmental activities and vehicular movement on the road, and would be controlled by water sprinkling. Pollutants like NO<sub>x</sub>, SO<sub>2</sub> and CO may also slightly increase due to increased vehicular traffic movement. However, the impact will be insignificant. As most of the construction equipments will be mobile, the emissions are likely to be fugitive.

It shall be ensured that gasoline and diesel powered construction vehicles are properly maintained to minimize smoke in the exhaust emissions. Additional recommendations include the following:

- Sprinkling of water shall be done at frequent intervals by preferably using truck-mounted sprinklers. Sprinkling of water will be done along the roads and work zone areas to reduce the fugitive dust;
- Construction equipment shall be maintained and serviced regularly so that the gaseous emissions from these equipments are maintained within the design specifications;
- Since electrical power is available near the plant, attempts shall be made to utilize the electrically powered machinery to the extent possible to minimize the emissions of SO<sub>2</sub> and NO<sub>x</sub> during construction.

**Water:** Temporary and localized impacts on hydrology are expected due to construction activities. These could arise from temporary obstruction to natural flow of rainwater due to foundation excavation, stacked material, etc. These are insignificant impacts which can be easily overcome by appropriate construction methodology and practices.

The water requirement during the construction period is estimated to be about 10 m<sup>3</sup>/d. No impact is expected on other users.

The wastewater generation during the construction period will be from the sanitary units provided for the workers. This waste will be treated in septic tanks and discharged into soak pits.

**Soil:** The earthen work will be avoided during monsoon. Stone pitching on the slopes and construction of concrete drains for storm water will be undertaken to minimize soil erosion in the area. Settling pond is planned for storage and recycling of surface water for use in the plant area. The green belt development in and around the plant will be taken up during the monsoon season. Soil binding and fast growing vegetation will be grown within the plant premises to arrest soil erosion.

**Noise:** The noise due to construction equipment will be a temporary phenomenon. However, noise levels due to construction equipment may result in significant impacts due to operation of several equipment simultaneously.

Noise levels are predicted at different distances and at project boundary using random distribution of the equipment in the project area. Based on the similar construction activity experience, it is assumed that only one-third of the equipment will be operational at a time.

The noise impact due to transportation will occur during the construction phase when maximum 20-30 trucks (each way) per day will be plying on State Highway for the transportation of construction materials. This will not be a continuous operation but it may last up to 2-3 years, during which added noise impact on background noise level will be 2-3 dBA.

### **Operational Phase**

**Air:** From the baseline monitoring in the study area, it shows that there will not be change in the present air quality as no process and emissions involved in the proposed project.

**Water:** Wastewater will be generated from domestic use. Septic tanks will be provided to treat the domestic wastewater. The treated water will be used for landscaping.

**Noise:** The entire operation will be carried out in confined area. The workers and staff, working in high noise areas, will be provided with necessary protective devices e.g. ear plug ear-muffs etc.

**Solid Waste:** No process / manufacturing involved. Hence no solid waste generated because of the operation. The solid domestic waste shall be segregated and stored within the premises temporarily and then sent to Salem Municipal Corporation waste management facility. The solid wastes such as paints, lubricants, oil or any other non-biodegradable wastes that have leachable constituents will be disposed to authorized recyclers.

### **7.0 Risk Assessment Study**

The main operation of LPG Bottling Plant in Salem is to receive bulk LPG, store into mounded storage vessels, and bottle in cylinders and dispatch the same to distributors in Puducherry and adjoining villages. The plant handles Liquefied Petroleum Gas and the composition (by mole fraction) is as follows: Propane: 0.55 and Butane: 0.45

The probabilities associated with the sequence of occurrences which must take place for the incident scenarios to produce hazardous effects and the modelling of their effects.

Considering the present case the outcomes expected are

- Jet fires
- Vapor Cloud Explosion (VCE) and Flash Fire (FF).

In Consequence Analysis studies, in principle three types of exposure to hazardous effects are distinguished:

1. Heat radiation due to fires. In this study, the concern is that of Jet fires and flash fires.
2. Explosions
3. Toxic effects, from toxic materials or toxic combustion products.

The knowledge about these relations depends strongly on the nature of the exposure. All above accident scenarios form the basis for conventional risk assessment. The results of consequence analysis for the above accident scenarios are detailed in Chapter 7 of the report.

## 8.0 Environmental Monitoring Plan

EMP is prepared separately for construction and operation phases, and it also includes green belt development and environmental monitoring program. EMP specifies various technological measures for pollution prevention, waste minimization, end-of-pipe treatment, attenuation, etc. proposed to be undertaken to mitigate the environmental impacts on each sector of environment.

**Schedules:** There will be three facets to design and follow the schedules viz.: (A) for compliance of responsibilities, (B) for day-to-day operation and management of ETP and ECE, and (C) for routine environmental monitoring, to assess the impact and take timely warning.

### *Daily Compliance*

- To record meter readings - initial and final, for checking the water consumption.
- Maintain the electricity consumption record for pollution control.
- Monitor ambient air quality periodically as per the Consent Order.

### *Monthly Compliance*

- Monitor the emission sources through the competent authority and submit the analysis reports to the board.
- Monitor ambient/work zone noise levels and ensure conformance to standards.

### *Quarterly Compliance*

- Monitor the ambient air quality in upwind and downwind locations.
- Review the Water Reuse performance.

### *Yearly Compliance*

- Prepare “Environmental Audit Statement” of various environmental aspects, review the environmental policies with the help of experts and make the up-gradation /changes accordingly.
- Submit the “Environmental Statement” to the State Pollution Control Board in Form V under Rule 14 of the Environment (Protection) Second Amendment Rules 1992 of the Environment (Protection) Act, 1986.
- Renew the Consent to Operate under the Water and Air Acts.
- File the Cess returns to the State PCB under the Water (Prevention and Control of Pollution) Cess Act, 1977.
- Renew the Hazardous Waste Authorization under sub-rule 3 of the Hazardous Waste (Management and Handling) Rules, 2003

**Cost Provision for Environmental Measures:** It is proposed to invest about Rs. 1.5 Crores annually on pollution control, treatment and monitoring systems.

## 9.0 Project Benefits

The project will result in creation of job opportunities for local persons during construction and operation phases.

The proposed expansion will provide direct employment and indirect employment. Apart from the employment and business opportunities for the local people, the society will also be benefited through various CSR initiatives proposed by the IOCL

## **10.0 Conclusion**

The Proposed project will have indirect positive impact on surrounding area which is as mentioned below:

- Plant will be set up within the existing plant boundary; hence no displacement of people is required.
- Substantial Socio-economic benefits.
- Good Techno-commercial viability.
- Around the project site semi-skilled and unskilled workmen are expected to be available from local population in these areas to meet the manpower requirement during construction and Operational phase.
- There will be employment opportunity for local people during construction and operation phase.
- Infrastructural facilities will be improved due to the project.
- Critical analyses of the existing socio-economic profile of the area indicate that the impact of the Project is expected to be of varying nature.
- Secondary employment will be generated thereby benefiting locals.
- Project will have substantial benefits in savings of transportation cost
- Thus a significant benefit to the socio-economic environment is likely to be created due to the project.



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# CHAPTER 1. INTRODUCTION

## 1.1 INTRODUCTION

**M/s Indian Oil Corporation Ltd.** proposes expansion and successful operation of Pondicherry Bottling Plant, from 300 MT to 900 MT by introducing 2 Mounded bullets of 300 MT capacities each.

As per EIA Notification, published in Gazette of India, Extraordinary Part-II, Section-3, sub-section (ii) of Ministry of Environment & Forest dated 14.09.2006 & subsequent amendments, the proposed project falls in Activity 6(b), Category-B of “List of Projects or Activities Requiring Prior Environmental Clearance”. But since the project falls under 10 km of interstate boundary between Pondicherry and Tamil Nadu and also Oussudu Bird sanctuary is within 10km radius of the projet site, the project now falls under A category. As per the above notification, proposed project will have to obtain Environmental Clearance.

## 1.2 Identification of Project and Project Proponent

### 1.2.1 *Project Proponent*

Indian Oil Corporation Limited (IOCL) is a government of India enterprise with a Maharatna status, and a Fortune 500 and Forbes 2000 company. Incorporated as Indian Oil Corporation Ltd. on 1<sup>st</sup> September, 1964 Indian Oil and its subsidiaries account for approximately 48% petroleum products market share, 34% national refining capacity and 71% downstream sector pipelines capacity in India. It is India’s flagship national oil company and downstream petroleum major thus being India’s largest commercial enterprise.

As the flagship national oil company in the downstream sector, Indian Oil reaches precious petroleum products to millions of people every day through a countrywide network of about 35,000 sales points. They are backed for supplies by 167 bulk storage terminals and depots, 101 aviation fuel stations and 90 Indane (LPG) bottling plants.

Indian Oil Corporation Ltd. (IOCL) is a premier public sector company in the Oil & Gas Sector and is engaged in the business of refining and retailing of petroleum products including LPG in the country. It is the leading Indian corporate in the Fortune 'Global 500' listing, ranked at the 83<sup>rd</sup> position in the year 2012. IOCL is having about 90 LPG bottling plants, which serve every corner of the country. Indane (the trade name of LPG of IOCL) is supplied to the consumers through a network of about 5,456 distributors (51.8% of the industry).The growth in demand of LPG for domestic purpose is increasing at a rapid pace.

### 1.2.2 *Identification of Project*

IOCL is having about 90 LPG bottling plants which serve every corner of the country. Indane (the trade name of LPG of IOCL) is supplied to the consumers through a network of about 5,456 distributors (51.8% of the industry).The growth in demand of LPG for domestic purpose is increasing at a rapid pace.

Augmentation of LPG storage capacity from 300 MT to 900 MT by installing 2x300 MT mounded storage unit at LPG bottling plant and will transfer these chemicals to end users by Road Tankers.

The gas leak detection, fire prevention and control system at Pondicherry LPG Bottling Plant are the latest and comply with the OISD norms. The same shall be extended to the new LPG vessels. All LPG storage vessels, cylinder storage/ filling/ repair sheds, LPG Pump House and TLD are fully covered by medium velocity water spray system. This Bottling Plant will also cater to the non-domestic LPG demand, Bulk LPG and Auto LPG demand of Pondicherry. The proposed additional facilities in Plant are estimated to cost of Rs.15 Crores.

## **1.2 Schedule and cost of the project**

The proposed project will be completed in approximately 24 months from the date of approval environmental & other statutory clearances. The total cost of the proposed project is around Rs 15 Crores.

## **1.3 Brief Description of the Project**

### ***1.3.1 Nature of the Project***

At present, the Bulk LPG required for bottling is transported to the Plant by road tankers of 18 MT capacities, which are specially fabricated for LPG transportation. LPG road tankers received from IPPL, Chennai and CPCL. LPG is decanted to the storage vessels (Mounded Bullets) by the pressure differential method using the LPG Vapour Compressors provided. The requirement of LPG is about 132 MT/day.

LPG from the storage vessels will be pumped to the 18 point electronic filling machines and the empty gas cylinders will be filled using the pneumatically operated filling guns. Each cylinder for Domestic use will be filled with 14.2 kg of LPG, weight being automatically adjusted. The cylinders for Industrial use will be filled with 19.0 kg of LPG. After filling, the cylinders pass through various quality checks including the weight check, leak test, etc., before sealing. Packed cylinders are delivered in a Truck with a capacity of 306 cylinders to the market.

### ***1.3.2 Size of the Project***

In the LPG Bottling Plant the additional storage will be pressurized form in mounded storage. The mounded storage will be in 2 bullets of 300 MT each with a total capacity of 600 MT. The system of mounded storage has been recognized as one of the safest form of storage of LPG. The details of existing and proposed LPG storage and bottling plant capacities are provided in **Table 1.1**.

**Table 1.1: Existing And Proposed - LPG Storage**

Type of Vessel	Existing/Proposed	Nos.	Capacity	Total Capacity
Mounded Bullets	Existing	3	100 MT	300 MT
Mounded Bullets	Proposed	2	300 MT	600 MT
Total				<b>900 MT</b>

Source: IOCL

### 1.3.3 Location of the Project

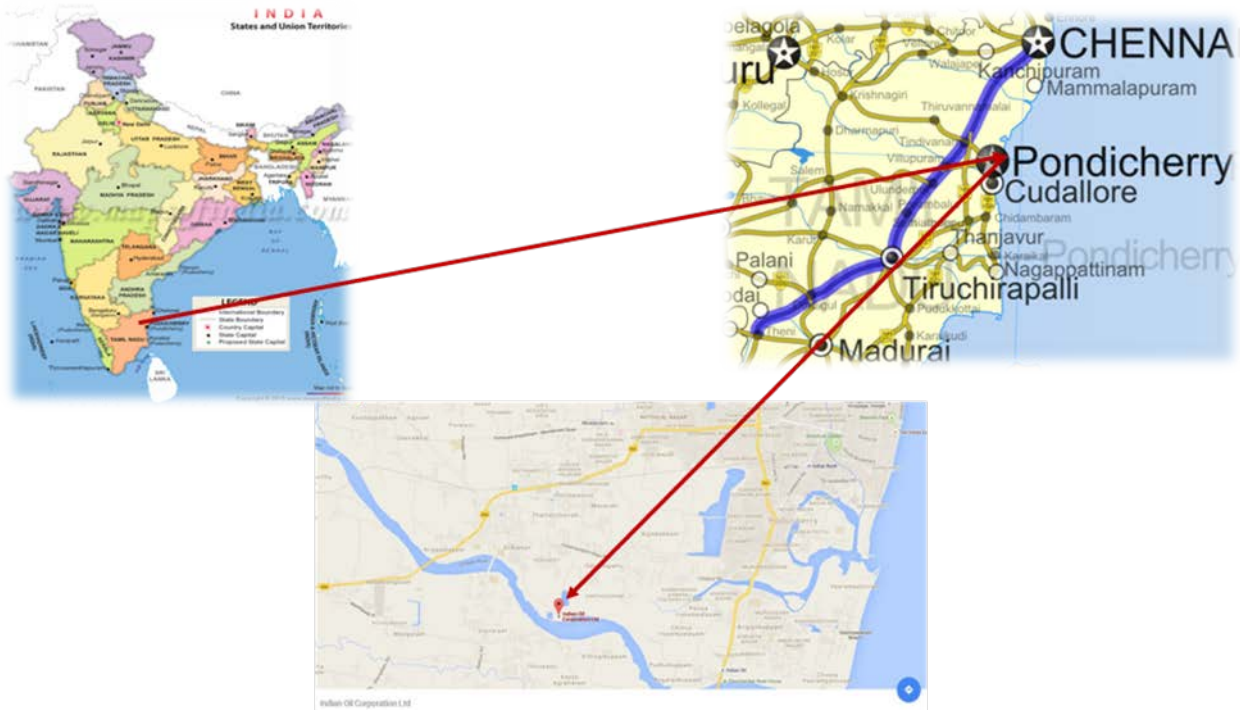
The project site is located at distance of about 10 Km from Pondicherry (5 Kms. from village Villianur). The site is well connected to Chennai by NH – 45A. The nearest Airport is Pondicherry Airport located at 10 Km.

The details of environmental setting are given in **Table 1.2**. The index map of the project site is shown in **Figure 1.1**.

**Table 1.2: Environmental Setting**

Sr. No.	Particulars	Details
1	Plant location	Area of 17 Acres of Govt land, about 10 Kms. from Pondicherry (5 Kms. from village Villianur) in the village Thirukanchi, Villianur Taluk, on the banks of the River Sankarabarani. The licensed area is 32,266 m <sup>2</sup> , the delicensed area is 5,300 m <sup>2</sup> and the Green Belt area is 31,260 m <sup>2</sup> .
2	Site Coordinates	Latitude : 11°89'57.81"N, Longitude: 79°76'78.51"E
3	Climatic conditions at Pondicherry	
4	Maximum temperature	35.7° C
5	Minimum temperature	20.9° C
6	Annual rainfall (total)	1,240 mm (49 in).
7	Relative humidity	Maximum- 82.8 % Minimum- 67 %
8	Predominant wind directions	From East to West
9	Present land use at the site	Land use pattern is notified for industrial use
10	Nearest highway	NH-45A
11	Nearest railway station	Railway station: Puduchery (~10.0 Km, NE)
12	Nearest Airport	Airport: Puduchery ( ~12 Km, N )
13	Nearest major water bodies	Sangarabarani River 0.147 Km Sea – 7 Km
14	Nearest town/City	Odiyamputti (~2.00 km,N)

Sr. No.	Particulars	Details
15	Archaeologically important places	Manakula Vinayagar Temple – 10 Km
16	Protected areas as per Wildlife Protection Act, 1972 (Tiger reserve, Elephant reserve, Biospheres, National parks, Wildlife sanctuaries, community reserves and conservation reserves)	Nil
17	Reserved / Protected Forests	NA
18	Defence Installations	Nil
19	List of major Industries in 10 km radius	<ul style="list-style-type: none"> <li>• Nithya Packaging Pvt Ltd (1 KM from Plant)</li> <li>• Vinbros (500 Mtrs from Plant)</li> </ul>
20	Seismicity	Seismic Zone-II as per IS 1893 (Part I): 2002



**Figure 1.1: Index Map Showing the Project Site**

### 1.3 Market Demand & Supply

India consumes about 16 MMTPA of LPG while domestic production is only 10 MMTPA. Net import of LPG is about 6 MMTPA. The consumption, import and export from last 5 years are presented in **Table-1.3**. During last 4 years, LPG consumption has grown at GAGR of 5.6% while production is almost static hence import has increased at CAGR of 25%.

**Table 1.3: LPG Demand**

<b>LPG</b>	<b>2009-10</b>	<b>2010-11</b>	<b>2011-12</b>	<b>2012-13</b>	<b>2013-14</b>
Consumption	13.13	14.33	15.35	15.60	16.34
Production	10.34	9.62	9.55	9.83	10.11
Export	0.13	0.15	0.17	0.20	0.23
Import	2.72	4.48	5.79	6.29	6.60

## **1.4 Scope of the Study**

With a view to assess the environmental impacts arising due to the proposed expansion of LPG storage facility, IOCL has availed the services of M/s Ultra-Tech Environmental Consultancy and Laboratory, to prepare the EIA Report and suggest an Environmental Management Plan (EMP) for mitigating adverse impacts from the proposed expansion project.

Environmental baseline monitoring has been carried out by M/s. Eco Services Labs Pvt. Ltd. Chennai during 1<sup>st</sup> January to 31<sup>st</sup> March 2016. The scope of the present study is in-line with the Standard Terms of References as published by MoEF&CC on April, 2015.

### **1.4.1 Study Area Details**

The study area for the EIA considered is within the 10 Km radius from the boundary of the facility. The topographical features of the study area are shown in **Figure 1.2**. Google image of the study area is shown in **Figure 1.3**. The environmental setting within the study area is given in **Table 1.2**.

### **1.4.2 Details of the Study**

The scope of study broadly includes:

- To conduct literature review and to collect data relevant to the study area;
- To undertake environmental monitoring so as to establish the baseline environmental status of the study area;
- To predict incremental levels of pollutants in the terrestrial study area due to the proposed project activities;
- To evaluate the predicted impacts on the various environmental attributes in the study area by using scientifically developed and widely accepted environmental impact assessment methodologies;
- Risk Assessment study;
- To prepare an EMP outlining the measures for improving the environmental quality and scope for future expansions for environmentally sustainable development; and
- To identify critical environmental attributes required to be monitored suggesting a post-project monitoring programme.

The literature review includes identification of relevant articles from various publications, collection of data from various government agencies and other sources.

### 1.4.3 Methodology of the Study

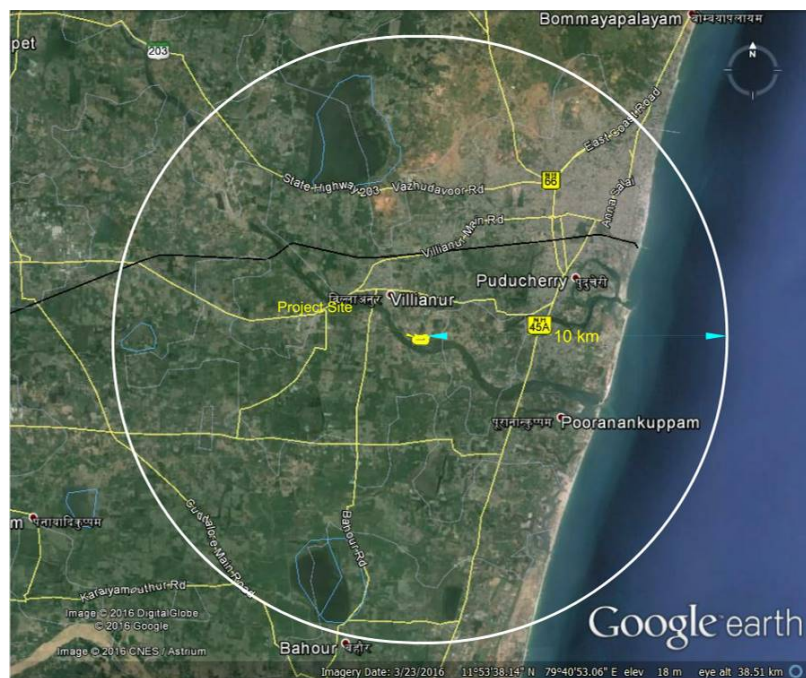
Reconnaissance survey was conducted by the consultants and concerned officials and sampling locations were identified on the basis of:

- Predominant wind directions in the study area as recorded by India Meteorological Department (IMD) at Chennai
- Existing topography, drainage pattern and location of surface water bodies like ponds, canals, and rivers;
- Location of villages/towns/sensitive areas;
- Areas which represent baseline conditions; and
- Collection, collation and analysis of baseline data for various environmental attributes.

The field observations are used to:

- To observe the baseline environmental status of study area;
- Identify extent of negative impacts on community/natural resources; and
- Identify mitigation measures and monitoring requirements.

The study also provides framework and institutional strengthening for implementing the mitigation measures. Field studies have been conducted to determine existing conditions of various environmental attributes as outlined in **Table 1.4**.



**Figure 1.2: Study Area Map of the Project (10 Km Radius)**



**Figure 1.3: Google Image**

**Table 1.4: Environmental Attributes and Frequency of Monitoring Adopted**

Sr. No.	Environmental Component	Sampling Locations	Sampling Parameters	Sampling Period	Sampling Frequency	Methodology
1	Meteorology	One central location	Temperature, Wind Speed, Wind Direction	3 months	Hourly	The parameters were recorded by automatic micro-meteorological machine having anemometer, wind vane and thermometer. IMD data of Gannavaram also reviewed.
			Rainfall	3 months	Daily	Rainfall was recorded every morning at 0830 hours
			Relative Humidity, Cloud Cover	3 months	Hourly	Humidity measured using wet & dry bulb thermometer and psychometric charts on hourly basis.
2	Ambient Air Quality	8 locations	As per NAAQS 2009- PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>x</sub> , CO, O <sub>3</sub> , As, Ni, Pb, C <sub>6</sub> H <sub>6</sub> , BaP, NH <sub>3</sub>	Two days per week for 13 weeks	24 hourly	Gravimetric method for PM <sub>2.5</sub> and PM <sub>10</sub> . Modified West & Geake method for SO <sub>2</sub> (IS-5182 part-II 1969) using Tetrachloromercurate 0.01 N absorbing solution. Jacob-Hochheiser method (IS-5182 part-IV 1975) for NO <sub>x</sub> using Sodium Arsenate absorbing solution of 0.01 N absorbing solutions. CO was measured by GC method.
3	Water Quality	10 locations	As per IS:10500-2012	Grab sampling	Once in study period	As per APHA methods. The conductivity, temperature were analyzed at site laboratory and rest of the parameters were analyzed at M/s. Eco Services Labs Pvt. Ltd. Chennai
		(2-Surface water 8-Ground water)	Heavy metals (As, Hg, Pb, Cd, Cr <sup>6+</sup> , Total Cr, Cu, Zn, Se, Fe)	Grab sampling	Once during study period	
4	Noise	8 locations	L <sub>eq</sub> , L <sub>day</sub> , L <sub>night</sub> , L <sub>D/N</sub>	Hourly readings for 24 hours	Once during study period	Integrated on hourly basis



5	Soil	8 locations	Soil profile, Chemical constituents, Suitability for agricultural growth	Composite sample up to 90-cm depth	Once during study period	Analysis was carried out as per Soil Chemical analysis by ML Jackson
6	Terrestrial Ecology	Total study area	Flora and fauna	Field observations	Once during study period	Through field visits and collected secondary data. Count and quadrat method
7	Demography and Socio-economic aspects	Total study area	Demographic profile	-	-	Through field visits and secondary information sources like National Informatics Centre, Delhi, Census, etc.

## CHAPTER 2. PROJECT DESCRIPTION

### 2.1 Type of the Project

Pondicherry LPG Bottling Plant was commissioned in 1993 with a total Area of 17 Acres of Govt Leased land, about 10 Kms. from Pondicherry (5 Kms. from village Villianur) in the village Thirukanchi, Villiyanur Taluk, on the banks of the River Sankarabarani. Current bulk storage capacity is of 3x100 i.e. 300 MT mounded bullet system and proposed to construct 2 x 300 MT additional mounded bullets.

### 2.2 Need for Project Activity

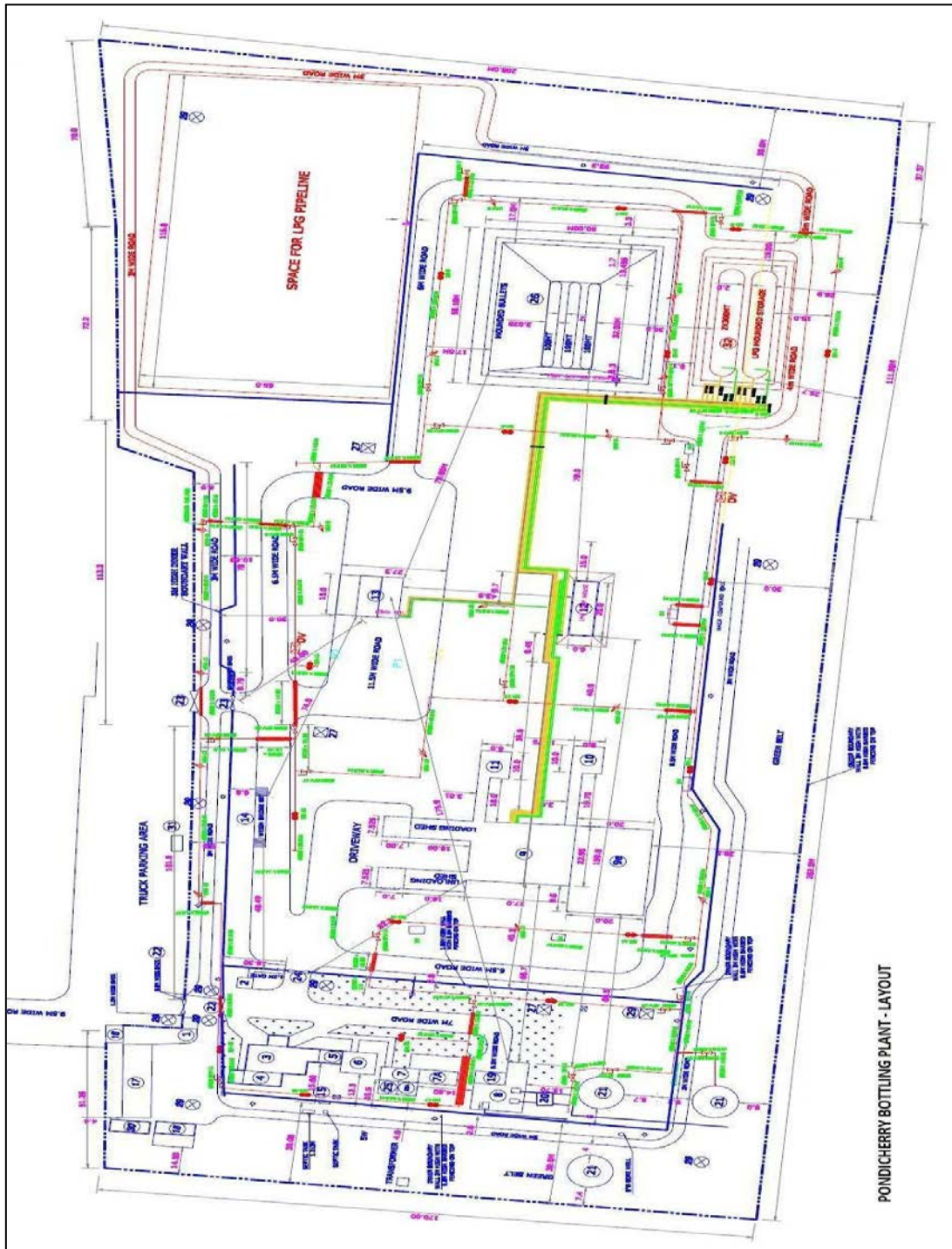
The Pondicherry BP currently has 2.0 days cover against a bottling capacity. This poses the following inconveniences:

- Any disruption in supplies from IPPL Ennore, there can be dry-out situation and may also lead to procure bulk LPG from non-economical sources.
- With small size vessels and dead stocks (unpumpable), the effective transfer/receipt quantity is even less which calls for frequent, switch-over between vessel under receipt and vessel engaged for cylinder bottling.
- Residual lives of 3 nos existing old Mounded bullets are limited. Any further reduction in storage would lead to severe constraint in day-to-day operation and a crisis situation.

In view of the foregoing, IOCL proposes for provision of additional 2 nos of mounded bullets with 300 MT capacities each in the plant. This will ensure 5.5 days cover on a stand-alone basis against total bulk LPG storage capacity of 900 MT. The augmentation at the BP is estimated to cost approximately INR 15 Crores.

### 2.3 Location and Layout

The layout of the bottling plant has been prepared as per prescribed OISD – 144 & 150. The safety distances are maintained as per the OISD standards. The road network is designed to ensure smooth movement of bulk/filled cylinder trucks. Layout plan of the bottling plant including proposed facilities have been given in **Figure 2.1**.



- Design Parameters: Temperature, Pressure, Internal Corrosion, Hydro Test Pressure
- Design Procedure: As per the Design Code: ASME SEC. VIII or PD - 5500 or equivalent duly approved by PESO
- Piping layout is as per OISD-150. One liquid line, one vapour line, 2no's SRVs, ROVs on liquid and vapour lines

## 2.4 Salient Features of the Project

The salient features of the proposed augmentation of Pondicherry LPG BP are presented in **Table 2.1**.

**Table 2.1: Salient Features of Existing and Proposed Plant**

Sr. No.	Description	Details				
1	Total Land	17 Acre				
2	Location	Indian Oil Corporation Limited P.B No. 001, Odiyampet, Villianur, Pondicherry - 605 110				
3	Land Use	No Change. Proposed expansion will be carried out within existing premises.				
4	Status of land acquisition	NA. Entire land is in the possession of IOCL.				
5	Type of Storage Tanks	1. Mounded Bullets				
6	Capacity of Storage Tanks	<b>Type of Vessel</b>	<b>Existing/Proposed</b>	<b>Nos.</b>	<b>Capacity</b>	<b>Total Capacity</b>
		Mounded Bullets	Existing	3	100 MT	300 MT
		Mounded Bullets	Proposed	2	300 MT	600 MT
		<b>Total</b>				
7	Power requirement	300 kVA Maximum Demand				
8	Water requirement	25 m <sup>3</sup> /day				
9	Man power	70				
10	Project Cost	Rs 15 Crores				
11	Cost towards environment protection	Rs 1.5 Crores				
12	Fire Fighting Facilities					
A	Fire water storage	3 x 1182 KL – 3546 KL				
B	Fire water pumps	3 fire water pumps of 410 cum/ hr				
C	Jockey pumps	2 jockey pumps of 10 m <sup>3</sup> /hr@7kg/cm <sup>2</sup>				
C	Water sprinkler / Deluge system	At all relevant places				
D	Fire Hydrant/monitor piping network	As per OISD				
E	DCP & CO <sub>2</sub> extinguishers	As per OISD				
F	Gas Monitoring System	As per OISD-150				
G	ILSD	As per OISD-144				

Source: Project Report, IOCL

### 2.4.1 Proposed Schedule and Approval for Implementation

The construction of LPG storage activities will commence on receipt of Environmental Clearance (EC) from MoEF Delhi

### 2.4.2 Land Use

The proposed expansion will be carried out within the existing premises, the site earmarked for expansion is a vacant land and hence the no change in land use. Land schedule is given in **Table 2.2.**

**Table 2.2: Land Schedule of the Project Site**

Sr. No	Land Schedule	Area in ha
1	Plant facilities	1.379
2	Administrative building	0.367
3	Greenbelt	2.995
4	Truck parking	0.438

Source: Project Report, IOCL

### 2.5 Pondicherry Bottling Plant Facilities

There is no process involved and the operations carried out will be receipt of LPG by pipe line, storage in mounded bullets and filling of LPG into cylinders using carousel and associated systems.

The additional mounded storage will be in 2 bullets of 300 MT capacities each with a total capacity of 900 MT. The mounded storage has been recognized as one of the safest form of storage of LPG. The facilities at the LPG BP, Pondicheery are shown in Table-2.3 (A & B).

Photographs of the existing Pondicherry Bottling Plant are shown in **Figure-2.2.** The plant layout showing existing and proposed plant facilities is shown in **Figure-2.1.**

**Table 2.3(A): Facilities At The LPG Bottling Plant, Pondicherry**

Sr. No.	Facility	Quantity/Capacity	Proposed
		Existing	
1	Storage	300 MT	600 MT
2	Un Loading Bay	3 Bays	2 Bays
3	No. of Carousel	1 No	
4	LPG Pumps	2 Nos	
5	LPG Vapour Compressor	3 Nos	

6	Truck Parking Area	4036 m <sup>2</sup>	4500 m <sup>2</sup>
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**Table 2.3(B): Storage Details of LPG**

Scenario	BP Cap, TMTPA	Bulk Storage (MT)	Filing MT/day	Nodal Transfer, TMTPA	Days' Cover
<b>Standalone BP Operation</b>					
Existing BP capacity & storage	22	300	115 MT	NA	2 Days
Future BP capacity & existing storage					
Existing storage without 3x150 MT A/G bullets	NA	NA	NA	NA	NA
With proposed BP storage	22	900	115 MT	NA	5.5
With proposed BP storage & without 3x150 MT A/G bullets					
<b>With Nodal Movements</b>					
With actual nodal transfer	NA	NA	NA	NA	NA
With actual nodal transfer & without 3x150 MT A/G bullets	NA	NA	NA	NA	NA
With future nodal transfer @270 MT/day	NA	NA	NA	NA	NA
With future nodal transfer @ 270 MT/day & without 3x150 MT A/G bullets	NA	NA	NA	NA	NA

From the above, it can be observed that the days' cover for Pondicherry BP would be in the range of 05-06 days' after proposed tankage addition.





**Buffer Zone Area 1**



**Buffer Zone Area 2**



**Buffer Zone Area 3**



**Buffer Zone Area 4**



**Inside Area 1**



**Inside Area 2**



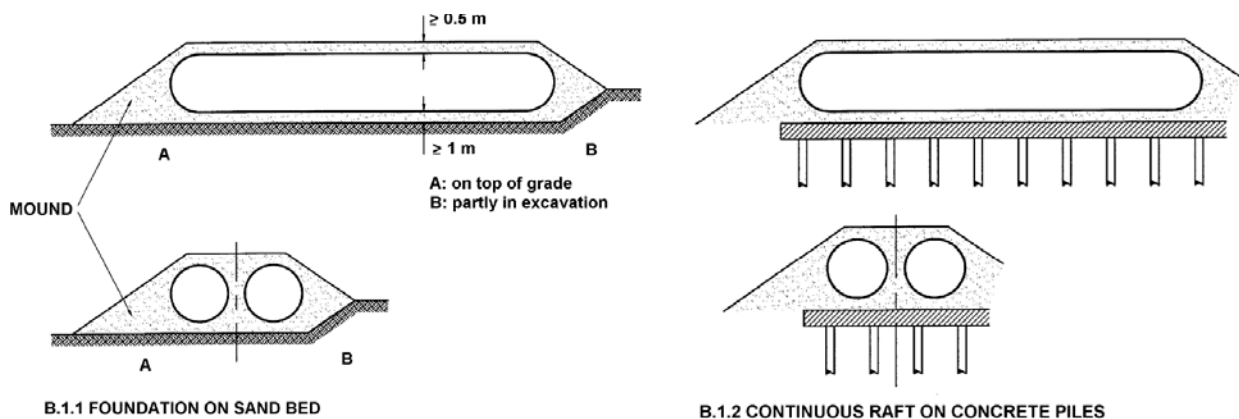
**Inside Area 3**

**Figure 2.2: Photographs of Existing Pondicherry Bottling Plant**

## 2.6 Description of Proposed Storage Facility

Proposed expansion of LPG storage facility is from 300 MT to 900 MT by installing 2x300 MT mounded bullet system and Truck Load Facility extension.

The tanks will be installed above the highest known water table level and the soil cover, therefore, usually protrudes above ground level as an earth mound, thereby reducing the possibility of boiling liquid expanding vapour explosion' (BLEVE) happening. The mounded structure is shown in **Figure 2.3**



**Figure 2.3: Mounded Storage Structure**

Material safety data sheet of LPG is enclosed as **Annexure-I**

### **Tank Equipment**

The following accessories will be installed on storage tank: vents, access hatches, gauge float wells, gauge-hatches, sample wells, rim vents, roof drains, roof legs, un-slotted guide pole



wells, slotted guide pole and vacuum breakers. The equipment for mounded tanks is given in **Table 2.4**.

**Table 2.4: Equipment for Mounded Tank**

Parameter	Equipment for mounded tanks
Equipment for mounded tanks	Vents
	Still wells and guide poles
	Instrumentation
	Access hatches
	Drains
	Sealing elements
	Valves

Description of accessories is given below:

**Vents:** Safety Relief Valves (SRVs) Pressure relief valves prevent excessive pressure build-up and vacuum valves prevent the tank collapsing due to a negative pressure in the tank. These functions may be combined in a Safety Relief Valves (SRV), also known as a breather valve.

#### **Still Well Guide Poles**

Still wells and guide poles are installed to:

- ✓ enable access for measuring the liquid level;
- ✓ enable access for measuring the temperature of the liquid;
- ✓ enable access for sampling the liquid; and
- ✓ Prevent the roof from rotating.

#### **Instrumentation**

Local or remote instrumentation shall be in accordance with appropriate standards; the Institute of Petroleum (IP) Petroleum Measurement Manual and IP Electrical Safety Code will provide specific advice, as well as other codes, standards and guidelines in this field.

#### **Level control and overflow protection**

During filling procedures, usually it is insufficient to control and record only the filling level. Because there is a danger of overflowing and consequent soil and water pollution, storage tanks are equipped with overflow protection to interrupt automatically filling before the maximum authorised liquid level is reached. In case the filling is not carried out automatically, the tank is equipped with an alarm to indicate the maximum authorised liquid level is reached. And filling is stopped manually.

#### **Flame arrester**

LPG storage tanks will have flammable atmosphere above the liquid. To prevent vapours from being ignited, by an external source (e.g. lightning), vents are fitted with flame arresters. These will be regularly inspected to avoid blockage.

### **Leak and gas detection**

Hydrocarbon detectors shall be installed to detect LPG liquid and/or gaseous leaks. The following is a non-exhaustive list of some typical techniques used:

- ✓ gas leaks can be detected by explosimeters, general purpose organic vapours analysers (OVA) or specific gas analysers; and
- ✓ Liquid leaks can be detected in the spillage collection systems. Level or interface level sensors can be used for insoluble organics, while pH meters and conductivity meters can be used.

### **Access Hatches**

Access hatches at the base of the tank allow access during a shut-down of the tank and to fulfil gas freeing of the tank. This is also the access route where any solids left in the tank are removed during cleaning operations. An access hatch is also usually provided for horizontal tanks (both atmospheric and pressurised) on the top of the tank.

### **Drains**

The two drain valves will be provided to enable simultaneous operation of both valves by a single operator. The downstream valve is normally a quick-acting spring loaded type (spring to close) valve that will operate as a dead man's handle. The drain outlet point can be lined up to a vapour treatment (i.e. thermal oxidiser) via a vapour knock out vessel.

## **2.7 Process Description**

The process flow chart of the LPG operations is shown in **Figure 2.4** and P&ID is shown in **Figure 2.5**.

The process involved can be divided into 4 Stages:

- Receipt of finished LPG products through tankers/pipeline
- Storage of LPG products in storage tanks as per OISD norms
- Packaging of the LPG into cylinders
- Dispatch of LPG products through packed trucks

Transport and handling through piping system, handling techniques, specific equipment used and standard operating procedures etc. the details are given below:

#### **Bottling/filling of LPG in packed cylinders**

LPG is transferred from storage vessel to carousels, where filling of cylinders takes place with help of LPG pump and also to increase the discharge pressure of LPG pump, pressurization takes place from the other bullet to this delivery bullet with help of LPG compressors.

#### **Dispatching of filled cylinders by stake trucks**

The filled cylinders are loaded in stake trucks and are sent to distributors. The movement of cylinders from one place to other place shall be done with help of trolley without rolling

Loading/unloading from bullet trucks

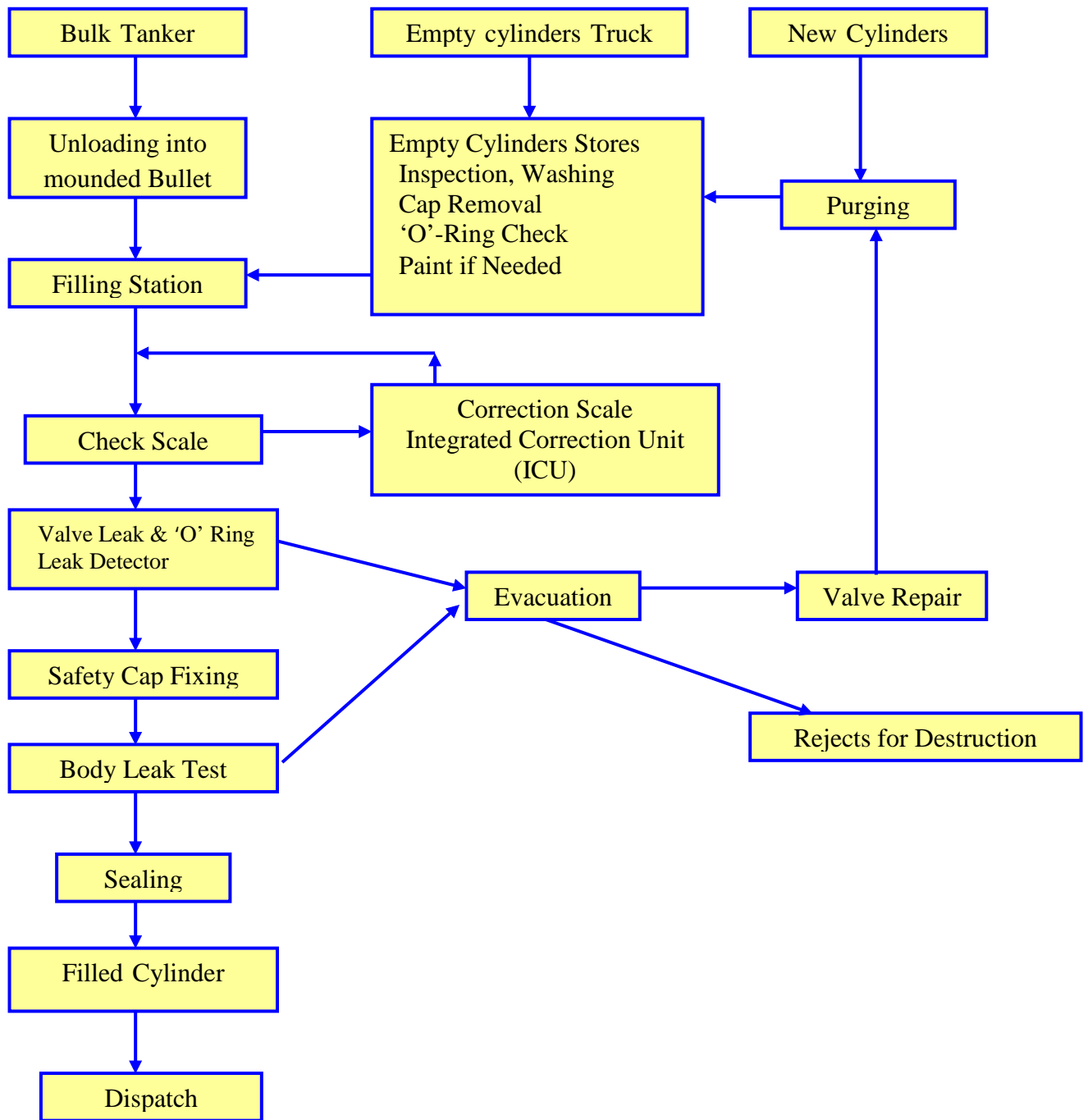
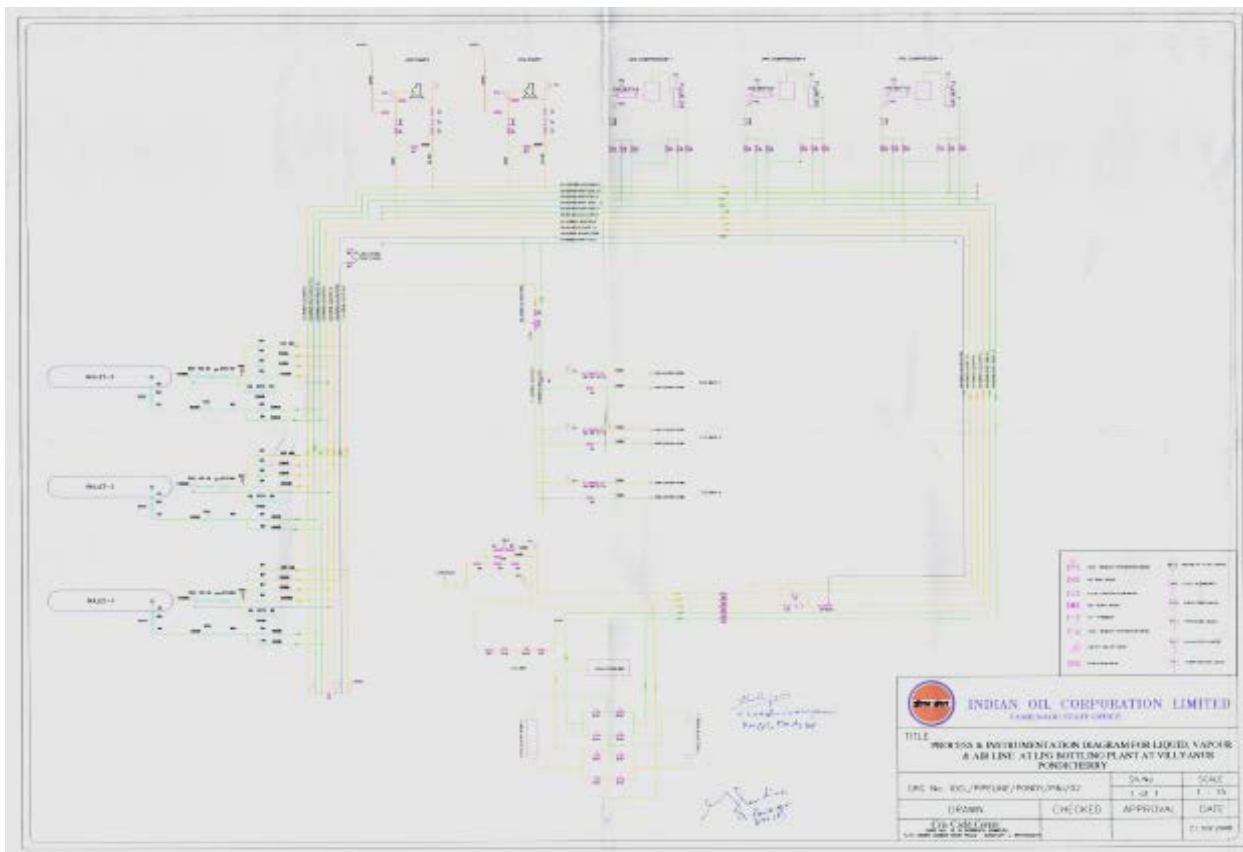


Figure 2.4: Process Flow Chart



**Figure 2.5: Piping System and Instrumentation**

### **LPG Pumps and Compressor House**

LPG pumps will take suction from bottom of Mounded Bullets and deliver liquid to carousel for filling in empty cylinders. Two vertical can type pumps have been installed to pump liquid LPG from storage vessels to carousel. These pumps have been provided with pop-action valves on discharge lines and are coupled to flame proof motors.

Three LPG vapour compressors each coupled to a flame-proof motor have been installed for loading/unloading of LPG based differential pressure mechanism. The maximum discharge pressure of these compressors is 160-250 M3/Hr. Details of LPG pumps and Compressor house are given in **Table 2.5**.

**Table 2.5: Pumps at the LPG BP, Pondicherry**

Pump Capacity (m <sup>3</sup> /hr)	Pump Type	Motor Rating, KW	Purpose (Bottling/TT Loading)	Line Size, inches	
				Suction	Discharge
36 M3/Hr	Vertical Can Type	22	Bottling	4	4
48 M3/Hr	Vertical Can Type	30	Bottling	4	4

### **LPG Vapour Compressors**

5 nos. of LPG vapour compressors have been provided for unloading of LPG from road tankers by pressurization and thereafter for recovery of LPG vapour from the road tankers when unloading is complete

### **Air Compressor & Air Drying Unit**

2 nos. of non-lubricated screw type Air compressor are provided for supply of compressed air for plant requirement as well as for instrument air at a press of 7 Kg/Cm<sup>2</sup>. The air compressor and air drying unit are located away from LPG handling facilities.

### **LPG Cylinder filling and associated facilities**

Types of cylinders used are 14.2, 19.0, and 5kg. Empty cylinders from storage shed are sent to filling shed by chain conveyer. LPG is filled by means of rotary machines (Carousel). The speed of the driving unit is variable so that the rotation of the carousel can be adapted to various filling capacities. The machine is preset for the net filling required in the cylinders. The filling machine is adjusted for the respective tare weight of the cylinders and is automatically cut off when the total gross weight reaches.

One with 18 point) electronic filling machines and cylinder conveyer have been installed for filling of 14.2 kg and 19 kg cylinders. Besides the above this shed also have electronic check scales for weight checking filled cylinders, Automatic weight correction unit machine, Automatic valve testing machines, test bath for checking any leakage from cylinder bung and body. Hot air sealing machine for sealing of cylinders prior to dispatch and RQC(Random Quality Check) machine for quality checks of cylinders facilities are there in the filling shed. Processed cylinders directly go to loading bays and failed cylinders during testing go to repair/servicing.

### **Checking of weight and Leak testing**

After filling, each cylinder is checked for the weight and the cylinders having less or more weight are segregated. The cylinders are checked for valve leakage by Gas Detector Machine (GD) and Pressure Transmitter Machine (PT) for Oring leak cylinders and then checking for body and bung leaks by totally submerging cylinders under water. Finally the cylinders are sent to filled cylinder storage via chain conveyers for loading in the trucks.

### **Air removal from cylinders and LPG vapour filling - Purging Unit**

This unit is required to fill LPG vapour in cylinders (new and repaired) after sucking the air from cylinders by vacuum pumps. This operation is essential to eliminate the possibility of forming explosive mixture with air. Vacuum is created up to 300 mm of Hg inside the cylinder and then LPG vapour is injected into the cylinder up to a pressure of 1.5 to 2 kg/cm<sup>2</sup>g before using them for filling.

### **Evacuation of leaky cylinders**

LPG is taken out from leaky cylinders and defective valve is replaced in the repairing shed. This unit consists of one LPG vapour compressor, two evacuation vessels and cylinder stand to keep the leaky cylinders in inverted position. Transfer of LPG from leaky cylinders is done by differential pressure method. The liquid collected in a vessel is transferred to AG Bullets by pressurization. Leaky cylinders are further evacuated and thereafter depressurized through cold flare unit before sending for cold repair.

### **Storage of filled cylinders & transportation**

Filled cylinders are stacked in the filled cylinder shed near the delivery end as per rules laid down by OISD/Gas Cylinder Rules, 1981. Filled cylinders are delivered only to the authorized LPG distributors. Drivers of the trucks carrying LPG are having valid license and are having training in safety & fire fighting procedures.

Transport and handling through piping system, handling techniques, specific equipment used and standard operating procedures etc. the details are given below:

### **Receipt of Empty LPG Cylinders**

Two Telescopic type unloading bays are provided for unloading of empty cylinders received in trucks at plant. All necessary inspections are carried out after unloading at telescopic conveyor before going for filling. The segregated cylinders are stacked separately and the same undergoes testing/repair.

### **Dispatch of Filled Cylinders**

After passing of all tests, the filled cylinders are loaded in Cylinder trucks by using Two Telescopic type loading bays. Packed cylinders are sent to distributors in a truck having capacity of 306 cylinders.

### **Tank Lorry Filling Shed**

Bulk LPG is supplied through Tankers. A three (3) bay Tank Lorry Decantation(TLD) has been provided to unload LPG from Tank Trucks to Storage Vessels.

It is proposed to construct another 2 No. of bays.

## **2.8 Resources requirement for the Proposed Project**

### **2.8.1 Land use and Land Ownership**

The proposed expansion will be carried out in the vacant land of existing terminal. Hence, no alternate sites were considered for the project, no change in land use.

The total land in possession of IOCL is about 17 acres, out of which proposed project needs 280 m<sup>2</sup> for proposed 2 mounded bullets, stone pitching around the bullets and motor-able road around the mounded bullets and for laying the fire fighting hydrant network around the mound.

### **2.8.2 Water requirement**

Water will be sourced from Municipal Corporation for additional 25 m<sup>3</sup>/d requirement. Breakup of existing and proposed water requirement is given in below **Table-2.6**. Water allocation letter enclosed as **Annexure-II**

**Table 2.6: Water Consumption**

Particulars	Quantity (m <sup>3</sup> /d)	
	Existing	Proposed
Hydraulic testing and washing of cylinders	0.40	0.40
Gardening	0.10	0.10
Plant Utilities	4.50	4.50
Domestic	9.00	9.00
Mock drills (once in six months)	1.00	1.00
Total	15.0	15.0

### **2.8.3 Power requirement**

Plant receives power from State electricity board, with connected load of 320 kW. In addition, IOC has stand by DG sets of 250 kVA and 100 kVA

## **2.9 Proposed Schedule and Approval for Implementation.**

The plant activities will be completed in a period of 24 months from the date of receipt of all the approvals from statutory authorities.

## **2.10 Utilities and Services**

### **2.10.1 Machinery Stores**

Adequate storage facilities for machinery spares and other consumables, including an open yard, have been established to meet the requirement of plant.

### **2.10.2 Workshop**

Based on the location of the plant, reasonably good workshop facilities have been established, both for mechanical and electrical equipment repairs and maintenance.

### ***2.10.3 Time Office and Security Office***

The time office and security office complex is well established.

### ***2.10.4 Fire Fighting System***

For protection system has following:

- Hydrant system;
- High pressure water sprinkler system;
- Portable fire extinguishers; and
- High-pressure fire hydrant system.

### ***2.10.5 Infrastructure Facilities for Labour Force***

Presently no infrastructure, except an all weather good motor-able public road, is available in the area. Thus, the infrastructure like offices, workshop, electricity etc. will be added.

The following amenities will be provided to the workers:

- Drinking water facility;
- Sanitation facilities will be constructed which will include the adequate number of separate toilets for men and women. The make shift treatment plant will be installed and treated wastewater will be utilized in greenbelt development;
- Bins will be installed to collect municipal waste

### ***2.10.6 First Aid Room***

First aid room of adequate size with required equipment will be established near the office, whereas the first aid station near the workings is of mobile type. Rest shelter of standard design will be provided near the first aid station. Cool and wholesome drinking water will be provided at the shelter in suitable container.

## **2.11 Sources of Pollution and Built-in Control Measures**

### ***2.11.1 General***

In the operations, as well as in the auxiliary units, different waste materials will be generated. These waste materials mainly include gaseous emissions, wastewater and solid wastes from the utilities:

- The emissions include the dust due to vehicular movement;



- The main atmospheric pollutant is fugitive emissions;
- The water in the plant is mainly used for domestic purpose and no process wastewater is generated
- The solid waste in the form of sludge is mainly generated will be used as manure

The various types of pollution from the proposed expansion project are categorized under the following types:

- Air pollution;
- Water pollution;
- Pollution emanating due to solid waste; and
- Noise pollution

### ***2.11.2 Air Pollution***

The following are the potential emission sources while handling the liquid and liquefied gas storage and handling area:

- Filling;
- Cleaning;
- Pigging;
- Purging;
- Sampling
- Disconnecting;
- Opening;
- Pressure relief;
- Fugitive; and
- Emptying/draining.

Fugitive emissions of VOCs are the major sources of air pollution in storage facilities and from static and dynamic joints and seals used in flanges, pumps, mixers, valve packing and connection joints. In order to minimize the fugitive emissions of VOCs, the following measures are incorporated at design stage:

- Minimum number of flanges, valves etc;
- Provision of leak proof valves like ROV/Gate Valves/Quick Shut-Off valves;
- High grade gasket materials
- Usage of pumps with (single/double) mechanical seals

### ***2.11.3 Wastewater Generation***

Sewage generation is envisaged during operation phase and existing soak pit will be adequate to cater the sewage load. Sewage from the administration building will be routed to the septic tanks followed by soak pits and the sludge generated from the septic tank will be dried and used as manure for green belt area.

#### **2.11.4 Solid Waste / Sub-Grade Material**

No process / manufacturing involved. Hence no solid waste generated.

#### **2.11.5 Noise Levels and Vibration**

The DG sets shall be acoustically insulated resulting in reduction of noise as per limits prescribed by Central Pollution Control Board. The exhaust pipe from DG sets shall be taken above the building as per Central Pollution Control norms.

#### **2.11.6 Source of potential Air and Water Emission sources**

The details of possible emission sources are given in **Table 2.7**.

**Table 2.7: Potential Emission Sources from Bottling Plant**

<b>Sr. No</b>	<b>Type of Storage</b>	<b>Potential Emissions to Air</b>	<b>Potential Emissions to Water</b>
1	Above ground horizontal storage tanks	Filling, breathing, emptying, cleaning,	Draining, cleaning, sampling
2	Mounded storage (pressurised)	blanketing, manual gauging, sampling, fugitive, draining	
Apart from operational losses, infrequent emissions also occur from incidents and (major) accidents such as leakages may occur			

## **CHAPTER 3. DESCRIPTION OF THE ENVIRONMENT**

### **3.1 General**

This chapter provides the description of the existing environmental status of the study area with reference to the environmental attributes like air, water, noise, soil, land use, ecology, socio economics, etc. The study area covers 10 km radius around the project site.

The existing environmental setting is considered to adjudge the baseline conditions which are described with respect to climate, atmospheric conditions, water quality, soil quality, ecology, socioeconomic profile, land use and places of archaeological importance.

### **3.2 Methodology**

The methodology for conducting the baseline environmental survey obtained from the guidelines given in the EIA Manual of the MoEF&CC. Baseline information with respect to air, noise, water and land quality in the study has been collected by primary sampling/field studies during the period of **January 2016 to March 2016**.

The meteorological parameters play a vital role in transport and dispersion of pollutants in the atmosphere. The collection and analyses of meteorological data, therefore, is an essential component of environmental impact assessment studies. The long term and short term impact assessment could be made through utilization and interpretation of meteorological data collected over long and short periods. Since the meteorological parameters exhibit significant variation in time and space, meaningful interpretation can only be done through a careful analysis of reliable data collected very close to the site.

### **3.3 Study Area included in Environmental Setting**

The study area is considered to be area within a radius of 10 km of the IOCL terminal boundary. The EIA guidelines of the MoEF mandate the study area in this manner for EIA's.

#### **3.3.1 Land Use/Land Cover of the Study Area**

Land Use Land Cover studies are conducted using satellite imagery. The details of satellite image are as follows:

Satellite Data: Landsat 8 cloud free data has been used for Landuse / landcover analysis.

Satellite Sensor – OLI\_TIRS

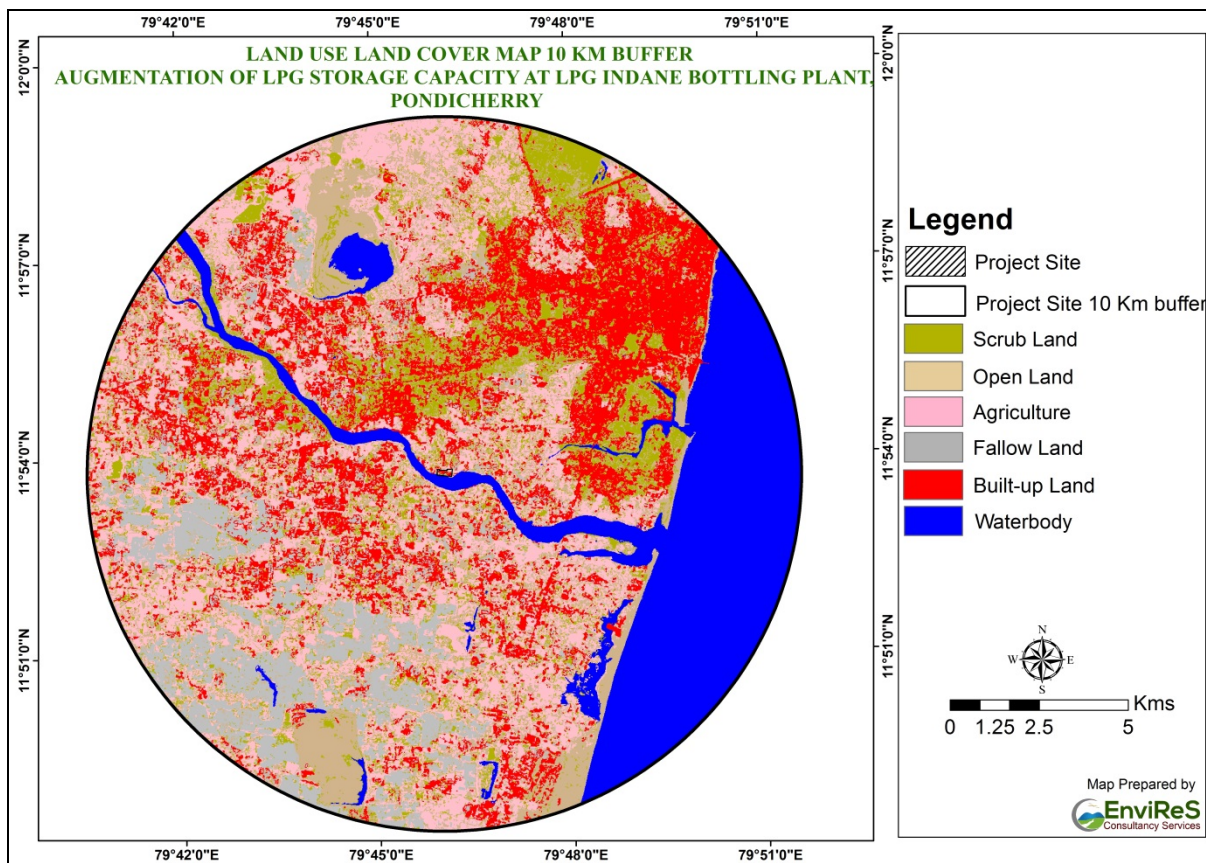
Path and Row – Path 142, Row 52

Resolutions – Panchromatic 15 m Reflective 30 m

Date of Pass: 24th June 2015

Ancillary Data: GIS and image-processing software are used to classify the image and for delineating drainage and other features in the study area.

The study area of 10 km radius from the centre of project site shows six (6) different land use classes. Agriculture land dominates the land use pattern covering 23.49% of the area. Since the project site is located within the Pondicherry Union Territory built-up area comprises of 20.04% landuse. Open land 18.27% and scrub land (11.45%) constitutes majority of landuse. Fallow land accounts for nearly 10% of landuse pattern within the 10 km radius around project site. Gingee River flows adjacent to project site. Gingee River along with a number of lakes within the 10 km radius around project site contributes to nearly 17% of the landuse. The LULC classes are identified and presented in **Table 3.1 and Figure 3.1**.



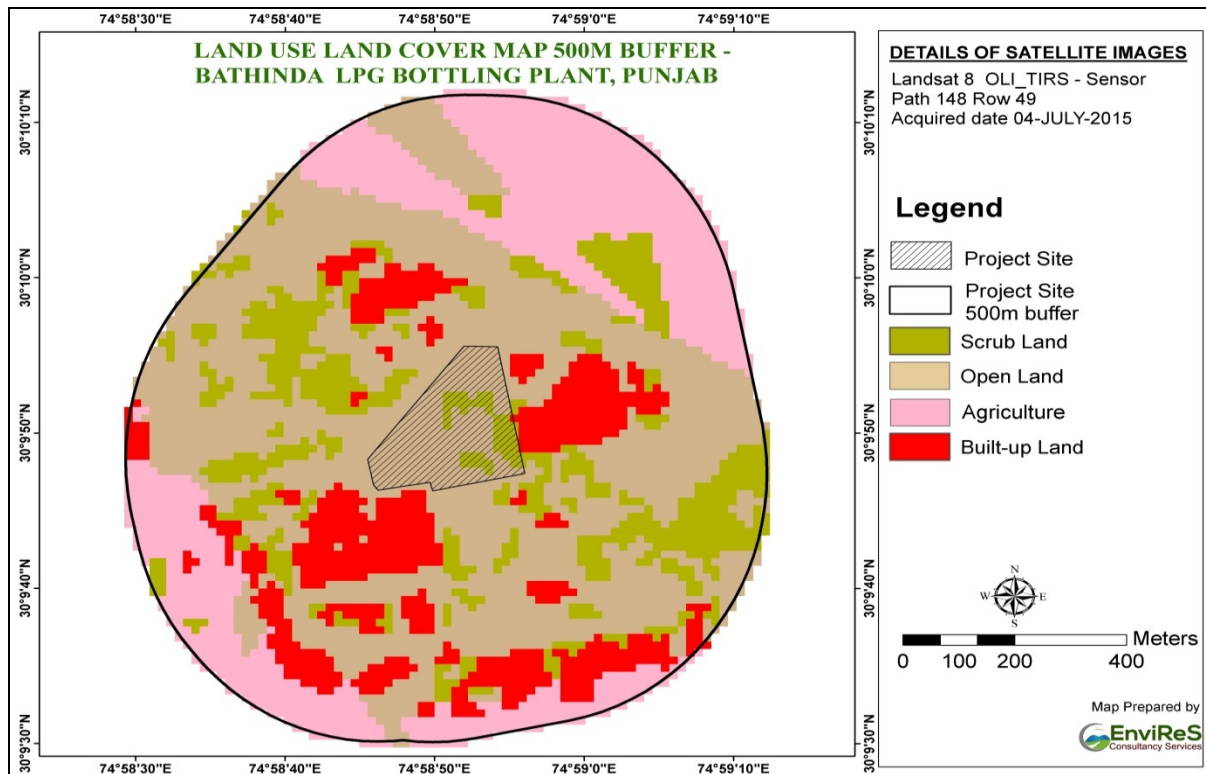
**Figure 3.1: Landuse/Landcover of 10 Km Study Area**

**Table 3.1: Landuse / Landcover Statistics of Area within 10 km Radius**

SN	Landuse/ Landcover Class	Area, Km <sup>2</sup>	Area, %
1	Scrub Land	36.01	11.45
2	Open Land	57.43	18.27
3	Agriculture	73.85	23.49

4	Fallow Land	30.73	9.77
5	Settlement	63.00	20.04
6	Waterbody	53.40	16.99
	<b>Total</b>	<b>314.42</b>	<b>100.00</b>

Open land (28.43%) and Scrub land (28.03%) dominate the landuse pattern covering 500 m angular distance around project site. Agriculture land (16.53%) and Fallow land (1.32%) indicate availability of irrigation in the surround area. Waterbody dominates the land use pattern in the study area covering 500 m angular distance around the project site. It covers 19.34% of the total study area. Built-up land constitutes 6.36% of the landuse. Six (6) different landuse/ landcover (LULC) classes are identified for the area covering 500m radial distance around proposed project site. The LULC classes are identified and presented in **Table 3.2 and Figure 3.2.**



**Figure 3.2: Landuse/Landcover of 500 m Buffer Area**

**Table 3.2: Landuse / Landcover Statistics of Area within 500m Buffer Area**

SN	Landuse/ Landcover Class	Area, Km <sup>2</sup>	Area, %
1	Scrub Land	0.41985	28.03
2	Open Land	0.4257	28.43
3	Agriculture	0.2475	16.53

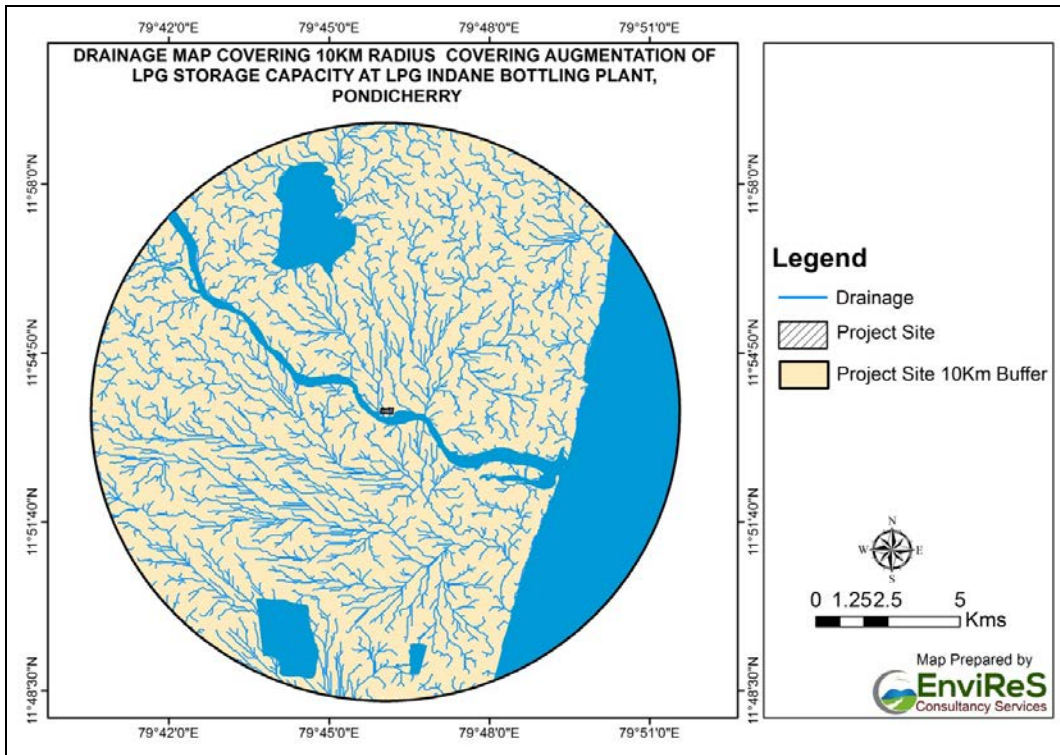
SN	Landuse/ Landcover Class	Area, Km <sup>2</sup>	Area, %
4	Fallow Land	0.0198	1.32
5	Settlement	0.095175	6.36
6	Waterbody	0.289575	19.34
	<b>Total Area</b>	<b>1.4976</b>	<b>100.00</b>

### 3.3.2 Drainage Map of the Study Area

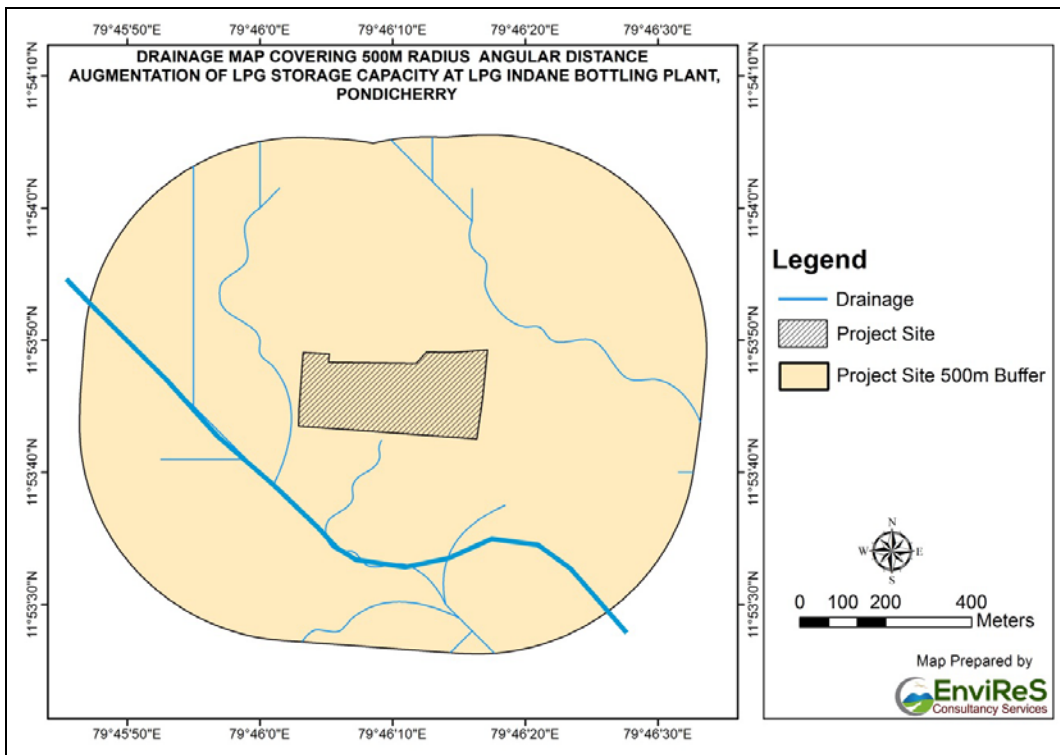
Drainage layer, which was generated after scanning the thematic manuscripts, was edited for line the errors. Two different layers were made separately for line drainage. Drainage order was given to all the drain lines in the layer's. Strahler method of ordering was used for giving order to drainage. Whenever two drains of any order joined the order of next drain was increase by one.

The study area exhibits majority of third order of drainage of drainage pattern. Gingee or Sangarbarani River passes along the southern plot boundary of project site. Malataru River and All River with sufficient width were put in polygon layer. Drainage pattern within 10 km radius around project site shows the dendritic type of drainage pattern of fourth order and majority of streams flow towards east side and merge into Bay of Bengal. The 10 km area around project site exhibit a number of lakes such as Osudu Lake, Korkadu Lake, Bahour Lake, Nathamadu Lake, Nallathur Lake and Pillayarkuppam Lake.

The area shows not much of undulating topography. The area covering 500 m angular distance around project site shows drainage lines passing towards Gingee or Sangarbarani River located South of Project site. No natural drainage lines pass through the project site and however those passing along the project site further confluence into River.



**Figure 3.3: Drainage Pattern of 10 Km Study Area**



**Figure 3.4: Drainage Pattern of 500 m Buffer Area**



### 3.3.3 Contour Pattern of the Study Area

Thematic manuscript for contour layer was generated from Digital Elevation Model (DEM). After scanning, coverage was generated. Coverage was edited to remove all errors of dangle. Attribute value was given to each contour in the coverage.

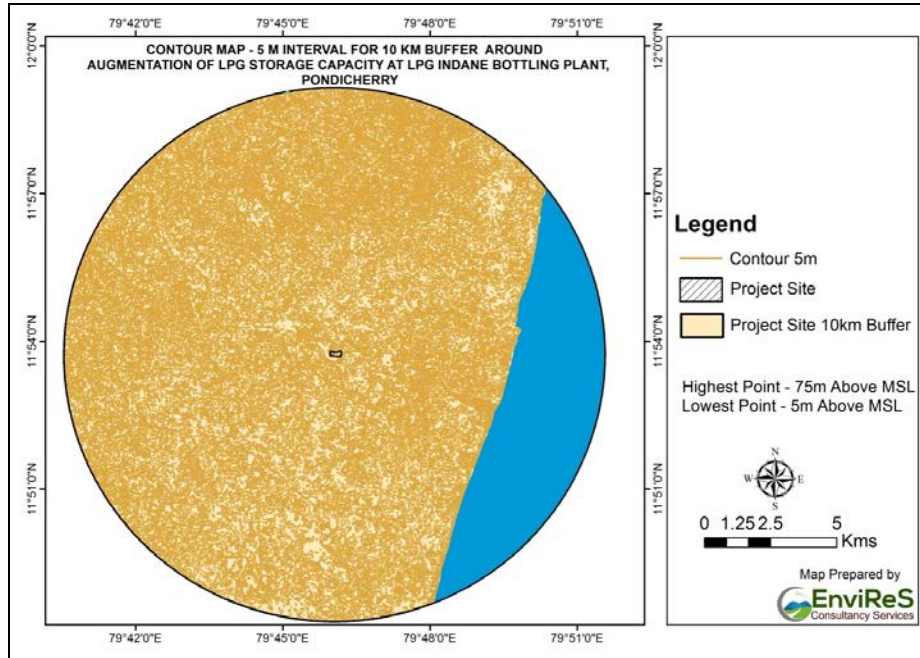


Figure 3.5: Contour Pattern of 10 Km Study Area

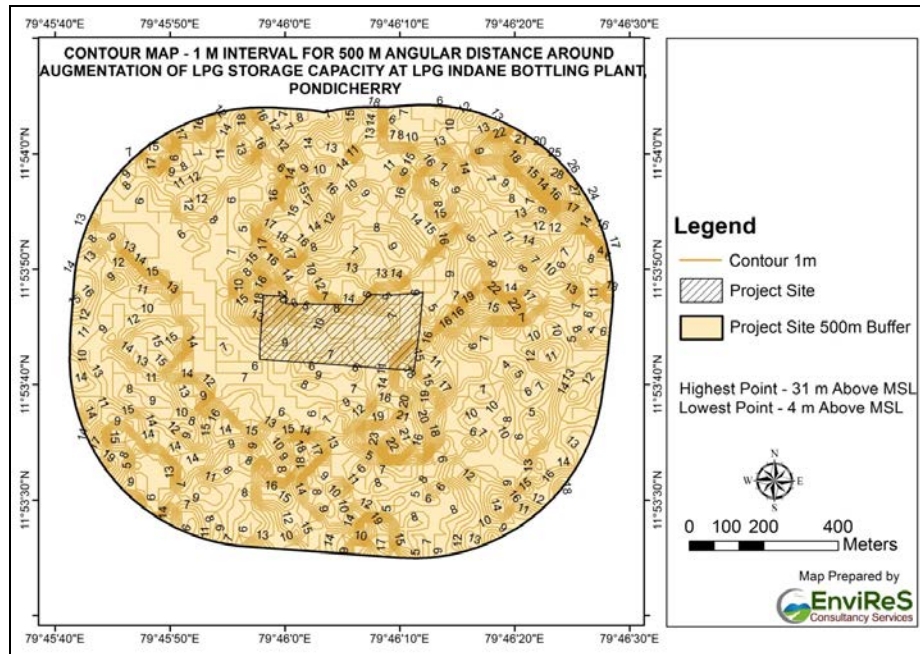


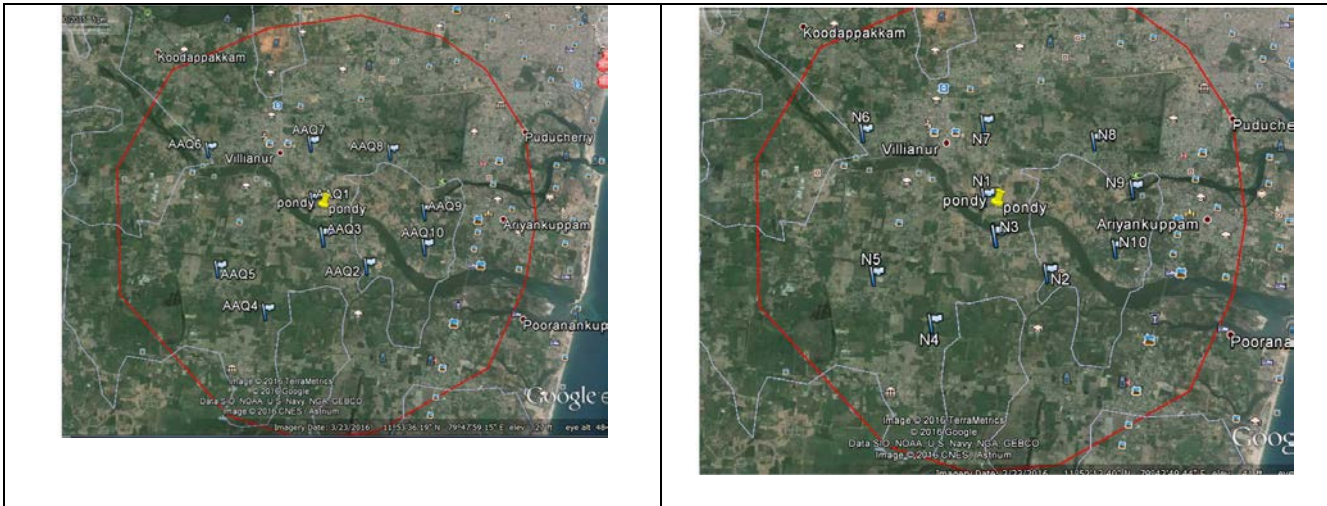
Figure 3.6: Contour Pattern of 500 m Buffer Area

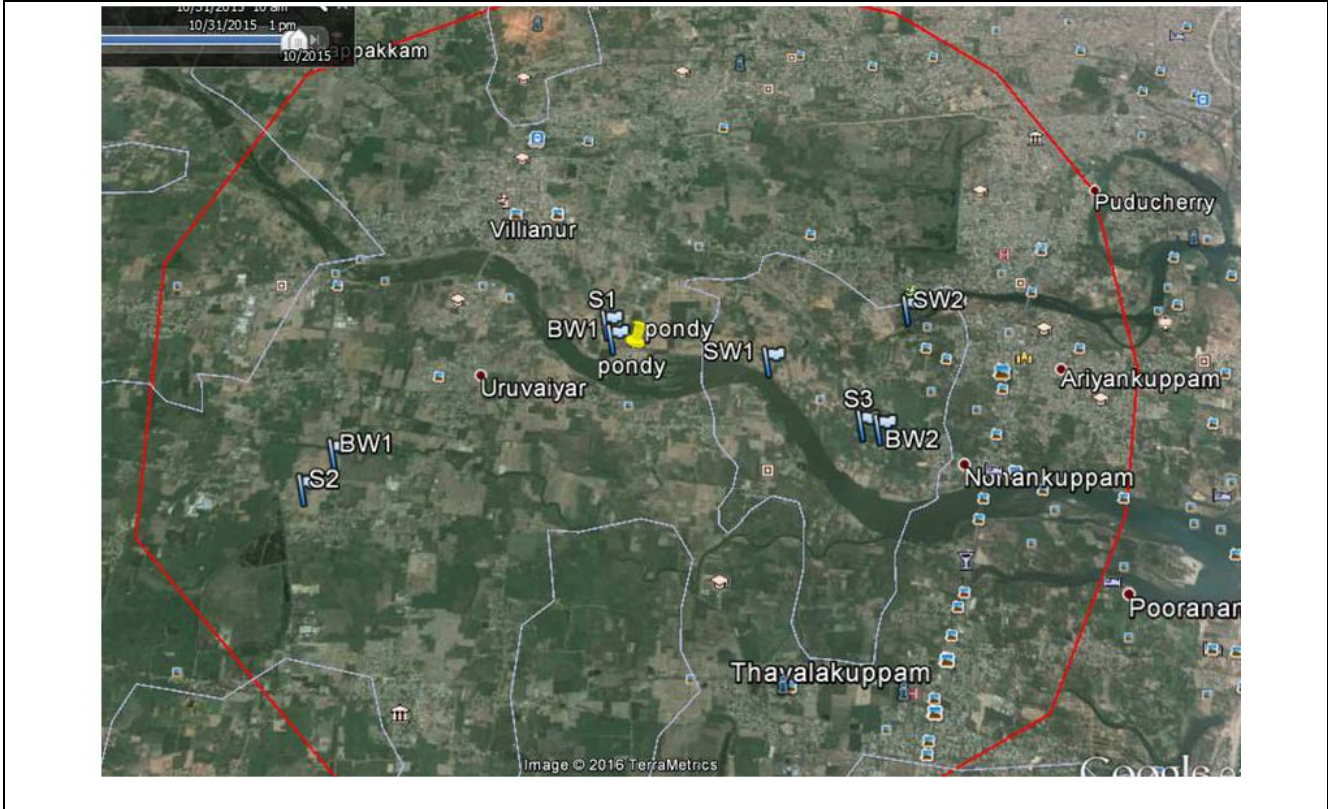


Contour map of 10 km radius around project site does not show any predominant mountain range. The project site is located on the Gingee or Sangarbarani River bank. Bay of Bengal is visible within the 10 km radius towards east side of the project site which is the lowermost contour level. The overall topography within the 10 km radius around project site is not very undulating and has overall slope towards east. Highest point of the area covering 10 km radius around project site is 75 m whereas the lowest point is less than 5m above mean sea level.

500 m angular distance around project site shows comparatively flat terrain. Overall expanse of the contours is gradual and do not show steep slopes. The project site shows slope towards south where Gingee River is flowing. Highest point of the area covering 500 m angular distance around project site is 31 m located at the southernmost side whereas the lowest point is at 4 m.

The 10 km study area inclusive of all the monitoring locations has been as shown in **Figure 3.7**.





**Figure 3.7: Baseline Sampling Monitoring Locations**

### 3.4 Meteorological Data

During study, a continuous automatic weather monitoring station was established at site to record wind speed, wind direction, relative humidity and temperature. Atmospheric pressure was recorded twice a day at **08.30 and 17.30 hrs**. Cumulative rainfall was monitored by rain gauge on daily basis. This station was in operation in study period.

The methodology adopted for monitoring meteorological observations is as per the standard norms laid down by Bureau of Indian Standards and the India Meteorological Department (IMD). Hourly maximum, minimum and average values of wind speed, direction and temperature are recorded continuously at site.

A fully instrumented continuous recording meteorological observatory is established and operated at project site during study period. The parameters are being monitored at site is given in **Table 3.3**.

**Table 3.3: Meteorological Monitoring At Site**

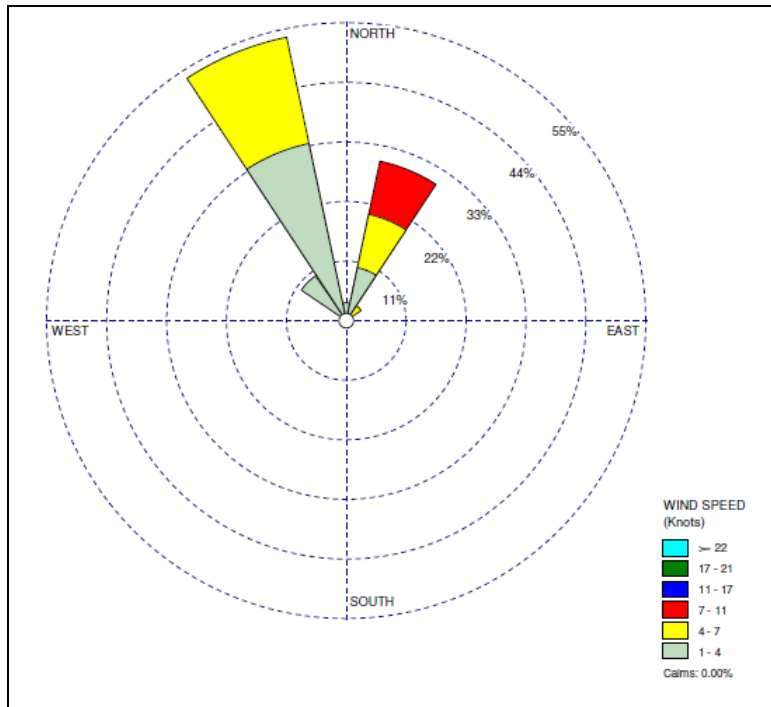
S.N.	Parameter	Instrument	Frequency
1	Wind Speed	Automatic Weather station (Envirotech WM 251)	Continuous Automatic
2	Wind Direction		1 hourly Average

3	Ambient Temperature		
4	Max. & Min Temperature	Wet & Dry Bulb Thermometer	Daily at 08:30 and 17:30 IST
5	Relative Humidity	Hygrometer	Daily at 08:30 and 17:30 IST
6	Rainfall	Rain Gauge	Daily

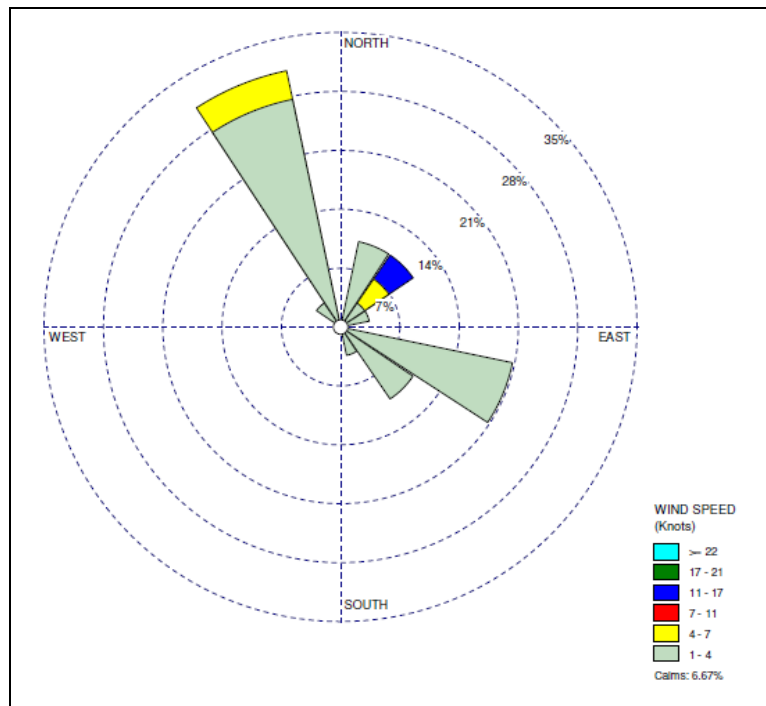
The aforesaid meteorological parameters were being observed in the field during monitoring period. The analysis of the field observations is given in **Table 3.4**. The wind rose during the study period is presented in **Figure 3.4**.

**Table 3.4: Meteorological Data Recorded at Site**

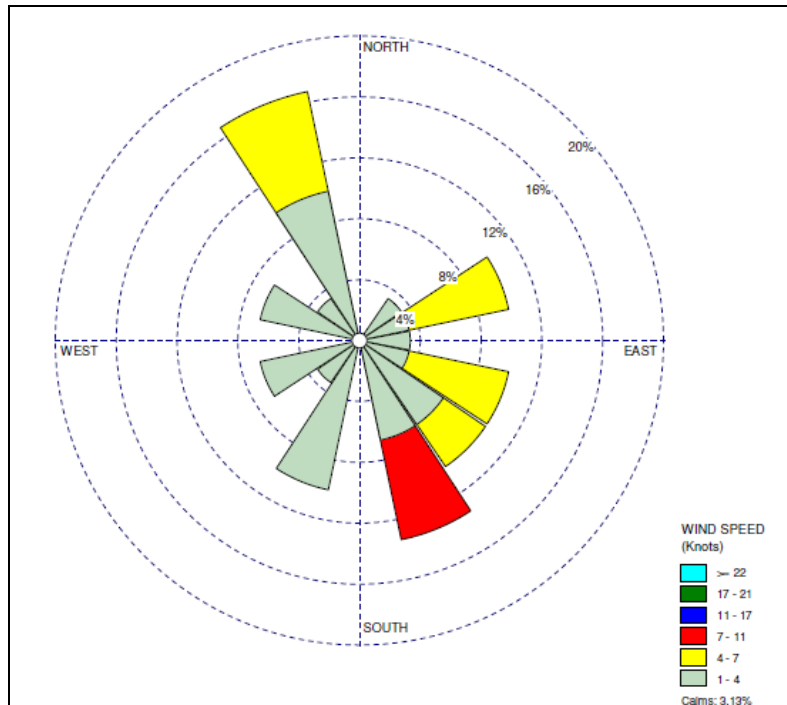
Month	Temperature, °C		Relative Humidity, %		Wind Speed, m/s	Predominant wind direction
	Min	Max	Min	Max	Mean	
January to March 2016	19.8	35.6	61	93	5	NNW



January 2016



February 2016



March 2016

**Figure 3.8: Windrose for period of January 2016 to March 2016.**

### 3.5 Ambient Air Quality

The ambient air quality monitoring was carried out at ten locations within the 10 km radius around the site of project to know the existing background ambient air quality. The purpose of the estimation of background pollutant concentration was to assess the impact of the project on the ambient air quality within the region based on the activities of the project. The parameters chosen for assessment of air quality were PM<sub>10</sub>, PM<sub>2.5</sub>, Sulphur Dioxide (SO<sub>2</sub>), Oxides of Nitrogen (NO<sub>x</sub>), Hydrocarbon (Methane and Non-methane HC) and VOCs.

#### 3.5.1 Methodology Adopted for the Study

PM<sub>10</sub>, PM<sub>2.5</sub>, Sulphur dioxide (SO<sub>2</sub>), Oxides of Nitrogen (NO<sub>x</sub>), Hydrocarbon (Methane and Non-methane HC) and VOCs were the major pollutants associated with project. The baseline status of the ambient air quality has been established through field monitoring data on PM<sub>10</sub>, PM<sub>2.5</sub>, Sulphur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>), Hydrocarbon (HC) Methane and Non-methane HC) and VOCs at 10 locations within the study area. The locations for air quality monitoring were scientifically selected based on the following considerations using climatological data.

- Meteorological conditions on synoptic scale;
- Topography of the study area;

- Representative ness of the region for establishing baseline status; and
- Representative ness with respect to likely impact areas.

Ambient air quality monitoring was carried out on 24 hour basis with a frequency of twice a week at a station during the study period for 10 locations.

The location of the monitoring stations with reference to the project site is given in **Table 3.4**.

**Table 3.4: Ambient Air Monitoring Locations**

SN	Location	Location Code
1	Main gate – IOCL Pandy	A1
2	Ambedhkar nagar	A2
3	Korkadu Village	A3
4	Perungalur village	A4
5	Keeznagraharam Village	A5
6	Aryapalayam Village	A6
7	Puluderi Village	A7
8	Pudhupoonjolakuppam village	A8
9	Kombakkam Village	A9
10	Periya irusampalam	A10

The ambient air quality results are as summarised in **Table 3.5**.

**Table 3.5: Ambient Air Quality Monitoring Results**

PM <sub>10</sub> (µg/m <sup>3</sup> )										
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
<b>Min</b>	45.4	35.8	39.4	36.4	35.1	35.7	39.2	30.9	40.0	36.0
<b>Max</b>	50.2	44.4	44.3	43.1	40.4	40.5	44.2	48.3	45.2	40.7
<b>Mean</b>	47.9	39.6	41.8	40.2	38.0	37.8	42.0	40.2	42.6	38.0
<b>Standard</b>	100	100	100	100	100	100	100	100	100	100
PM <sub>2.5</sub> (µg/m <sup>3</sup> )										
<b>Min</b>	21.8	15.2	15.3	15.5	15.2	14.9	14.8	16.1	16.0	16.2
<b>Max</b>	30.4	19.0	20.4	20.4	18.6	20.1	20.1	23.6	23.1	25.2
<b>Mean</b>	25.5	17.2	17.8	17.9	17.1	17.5	17.2	18.6	20.0	20.5
<b>Standard</b>	60	60	60	60	60	60	60	60	60	60
SO <sub>2</sub> (µg/m <sup>3</sup> )										
<b>Min</b>	1.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

<b>Max</b>	6.4	6.1	1.8	4.9	6.2	5.2	1.8	6.0	1.9	5.3
<b>Mean</b>	5.3	1.9	BDL	BDL	4.6	1.5	BDL	4.8	BDL	1.5
<b>Standard</b>	80	80	80	80	80	80	80	80	80	80
<b>NO<sub>x</sub> (µg/m<sup>3</sup>)</b>										
<b>Min</b>	8.8	8.1	9.0	9.6	7.5	7.6	6.0	7.4	6.0	6.6
<b>Max</b>	14.9	11.5	13.8	15.9	11.2	12.0	10.2	13.7	9.3	13.2
<b>Mean</b>	11.9	9.7	11.3	13.0	9.2	9.9	8.2	10.2	7.7	9.3
<b>Standard</b>	80	80	80	80	80	80	80	80	80	80

### 3.5.2 Sampling and Analytical Techniques

Respirable Dust Samplers APM-451 of Envirotech instruments were used for monitoring Respirable fraction (<10 microns) and gaseous pollutants like SO<sub>2</sub>, NO<sub>x</sub>, Methane and Non-methane (HC) and VOCs. **Table 3.5** shows the techniques for sampling and analysis for these parameters.

**Table 3.6: Techniques Used For Ambient Air Quality Monitoring**

Parameters	Technique	Technical Protocol	Detectable Limit, µg/m <sup>3</sup>
PM <sub>10</sub>	Respirable Dust Sampler (Gravimetric method)	CPCB Guidelines	10.0
Sulphur Dioxide	West and Gaeke	IS-5182 (Part-II)	5.0
Nitrogen Oxide	Jacob & Hochheiser	IS-5182 (Part-VI)	5.0
Hydrocarbon (Methane and Non-Methane)	Gas Chromatograph (FID Detector)	Is-5182 (Part-XXI)	0.1 ppb
VOCs	Activated Charcoal method (GC FID Detector)	EPA TO-17	1 mg/m <sup>3</sup>

Ambient air at the monitoring location is sucked through a cyclone. Coarse and non-respirable dust is separated from the air stream by centrifugal forces acting on the solid particles and these particles fall through the cyclone's conical hopper and get collected in the sampling cap placed at the bottom. The fine dust (<10 microns) forming the PM<sub>10</sub> passes the cyclone and is retained on the filter paper. A tapping is provided on the suction side of the blower to provide suction for sampling air through a set of impingers for containing absorbing solutions for SO<sub>2</sub> and NO<sub>x</sub>. Samples of gases are drawn at a flow rate of 0.2 liters per minute.

PM<sub>10</sub> has been estimated by gravimetric method. Modified West and Gaeke method (IS-5182 part-II, 1969) has been adopted for estimation of SO<sub>2</sub> and Jacobs-Hochheiser method (IS-5182 part-VI, 1975) has been adopted for the estimation of NO<sub>x</sub>. Calibration charts have been prepared for all gaseous pollutants.

### **3.6 Noise**

Noise in general is sound, which is composed of many frequency components of various loudness distributed over the audible frequency range. The most common and universally accepted scale is the A weighted scale which is measured as dB (A). This is more suitable for audible range of 20 to 20,000 Hz and has been designed to weigh various components of noise according to the response of a human ear. The environmental assessment of noise from the industrial activity, construction activity and vehicular traffic can be undertaken by taking into consideration various factors like potential damage to hearing, physiological responses, and annoyance and general community responses.

#### **3.6.1 Objective**

The main objective of monitoring of ambient noise levels was to establish the baseline noise levels in different zones. i.e. Residential, Industrial, Commercial and Silence zones, in the surrounding areas and to assess the total noise level in the environment of the study area.

#### **3.6.2 Methodology**

- **Identification of Sampling Locations**

A preliminary reconnaissance survey was undertaken to identify the major noise sources in the area. The sampling location in the area was identified considering location of industry, commercial shopping complex activities, residential areas with various traffic activity and sensitive areas like hospital, court, temple and schools also near the railway track for railway noise.

The noise monitoring was conducted at eight locations in the study area during monitoring period. 10 sampling locations were selected for the sampling of noise.

- **Equivalent sound pressure level (Leq)**

The sound from noise source often fluctuates widely during a given period of time. Leq is the equivalent continuous sound level, which is equivalent to the same sound energy as the actual fluctuating sound measured in the same time period.

- **Instrument used for Monitoring**

Noise levels were measured using an Integrating sound level meter manufactured by Cygnet (Model No. 2031). It had an indicating mode of Lp and Leq. Keeping the mode in Lp for few



minutes and setting the corresponding range and the weighting network in “A” weighing set the sound level meter was run for one hour time and Leq was measured at all locations.

There are different types of fields for measuring the ambient noise level, e categorized as free field, near field and far field.

- **Free Field**

The free field is defined as a region where sound wave propagates without obstruction from source to the receiver. In such case, the inverse square law can be applied so that the sound pressure level decreases by 6dB (A) as the distance is doubled.

- **Near Field**

The near field is defined as that region close to the source where the inverse square law does not apply. Usually this region is located within a few wavelengths from the source.

- **Far Field**

The far field is defined as that region which is at a distance of more than 1-meter from the source.

**Table 3.7: Noise Level Monitoring Stations in the Study Area**

Sl. No	Location	Location Code
1	Main gate – IOCL Pondy	N1
2	Near Govt. Higher.Secon. School – Ambedhkar nagar	N2
3	Near mariyamman Temple – Korkadu Village	N3
4	Near Govt. Primary school - Perungalur village	N4
5	Near Govt. Middle School - Keeznagraharam Village	N5
6	Near Govt. Primary. school - Aryapalayam Village	N6
7	Near Temple – Pudhukuppam Village	N7
8	Near Temple – Kadalur Village	N8
9	Near Govt. High School– Kombakkam Village	N9
10	Near Muthumariyamman Temple - Periyairusampalam Village	N10

### 3.6.3 Method of Monitoring and Parameters Measured

Noise monitoring was carried out continuously for 24-hours with one hour interval. During each hour parameters like L<sub>10</sub>, L<sub>50</sub>, L<sub>90</sub> and Leq were directly computed by the instrument based on the sound pressure levels. Monitoring was carried out at ‘A’ weighting and in fast response mode.

The important parameters to be measured are L<sub>eq</sub>, L<sub>day</sub>, and L<sub>night</sub>.

L<sub>eq</sub>: Latest noise monitoring equipments have the facility for measurement of L<sub>eq</sub> directly. However, L<sub>eq</sub> can also be calculated using the following equation:

$$L_{eq (hrly)} = L_{50} + (L_{10} - L_{90})^2 / 60$$

**Where,**

$L_{10}$  (*Ten Percentile Exceeding Level*) is the level of sound exceeding 10% of the total time of measurement.

$L_{50}$  (*Fifty Percentile Exceeding Level*) is the level of sound exceeding 50% of the total time of measurement.

$L_{90}$  (*Ninety Percentile Exceeding Level*) is the level of sound exceeding 90% of the total time of measurement.

$L_{day}$  : This represents  $L_{eq}$  of daytime.  $L_{day}$  is calculated as Logarithmic average using the hourly  $L_{eq}$ 's for day time hours from 6.00a.m to 10.00p.m

$L_{night}$ : This represents  $L_{eq}$  of night time.  $L_{night}$  is calculated as Logarithmic average using the hourly  $L_{eq}$ 's for nighttime hours from 10.00p.m to 6.00a.m.

### 3.6.4 Noise Results

The values of noise level parameters like  $L_{eq}$  (day), and  $L_{eq}$  (night), were monitored during study period and are presented in **Table 3.8**.

**Table 3.8: Ambient Noise Monitoring Results**

SN	Villages	Code	Leq (day)	Leq (night)	Remarks
1	Main gate – IOCL Pondy	N1	54.0	49.2	Within Limits
2	Near Govt. Higher.Secon. School – Ambedhkar nagar	N2	49.7	39.4	Within Limits
3	Near mariyamman Temple – Korkadu Village	N3	51.7	41.7	Within Limits
4	Near Govt. Primary school - Perungalur village	N4	49.7	38.3	Within Limits
5	Near Govt. Middle School - Keeznagraharam Village	N5	52.1	39.6	Within Limits
6	Near Govt. Primary. school - Aryapalayam Village	N6	51.4	40.7	Within Limits
7	Near Temple – Pudhukuppam Village	N7	50.5	40.3	Within Limits
8	Near Temple – Kadalur Village	N8	51.5	41.6	Within Limits
9	Near Govt. High School–	N9	51.9	41.2	Within Limits

	Kombakkam Village				
10	Near Muthumariyamman Temple - Periyairusampalam Village	N10	50.9	40.8	Within Limits

• **Noise Standards**

Ambient air quality standard in respect of noise have been stipulated by Govt. of India vide Gazette notification dated. 14.2.2000. **Table 3.9** describes ambient noise standards.

**In Respect of Noise\***

**Table 3.9: Ambient Noise Standards**

Area Code	Category of Area	Limits in dB(A), $L_{eq}$	
		** Day time	#Night time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone @	50	40

\* As per Environment protection act.

\*\* Day Time: 6.00a.m to 10.00p.m.

# Night Time: 10.00p.m to 6.00a.m.

@ Silence zone is defined as an area upto 100 meters around such premises ashospitals, educational institutions and courts. The silence zones are to be declared by the competent authority; Use of horns, loudspeakers and bursting of crackers shall be banned in these zones.

The noise data compiled on noise levels is given in **Table 3.8**. Noise level of the study area varied from 49.7 to 54.0 dB (A) in day time and from 38.3 to 49.2 dB (A) in the night time

**3.7 Water Environment**

**3.7.1 Ground Water Hydrology**

Hydro-geologically the weathered and fractured zones of crystalline constitute the predominant hydro-geological units. Groundwater occurs under phreatic condition in the weathered horizons. Highly weathered and jointed granitic gneisses occurring the undulating plains form the potential aquifers in the hard rock terrain. Micaschists and shales having very thick weathered residuum also sometimes form good shallow aquifers to be tapped through dug wells.

In the study area, ground water occurs under semi-confined and confined aquifer conditions. The quality of ground water at project site is saline.

### 3.7.2 Selection of Sampling Locations

The assessment of present status of water quality within the study area was conducted by collecting water from ground water sources and surface water sources during Monitoring Period. The sampling locations were identified on the basis of their importance. Two (2) surface water samples and three (3) ground water samples were collected during monitoring period.

**Table 3.10: Water Quality Sampling Locations**

Station Code	Location
GW1	Korakkadu
GW2	IOCL Pondicherry BP, Project Site
GW3	Pudukuppam
SW1	Periyairruchampalayam
SW2	Ottiyampedu

### 3.7.3 Methodology

Water samples were collected from all the sampling locations and analyzed for relevant physical, chemical and bacteriological parameters. Collection and analysis of the samples was carried out as per established standard methods and procedures, prescribed by CPCB, relevant IS Codes and Standard Methods of Examination of Water. This report presents data for the Monitoring Period. Analyses of the parameters like temperature; pH, dissolved oxygen and alkalinity were carried out at the sampling stations immediately after collection of samples with the help of Field Analysis Kits. For analysis of other parameters, the samples were preserved and brought to laboratory. The metallic constituents like arsenic, mercury, lead, cadmium, chromium, copper, zinc, selenium, iron and manganese were analyzed with Atomic Absorption Spectroscope.

### 3.7.4 Ground and Surface Water Quality

The analysis data for the monitoring period is presented in **Table 3.11**. The physico-chemical characteristics of Ground water are confirming to permissible limits of drinking water standards, prescribed in IS: 10500 (Test Characteristics for Drinking Water) and suitable for consumption

**Table 3.11: Ground and Surface Water Quality Results**

S.No	Parameter (Characteristic)	Unit	Korrakkadu (GW)	IOCL-Pondicherry (GW)	Pudukuppam (GW)	Periyairruchampalayam (SW)	Ottiyampedu (SW)
01	Turbidity in NTU	NTU	BDL(DL:1.0)	4.4	BDL(DL:1.0)	2.4	4.2
02	Temperature	°C	25.5	25.5	25.2	25.6	25.4
03	pH @ 25°C	--	7.70	7.40	7.16	7.69	7.39
04	Salinity	g/l	0.34	4.42	0.69	0.79	0.89
05	Total Dissolved Solids	mg/l	464	5116	914	1030	1149
06	Alkalinity	mg/l	240	272	360	236	336
07	Total Hardness as CaCO <sub>3</sub>	mg/l	320	2096	464	288	392
08	Calcium as Ca	mg/l	63	482	106	45	59
09	Magnesium as Mg	mg/l	40	146	49	43	57
10	Sodium as Na	mg/l	52	988	103	164	162
11	Potassium as K	mg/l	6	36	16	26	14
12	Chloride as Cl	mg/l	86	1968	158	264	224
13	Sulphate as SO <sub>4</sub>	mg/l	58	586	142	247	266
14	Nitrate as NO <sub>3</sub>	mg/l	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)
15	Total Nitrogen as N	mg/l	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)
16	Total Phosphorous as P	mg/l	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)	BDL(DL:0.1)
17	Phenol as C <sub>6</sub> H <sub>5</sub> OH	mg/l	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
18	Dissolved Oxygen	mg/l	5.8	5.6	5.9	6.0	6.1
19	Chemical Oxygen Demand	mg/l	BDL(DI:4.0)	BDL(DI:4.0)	BDL(DI:4.0)	BDL(DI:4.0)	BDL(DI:4.0)
20	Bio Chemical Oxygen Demand	mg/l	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)
21	Fluoride as F	mg/l	1.6	1.9	1.7	1.2	1.8
22	Iron as Fe	mg/l	0.1	0.24	0.12	0.16	0.2
23	Chromium as Cr <sup>6+</sup>	mg/l	BDL(DL:0.03)	BDL(DL:0.03)	BDL(DL:0.03)	BDL(DL:0.03)	BDL(DL:0.03)
24	Copper as Cu	mg/l	BDL(DL:0.03)	BDL(DL:0.03)	BDL(DL:0.03)	BDL(DL:0.03)	BDL(DL:0.03)
25	Manganese as Mn	mg/l	BDL(DL:0.01)	BDL(DL:0.01)	BDL(DL:0.01)	BDL(DL:0.01)	BDL(DL:0.01)
26	Nickel as Ni	mg/l	BDL(DL:0.03)	BDL(DL:0.03)	BDL(DL:0.03)	BDL(DL:0.03)	BDL(DL:0.03)

27	<b>Aluminium as Al</b>	mg/l	BDL(DL:0.02)	BDL(DL:0.02)	BDL(DL:0.02)	BDL(DL:0.02)	BDL(DL:0.02)
28	<b>Zinc as Zn</b>	mg/l	2.6	12.4	3.9	5.9	5.4
29	<b>Mercury as Hg</b>	mg/l	BDL(DL:0.0005)	BDL(DL:0.0005)	BDL(DL:0.0005)	BDL(DL:0.0005)	BDL(DL:0.0005)
30	<b>Arsenic as As</b>	mg/l	BDL (DL:0.005)	BDL (DL:0.005)	BDL (DL:0.005)	BDL (DL:0.005)	BDL (DL:0.005)
31	<b>Lead as Pb</b>	mg/l	BDL (DL:0.005)	BDL (DL:0.005)	BDL (DL:0.005)	BDL (DL:0.005)	BDL (DL:0.005)
33	<b>Cadmium in mg/l</b>	mg/l	BDL (DL:0.005)	BDL (DL:0.005)	BDL (DL:0.005)	BDL (DL:0.005)	BDL (DL:0.005)

### 3.8 Soil

Soil is generally differentiated into two horizons of minerals and organic constituents of variable depth, which differ from the parent material below in morphology, physical properties, constituents, chemical properties, and composition and biological characteristics.

The physico- chemical characteristics of soil have been determined at 3 locations during the monitoring period with respect to colour, texture, cation exchange capacity, pH, N, P, and K etc. The sampling locations have been selected to represent the study area.

#### 3.8.1 Selection of sampling Locations

The soil sampling locations were identified primarily based on the local distribution of vegetation and the agricultural practices. The sampling locations were mainly selected from agricultural field and project site. The sampling locations are given in **Table 3.12** and presented in **Figure 3.7**.

**Table 3.12: Soil Sampling Stations in the Study Area**

Code	Locations
S1	Periyairruchampalayam
S2	Korrakkadu
S3	Pudukuppam

#### 3.8.1 Methodology

The soil samples were collected during monitoring period. The samples collected from the all locations are homogeneous representative of each location. At random 10 sub locations were identified at each location and soil was dug from 30 cm below the surface. It was uniformly mixed before homogenizing the soil samples. The samples were filled in polythene bags, labeled in the field with number and site name and sent to laboratory for analysis.

#### 3.8.3 Soil Results

The detailed soil results of all the monitoring locations are as shown in **Table 3.13**.

**Table 3.13: Chemical Characteristics of Soil in the Study Area**

S.N	Test Parameters	Method	Unit	Periyairruchampalayam	Korrakkadu	Pudukuppam
01	pH @ 25°C	IS 2720 Part 26:(Reaff:2011)	--	8.26	8.05	8.14
02	Electrical Conductivity @ 25°C	IS 14767: 2000 (Reaff.2010)	µmhos/cm	465	764	658
03	<b>Particle Size Distribution</b>					
	a) 10 mm	IS 2720 - Part 4	%	Nil	0.7	Nil
	b) 4.75 mm	IS 2720 - Part 4	%	1.4	3.7	0.2
	c) 2 mm	IS 2720 - Part 4	%	10.4	12.2	7.8
	d) 425 micron	IS 2720 - Part 4	%	69.7	67.5	80.3
	e) 75 micron	IS 2720 - Part 4	%	14.1	15.6	10.4
04	<b>Texture</b>					
	a. Percent Clay	FAO United Nations Rome,2007	%	16	18	12
	b. Percent Silt	FAO United Nations Rome,2007	%	76	68	82
	c. Percent Sand	FAO United Nations Rome,2007	%	8	14	6
05	Calcium as Ca	ESIPL/SOP/C-S/13	meq/L	4.2	1.2	2.2
06	Magnesium as Mg	ESIPL/SOP/C-S/13	meq/L	0.76	1.02	1.8
07	Sodium as Na(Soluble) in	FAO United Nations Rome,2007	meq/100g	1.6	2.2	2.8
08	Potassium as K(Soluble) in meq/100g	FAO United Nations Rome,2007	meq/100g	0.78	BDL(DL:0.05)	1.23
09	Cation Exchange Capacity in meq/l	FAO United Nations Rome,2007	meq/100g	1.34	1.8	3.3
10	Sodium Absorption Ratio	IS 11624 - 1986	meq/L	1.01	-	1.97



### **3.9 Ecological and Biological Environment**

#### **3.9.1 Objectives**

1. To carry out a systematic baseline survey of flora and fauna around 10 km radius of the project site.
2. To list the plants and animals present in the study area as per the taxonomic position.
3. To identify the impacts of the proposed activities on the plants and animals.
4. To delineate measures to avert negative impacts, if any, and to propose Environmental Management Plan.

#### **3.9.2 Biological Assessment - Flora & Fauna**

A habitat or an area comprises of different kinds of plants and animals within its boundary. The distribution of flora and fauna in the given area represents the biological elements present in the study area, its value, description of community uniqueness, the dominant species, its response to impacts and mitigation measures to overcome any negative impacts. The detailed ecological assessment of the study area has been carried out.

##### ***Flora***

The Study of flora involved intensive sample survey of vegetation in the project site and other locations applying standard methods. The species of vegetation found in each station were identified and listed according to their families, both in dicotyledons and monocotyledons of the plant kingdom.

##### ***Fauna***

Both direct and indirect observation methods were used to survey the fauna. Visual encounter (search) method was employed to record vertebrate species. Additionally survey of relevant literature was also done to consolidate the list of vertebrate fauna distributed in the area.

#### **3.9.3 Description of the Study sites**

The study was carried out in the core and buffer zones including the proposed site. The terrain of the area is undulating with mixed scrub vegetation. There is a River Sangarabarani within the study area. This river flows towards the east and confluences with Bay of Bengal. The entire area is characterized by scrubby elements, representing by Acacias and Prosopis communities.

#### **3.9.4 Assessment of Flora**

##### **Plant Communities**

The Vegetation present within a defined area is termed as a plant community. This is determined by the nature of the dominant species it contains. By the term dominant species or dominance it is understood that species of plants having same life and growth, forms predominating in an area. A systematic order of angiosperm families recorded in the study area is given in **Table 3.14**. It

was observed that the flora, which includes herbs, shrubs and trees, were sparsely distributed in core zone. Around the core zone, the natural vegetation showed moderate growth. The core zone has herbaceous and shrubby vegetation which are scarcely distributed.

Among natural vegetation, the common herbs such as croton, common grasses like *Aristida hystrix*, *Cynodon dactylon*, etc. were in the study areas. Less population of herbs were found in the core zone as compared to the buffer zone.

**Table 3.14: Distribution of flora under different families within project site & up to 10 km buffer zone**

<b>Family</b>	<b>Botanical Name</b>	<b>Type</b>
<b>Alangiaceae</b>	<i>Alangium salvifolium</i>	Tree
<b>Anacardiaceae</b>	<i>Anacardium occidentale</i> , <i>Rhus mysorensis</i>	Tree
<b>Annonaceae</b>	<i>Annona muricata</i>	Tree
<b>Arecaceae</b>	<i>Theriophonum minutum</i> , <i>Areca catechu</i>	Tree
<b>Avicenniaceae</b>	<i>Avicennia marina</i>	Tree
<b>Barringtoniaceae</b>	<i>Carerya arborea</i>	Tree
<b>Oxalidaceae</b>	<i>Averrhoa carambola</i>	Tree
<b>Begoniaceae</b>	<i>Begonia malabarica</i> , <i>Tecomaria capensis</i>	Tree
<b>Bombacaceae</b>	<i>Bombax cciba</i>	Tree
<b>Caesalpiniaceae</b>	<i>Delonix regia</i>	Tree
<b>Caricaceae</b>	<i>Carica papaya</i>	Tree
<b>Celastraceae</b>	<i>Pleurostylia opposite</i>	Tree
<b>Clusiaceae</b>	<i>Calophyllum inophyllum</i>	Tree
<b>Boraginaceae</b>	<i>Carmona retusa</i>	Tree
<b>Combretaceae</b>	<i>Terminalia chebula</i>	Tree
<b>Ebenaceae</b>	<i>Diospyros ovalifolia</i>	Tree
<b>Elaeocarpaceae</b>	<i>Muntingia calabura</i>	Tree
<b>Erythroxylaceae</b>	<i>Erythroxylum monogynum</i>	Tree
<b>Euphorbiaceae</b>	<i>Acalypha ciliata</i>	Tree
<b>Lamiaceae</b>	<i>Plectranthus amboinicus</i>	Tree
<b>Locaniaceae</b>	<i>Strychnos nuxvomica</i> , <i>Strychnos lenticellata</i>	Tree
<b>Lythraceae</b>	<i>Ammania baccifera</i>	Tree
<b>Maganoliaceae</b>	<i>Michelia champaca</i>	Tree
<b>Malpighiaceae</b>	<i>Hiptage benghalensis</i>	Tree
<b>Malvaceae</b>	<i>Abutilon indicum</i>	Tree
<b>Melastomataceae</b>	<i>Osbeckia zeylanica</i>	Tree

<b>Meliaceae</b>	<i>Aglaia elaeagnoidea</i>	Tree
<b>Mimosaceae</b>	<i>Prosopis spicigera</i>	Tree
<b>Moraceae</b>	<i>Artocarpus heterophyllus</i>	Tree
<b>Myristicaceae</b>	<i>Myristica fragrans</i>	Tree
<b>Myrtaceae</b>	<i>Callistemon citrinus</i>	Tree
<b>Nyctanthaceae</b>	<i>Nyctanthes arbor-tristis</i>	Tree
<b>Rramnaceae</b>	<i>Scutia myrtina</i>	Tree
<b>Rhizophoraceae</b>	<i>Rhizophora mucronata</i>	Tree
<b>Rosaceae</b>	<i>Rosa centifolia</i>	Tree
<b>Rubiaceae</b>	<i>Tarenna asiatica</i>	Tree
<b>Rutaceae</b>	<i>Aegle marmelos</i>	Tree
<b>Salvadoraceae</b>	<i>Salvadora persica</i>	Tree
<b>Santalaceae</b>	<i>Santalum album</i>	Tree
<b>Sapindaceae</b>	<i>Allophylus serratus</i>	Tree
<b>Sapotaceae</b>	<i>Chrysophyllum canito</i>	Large tree
<b>Sterculiaceae</b>	<i>Guazuma ulmifolia</i>	Large tree
<b>Tiliaceae</b>	<i>Triumfetta rotundifolia</i>	shrub
<b>Araccae</b>	<i>Acorus calamus,</i> <i>Amorphallus sylvaticus</i>	Tree
<b>Aristolochiaceae</b>	<i>Aristolochia bracteolata</i>	Herbs
<b>Asepladaccae</b>	<i>Calotropis procera, Ceropogia</i> <i>juncea, Gymnema sylvestre</i>	Shrubs
<b>Caesalpinlaccae</b>	<i>Saraca asoca</i>	Tree
<b>Capparaccae</b>	<i>Crateva adansonii</i>	Climber
<b>Fabaccae</b>	<i>Abrus precatorius,</i> <i>Derris ovalifolia,</i> <i>Ormocarpum senses</i>	Tree
<b>Hypoxidaccae</b>	<i>Curculigo orchioides</i>	Herb
<b>Lillaccae</b>	<i>Gloriosa superba</i>	Herb
<b>Magnoliaccae</b>	<i>Michelia champaca</i>	Tree
<b>Mimosaccae</b>	<i>Prosopsis cineraria</i>	Tree
<b>Rutaccae</b>	<i>Aegle marmelos</i>	Tree
<b>Santalaccae</b>	<i>Santalum album</i>	Tree
<b>Zingiberaccae</b>	<i>Alpinia galanga</i>	Herb

Source: State Forest Department

### Life form

The life, form in a broad sense, is meant the characteristic vegetative appearance such as the size, shape, branching etc. The life form observed in the study area reveals that there are several communities ranging from open grassland, succulent perennials (*Opuntia* sps. and *Euphorbia*

sps), and small annual plants. The kinds of life forms, the number of individuals of each kind and their spacing gives a good structure to the community.

### **Status of the plants**

There is no endangered, threatened, or rare species of plants recorded in the study area.

### **Assessment of Fauna**

The details of fauna found in core zone and buffer zone are given in **Table 3.15**

**Table 3.15: List of fauna recorded within 10 km surroundings of the Project site**

<b>Common Name</b>	<b>Scientific Name</b>	<b>Status</b>
<b>Mammals</b>		
Common cat	<i>Felis silvestris catus</i>	Common
Common dog	<i>Canis lupus familiaris</i>	Common
Common cow	<i>Bos taurus</i>	Common
Domestic buffalo	<i>Bubalus bubalis</i>	Common
Goat	<i>Capra hircusaegagrus</i>	Common
Squirrel	<i>Funambulus palmarum</i>	Common
Indian grey mongoose	<i>Herpestes edwardsii</i>	Scarce
<b>Reptiles (other than snakes)</b>		
Common Garden Lizard	<i>Calotes versicolor</i>	Common
Mugger or Marsh crocodile	<i>Crocodylus palustris</i>	Common
Starred Tortoise	<i>Geochelone elegans</i>	Common
Southern House Gecko	<i>Hemidactylus frenatus</i>	Common
Indian Flap-Shelled Turtle	<i>Lissemys punctata</i>	Common
Common Skink	<i>Mabuya carinita</i>	Common
Indian Pond terrapin	<i>Melanochelys trijuga</i>	Common
Fan-throated lizard	<i>Sitana ponticeriana</i>	Common
Common Indian Monitor	<i>Varanus bengalensis</i>	Common
<b>Snakes</b>		
Common vine snake	<i>Ahaetulla nasutus</i>	Common
Striped keel back snake	<i>Amphiesma stolata</i>	Common
Common cat snake	<i>Boiga trigonata</i>	Common
Common krait	<i>Bungarus caeruleus</i>	Common
Dog-faced water snake	<i>Cerberus rhynchops</i>	Common
Common bronze back tree snake	<i>Dendrela ,phis tristis</i>	Common
Saw scaled viper	<i>Echis carinatus</i>	Common

Common trinket	<i>Elaphe Helena</i>	Common
Hook nosed sea snake	<i>Enhydrina schistos</i>	Common
Common sand boa	<i>Eryx conicus</i>	Common
Rat snake or Dhaman	<i>Gonyosoma mucosus</i>	Common
Colubrine amphibious sea snake	<i>Laticanda colubrine</i>	Common
Common wolf snake	<i>Lycodon aulicus</i>	Common
Spectacled or common cobra	<i>Naja naja naja</i>	Common
Common kukri snake	<i>Oligodon arnensis</i>	Common
Russels kukri snake	<i>Oligodon taeniolatus</i>	Common
Green keel back snake	<i>Pseudoxenodon plumbicolor</i>	Common
Cheekered keel back snake	<i>Pseudoxenodon piscator</i>	Common
Olive keel back water snake	<i>Pseudoxenodon schistosum</i>	Common
Common worm snake	<i>Typhlina bramina</i>	Common
Slender worm snake	<i>Typhlina porrectus</i>	Common
Russels viper	<i>Vipera russellii</i>	Common
<b>Fishes and Crustaceans</b>		
Mackerels	<i>Rastrelliger sp</i>	Common
Oil Sardines	<i>Sardinella longiceps</i>	Common
White sardine	<i>Sardinella albella</i>	Common
Tuna	<i>Allothunnus fallai</i>	Scarce
Pomfrets	<i>Brama brama</i>	Scarce
Silver Pomfret	<i>Pampus argenteus</i>	Scarce
Blue butterfish	<i>Stromateus fiatola</i>	Common
Hilsa	<i>Hilsa llisha</i>	Common
Bombay duck	<i>Harpodon nehereus</i>	Common
Flying fish	<i>Exocoetus spp.</i>	Scarce
Jumping halfbeak	<i>Hemiramphus archipelagicus</i>	Scarce
Hooghly halfbeak	<i>Zenarchopterus striga</i>	Scarce
Spadenose shark	<i>Scoliodon laticaudus</i>	Scarce
Great Barracuda	<i>Sphyraena barracuda</i>	Common
Croaker	<i>Leuciscus leuciscus</i>	Common
Purple-Spotted Bigeye	<i>Priacanthus tayenus</i>	Common
Ribbon fish	<i>Trichiurus lepturus</i>	Common
Thread herring	<i>Opisthonema libertate</i>	Common

Milk fish	<i>Chanos chanos</i>	Common
Indian pellona	<i>Pellona ditchela</i>	Common
Horseface loach	<i>Acantopsis choirorhynchos</i>	Common
Guntea loach	<i>Lepidocephalichthys guntea</i>	Scarce
Rainbow sardine	<i>Dussumieria acuta</i>	Common
Spottail shark	<i>Carcharhinus sorrah</i>	Scarce
Pondicherry shark	<i>Carcharhinus hemiodon</i>	Scarce
Java spaghetti eel	<i>Moringua javanica</i>	Common
Rice-paddy eel	<i>Pisodonophis boro</i>	Scarce
Indian anchovy	<i>Stolephorus indicus</i>	Common
Indian pike conger	<i>Congresox talabonoides</i>	Common
Indian cod	<i>Bregmaceros mccllelandi</i>	Common
Indian lizardfish	<i>Synodus indicus</i>	Common
Attenuated spider fish	<i>Bathypterois atricolor</i>	Common
Bartail flathead	<i>Platycephalus indicus</i>	Common
Clown featherback	<i>Chitala lopis</i>	Common
Golden Snapper	<i>Centroberyx affinis</i>	Common
Blue Herring	<i>Alosa chrysochloris</i>	Common
Mola carplet	<i>Amblypharyngodon mola</i>	Common
Giant snakehead	<i>Channa micropeltes</i>	Common
Murrel	<i>Channa striata</i>	Common
Bighead carp	<i>Aristichthys nobilis .</i>	Common
Naked breast trevally	<i>Decapterus ruselli</i>	Common
Malabar trevally	<i>Carangoides malabaricus</i>	Common
Scad	<i>Alepes mate</i>	Common
Indus baril	<i>Barilius modestus</i>	Common
Horse mackerel	<i>Megalaspis cordyla</i>	Common
Giant freshwater Prawn	<i>Macrobrachium spp.</i>	Common
Rainbow runner	<i>Elagatis bipinnulata</i>	Common
Tilapia	<i>Sarotherodon mossambica</i>	Common
Indian longfin eel	<i>Anguilla bengalensis</i>	Common
Boal	<i>Wallogo attu</i>	Common
Red Mullet	<i>Mullus barbatus</i>	Common

Ribbon Fish	<i>Lepturacanthus saval</i>	Common
Green crab	<i>Scylla serrata</i>	Common
Tiger prawn	<i>Penaeus monodon</i>	Common
White prawn	<i>Penaeus indicus</i>	Common
<b>Birds</b>		
Shikra	<i>Accipiter badius</i>	Common
Common Myna	<i>Acridotheres tristis</i>	Common
Blyth 's Reed Warbler	<i>Acrocephalus dumetorum</i>	Common
Great Reed Warbler	<i>Acrocephalus stentorcus</i>	Common
Common lora	<i>Aegithina tiphia</i>	Common
Eastern Skylark	<i>Alauda gulgwla</i>	Common
Common Kingfisher	<i>Alcedo atthis</i>	Common
White breasted water hen	<i>Amaurornis phoenicurus</i>	Common
Pintail	<i>Anas acute</i>	Common
Shoveller	<i>Anas clypeata</i>	Common
Common Teal	<i>Anas crecca</i>	Common
Spot bill Duck	<i>Anas poecilorhyncha</i>	Common
Open bill Stork	<i>Anastomus oscitans</i>	Common
Darter or Snake Bird	<i>Anhinga rufa</i>	Common
Bar headed Goose	<i>Anser indicus</i>	Common
Paddy field Pipit	<i>Anthus novacseelandiae</i>	Common
Large Egret	<i>Ardea alba</i>	Common
Grey Heron	<i>Ardea cinerea</i>	Common
Purple Heron	<i>Ardea purpurea</i>	Common
Pond Heron	<i>Ardebla grayii</i>	Common
Little Green Heron	<i>Ardeola Striatus</i>	Common
Spotted Owlet	<i>Athene brama</i>	Common
Cattle Egret	<i>Bubulcus Idis</i>	Common
White-eyed Buzzard Eagle	<i>Butastur teesa</i>	Common
Indian Plaintive Cuckoo	<i>Cacomantis merulinus</i>	Common
Curlew-Sandpiper	<i>Calidris ferruginea</i>	Common
Little Stint	<i>Calidris minuta</i>	Common
Temminck's Stint	<i>Calidris temminckii</i>	Common
Common Nightjar	<i>Caprimulgus asiaticus</i>	Common
Crow - Pheasant	<i>Centropus sinensis</i>	Common
Lesser Pied Kingfisher	<i>Ceryle rudis</i>	Common
Kentish Plover	<i>Charadrius alexadrinus</i>	Common
Little Ringed plover	<i>Charadrius dubius</i>	Common

Lesser Sand Plover	<i>Charadrius mongolus</i>	Common
Whiskered Tern	<i>Chlidonias hybrida</i>	Common
White necked Stork	<i>Ciconia episcopus</i>	Common
Short-toed Eagle	<i>Circus gailicus</i>	Common
Pied Harrier	<i>Circus melanoteucos</i>	Common
Montagu's Harrier	<i>Circus pygargus</i>	Common
Blue Rock Pigeon	<i>Colunda livia</i>	Common
Magpie-Robin	<i>Copsychus saularis</i>	Common
Indian Roller or Blue jay	<i>Coracias benghalensis</i>	Common
Black headed Cuckoo	<i>Coracina melanoptera</i>	Common
Jungle Crow	<i>Corvus macrorhynchos</i>	Common
House Crow	<i>Corvus sales</i>	Common
Common Hawk Cuckoo	<i>Cuculus varius</i>	Common
Palm Swift	<i>Cypsiurus parvus</i>	Common
Indian Tree Pie	<i>Dendrocitta Vagabunda</i>	Common
Tickell's Flower pecker	<i>Dicaeum erythrorhynchos</i>	Common
Black Drongo	<i>Dicrurus adsimilis</i>	Common
Lesser Golden backed Woodpecker	<i>Dinopium benghalense</i>	Common
Little Egret	<i>Egretta garzetta</i>	Common
Indian Reef Heron	<i>Egretta gulatis</i>	Common
Smaller or Median Egret	<i>Egretta intermedia</i>	Common
Black winged Kite	<i>Elanus caeruicus</i>	Common
Ashy crown Finch-Lark	<i>Eremopterix grisea</i>	Common
Koel	<i>Eudynamys scolopacea</i>	Common
Kestrel	<i>Faleo tinnunculus</i>	Common
Grey partridge	<i>Francolinus pondicerianus</i>	Common
Coot	<i>Fulica atra</i>	Common
Common Snipe	<i>Gallinago gailinago</i>	Common
Indian Moorhen	<i>Gallinula chloropus</i>	Common
White breasted Kingfisher	<i>Halcyon smyrnensis</i>	Common
Black winged Stilt	<i>Himantopus himantopus</i>	Common
Swallow	<i>Hirundo rustica</i>	Common
Pheasant - tailed Jacana	<i>Hydrophasianus chirurgus</i>	Common
Chestnut Bittern	<i>Ixobrychus cinnamomeus</i>	Common
Little Bittern	<i>Ixobrychus minutus</i>	Common
Yellow Bittern	<i>Ixobrychus sinensis</i>	Common
Brown Shrike	<i>Lanius cristatus</i>	Common
Bay backed Shrike	<i>Lanius vittatus</i>	Common



Herring Gull	<i>Larus argentatus</i>	Common
Brown headed Gull	<i>Larus brunnicephalus</i>	Common
White throated Munia	<i>Lonchura malabarica</i>	Common
Black headed Munia	<i>Lonchura malacca</i>	Common
Spotted Munia	<i>Lonchura punctulata</i>	Common
White backed Munia	<i>Lonchura striata</i>	Common
Green Bee-eater	<i>Merops orientalis</i>	Common
Bronze winged Jacana	<i>Metopidius indicus</i>	Common
Grey Wagtail	<i>Motacilla caspica</i>	Common
Yellow headed Wagtail	<i>Motacilla citreola</i>	Common
Yellow Wagtail	<i>Motacilla flava</i>	Common
Large Pied Wagtail	<i>Motacilla maderaspatensis</i>	Common
Brown Flycatcher	<i>Muscicapa latirostris</i>	Common
Painted Stork	<i>Mycteria leucocephala</i>	Common
Purple Sunbird	<i>Nectarinia asiatica</i>	Common
Red crested Pochard	<i>Netta rufzna</i>	Common
Cotton Teal	<i>Nettapus coromandelianus</i>	Common
Night Heron	<i>Nycticorax nycticorax</i>	Common
Golden Oriole	<i>Oriolus oriolus</i>	Common
Tailor Bird	<i>Orthotomus sutorius</i>	Common
Osprey	<i>Pandion haliaetus</i>	Common
House Sparrow	<i>Passer domesticus</i>	Common
Grey or Spotted billed Pelican	<i>Pelecanus philippensis</i>	Common
Large Cormorant	<i>Phalacrocorax cargo</i>	Common
Little Cormorant	<i>Phalacrocorax niger</i>	Common
Dull Green Leaf Warbler	<i>Phylloscopus trochiloides</i>	Common
Spoon bill	<i>Platalea leucorodia</i>	Common
Weaver Bird	<i>Ploceus bengalensis</i>	Common
Grey Plover	<i>Pluvialis squatarola</i>	Common
Ashy Wren Warbler	<i>Prinia socialis</i>	Common
Rose ringed Parakeet	<i>Psittacula krameri</i>	Common
Red vented Bulbul	<i>Pycnonotus cater</i>	Common
Black bellied Tern	<i>Sterna acuticauda</i>	Common
Little Tern	<i>Sterna andirons</i>	Common
Conunon Tern	<i>Sterna hirundo</i>	Common
Indian Spotted Dove	<i>Streptopelia chinensis</i>	Common
Indian Ring Dove	<i>Streptopetia decaocto</i>	Common
Grey headed Myna	<i>Sturnus malabaricus</i>	Common

Brahminy Myna	<i>Sturnus pagadorum</i>	Common
Paradise Flycatcher	<i>Terpsiphone paradise</i>	Common
Wood or Spotted Sandpiper	<i>Tringa glareola</i>	Common
Common Sandpiper	<i>Tringa hypoleucos</i>	Common
Marsh Sandpiper	<i>Tringa states</i>	Common
Terek Sandpiper	<i>Tringa terek</i>	Common
Common Redshank	<i>Tringa totanus</i>	Common
White headed Babbler	<i>Turdoides affinis</i>	Common
Hoopoe	<i>Upupa epops</i>	Common
Red wattled Lapwing	<i>Vanellus indicus</i>	Common
Yellow wattled Lapwing	<i>Vanellus malabaricus</i>	Common
<b>Butterflies</b>		
Common leopard	<i>Atella phalanta</i>	Common
Common Pierrot	<i>Castalius rosimon</i>	Common
Common emigrant	<i>Catopsilia crocale</i>	Common
Common gull	<i>Cepora nerissa phryne</i>	Common
Black raja	<i>Charaxes fabius</i>	Common
Common mine	<i>Chilasa clytia</i>	Common
Small salmon arab	<i>Colotis amata</i>	Common
Plain orange tip	<i>Colotis eucharis</i>	Common
Large salmon arab	<i>Colotis fausta fulvia</i>	Common
Plain tiger	<i>Danais chrysippus</i>	Common
Dark blue tiger	<i>Danais melissa dravidarum</i>	Common
Common tiger	<i>Danais plexippus</i>	Common
Common jezebel	<i>Delias eucharis</i>	Common
Angled castor	<i>Ergolis ariadne</i>	Common
South Indian common castor	<i>Ergolis merione taprobana</i>	Common
Common Indian crow	<i>Euploea core</i>	Common
Common grass yellow	<i>Eurema hecabe simulata</i>	Common
Baron	<i>Euthalia garuda</i>	Common
Indian cupid	<i>Everes parrhasius</i>	Common
Tailed jay	<i>Graphium agamemnon</i>	Common
Common bluebottle	<i>Graphium sarpedon teredon</i>	Common
Great egg fly	<i>Hypolimnas bolina</i>	Common
Common mormon	<i>Papiliopolytes romulus</i>	Common
Common rose	<i>Polydorus aristolochiae</i>	Common
Crimson rose	<i>Polydorus hector</i>	Common
Peacock pansy	<i>Precis almana</i>	Common

Grey pansy	<i>Precis atlites</i>	Scarce
Yellow pansy	<i>Precis hierta</i>	Common
Chocolate pansy	<i>Precis iphita pluviatilis</i>	Scarce
Lemon pansy	<i>Precis lemonias vaisya</i>	Scarce
Blue pansy	<i>Precis orithya swinhoei</i>	Common
Common silverline	<i>Spindasis vulcanus</i>	Scarce
Tawny castor	<i>Telchinia violae</i>	Common
<b>Dragonflies and Damselflies</b>		
Crimson marsh glider	<i>Trithemis aurora</i>	Common
Ditch jewel	<i>Brachythemis contaminata</i>	Common
Ground skimmer	<i>Diplocodes trivialis</i>	Scarce
Long legged marsh skimmer	<i>Trithemis pallidinervis</i>	Scarce
Blue grass dartlet	<i>Pseudagrion microcephalum</i>	Common
Golden dartlet	<i>Ischnura aurora</i>	Common
Yellow bush dart	<i>Copera marginipes</i>	Common
Senegal golden dartlet	<i>Ischnura senegalensis</i>	Scarce

### 3.9.6 Observations

- The insects in the study area are interrelated with each other. Some of them act as pests, while others are useful and beneficial to the environment and human beings.
- The reptiles recorded in the study area are represented by wide varieties of snakes and others, including aquatic and terrestrial habitats.
- Birds play an important role in understanding the ecological balance and its interrelationships. The occurrence of birds in various locations largely depends on the site characteristics, and their presence in different study sites reveals that there is a good relationship between the birds and other organisms in the environment.
- The distribution of mammals is largely dependent upon the environment of the respective areas. The mammals present in the study area include mongoose, Indian palm squirrel and domestic animals. Since there are no forests in the area, wild animals were not recorded.

## 3.10 Socio-Economic Environment

### 3.10.1 Introduction

Socio-economic assessment is an important part of the Environment Impact Assessment of any industrial project. It is conducted to develop the sustainability strategy for the area, where the

industrial project would be executed. This section studies the socio-economic profile of the study area for the IOCL Pondicherry project and analyses the baseline status as well as assess the social impacts of the projects in the study area and suggest mitigation measures to the anticipated adverse impacts of the project. The socio-economic aspects in general, divided into economy, demography, education, health, employment & infrastructure in the study area.

### **3.10.2 Project Location**

The proposed project i.e. M/s Indian Oil LPG bottling plant is located in the Village: Odiampet, Taluk: Villianur, District: Pondicherry in Pondicherry Union Territory at latitude 11°53'44.33"N and longitude 79°46'03.39"E.

### **3.10.3 Pondicheery: Basic Information**

Pondicherry district is the largest district of Pondicherry Union Territory and geographically spread over an area of 294 sq. km. and is administratively divided into four Taluks (Pondicherry, Ozhukarai, Villianur, Bahour). As per the 2011 census Pondicherry district has a population of 9.5 lakhs representing 76.15 percent of the UT population. The district has a population density of 3232 persons per sq. km. Its population growth rate over the decade 2001-2011 was 29.23 percent. Pondicherry district has a sex ratio of 1029 females for every 1000 males, and a literacy rate of 85.44 percent. There are around 62 villages in the district with 6 towns.

**Table 3.16: Demographic Attributes for Pondicherry**

1.	Area	294 sq. km.
2.	Population	9.5 Lakhs
3.	Decadal Growth rate	29.23 %
4.	Male population	4.68 lakhs
5.	Female population	4.82 lakhs
6.	Density of population (persons per km <sup>2</sup> .)	3232
7.	Sex Ratio (females per 1000 males)	1029
8.	Literacy	85.44 %
9.	Male literacy	91.23 %
10.	Female literacy	79.86 %
11.	Urban Population	69.16 %

Source: District Census Handbook, Puducherry, Census of India 2011

### **3.10.4 Socio-Economic Details of Study Area**

The data is collected and analysed using secondary sources viz. District Census Handbook, Statistical Abstract, Official Documents etc. The study area is spread over the district of Pondicherry in Pondicherry UT. The demographic profile, infrastructure facilities and socio-economic condition is being described under different classifications in the following section.

### ***3.10.5 Methodology***

The data is collected and analysed using secondary sources. The secondary data was collected and collated from sources such as viz. District Census Handbook 2011, Census of India website, District Statistical Abstract etc

### ***3.10.6 Demography***

In 2011, Pondicherry had population of 950,289 of which male and female were 468,258 and 482,031 respectively. Pondicherry District population constituted 76.15 percent of total Pondicherry UT population. There was change of 29.23 percent in the population compared to population as per 2001. In the previous census of India 2001, Pondicherry District recorded increase of 20.88 percent to its population compared to 1991.

In 2011, the Density of population in Pondicherry district is 3,232 people per sq. km. In 2001, Pondicherry district density was at 2,510 people per sq. km. Pondicherry district administers 294 square km of areas.

### ***3.10.7 Vulnerable Population***

According to the 2011 census, the ratio of scheduled caste population to the total population is 16.04 percent in Pondicherry district and there is no Scheduled Tribe population in the district. If things are looked out at gender wise, male and female Scheduled Caste population were 15.83 percent and 16.24 percent respectively. The Scheduled Caste population in the district is more or less same as compared to the ratio of the SC population in Pondicherry UT which is 15.73 percent.

### ***3.10.8 Literacy***

Average literacy rate of Pondicherry in 2011 were 85.44 percent compared to 80.66 percent of 2001. If things are looked out at gender wise, male and female literacy were 91.23 and 79.86 respectively. For 2001 census, same figures stood at 88.44 percent and 72.84 percent in Pondicherry District. Total literate in Pondicherry District were 726,649 of which male and female were 380,946 and 345,703 respectively. In 2001, Pondicherry District had 522,782 in its district.

### ***3.10.9 Economic Activity***

As per the Census 2011, the workforce in the Pondicherry district is 348,105 which constitute 36.63 percent of the total population of the study area. The workers comprise more than 315,570 main workers and 32,535 marginal workers. Of the 348,105 workers, 112,480 are rural and 235,625 are urban workers. This would mean that only 32.31 percent of the total workers are

rural and 67.69 percent of the total workers are urban workers. The number of rural workers is about less than half the number of urban workers.

Main workers<sup>1</sup> constitute 90.65 percent of the total workers. The remaining (9.35 percent) are marginal workers<sup>2</sup>. Among the main workers, female workers, are only 24.60 percent and 75.40 percent are male workers. Majority of main workers (70.36 percent) are from urban areas.

### Occupational structure

The occupational structure of the population in the Pondicherry district has been studied. The Main workers are classified on the basis of Industrial category of workers into the following four categories:

1. Cultivators
2. Agricultural Labourers
3. Household Industry Workers
4. Other Workers

Of the total main workers in the study area, about 83 percent is engaged in the other workers category. The type of workers that come under this category of 'Other Worker' include all government servants, municipal employees, teachers, factory workers, plantation workers, those engaged in trade, commerce, business, transport banking, mining, construction, political or social work, priests, entertainment artists, etc. In effect, all those workers other than cultivators or agricultural labourers or household industry workers are 'Other Workers'.

**Table 3.17: Distribution of Main Workers by Category**

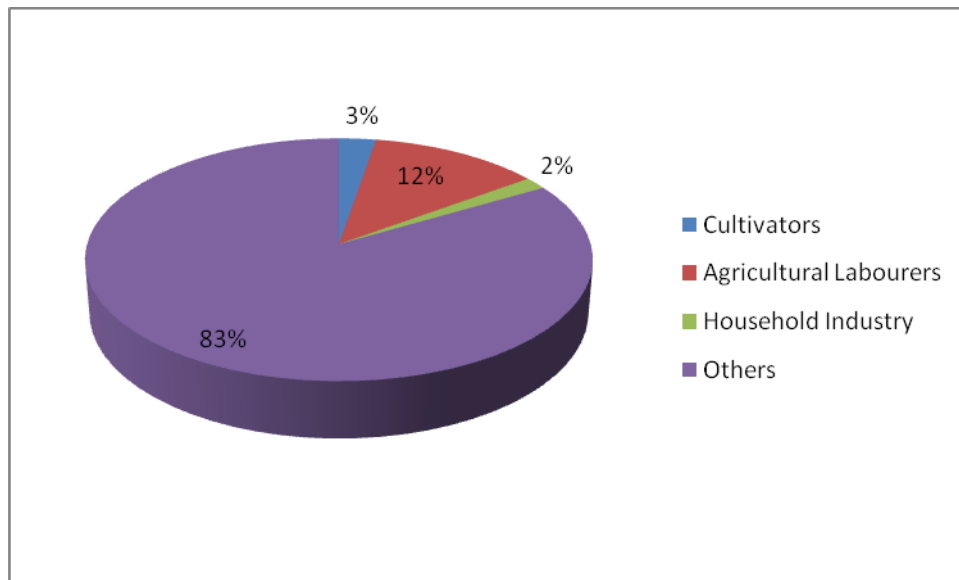
	Main Workers	Main Workers			
		Cultivators	Agricultural Labourers	Household Industry	Others
Rural	93,536	6,247	35,087	1,491	50,711
Urban	222,034	2,158	3,767	3,712	212,397
Total	315,570	8,405	38,854	5,203	263,108

After other workers category, cultivators (3 percent) and agricultural labour (12 percent) together constitute 15 percent of the total main workers. It reflects that agricultural sector has only absorbed 15 percent of the main workers. Most of the main workers engaged in agricultural sector as cultivators & agricultural labourers are rural (87.46 percent) in nature. Of the Only 2 percent of workers in the study area are engaged in the household industry. In the other workers

<sup>1</sup> Main workers were those who had worked for the major part of the year preceding the date of enumeration i.e., those who were engaged in any economically productive activity for 183 days (or six months) or more during the year.

<sup>2</sup> Marginal workers were those who worked any time at all in the year preceding the enumeration but did not work for a major part of the year, i.e., those who worked for less than 183 days (or six months).

category, 80.72 percent of the total main workers in other category are urban in nature whereas only 19.28 percent are rural in nature. Thus it reflects that the opportunities for other category workers are more in urban areas of the Pondicherry district as compared to the rural areas.



**Figure 3.9: Percentage Distribution of Main Workers in the Study Area**

The high level of urbanization of the district, low level of engagement in agriculture and the low WPR for females compared to India and in all the neighbouring States depress the work participation rates in the district. Generally, the patterns of work participation in the different districts of the UT closely follow the patterns in the adjacent States.

Ratio of employment in the district does not increase proportionate to the level of education. The non-literate persons, males or females in the rural or urban areas seem to have better employment opportunities. In fact, in the case of females in the rural areas, non-literates have their highest ratio of employment and it decreases disproportionately to the level of education. This scenario is reflective of the general situation of educated unemployed in the country.

### **Infrastructure**

The Pondicherry district consists of 62 villages, 6 towns. The area is more urban in nature with 69.16 percent as urban population and only 30.84 as urban population. This section analyses the infrastructure facilities like water supply, roads, markets, banks, post offices, schools and electrification in the study area. Pondicherry town, the district headquarter is the biggest urban pocket in the district with excellent physical and social infrastructure and basic amenities.

### **Education**

Educational facilities in this Territory is a well developed one comprising of different institutions of learning well spread over the entire regions of this Territory.

**Access**

Access to education in the district is of a high order, conforming to All India norms. About 90 percent of the villages had primary schools located within the habitations themselves and the rest 10 percent had primary schools located within one kilometre of walking distance.

**Enrolment**

At all levels of education in the district, primary to higher secondary, girls and boys have more or less equal size of enrolment. The Gross enrolment ratio of girls at the various levels is not significantly lesser than of boys. The number of girls enrolled per 100 boys is 94 at the primary level, 92 at the elementary level and 96 at the secondary level. In fact, at the higher secondary level the number of girls enrolled per 100 boys is 104.

**Quality**

One of the indicators of quality of education is the availability of adequate number of teachers, especially trained teachers. Lesser the number of pupils a teacher handles better is the attention to the pupils and therefore the quality of education given. Pupil teacher ratio in Pondicherry is generally much better than in other South Indian States. This is especially true of primary and upper primary levels of education. Generally, in Pondicherry as well as other South Indian States, pupil-teacher ratio is better in urban areas than in rural areas in primary and secondary levels.

**Higher Education**

Pondicherry has, apart from a University, 33 higher educational institutions 11 Arts, Science and Commerce Colleges, 5 Engineering, Technical and Architecture Colleges, 6 Medical Colleges, 5 Teacher Training Colleges and 6 other Institutions imparting education in Law, Management, Information Technology and Agriculture. Further, there are 10 Teacher Training Schools, 5 Polytechnics and 14 Technical Schools.

While the enrolment of the girls for higher education is more or less equivalent to that of boys (9,233 girls as against 9,691 boys), their enrolment in Polytechnics is much lesser 674 against 1,118. Their enrolment in Teacher Training Schools is higher than of boys 287 against 160.

**Health Infrastructure**

Medical and health facility in this district is quite satisfactory. There are 12 primary health centres and eight hospitals, besides Jawaharlal Institute of Post-graduate Medical Education and Research (JIPMER). There are 412 doctors and 599 nursing staff in Government service." Apart from these Governmental institutions, there are a number of private nursing homes and private doctors providing health service to the people. However, majority (86) of these institutions are in Pondicherry region.



Pondicherry has a health care infrastructure superior to that in existence in the rest of India despite the logistical problems that the district has in facilitating access to medical services. It has also been estimated that more than 40% of the patients accessing medical care in Pondicherry are from the adjoining States of Tamil Nadu. Access to medical care is available for the people of the UT within an average distance of less than 1.18 km. The district is significantly better off in provision of health access facilities.

Pondicherry also ranks quite high compared to India as a whole in terms of fulfilment of national norms in respect of several health infrastructure indicators. The health policy and strategy of Pondicherry is one of comprehensively addressing the issues arising out of preventive and curative problems. Health protection, promotion and rehabilitation are given attention in a holistic manner.

### **Access to Safe Drinking Water**

The people of Pondicherry have reasonably good access to safe drinking water. As of 2011, 89% of the households had access to safe drinking water. Tube wells are the chief source of protected water supply for many villages in the Pondicherry district. This also reflects an eight-percentage point increase over the households having access to safe drinking water in the year 2001. In this respect, the situation in Pondicherry is far better than the All India picture. The All India figure (2011) of households having access to safe drinking water was 62.30% only.

**Post and Telegraph** facility is available in all the villages and towns of district. Although phone connections are available in most of the villages but people tend to use mobile phones for communication.

### **Road and Rail connectivity**

Pondicherry is endowed with infrastructural facilities on par with the best available in India. A network of all-weather metalled roads connecting every village exists in the territory. Pondicherry has a road length of 2552 km (road length per 4.87 km<sup>2</sup>), the highest in the country. Pondicherry is well connected to most of the major towns of southern India by road. Pondicherry and Chennai are well linked through picturesque East Coast Road (ECR) road.

The roads are classified as national highways, state highways, district and other roads and rural roads. There are 63 kms of National Highways, 35 kms of State Highways, 295 kms of District and Other Roads, 212 kms of Rural Roads in the Union Territory of Pondicherry. These roads are maintained and improved by Public Works department. Due to execution of various major works, all the villages are connected with the arterial roads.

Pondicherry is connected through a meter gauge (being converted to broad gauge) railway line with Villupuram. There is only one railway station between Pondicherry and Villupuram i.e. Villianur. Pondicherry is connected with Chennai by Broad Gauge railway line via Villupuram

### **Electrification**

The proportion of electrified villages for the study area is impressive. All villages and town are enjoying power supply facility for all the purposes. With all the Towns and villages electrified in as early as 1972, the district is 100% electrified.

### **Economy**

Despite of the high degree of urbanisation, about 15% of the people depend on agriculture for their livelihood. Beside rice and some other food crops, like ragi, bajra and pulses, a number of cash crops like sugarcane, cotton and groundnuts are also produced in Pondicherry.

Milk production and distribution is well organised and it is largely in the cooperative sector. A well established modern dairy is one of the achievements of Pondicherry.

Fishery is an important occupation as the Union Territory has a total length of about 45 km of coastline. There is sea fishing villages in the district, while some are engaged purely in inland fishing. The inland fishery depends on lakes, ponds, tanks and river water. Main item exported includes rice, fish, hides and skin etc.

There are 23 large and 79 medium scale industries. There are also 5, 400 small scale industries. All these generate employment opportunities to nearly 50,000 persons.

### **Agriculture**

Nearly 15 per cent of the population of the Pondicherry district is engaged in agriculture and allied pursuits. Ninety per cent of the cultivated area is irrigated. Paddy is the predominant crop followed by pulses.

### **Industry**

With an investment of over Rs. 1,429 crore, 6.607 industries are providing employment to 77,341 persons as on 31 March 2001. The number of industrial units registered up to May 2001 is 6,634 units. The total value of production from these industrial units works out to Rs. 9,141.34 crore. The industrial units are manufacturing items such as textiles, computers and peripherals, UPS and other electronic products, consumer durables, fast moving consumer goods, pharmaceuticals, leather goods, earth moving equipments, sugar, yarn, spirit, beer, potassium chlorate, rice-bran oil, auto parts, disposable syringes, roofing sheets, washing machines, biopolymers, steel tubes, LPG cylinders, etc. The export value of various products manufactured by the industries was Rs.307.31 crore during 1999-2000.

**Irrigation**

Irrigation in Pondicherry is mainly through tanks and tube wells. There are 84 tanks with an ayacut of 6,456 hectare of which tow are comparatively bigger (Oustery and Bahour). In addition, there were 84 surface water storage irrigation tanks with a total command area of 6,765 ha, and with a water holding capacity of 46.4 mcm. There were also 140 small tanks for harvesting surface water. The number of bore well has increased to about 7,000 from nearly 1,000 in the early sixties. Nearly 90 per cent of the net cropped area is now under irrigation. During 2001-02, 13 tanks have been identified for rehabilitation and community organising works have been completed in 12 tanks.

## **CHAPTER 4. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES**

### **4.1 Introduction**

Identification of impacts and mitigation measures of the same in Environmental Impact Assessment study helps in quantification and evaluation of impacts. During baseline study several impacts can be identified but it is necessary to identify the critical impacts both positive and negative on various components of the environment that are likely due to installation of LPG mounded bullets.

The environmental impacts can be categorized as either primary or secondary. Primary impacts are the ones that are caused directly due to the project activity on environmental attributes, whereas secondary impacts are indirectly induced.

The construction and operational phase of the project activity comprises various activities, each of which may have either positive or negative impact on some or other environmental attributes. The proposed project activities would impart impact on the environment in two distinct phases:

- ✚ During construction phase - Temporary or short term impact
- ✚ During operation phase - May have long term impact

### **4.2 Impact Assessment**

#### ***4.2.1 During Construction Phase***

##### ***Identified Impacts on Land/Soil Environment***

During site preparation, excavation will be done at places in the project site where sheds, Mounded Storage bullets and the approach road will be constructed. This is required to provide solid base/foundations for structures & roads.

- ✚ Improper disposal of the excavated earth during installation of storage tanks/structures may result into temporary loss of topsoil productivity of that particular area.
- ✚ Storage of construction material/chemicals (if any) if not done at designated place can cause nuisance and hazards
- ✚ Accidental spillage of Hazardous chemicals/oil during handling may lead to soil contamination
- ✚ Improper segregation and disposal of solid waste generated during construction phase by workers working at site
- ✚ Filth generation if dry waste/garbage generated during construction period is not handling efficiently

### ***Identified Impacts on Air Environment***

- ✚ The emission anticipated during construction period will include fugitive dust due to excavation of soil, leveling of soil, use of DG sets, movement of heavy construction equipments/vehicles, site clearing and other activities
- ✚ This type of fugitive dust is expected to result in change in the baseline air quality specifically during the construction phase
- ✚ If burning of solid wastes is required it may cause air pollution

### ***Identified Impacts on Noise Environment***

The proposed project will lead to emission of noise that may have significant impact on the surrounding communities in terms of increase in noise levels and associated disturbances.

Following activities would result in increase in noise level;

- ✚ Noise generated from operation of pumps and blower
- ✚ Noise generated from vehicular movement
- ✚ Noise generated from DG Set
- ✚ Nuisance to nearby areas due to noise polluting work at night

### ***Identified Impacts on Water Environment***

- ✚ Increased water demand during construction phase for site preparation, dust spraying, construction activities, curing, domestic and other water requirements for labour and staff onsite
- ✚ Increase in site runoff and sedimentation
- ✚ Stagnant water and unsanitary conditions may cause mosquito breeding at site

### ***Identified Impacts on Ecology and Biodiversity***

- ✚ During construction activities vegetation may be disturbed which can be considered insignificant.
- ✚ Earth enabling work involving excavation and filling up operations may result in fugitive dust emission. Deposition of fugitive dust on pubescent leaves of nearby vegetation may lead to temporary reduction of photosynthesis.
- ✚ The runoff from construction area may lead to a short-term increase in suspended solids and decrease in dissolved oxygen near the discharge point in receiving water body. This may lead to a temporary decrease in the photosynthetic activity of phyto-planktons, rise in anaerobic conditions and food chain modification.

### ***Identified Impacts on Socio-Economic Environment***

- ✚ The proposed project does not involve any displacement of inhabitants for the construction of LPG Bottling Plant.
- ✚ Construction phase could lead to creation of employment and procurement opportunities.
- ✚ A multiplier effect will be felt on the creation of indirect employment through the local community establishing small shops like tea stalls, supply of intermediate raw materials, repair outlets, hardware stores garrages etc.
- ✚ Self- employment options for individuals possessing vocational or technical training skills like electricians, welders, fitters etc, which are likely to be sourced locally;
- ✚ There would be influx of workers during construction phase which could lead to pressure on key local infrastructure such as water, healthcare, electricity.
- ✚ The construction activity could lead to increased nuisance level from air emissions and noise due to transportation of material and equipment as well as labourers.
- ✚ The construction activity could also lead to water stagnation at pockets which may lead to breeding of mosquito and related health impacts.

#### ***4.2.2 During Operation Phase***

### ***Identified Impacts on Land/Soil Environment***

- ✚ Soil quality may be affected by accidental leakage and spillage of hazardous chemicals/oils during handling
- ✚ Improper segregation and disposal of solid waste generated during operation of the proposed project

### ***Identified Impacts on Air Environment***

- ✚ No emission is envisaged during the storage and handling of LPG in mounded bullets
- ✚ No fugitive emission during loading and unloading of LPG in and from mounded bullets is envisaged
- ✚ Impacts on ambient air during operation phase would be due to emissions from operation of DG sets only during power outages.

### ***Identified Impacts on Noise Environment***

- ✚ Impact of noise due to vehicular traffic
- ✚ Noise generated due to DG sets

### ***Identified Impacts on Water Environment***

- ✚ Stress on existing water supply
- ✚ Generation of waste water & domestic effluent

- ✚ Increased run off from site.

### ***Identified Impacts on Ecology and Biodiversity***

- ✚ The probability and consequences of significant ecological impacts occurring as a result of the operation of the Mounded Bullets/facility are considered to be almost negligible. The risk of any leakage is almost negligible owing to stringent leak prevention technologies.
- ✚ In normal condition, no waste water is discharged outside the bottling plant. During monthly mock-drill and in monsoon, the waste/rain water will be discharged through properly designed storm water drain after passing through vapour trap.

### ***Identified Impacts on Socio-Economic Environment***

- ✚ Project and associated construction of LPG Bottling Plant will eventually lead to permanent job opportunities in the organized and unorganized sector. There is likely to be increased demand for security, kitchen help, need for drivers etc.
- ✚ Development of physical infrastructure due to construction of the plant which could benefit the local population.

## **4.3 Impact Mitigation Measures**

### ***4.3.1 During Construction Phase***

#### ***Land/Soil Environment Impact Mitigation Measures***

- ✚ Top soil will be stored carefully and will be used again after construction/installation phase is over so as to restore the fertility of project site
- ✚ Bituminous materials / other chemicals, if any, shall not be allowed to leach into the soil
- ✚ Methods to reuse earth material generated during excavation will be followed
- ✚ Waste oil generated from D. G. sets will be handed over to authorized recyclers approved by CPCB
- ✚ Usage of appropriate monitoring and control facilities for construction equipments deployed
- ✚ All hazardous wastes shall be securely stored, under a shed for eventual transportation and disposal to the authorized dealers
- ✚ The solid waste generation due to workers working at site will be segregated and will be transported and disposed of to Bathinda Municipal Corporation waste disposal facility
- ✚ Chemicals/Paints etc. used during construction phase will be stored safely

#### ***Air Impact Mitigation Measures***

- ✚ Checking of vehicles and construction machinery to ensure compliance to Indian Emission Standards<sup>3</sup>
-

- ✦ Transportation vehicles, DG sets and machineries to be properly and timely maintained and serviced regularly to control the emission of air pollutants in order to maintain the emissions of NO<sub>x</sub> and SO<sub>x</sub> within the limits established by CPCB
- ✦ Minimize idling time for vehicles and adequate parking provision and proper traffic arrangement for smooth traffic flow
- ✦ Use of good quality fuel and lubricants will be promoted. Moreover, low sulphur content diesel shall be used as fuel for DG sets to control emission of SO<sub>2</sub>
- ✦ Water sprinkling shall be carried out to suppress fugitive dust during earthworks and along unpaved sections of access roads
- ✦ Attenuation of pollution/ protection of receptor through strengthening of existing greenbelt/ green cover

However, the construction activities will be for temporary period and hence, its impact on the existing ambient air quality as well as vegetation will be reversible. Dust emissions are likely to be confined within the limited area.

#### ***Noise Impact Mitigation Measures***

- ✦ No noise polluting work in night shifts
- ✦ Acoustic enclosures for DG Sets will be provided as per CPCB guidelines
- ✦ Pumps – Enclosure in acoustic screen, allowing for engine cooling and exhaust, use of anti-vibration mounting, flexible couplings of hoses, maintaining adequate inlet pressure
- ✦ Provision of Intake mufflers, unidirectional fan for Cooling and enclosures for electrical motors
- ✦ Provision of ear plugs for labour in high noise area
- ✦ Provision of barricades along the periphery of the site
- ✦ All contractors and subcontractors involved in the construction phase shall comply with the CPCB noise standards<sup>4</sup>
- ✦ Activities that take place near sensitive receptors to be carefully planned (restricted to daytime, taking into account weather conditions etc.)
- ✦ Vehicles and generator sets to be serviced regularly and maintained properly to avoid any unwanted generation of noise or vibration from them
- ✦ Use of suitable muffler systems/ enclosures/ sound proof glass paneling on heavy equipment/ pumps/ blowers
- ✦ Pumps and blowers may be mounted on rubber pads or any other noise absorbing materials
- ✦ In case of steady noise levels above 85 dB (A), initiation of hearing conservation measures
- ✦ Strengthening of greenbelt for noise attenuation may be taken up, etc.

<sup>4</sup> <http://CPCB.nic.in/divisionsofheadoffice/pci2/Noise-vehicle.pdf>

[http://cpcb.nic.in/divisionsofheadoffice/pci2/noise\\_rules\\_2000.pdf](http://cpcb.nic.in/divisionsofheadoffice/pci2/noise_rules_2000.pdf)



### ***Water Impact Mitigation Measures***

- ✚ Water Avoidance of wastage of curing water
- ✚ Use of tanker water for construction activity.
- ✚ Provision of temporary toilets for labour
- ✚ Wastewater generated will be recycled/reused during operation of the LPG Plant

### ***Ecology and Biodiversity Impact Mitigation Measures***

- ✚ The impacts as mentioned earlier, however, be confined mostly to the initial periods of the construction phase and would be minimized through adoption of control measures such as paving and surface treatment, water sprinkling and plantation schemes.
- ✚ The impact would be restricted within the plant boundary. Thus, the impacts of construction activities will be marginal in scale.
- ✚ However, for major part of the year during construction phase, no detectable impact is expected because water quality will not change significantly. Hence, no tangible impact on the aquatic eco-system is anticipated.

### ***Socio-Economic Environment Impacts Mitigation Measures***

- ✚ Employing local people for construction work to the maximum extent possible.
- ✚ Providing proper facilities for domestic supply, sanitation, domestic fuel, education, transportation etc. for the construction workers.
- ✚ Barricades, fences and necessary personnel protective equipment such as safety helmet, shoes, goggles, gloves, harness etc. will be provided to the workers and employees.
- ✚ Constructional and occupational safety measures to be adopted during construction phase of the industry.
- ✚ The health of workers will be checked for general illness; first time upon employment and thereafter at periodic intervals, as per the local laws and regulations.
- ✚ The workers will be diagnosed for respiratory functions at periodic intervals and during specific complaints etc. Medical Aid as per Factory Act and Panel doctor facility will be provided to the workers.
- ✚ Job rotation schemes will be practiced for over-exposed persons. Insignificant impact is expected on the workers health and safety during the operation phase stage.

#### ***4.3.2 During Operation Phase***

### ***Land/Soil Environment Impact Mitigation Measures***

- ✚ Installation of drainage ditches at project site to prevent erosion
- ✚ All hazardous wastes shall be securely stored, under a shed for eventual transportation and disposal to the authorized dealer by CPCB

- ✚ The solid domestic waste shall be segregated and stored within the premises temporarily and then sent to Bathinda Municipal Corporation waste management facility

### ***Air Impact Mitigation Measures***

- ✚ Checking of vehicles and construction machinery to ensure compliance to Indian Emission Standards<sup>5</sup>
- ✚ Transportation vehicles, generators and machineries to be properly and timely maintained and serviced regularly to control the emission of air pollutants in order to maintain the emissions of NO<sub>x</sub> and SO<sub>x</sub> within the limits established by CPCB
- ✚ Stack height of DG sets shall be as per norms of CPCB to allow effective dispersion of pollutants
- ✚ Storage facilities shall be equipped with leak detection systems
- ✚ Minimize idling time for vehicles and adequate parking provision and proper traffic arrangement for smooth traffic flow
- ✚ Attenuation of pollution/ protection of receptor through strengthening of existing greenbelt/ green cover

### ***Noise Impact Mitigation Measures***

- ✚ Provision of proper parking arrangement, traffic management plan for smooth flow of vehicles help to abate noise pollution due to vehicular traffic.
- ✚ Green belts and landscaping shall act as noise buffer.

### ***Water Impact Mitigation Measures***

- ✚ waste water shall be recycled /resued for flushing, gardening and cooling tower makeup)
- ✚ Rain water harvesting shall be promoted. Rainwater from the landscape area and hardscape area will be used to recharge the ground water sources through recharge pit
- ✚ Provision of Storm water drainage system with adequate capacity, Proper maintenance of storm water drainage.

### ***Ecology and Biodiversity Impact Mitigation Measures***

- ✚ The proponent has a plan of extensive green belt programme. The area, varieties of plants, density etc. have been mentioned in the report
- ✚ In normal condition, no waste water shall be discharged outside the Depot. During mock-drill (once in a month) and rainy season, the waste/rain water shall be discharged through properly

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<sup>5</sup> <http://cpcb.nic.in/divisionsofheadoffice/pci2/Noise-vehicle.pdf>

[http://cpcb.nic.in/divisionsofheadoffice/pci2/noise\\_rules\\_2000.pdf](http://cpcb.nic.in/divisionsofheadoffice/pci2/noise_rules_2000.pdf)

<sup>5</sup> [http://cpcb.nic.in/Vehicular\\_Exhaust.php](http://cpcb.nic.in/Vehicular_Exhaust.php)

designed storm water drain after passing through Vapour Trap. Hence, no impact is envisaged on aquatic ecology from the operation of facilities.

- ✚ The probability and consequences of significant ecological impacts occurring as a result of the operation of the facility are considered to be almost negligible. The risk of any leakage is almost negligible owing to stringent leak prevention technologies.

#### ***Socio-Economic Environment Impacts Mitigation Measures***

- ✚ Both skilled and unskilled local person shall be given preference for the jobs in the operation and maintenance of the plant.

#### **4.4 Impact Matrix**

The matrix was designed for the assessment of impacts associated with almost any type of project. Its method of a checklist that incorporates qualitative information on cause-and-effect relationships but it is also useful for communicating results.

Matrix method incorporates a list of impacting activities and their likely environmental impacts, presented in a matrix format. Combining these lists as horizontal and vertical axes in the matrix allows the identification of cause effect relationships, if any, between specific activities and impacts. The impact matrix for the actions identified in Table 4.1 along with various environmental parameters. A rating scale has been devised to give severity of impacts in the following manner.

- A. Beneficial (positive) impact – Long term
- B. Low beneficial impact – Short term
- C. Strong adverse (negative) impact – Long term
- D. Low adverse impact (localized in nature) – Short term
- E. No impacts on environment

**Table 4.1: Impact Matrix**

S.N.	Activity	Positive Impact		Negative Impact		No Impact
		Short Term	Long Term	Short Term	Long Term	
<b>Pre-Project Activity</b>						
1	Displacement and resettlement of local people					√
2	Change in land use					√
3	Loss of trees/vegetation		√			
4	Shifting of equipment, machinery and material					√
5	Employment for local people		√			

S.N.	Activity	Positive Impact		Negative Impact		No Impact
		Short Term	Long Term	Short Term	Long Term	
<b>Construction Phase</b>						
1	Pressure on infrastructure and transportation system			√		
2	Impact on air quality including dust generation			√		
3	Noise Pollution			√		
4	Traffic					√
5	Impact on the land/soil environment			√		
6	Impact on groundwater					√
7	Stacking and disposal of construction material			√		
8	Impact on water quality			√		
9	Health and safety conditions of people			√		
10	Social impact	√				
11	Economic impact	√				
<b>Operation Phase</b>						
1	Increase in air pollution and noise levels				√	
2	Water harvesting and recharge		√			
3	Disposal of solid waste				√	
4	Infrastructure development		√			
5	Quality of life		√			
6	Handling operations for transfer, charging of raw materials, final product				√	

#### 4.5 Summary of Environment Impacts and Mitigation Measures

The summary of the Impacts and Mitigation measures for the above mentioned environmental attributes is as summarized in **Table 4.2**.

**Table 4.2: Summary of Impacts and Mitigation Measures**

Impacting Activity		Potential Impact		Mitigation Measures Environment/ Social Attribute	Compliance/ Standards/ Best Practice Guidelines Source Contaminants
Environment/ Social Attribute	Source Contaminants	Environment	Health and Safety		
Construction Phase					
Construction Workers	Generation of sewage, organic wastes, construction debris etc.	Possible contamination of project site and nearby water bodies	Potential risk of respiratory irritation, discomfort, or illness to workers	<ul style="list-style-type: none"> <li>Local workers will be employed, as far as possible.</li> <li>Proper sanitation facilities will be provided for the workers</li> <li>There are no temporary shelters provided because local workers will be engaged</li> </ul>	--
Air Emissions	Dust and air emission particularly due to the excavation, construction and movement of vehicles resulting in air pollution	Rise in RSPM level at project site	Potential risk of respiratory irritation, discomfort, or illness to workers	<ul style="list-style-type: none"> <li>Barricading sheets shall be provided</li> <li>Provision of spraying water to reduce dust emission</li> <li>Excavated topsoil to be preserved and reused for landscaping</li> <li>Ensuring all vehicles, generators and compressors are shall be maintained and regularly serviced</li> </ul>	CPCB - National Ambient Air Quality Standards
Noise Generation	Construction noise mainly due to excavation, Moving of vehicles, operations of cranes etc.	Rise in decibel level of ambient noise	Unwanted sound can cause problems within the body. Excessive noise pollution in working areas at construction sites can influence	<ul style="list-style-type: none"> <li>The vehicles used will be with the proper acoustic measures</li> <li>Wherever this cannot be achieved the area will be earmarked as high noise level area requiring use of ear protection gadgets</li> <li>Avoid night time work</li> </ul>	CPCB - Noise Pollution (Regulation and Control) Rules

Impacting Activity		Potential Impact		Mitigation Measures Environment/ Social Attribute	Compliance/ Standards/ Best Practice Guidelines Source Contaminants
Environment/ Social Attribute	Source Contaminants	Environment	Health and Safety		
			psychological health viz. occurrence of aggressive behaviour, disturbance of sleep, constant stress, fatigue and hypertension. Hampered sleeping pattern and may lead to irritation and uncomfortable situations.		
Soil and Groundwater Contamination	<ul style="list-style-type: none"> <li>• Spillage of concrete mixture containing additives and plasticizers.</li> <li>• Spillage of construction material containing heavy metals, paints, coatings, liners, etc.</li> </ul>			<ul style="list-style-type: none"> <li>• All fuel, Liquid Cargo storage will be sited on an impervious base within a bund and secured place. The base and bund walls will be impermeable to the material stored and of an adequate capacity. Storage at or above roof level will be avoided</li> <li>• Leaking or empty drums will be handled as per environment management plan</li> <li>• Special care will be taken during deliveries of construction materials, especially when fuels and hazardous materials are being handled</li> <li>• Ensure that workers know what to do in the event of a spillage</li> </ul>	

Impacting Activity		Potential Impact		Mitigation Measures Environment/ Social Attribute	Compliance/ Standards/ Best Practice Guidelines Source Contaminants
Environment/ Social Attribute	Source Contaminants	Environment	Health and Safety		
Operation Phase					
Air Emissions	<ul style="list-style-type: none"> <li>Release of emission from the DG Sets in case of power failure and operation of fire Engine in case of fire drill or emergency</li> </ul>	<ul style="list-style-type: none"> <li>Negligible Impact</li> </ul>	Negligible Impact	<ul style="list-style-type: none"> <li>The DG sets shall be provided with Stack Height per CPCB guidelines above roof level.</li> </ul>	
Wastewater	Domestic waste water arising from Restroom and Canteen	<ul style="list-style-type: none"> <li>Negligible Impact</li> </ul>	Negligible Impact	<ul style="list-style-type: none"> <li>Septic Tank and Soak Pit shall be provided for domestic sewage.</li> </ul>	
Hazardous Materials, Fire and Explosion		<ul style="list-style-type: none"> <li>Risk of fire and explosions due to the flammable and combustible nature of petroleum products.</li> <li>Risk of leaks and accidental releases from equipment, tanks, pipes etc during loading and unloading (handling)</li> </ul>	Potential risk of loss of life or injury due to fire	Storage equipment should meet standards for structural design and integrity.	OISD-STD 144 - Fire Protection Facilities for LPG Bottling Plant.
Hazardous Waste	<ul style="list-style-type: none"> <li>No Hazardous Waste except</li> </ul>	Same to be Stored in barrels	<ul style="list-style-type: none"> <li>To be Stored in Designated place</li> </ul>		To be disposed to CPCB accredited

Impacting Activity		Potential Impact		Mitigation Measures Environment/ Social Attribute	Compliance/ Standards/ Best Practice Guidelines Source Contaminants
Environment/ Social Attribute	Source Contaminants	Environment	Health and Safety		
	used lubricating Oil		on Concrece platform		Party.



## **CHAPTER 5: PROJECT BENEFITS**

### **5.1 Project Benefits**

The Proposed project will have indirect positive impact on surrounding area which is as mentioned below:

- Plant will be set up on barren land; hence no displacement of people is required.
- Substantial Socio-economic benefits.
- Good Techno-commercial viability.
- Around the project site semi-skilled and unskilled workmen are expected to be available from local population in these areas to meet the manpower requirement during construction and Operational phase.
- There will be employment opportunity for local people during construction and operation phase.
- Infrastructural facilities will be improved due to the project.
- Critical analyses of the existing socio-economic profile of the area indicate that the impact of the Project is expected to be of varying nature. The following are the impacts predicted.
- Secondary employment will be generated thereby benefiting locals.
- Project will have substantial benefits in savings of transportation cost
- Thus a significant benefit to the socio-economic environment is likely to be created due to the project.

### **5.2 Improvements in the Physical Infrastructure**

The project will improve supply position of LPG in Punjab State.

- Maintain continuity of LPG gas cylinder supply to the consumers through distributors.
- Increase the days cover for LPG storage.
- Safety measures for hazard detection and prevention system will be upgraded as per OISD-144/OISD-150.
- By adding 2x300 MT Mounded Bullets, risk profile of the existing plant will not be enhanced.
- Discourage deforestation and reduce the use of fire wood and fossil fuels.

Establishment of large developmental projects improve the availability of the physical infrastructures like approach roads, drainage, communication and transportation facilities etc.

### **5.3 Improvements in the Social Infrastructure**

IOCL Bathinda LPG Plant shall take up some community welfare activities under Corporate Social Responsibility and also improve the social infrastructures like education and health care system etc.

#### **5.4 Employment Potential**

The project shall provide employment potential under unskilled, semi-skilled and skilled categories. The employment potential shall increase with the start of construction activities, reach a peak during construction phase and then reduce with completion of construction activities. During operation phase also there will be employment opportunities, mainly in service sector, although its magnitude will be much less.

The direct employment opportunities with IOCL are extremely limited and the opportunities exist mainly with the contractors and sub-contractors. These agencies will be persuaded to provide the jobs to local persons on a preferential basis wherever feasible.

The total employment potential of plant is 60 people which will include 20 direct and 40 indirect that includes contract labours and even security personnels.

#### **5.5 CSR and Socio-Economic Development**

IOCL not only carries out business but also understands the obligations towards the society. The unit is aware of the obligations towards the society and to fulfill the social obligations unit will employ semi-skilled and unskilled labor from the nearby villages for the proposed project as far as possible. Unit will also try to generate maximum indirect employment in the nearby villages by appointing local contractors during construction phase as well as during operation phase. The Project Proponents will contribute reasonably as part of their Corporate Social Responsibility (CSR) in and will carry out various activities in nearby villages.

Moreover, unit has planned to carry out various activities for the up-liftment of poor people, welfare of women and labors, education of poor students as part of CSR in the nearby villages and therefore , during and after proposed project, unit will spent more than that required by statutory norms every year towards CSR activities. The various CSR activates planned at present by the unit is described below;

- Plantation along the road side and development of garden/greenbelt on government barren land/common plots
- Education aids and scholarship to poor students
- Organize medical camp and providing support for the development and maintenance of the health facilities
- Financial support and assistance for the development and maintenance of the infrastructure facilities
- Participate and contribute in local social programs
- Organize various types of training program for the community like training on scientific agricultural practices, educational training, (training for tailoring, embroidery), etc. which ultimately helpful for income generation

- Organize various types of awareness program for the community like awareness on the child labor, educational promotion etc.

The activities listed above are not limited to and IOCL will plan and perform other activities according to the need of local community in future. The utilization of this fund in various areas with time bound action plan will be decided based on the requirement of the local community.

### **5.6 Direct Revenue Earning to the National and State Exchequer**

This project will contribute additional revenue to the Central and State exchequer in the form of excise duty, income tax, state sales tax or VAT, tax for interstate movement, corporate taxes etc. Indirect contribution to the Central and State exchequer will be there due to Income by way of registration of trucks, payment of road tax, income tax from individual as well as taxes from associated units. Thus, the proposed project will help the Government by paying different taxes from time to time, which is a part of revenue and thus, will help in developing the area.

### **5.7 Other Tangible Benefits**

Both tangible and non-tangible benefits will result from this activity and many of those are described above. Apart from direct employment, many other benefits will accrue like

- Erosion control by nalla training, terracing and bunding
- Flood control by rain-water arresting, and harvesting
- Aesthetics improvement by general greening with emphasis on biodiversity
- Developed economy strengthens democratic set-up.
- Developed economy brings with it literacy and healthful living
- Improved safety-security in surrounding with better Law and Order
- Symbiosis and sustainable development will be the ultimate objective

## **CHAPTER 6: ANALYSIS OF ALTERNATES**

### **6.1 Alternative Technology**

- The project proposal relates to installation of 02 nos. of Mounded Bullets of 300 MT capacity each for storage of LPG.
- IOCL has mastered the art and technology of installation of Mounded Bullets.
- The LPG department of Marketing Division of IOCL has earned a good credential for installation of Mounded Bullets.
- The above expertises of IOCL are well proven and working efficiently at different locations of the country including North-Eastern states without fail.
- IOCL is having excellent track record and progressive outlook in regularly updating its technology. The technology adopted by IOCL for installation of Mounded Bullets for storage of LPG is a fail-safe.

### **6.2 Alternative Site**

Since, the proposed bullets shall be annexed to the existing plant and already vacant space is available hence, alternate site selection is not relevant.

## **CHAPTER 7. ADDITIONAL STUDIES**

### **7.1 Public Consultation**

As per requirement of the Notification, we will conduct Public Consultation and the report will be submitted to MoEF Delhi. The summary of points raised during Public consultation will be considered for action at our end.

### **7.2 Quantitative Risk Assessment**

We have carried out Quantitative Risk Assessment study for the proposed project and the report is attached as Annexure along with this EIA report.

## **CHAPTER 8. ENVIRONMENT MANAGEMENT AND MONITORING PLAN**

### **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 EMP during Construction Phase**

Environmental pollution during construction stage will be limited and for a temporary period during the construction activity. Construction shall be planned in such a way that excavated material shall be disposed safely. The manpower required for these activities shall preferably be employed from nearby villages so that avenues of employment will be open to local people.

Directly or indirectly all the environmental components get affected due to the construction activity. The following environmental protection and enhancement measures are suggested for implementation by the contractor or the authority during the construction as applicable.

### **8.2.1 Air Environment**

During the construction phase, gaseous emissions are expected from the heavy machineries deployed for construction. All other emission sources are intermittent. Though the gaseous emissions are not expected to contribute significantly to the ambient air quality, some generic measures to reduce fugitive and gaseous pollutants emissions during construction phase from point area and line sources shall include the following:

- All equipment used during construction shall have valid PUC certificate.
- The storage and handling of soil, sub-soils, top-soils and materials will be carefully managed to minimize the risk of wind blown material and dust
- To avoid generation of air borne dust, water sprinkling shall be done.
- There will be no on-site burning of any waste arising from any construction activities
- All vehicles delivering construction materials or removing soil will be covered to prevent escape of dust
- Engines and exhaust systems of all vehicle and equipment will be maintained so that exhaust emissions do not exceed statutory limits and that all vehicles and equipment are maintained in accordance with manufactures' manuals. Periodic monitoring of this shall be undertaken to ensure compliance
- Exhausts of other equipment used for construction (e.g. generators) will be positioned at a sufficient height to ensure dispersal of exhaust emissions and meet the standards set by CPCB.

### **8.2.2 Noise Environment**

The following environmental management measures are recommended to mitigate adverse impacts on noise environment during construction phase:

- Earth movers and construction machinery with low noise levels shall be used
- Periodic maintenance of construction machinery and transportation vehicles shall be undertaken
- Onsite workers shall be provided with noise protection devices such as ear plugs/ muffs wherever necessary
- Periodic monitoring for the noise levels within the project site shall be undertaken to ensure compliance per CPCB set standards

### **8.2.3 Water Environment**

Drinking water requirements during the construction phase by the contractors shall be met from proposed borewells on site. Construction labourers shall be provided with adequate quantity of drinking water of potable quality.

Sufficient and appropriate sanitary facilities shall be provided in order to maintain hygienic conditions in the camps of construction labourers. The wastes, such as, sanitary wastes shall be treated in STP of 10 m<sup>3</sup>/day capacity.

The solid waste generated shall be collected and disposed in an appropriate manner either at a landfill site or used as compost to be used in lawns/gardening purpose.

#### **8.2.4 Land Environment**

- On completion of construction works all temporary structures, surplus materials and wastes shall be completely removed. Dumping of construction waste on agricultural land will be prohibited and used appropriately.
- The solid wastes such as paints, lubricants, oil or any other non-biodegradable wastes that have leachable constituents will be disposed to authorized recyclers.
- A waste management plan shall be prepared or integrated with existing plan before the commissioning, implemented and monitored. In areas, where soil quality for natural vegetation is of critical concern, loosening of soil in such areas will be done to mitigate soil compaction caused due to operation of heavy machinery.

#### **8.2.5 Biological Environment**

The region does not have dense vegetation and land use is dominated by agriculture activities. Following environmental management measures are recommended to mitigate adverse impacts on biological environment during construction phase:

- Plantation will be commenced at the time when site clearing will be undertaken.
- Number of trees will be replanted against the trees removed from site.
- Native species will be preferred for plantation in addition to beautification plants/species.

#### **8.2.6 Socio-economic Environment**

Given that the project and related developments like construction camps will not be dependent on local resources (power, water), during both construction and operations, the only likely impact on infrastructure would be on the roads, especially SH17 during the construction phase. Considering the high traffic emanating during construction phase an effective traffic management scheme will be put in place to avoid congestion on the nearby and local roads.

Local persons will get employment during Construction phase.



### **8.2.7 Health and Safety**

- The movement of heavy equipment will be undertaken with proper precaution to prevent any accidents on the road. Occupational risk shall be minimized at the project site through implementation of a full proof safety system. Speed limit set for movement of vehicles with 20 km/hr on village roads to reduce risks of accidents or injuries.
- Safety training shall be provided to all construction workers on operation of equipment. Security shall also be extended during non-working hours to ensure there is controlled access to the machinery and equipment.
- The contractors shall also be vigilant to detect workers showing symptoms of communicable diseases. Health check up of the contract labors shall be done/ recorded at times. All illness and incidents shall be reported and recorded.

### **8.3 EMP during Operation Phase**

In order to mitigate the impacts due to capacity expansion of facility on various environmental components, the following environmental management measures are recommended:

#### **8.3.1 Air Environment**

- Leak detection and repair (LDAR) program shall be implemented in the facility
- Ambient air quality with respect to SPM, RPM, SO<sub>2</sub>, NO<sub>x</sub>, H<sub>2</sub>S, CO and HC monitoring shall be continued in the impact zone as per regulations
- To minimize occupational exposure/hazards, the present practice of using personal protective equipment e.g. helmets, safety (gas) mask/safety dress, safety harness for working at heights, safety shoes, safety goggles, low temperature hand gloves & shock resistant hand gloves etc. be ensured for workers engaged in operation of process units within the facility complex
- Stacks of adequate height (CPCB norms) for DG Sets to ensure adequate dispersal of pollutants will be provided.
- Waste Lube oil will not be incinerated and will be sold to MoEF/TNPCB authorised waste oil recyclers
- All access roads (internal as well as external) to be used by the project authorities will be paved (either with WBM, concrete or bitumen) to suppress the dust generation along the roads

#### **8.3.2 Noise Environment**

Similar measures as proposed in the construction phase for noise making machinery, to ensure practicably low noise levels within the work environment.

- The major areas of concern for noise generation will be adequately addressed by considering it during procurement of the machinery from vendors, project implementation stage. Further feedback from the monitored noise levels at sensitive locations will be taken to ensure that the impact due to high noise levels is practically minimized
- Monitoring job and location specific noise levels for compliance with HSE regulations by verifying acceptability of noise levels caused by the project activities and comparison with noise criteria
- Conducting periodic audiometric tests for employees working close to high noise levels, such as compressors, DG sets, etc
- Provision of PPE's will be done and their proper usage will be ensured for eardrum protection of the workers as well as visitors
- Acoustic barriers and silencers shall be used in equipment wherever necessary
- Sound proofing/ glass panelling shall be provided at critical operating stations/ control rooms, etc
- Monitoring of ambient noise levels shall also be carried out regularly both inside the facility area as well as outside the peripheral greenbelt.

### **8.3.3 Water Environment**

- For domestic sewage, Septic Tank and Soak Pit shall be provided.
- There will be no industrial effluent generated in this plant. However, waste water generated during plant operations (during washing of empty cylinders) shall be recirculated/ reused.
- There shall no increase in quantity of waste water generation from operation of proposed Mounded Bullets. The existing sources of waste water generation are as follows:
  - ✓ Sanitary waste water from toilets, wash-rooms and canteen.
  - ✓ Non-sanitary waste water from mock drills.
- **Rain Water Harvesting:** The rain water harvesting program shall be implemented in LPG bottling plant. The system has been developed around the storage tanks, admn. Building in the plant. The practice shall be continued and extended further with the proposed mounded storage facilities.

### **8.3.4 Land Environment**

- Greenbelt in and around the facility will be strengthened/maintained
- A record w.r.t quantity, quality and treatment/management of solid/hazardous waste shall be maintained at environmental monitoring cell

Solid/Hazardous Waste Management

- No solid hazardous waste will be generated in the operation of LPG Bottling Plant.

### **8.3.5 Biological Environment**

Development of green belt with carefully selected plant species is of prime importance due to their capacity to reduce noise and air pollution impacts by attenuation/assimilation and for providing food and habitat for local micro fauna.

### **8.3.6 Socio-economic Environment**

In order to mitigate the impacts likely to arise out of the proposed project and also to maintain good will of local people, steps will be taken for improving the social environment. Necessary social welfare measures by the industry shall be undertaken in gaining public confidence and to meet local area development requirement. The following measures are suggested:

- IOCL shall continue to undertake social welfare programs for the betterment of the Quality of Life of villages around in collaboration with the local bodies
- Some basic amenities, viz. education, safe drinking water supply to the nearby villages may be taken up
- Regular medical check up shall be continued at times in the villages around the facility
- Focus shall be on to educate villagers regarding safety measure provided in the plant.

## **8.4 Environmental Monitoring Programme**

### **Introduction**

Environmental Management is nothing but resource management and environmental planning is just the same as development planning. They are just the other side of the same coin. The resource management and development planning look at the issue from narrow micro-economical point of view while environmental management views the issue from the broader prospective of long term sustained development option, which ensures that the environment is not desecrated.

For the effective and consistent functioning of the project, proper environmental monitoring programme shall be carried at the LPG Bottling Plant.

The programme shall include the following:

- Environmental Monitoring
- Personnel Training
- Regular Environmental audits and Correction measures

- Documentation–standards operation procedures Environmental Management Plan and other records

### Environmental Monitoring

Work of monitoring shall be carried out at the locations to assess the environmental health in the post period. A post study monitoring programme is important as it provides useful information on the following aspects.

- It helps to verify the predictions on environmental impacts presented in this study.
- It helps to indicate warnings of the development of any alarming environmental situations, and thus, provides opportunities for adopting appropriate control measures in advance.

The monitoring programmes in different areas of environment, outlined in the next few sections, have been based on the findings of the impact assessment studies described in Chapter 4. Post study monitoring programme have been summed up in **Table 8.1**.

**Table 8.1: Post Study Environmental Monitoring Program**

Area of Monitoring	Sampling locations	Frequency of Sampling	Parameters to be Analysed
Ambient Air Quality	Station within premises.	Once in six months	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>x</sub> , HC, VOCs and other parameters as specified by TNPCB consents
	Stack monitoring of DG Set	Once in three months	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>x</sub> , CO and other parameters as specified by TNPCB consents
Water	Ground water sample within the Plant	Twice in a year	<ul style="list-style-type: none"> <li>• Physical and Chemical parameters</li> <li>• Bacteriological parameters</li> <li>• Heavy metals and toxic constituents</li> </ul>
Noise	Within Plant shed for bottling operations	Twice a year	Sound Pressure Levels (Leq) during Plant operations.
Solid Waste	Records of generation of used drums, bags and records of their dispatch to suppliers for	As & when required	--

	refilling		
Environmental Audit	Environmental statement under the EP (Act) 1986	Once in a year	--

#### **8.4.1 Ambient Air Quality**

Monitoring of ambient air quality at the LPG Bottling Plant site shall be carried out on a regular basis to ascertain the levels of hydrocarbons in the atmosphere; ambient air quality shall be monitored as per Table 7.1.

#### **8.4.2 Surface Water Quality**

Water quality constitutes another important area in the post study monitoring programme. There are no major streams or perennial sources of surface water in the study area. Contamination of surface water in the vicinity of LPG Bottling Plant area during the operation is possible only in one form. Contamination of rain water passing through the LPG Bottling Plant

Surface water near the LPG Bottling Plant area shall be generally sampled as per the above table.

#### **8.4.3 Noise Level**

Ambient noise levels have been monitored at 10 stations inside and outside the plant in **January 2016 to March 2016** seasons for day time and night time Leq.

### **8.5 Environmental Management Cell**

The Location-in-charge of the LPG Bottling Plant with the assistance of operation and maintenance engineers at respective stations presently look after environmental management. Technical officers of the LPG Bottling Plant station shall regularly carry out the following:

- Sampling and analysis of noise and water samples.
- Systematic and routine housekeeping at the LPG Bottling Plant

Apart from the regulatory requirements, officials conduct inter station environment auditing to improve the performance. As part of company's endeavor, the IOCL has been accredited with national and international certification of repute such as ISO: 14001 and ISO: 9002. Under this following aspects are covered.

- Reviewing the whole operation of LPG Bottling Plant, once in every two years, to identify the environmental aspects.

- Following the changes/amendments to central/state legislation pertaining to environment management.
- Assessing the level of experience, competence and training to ensure the capability of personnel, especially those carrying out specialized environmental management functions.
- Conducting environmental awareness programme for the employees at LPG Bottling Plant site.
- Measurement of pollution emissions and levels at LPG Bottling Plant through an external agency approved by PPCB.

### 8.6 Budgetary Allocation for Environmental Protection Measures

IOCL has proposed a capital investment of Rs.15 crores and a recurring cost of Rs. 1.50 crores per annum for environmental protection measures. The details of investment for procuring the equipment for efficient control and monitoring of pollution along with annual recurring cost are given in **Table 8.2**.

**Table 8.2: Cost of Environmental Protection Measures**

<b>Sr. No.</b>	<b>Particulars</b>	<b>Proposed Cost (Rs. Crores)</b>
1	Dust suppression	0.40
2	Water quality monitoring & management	0.25
3	Air quality and noise monitoring	0.50
4	Greenbelt / Plantation	0.35
	<b>Total</b>	<b>1.50</b>

## CHAPTER 9. DISCLOSURE OF CONSULTANTS ENGAGED

### 9.1 Consultants Engaged

This EIA report is prepared on behalf of the proponents, taking inputs from proponent's office staff, their R and D wing, Architects, Project Management Professionals etc. by Environmental Consultants **M/s. Ultra-Tech Environmental Consultancy and Laboratory, Thane.**

#### **M/s Ultra-Tech Environmental Consultancy and Laboratory:**

Ultra-Tech Environmental Consultancy and Laboratory [Lab Gazetted by MoEF – Govt. of India] not only give environmental solutions for sustainable development, but make sure that they are economically feasible. With innovative ideas and impact mitigation measures offered, make them distinguished in environmental consulting business. The completion of tasks in record time is the key feature of Ultra-Tech. A team of more than hundred environmental brigadiers consists of engineers, experts, ecologists, hydrologists, geologists, socio-economic experts, solid waste and hazard waste experts apart from environmental media sampling and monitoring experts and management experts , strive hard to serve the clients with up to mark and best services.

Ultra-Tech offers environmental consultancy services to assist its clients to obtain environmental clearance for their large buildings, construction, CRZ, SEZ, high rise buildings, township projects and industries covering sugar and distilleries from respective authorities.

Ultra-Tech also provide STP/ETP/WTP project consultancy on turn-key basis apart from Operation and Maintenance of these projects on annual contract basis. Also, having MoEF approved environmental laboratory, Ultra-Tech provide laboratory services for monitoring and analysis of various environmental media like air, water, waste water, stack, noise and meteorological data to its clients all over India and abroad.

The EIA team involved for the proposed EIA Report is as mentioned in **Table 9.1.**

**Table 9.1: EIA Team**

SN	Name of the expert	Area of functional Expert(NABET Accredited)
1	Mr. Santosh Gupta Mr. Timir Shah	EIA Coordinator Associate Team Member
2	Mr. Timir Shah	Air Pollution
2	Mr. Timir Shah	Water Pollution
3	Mr. Santosh Gupta Mr. Harsh Natu	Solid Hazardous Waste Functional Area Associate
5	Dr. T. K. Ghosh	Ecology and Biodiversity

6	Dr. Kishore Wankhede	Socio Economic
7	Mr. Harsh Natu Mr. Ajay Patil Ms. Tejasvita Misra	Team Member

Functional area experts and assistance to FAE involved in the EIA study for “M/s.Indian Oil Corporation Ltd.” is as shown in **Table 9.2:**

**Table 9.2: Functional Area Experts Involved in the EIA**

S.N.	NAME OF SECTOR	NAME OF PROJECT	NAME OF CLIENT	FUNCTIONAL AREA EXPERTS INVOLVED	
				FA	NAME/S
1.	Schedule 6 (b) Category 'B'	Isolated storage and handling of hazardous chemicals	M/s.Indian Oil Corporation Limited.	AP	Mr. Timir Shah
				WP	Mr. Timir Shah
					Associate: Mr. Ajay Patil
				EB	Dr. T. K. Ghosh
					Associate: Ms. Bharti Khairnar
				SE	Dr. Kishore Wankhede
				SHW	Mr. Santosh Gupta
					Associate: Mrs. Deepa Tamhane Karnik
LU	Mr. Swapnil Avghade				
	Associate: Mr. Prasad Khedkar				
RH	Dr. Ravindra Kode				
	Associate: Mr. Ajay Patil				

## 9.2 Laboratory for Analysis

NAME OF LABORATORY	SCOPE OF SERVICES	ACCREDITATION STATUS
M/s Eco Services India Pvt. Ltd.	<b>Monitoring and Analysis of:</b> <ul style="list-style-type: none"> <li>• Ambient Air Monitoring</li> <li>• Stack Emission Monitoring</li> <li>• Bore Water(Analysis)</li> <li>• Domestic and Potable Water(Analysis)</li> <li>• Waste Water(Analysis)</li> </ul>	Accredited by NABL Valid upto 01.05.2017