

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT
FOR
CAPACITY AUGMENTATION OF EXISTING OPERATIONAL MARINE
LIQUID TERMINAL (MLT) FROM 3 MMTPA TO 6 MMTPA AT
KAMARAJAR PORT LIMITED, CHENNAI

BY
KAMARAJAR PORT LIMITED

At
VILLAGE : PUZHUTHIVAKKAM
TALUK: PONNERI
DISTRICT: TIRUVALLUR
STATE: TAMIL NADU

ToR File No: 10/15/2024-IA.III dated: 06.09.2024

Baseline Monitoring period: March 2024 –May 2024

Project Schedule: 7(e) “Ports, Harbours, Breakwaters Dredging” falls under Category A as per
EIA Notification 2006 and its amendment

EIA Consultant & Laboratory



M/s. HUBERT ENVIRO CARE SYSTEMS (P) LTD

NABET/ EIA/24-27/ RA-0335 valid upto 31.03.2027

NABL Certificate No: TC-12310

Submitted to

TNPCB Gummindiponndi

(July 2025)



Declaration by the Project Proponent

I, Captain G.Balan , The General Manager , Marine service declaration undertaking that owing the contents (information and data) of EIA report preparation has been undertaken for the “Capacity augmentation of existing operational Marine Liquid Terminal from 3 MMTPA to 6 MMTPA at – Kamarajar Port Limited” and the information and content provided in the report are factually correct.

For, M/s. Kamarajar Port Limited



General Manager (Marine Services)

ACKNOWLEDGEMENT

The following personnel are gratefully acknowledged for their fullest support in collection, compilation of needful data regarding the project and kind co-operation in fulfilling the report on Environmental Impact Assessment (EIA) Report “Capacity augmentation of existing operational Marine Liquid Terminal from 3 MMTPA to 6 MMTPA at – Kamarajar Port Limited”.

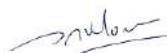
For, M/s. Kamarajar Port Limited


24/3/2025
General Manager (Marine Services)

Declaration by the Head of the Accredited Consultant Organization

I, Dr. J. R. Moses hereby, confirm that the below mentioned experts prepared the Draft or Final EIA/EMP for the **“Capacity augmentation of existing operational Marine Liquid Terminal from 3 MMTPA to 6 MMTPA at – Kamarajar Port Limited”** by **M/s. Kamarajar Port Limited** and also confirm that I shall be fully accountable for any misleading information mentioned in this statement.

Signature:



Date: 12.07.2025

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Designation: CEO

Name of the EIA Consultant Organization: M/s. Hubert Enviro Care Systems (p). Ltd., Chennai.

NABET Certificate No & Validity: NABET/EIA/24-27/RA0335 valid upto 31.03.2027

Declaration of Experts contributing to the EIA

I hereby certify that I was involved in the preparation of EIA/EMP for the “**Capacity augmentation of existing operational Marine Liquid Terminal from 3 MMTPA to 6 MMTPA at – Kamarajar Port Limited**” by **M/s. Kamarajar Port Limited** as EIA Coordinator with the support of the following Functional Area Experts.

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Period of Involvement:	January 2022 To Till date

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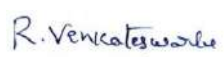
Chennai –600032.

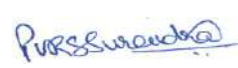
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Functional Area Experts

S. No.	Functional Areas		Name of the Expert	Involvement (Period & task)	Signature
1.	WP	FAE	Dr J R Moses	Period: January 2022 – Till date Task: Identification of surface and ground water quality monitoring locations, interpretation of water quality analysis results. Identification and quantification of impacts and proposed suitable control measures and Environmental Management Plan.	
2.	EB	FAE	Dr Rajkumar Samuel	Period: January 2022 – Till date Task: Site visit, collection of baseline data from primary and secondary sources on flora and fauna species, and comparing of field data. Compilation of Ecology and bio diversity data and their impact assessment on the study area, preparation of conservation plan, greenbelt development plan and environmental management plan for biological environment.	
3.	SE	FAE	Mr Dhivakar	Period: January 2022 – Till date Task: Site visit, and conducted baseline socio-economic surveys. Collection of secondary data, discussion with stake holders and preparation of socio-economic status of the study area. Review of demographic characteristics, and supervision of baseline data collection. Collection and analysis of perception study carried out for the proposed project.	
4.	LU	FAE	Mr Venkateshwarlu Rachala	Period: March – May 2024 Task: Development of land use maps and land use pattern of study area using GIS/related tools, and finalization of land use maps. Performed site visit for ground reality survey, and marking of eco- sensitive areas within the study area as per Topo map and Gazette notifications.	
5.	AP	FAE	Dr J R Moses	Period: January 2022 – Till date Task: Selection of air quality monitoring location, sampling and interpretation of ambient air quality results. Estimation of fugitive emissions, identification and assessing of impacts due to air pollution and suggested suitable mitigation measures.	
6.	AQ	FAE	Dr J R Moses	Period: January 2022 – Till date Task: Collection and developing of micro-meteorological data from secondary sources, preparing site-specific wind rose pattern, prediction of dispersion of pollutants and incremental pollution levels with air quality modelling. Identification of impacts and proposed the suitable control measures, development of EMP.	

S. No.	Functional Areas		Name of the Expert	Involvement (Period & task)	Signature
7.	NV	FAE	Mr Vamsee Krishna Navooru	Period: January 2022 – Till date Task: Identification of noise monitoring locations and measured the ambient noise levels & vibrations generated due to various activities. Verification of Noise and traffic baseline data, and their impact assessment, Prediction of noise in residential/commercial area using noise modelling, identifying the probable impacts due to noise & vibrations and suggested noise pollution control measures along with environmental management plan.	
8.	SC	FAE	Dr BC Nagaraja	Period: March – May 2024 Task: Identification of soil quality monitoring locations, assessing of soil nutrients/characteristics in the study area, assessing the impacts on soil and proposing the soil management practices during construction and operation phase of project.	
9.	SHW	FAE	Mr Vamsee Krishna Navooru	Period: January 2022 – Till date Task: Identification and Quantification of municipal solid waste and hazardous waste generated due to the proposed activity. Proposed suitable management methodologies for handling, disposal, treatment and storage of wastes.	
10.	HG	FAE	Mr PVR S Surendra	Period: January 2022 – Till date Task: Identification of ground water potential in the study area, analysis of surface hydro geological data, its flow rate and direction. Preparation of report with respect to hydro geological condition in and around the study area.	
11.	RH	FAE	Dr J R Moses	Period: January 2022 – Till date Task: Identification of hazards materials, fire accidents within the facility and validation of existing risk assessment & Disaster management plan along with the preparation of risk for the proposed unit with consequence analysis and mitigation measures	

EIA Team Members:

S. No	Name	Role
1.	Dr Ramrajan S	TM for EB
2.	Praveenkumaar R	FAA for AP & LU

3.	Ajeeth Kumar	TM for EB
4.	Sriya G Nath	TM for RH
5.	Dr Ramrajan S	TM for EB

- AP - Air pollution monitoring, prevention and control*
AQ - Meteorology, air quality Modelling and prediction
WP - Water pollution monitoring, prevention and control
LU - Land use
EB - Ecology and bio-diversity
NV - Noise & Vibration
SE - Socio-economics
HG - Hydrology, ground water and water conservation
SC - Soil conservation
RH - Risk assessment and Hazard management
SHW - Solid and Hazardous waste management

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LIST OF ACRONYMS

⁰ C	DEGREE CELSIUS
API	AMERICAN PETROLEUM INSTITUTE
ATF	AUTOMATIC TRANSMISSION FLUID
BLQ	BELOW LIMIT OF QUANTIFICATION
BOD	BIOCHEMICAL OXYGEN DEMAND
COD	CHEMICAL OXYGEN DEMAND
CPCB	CENTRAL POLLUTION CONTROL BOARD
CRZ	COASTAL REGULATION ZONE
CZMP	COASTAL ZONE MANAGEMENT PLAN
DG	DIESEL GENERATOR
DMP	DISASTER MANAGEMENT PLAN
DWT	DEAD WEIGHT TONNAGE
EIA	ENVIRONMENTAL IMPACT ASSESSMENT
EMS	ENVIRONMENTAL MANAGEMENT STUDIES
EMP	ENVIRONMENTAL MANAGEMENT PLAN
ETP	EFFLUENT TREATMENT PLANT
ETTPL	ENNORE TANK TERMINALS PVT LTD
GLC	GROUND LEVEL CONCERATION
IMD	INDIA METEOROLOGICAL DEPARTMENT
IRS	INSTITUTE OF REMOTE SENSING
KPL	KAMARAJAR PORT LIMITED
KLD	KILO LITER PER DAY
KVA	KILOVOLT AMPERE
LPG	LIQUIFIED PETROLEUM GAS
LPA	LITRE PER ANNUM
LOQ	LIMIT OF QUANTIFICATION
MLT	MARINE LIQUID TERMINAL
MTPS	MADRAS THERMAL POWER STATION
MTPA	MILLIONS TONNES PER ANNUM
MOEF&CC	MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE
MSL	MEAN SEA LEVEL
NAAQ	NATIONAL AMBIENT AIR QUALITY STANDARDS
NCTPS	NORTH CHENNAI THERMAL POWER STATION

NABL	NATIONAL ACCREDITATION BOARD FOR TESTING AND CALIBRATION LABORATORIES
NR	NO RELAXATION
OISD	OIL INDUSTRY SAFETY DIRECTORATE
POL	PETROLEUM, OIL AND LUBRICANTS
PPM	PARTS PER MILLION
RMC	READY MIX CONCRETE
QCI NABET	QUALITY COUNCIL OF INDIA - NATIONAL ACCREDITATION BOARD FOR EDUCATION AND TRAINING
RA	RISK ASSESSMENT
TDS	TOTAL DISSOLVED SOLIDS
TNEB	TAMILNADU ELECTRICITY BOARD

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Annexure 12	CRZ Report
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CHAPTER 1

INTRODUCTION

1 INTRODUCTION

1.1 Purpose of the report

The purpose of this report is to get EC and CRZ clearance for “Capacity Augmentation of existing operational Marine Liquid Terminal (MLT) from 3 MMTPA TO 6 MMTPA at Kamarajar Port Limited, Chennai”. Kamarajar Port Limited (KPL) has obtained the initial Environmental Clearance (EC) for their projects on 19th May 2006 for their projects which includes construction and operation of Marine Liquid Terminal of capacity 3 MMTPA. Ennore Tank Terminals Pvt Ltd (ETTPL) designed, constructed and operating the said Terminal on a 30 Years BOT basis with KPL. Further, recently customers evinced interest to discharge multiple products from one or more vessels simultaneously to improve overall turn around time of the vessels and also intend to increase the throughput volumes through ETTPL to cater to the increased market demand. To facilitate this, ETTPL is planning to augment its throughput capacity from 3 MMTPA to 6 MMTPA.

The purpose of this EIA study is to study the baseline environmental condition of the area, assess the environmental impact of various E&P operations and to suggest mitigation measures to address the same. ETTPL proposing for the clearance of CRZ to augmenting its throughput capacity from 3 MMTPA to 6 MMTPA.

The main methods proposed to be followed in the capacity augmentation in enhancing the throughput capacity of the MLT from 3 MMTPA to 6 MMTPA based on the detailed feasibility study are furnished below:

- Sweating of existing assets and facilities to yield additional throughput .
- In-Line berthing of one Medium Range (MR) and one Lower Range (LR) vessels for simultaneous discharge improving the vessel turnaround time and in turn the throughput capacity.
- Simultaneous discharge of 2 POL products namely MS and HSD through 2 separate dock lines namely 24” and 16” thereby POL vessel discharge time is reduced by 40%. This is done through pipeline modification at jetty and at common manifold to connect the second pipeline to the outside terminals like BPCL, HPCL & RIL.
- Convincing the Customers to bring larger size vessels with increased parcel size of POL products. This will reduce the idle time such as vessel berthing/un-berthing time, sampling and ullaging time and pre discharge testing time etc., thus effectively reducing the number of vessels of POL, thereby improving the jetty efficiency and throughput capacity.

- Convincing the POL customers like IOCL, BPCL, and HPCL to club their parcels in single larger size vessels whereby the overall non-working time gets reduced improving the efficiency and throughput.
- Out of the additional throughput of 3 MMTPA proposed in this proposal, 80% will be going to the terminals outside the port boundary (through captive pipelines of IPPL, HPCL, RIL and BPCL).

1.2 Project Background

- Ministry of Environment & Forests had accorded Environmental clearance for the development of satellite port at Ennore near Madras vide letter No. J16011/9/87-IA.III dated 28.9.1992. After commissioning of the satellite port in June 2001
- Initially M/s Ennore Port Limited obtained the EC vide letter no.10-28/2005-IA.III dated 19th May, 2006 by the Ministry for Expansion Proposals-development of Terminals for marine liquids, coal, Iron and containers in second phase and associated capital dredging at Ennore Port.
- Subsequently, Ennore Port obtained modification in EC by the Ministry vide letter dated 10th September, 2007, thereafter, PP obtained the Environmental and CRZ clearance vide letter no 11-21/2009-IA.II dated 23rd July, 2009 for the construction of general Cargo berth at Ennore Port Cargo Terminal project, Ennore, Ponneri Taluk, District Tiruvallur, Tamilnadu, in the name of M/s Ennore Port Terminal.
- Thereafter the name of the Ennore port has changed from M/s Ennore port limited to M/s Kamarajar Port limited, after change of the name PP has submitted that the Kamarajar Port ltd (formerly known as Ennore Port ltd.) and obtained environmental and CRZ clearance for expansion and modernization of existing handling of Multicargo container terminal at Kamarajar Port, Tamil Nadu by M/s Kamarajar Port Limited (Formerly known as Ennore Port Ltd) subsequently obtained Environmental and CRZ clearance for construction of (CB3 and CB4) at Kamarajar Port, Tamilnadu vide letter dated 1 March, 2015. Subsequently M/s Kamarajar Port Ltd obtained the EC vide letter no F.No.11-51/2012-IA-II dated 30th October, 2018 for development of the facilities envisaged in the Port Master Plan (Phase III) by M/s. Kamarajar Port Limited.
- Further, the Kamarajar Port limited has applied in the Ministry for capacity optimisation of the ECTPL from present 8 MTPA to 9.6 MTPA, the proposal was considered by the Expert Appraisal Committee (EAC) in its 321st meeting during 28th February-1st March, 2023. The MoEF&CC granted Environment and CRZ Clearance under clause 7 (ii) of EIA Notification, 2006 vide letter no. 10-28/2005-IA.III dated 17/07/2023
- ETTPL has obtained Consent to operate vide 2208242865923 dated 22/08/2022 it is valid upto 31.03.2027.

- Kamarajar port has obtained CCR vide F.No.EP/12.1/2017-18/17/TN/1299 dated 26.08.2024.
- As per the obtained ToR vide 10/15/2024-IA.III dated: 06.09.2024 draft EIA report is prepared for Public hearing submission TNPCB, Gummindipoondi , Thiruvallur, for the Capacity Augmentation of Existing Operational Marine Liquid Terminal (MLT) from 3 MMTPA to 6 MMTPA at Kamarajar Port Limited, Chennai the project obtained recommendation from State Coastal Zone management Authority for the CRZ area.

1.2.1 Infrastructures and details of KPL Port

- Total area of the port is 2787.2 Acres which includes both customs and outside customs boundary
- Total manpower is 1500Nos. (KPL=155Nos. + Other BOT operators = 1345 Nos.)
- Water requirement is Presently drawing 269.46 KLD out of 1000KLD approved by CMWSSB.
- Power requirement is 650 KVA & 37342514 KWH per year (Including KPL and all other BOT Operators).

1.2.2 Compliance status of earlier EC's of KPL Port

S.No	EC Number	EC name	Total EC Condition	General Condition	Special condition	Complied	Not Complied	Partially complied	Refer Below	Agree to comply	Pertained to TNPCB
1	EC.No. J-16011/9/1987-IA.III, dated 28.09.1992	Construction of New Satellite Port at Ennore near Madras.	23	23	0	9	2	3	9	0	0
2	EC.No. 10-28/2005-IA-III dated 19.05.2006, 10.09.2007 & 18.12.2007.	Development of Terminals for marine liquids, coal, iron and containers in the second phase and associated capital dredging at Ennore Port	35	19	16	18	1	2	11	3	0
3	EC. No. 11-21/2009-IA.III dated 23.07.2009.	Construction of General Cargo Berth at Ennore Port cargo terminal project	27	21	6	12	0	1	9	4	1
4	EC.No. 10-28/2005-LA-III dated 24.12.2014.	Expansion and modernization of existing handling Multicargo container terminal at Kamarajar Port	26	20	6	16	0	0	7	3	0
5	EC.No.11-51/2012-IA.III, dated 12.03.2015	Development of additional coal berths (CB3 and CB4) at Kamarajar Port, Tamil Nadu	54	19	35	14	0	1	12	26	1
6	EC.No. 10-28/2005-IA.III dated 09.05.2018 & 10.07.2018	Modification of existing Iron ore terminal on 'as is where is basis to handle common user coal at Kamarajar Port	Present Status of the project: The project was accorded Environmental and CRZ Clearance for modification of the already approved iron ore terminal of 12 MTPA capacities to handle common user coal at Kamarajar Port vide letter date 0005.2018. The mod of the terminal was canned out by M/s. SICAL iron Ore Terminal Limned. The unit has Consent for Establishment under Air (Prevention and control of pollution) Act, 1981 and Water (Prevention and control of pollution) Act, 1974, vide order No. 18012102720/2 & 1801110272073, dated 20.07.2018, valid till 31.03.2025. The copy of the clearance is uploaded on the website of the Project Proponent: https://www.ennoreport.gov.in/content/innerpage/environment.php The lender of the project M/s. YES Bank Limited has given notice for event of financial default on the BOT operator to KPL on 07.11.2020: Accordingly, in line with the license agreement, KPL had served "Notice of intent to terminate" to								

S.No	EC Number	EC name	Total EC Condition	General Condition	Special condition	Complied	Not Complied	Partially complied	Refer Below	Agree to comply	Pertained to TNPCB
			M/s. SICAL Iron Ore Terminal Limited on 20.12.2020. Consequent to which, the project is stalled till now. Hence, the compliance of the conditions stipulated in the EC& CRZ clearance dated 09.05.2018 does not arise.								
7	EC.No. 11-51/2012-IA.III dated 30.10.2018	Development of facilities envisaged in the Port Master Plan (Phase-III).	54	19	35	15	0	1	11	26	1
8	EC.No. 11-10/2022-IA.III dated 22.04.2022	Establishment of 1MLD RO Desalination Plant	Present Status of the project: The Ministry had accorded CRZ Clearance for the establishment of 1 MLD desalination plant letter dated 22.04.20 e unit had obtained for Establishment under Air (Prevention and control of pollution) Act, 1981 and Water (Prevention and control of pollution) Act, 1974, vide order No. 2201148160108 & 2201048160108, dated 03.11.2022, valid till 31.03.2026. The clearance details were advertised in English (The Indian Express) and Tamil (Dinamani) Newspapers on 05.05.2022. The copy of the clearance is uploaded on the website of the Project Proponent: https://www.ennoreport.gov.in/content/innerpage/environment.php However the project is yet to commence construction work. Tender work is in progress. Hence, the compliance of the conditions stipulated in the CRZ clearance dated 22.04.2022 does not arise.								
9	EC.No. 10-28/2005-IA-III dated 17.07.2023 &14.11.2023.	Capacity Optimisation of Existing ECTPL Terminal from 8MTA to 9.6 MTPA at Kamarajar Port Ltd	16	4	12	7	0	1	5	3	0

1.3 Identification of the Project

Kamarajar Port is planning to augment the Capacity Augmentation of existing operational Marine Liquid Terminal (MLT) from 3 MMTPA TO 6 MMTPA at Kamarajar Port Limited operated by ETTPL **Table 1-1** at Tiruvallur District, Tamilnadu. The project falls under **CRZ III, CRZ III(NDZ), CRZ-IV(A)** and the tank farm area falls under Non- CRZ area. The Existing users of the Marine Liquid Terminal is given in the **Table 1-2**

Table 1-1 Planning augmentation and its throughput capacity

S.No.	Details	Remarks		
1	Modification of Common Manifold to facilitate simultaneous discharge to BPCL	Hooking up lines to 2 x 24" lines of BPCL		
2	Modification of 16" dock line to make it suitable for receipt of motor spirit from vessels	Modifications at jetty, common manifold and at exchange pit		
3	Modification of 8" SS Dock Line for in line berthing of chemical vessel with POL vessels	Extension of 8" SS Dock line to south side of the jetty for in-line berthing of 2 vessels		
S.NO	Product Group	Existing Throughput Capacity in MMTPA	Proposed Throughput Capacity in MMTPA	After Expansion Throughput Capacity in MMTPA
1	LPG (Refrigerated Propane and Butane)	1.20	0.4	1.60
2	Petroleum, Oil, and Lubricants.(POL)Products	1.45	1.75	3.20
3	Black Oil	0.20	0.70	0.90
4	Chemicals and Petro Chemicals	0.15	0.15	0.30
Total		3.0	3.0	6.0

1.3.1 Identification of the Project Proponent

In 2014, the Ennore Port Ltd. was officially renamed as Kamarajar Port Ltd., originally conceived as a satellite port to the Chennai Port, primarily to handle thermal coal to meet the requirement of Tamil Nadu Electricity Board (TNEB), and was endowed with large chunks of land (about 2,000 acres). The scope was expanded taking into consideration of subsequent developments such as the plan of Government of Tamil Nadu to setup an 1,880 MW LNG power project in association with a private consortium, a large

petrochemical park commissioned on 1st February 2001 and a naphtha cracker plant. The port was set up under the Companies Act, keeping it outside the scope of the Tariff Authority for Major Ports, the tariff regulator for 11 of the 12 ports owned by the Indian government. The first phase of the port consisted of two berths for handling coal vessels up to 65,000 DWT, dredging for the approach channel and harbour basin, onshore civil works, navigational aids, and two breakwaters - 4 km in the north side and 1 km in the south—close to the NCTPS (North Chennai Thermal Power Station) and the Ennore Creek. The port subsequently acquired additional 440 hectares of land for future expansions.

Ennore Tank Terminals Pvt. Ltd. is a subsidiary of IMC Limited, the largest independent Bulk Liquid Storage Company in India. IMC is in the business of port-based bulk liquid storage and international trading for the last seven decades.

1.3.2 Advantages of ETTPL

- (1) Kamarajar Port is designed with higher dredged depths of 15 to 18.5 meters and large tankers (150,000 DWT) can be berthed at present. Users thus have the option to import/export in higher parcel sizes and benefit from lower freight costs.
- (2) Kamarajar Port is located on the international shipping route. Kamarajar Port is a major port of call for Products, chemicals and vegetable oil tankers. Hence, Ennore is an ideal port of call for ships from the west and from Singapore, Malaysia, Korea and other far-east countries.
- (3) The terminal is planned for handling and storage of a wide range of liquid bulk including low flash liquids, which makes Ennore an attractive option for users and shipping companies.
- (4) In view of the higher draught, there is potential for Kamarajar Port to be used as a hub port. Large parcels may be imported at Kamarajar Port and then moved to the consumption points either by road, rail or coastal shipping.
- (5) Chennai Port does not have storage facility for handling LPG. Also, there is no storage infrastructure for Class A/B products, which is forcing importers in the hinterland of Chennai to route their import through other ports such as Cochin and Mangalore. Ennore would therefore be an automatic choice for importers and exporters.

1.4 Brief description of Nature, Size and Location of the Project

Existing Built up area as per EC vide letter no 10-28/2005-IA-III dated on 19.05.2006 which is enclosed as **Annexure-1**. This project is about the Capacity Augmentation of existing operational Marine Liquid Terminal (MLT) from 3 MMTPA TO 6 MMTPA at Kamarajar Port Limited, Chennai.

1.4.1 Nature of the project

1.4.1.1 Petroleum products

The demand for marine terminal facilities for petroleum products is expected to increase significantly due to:

- Increasing importance of coastal shipping in petroleum product movement

- Growing POL product traffic at ports in the southern region
- Overlapping product movement of petroleum products
- Demand serviced from refineries outside the region - Private sector players like RIL and Nayara Energy expect to rely substantially on coastal movements from their refineries in the western region to service their share of demand in the southern region
- Retail marketing plans of private sector oil companies
- CPCL expansion and capacity constraints at Chennai Port

In view of the advantages, a wide range of vessels ranging from large product tankers to small chemical tankers are expected to call at the MLT.

1.4.1.2 Liquid Petroleum Gas

Traffic in LPG is expected at Ennore in view of the potential demand-supply gap in the immediate hinterland of Kamarajar Port. The requirement of domestic and industrial and auto LPG of entire North Tamilnadu will be catered through the IPPL's LPG storage terminal at Athipattu Pudhunagar and the products will be handled through the ETTPL's MLT.

The demand is likely to grow at 5-8% on annual basis with Pradhan Mantri Ujjwala Yojana scheme being implemented across the country for supply and distribution of domestic LPG.

1.4.1.3 Chemicals/other liquids

MLT is well placed to service the chemical cluster in and around Chennai, in its immediate hinterland. Manali Industrial Belt is well connected to Ennore for any import of their raw materials and finished goods as Chennai Port Authority will not be in a position to handle hazardous products and also traffic congestion outside the Ports will encourage the importers to prefer Ennore to Chennai.

Table 1-2 Existing users of the Marine Liquid Terminal

S.No	Existing users	Products
1.	Indian Oil Petronas Pvt. Ltd (JV of IOCL & Petronas)	Propane/Butane/LPG
2.	Hindustan Petroleum Corporation Ltd	POL
3.	Bharat Petroleum Corporation Ltd	POL
4.	IOCL	POL
5.	Hi-Tech Carbon – A unit of SKI	Carbon Black Feed Stock

	Carbon India Ltd	
6.	Shell India Marketing Pvt Ltd	POL
7.	Ponpure Logistics	Various chemicals
8.	MRPL	POL
9.	Manali Petrochemicals Ltd	Propylene Oxide
10.	Tamilnadu Petroproducts Ltd	Benzene/LAB
11.	Supreme Petrochem	Styrene Monomer
12.	Reliance Industries Ltd	POL
13.	SKS Logistics Private Limited	Petro Chemicals
14.	KLJ Group of Industries	Petro Chemicals
15.	Jesons Industries Limited	Styrene Monomer
16.	Nayara Energy Limited	POL
17.	Other Customers of Chemicals	AR Stanchem, Kothari Petrochemicals Pvt Ltd., Thirumalai Chemicals Ltd.

1.4.2 Location

Ennore is a suburb in Chennai, India. Ennore is situated on a peninsula and is bounded by the Korttalaiyar River, Ennore creek and the Bay of Bengal. The creek separates Ennore from the Ennore Port and Athipattu Pudunagar. The neighbourhood is served by Ennore railway station. The project site is located near to Coastline of Bay of Bengal and the location map is presented in **Figure 1-2**. The coordinates of the project site is given as **Table 1-3** and **Figure 1-3**. Site photographs are given in **Figure 1-1**.

1.4.3 Size of the project

The ETTPL a subsidiary of IMC Ltd was commissioned in the year 2009 with a total Tankage of 2,56,636 KL with various Petroleum and Chemicals storage and handling, on a Plot of about 33.26 Acres.

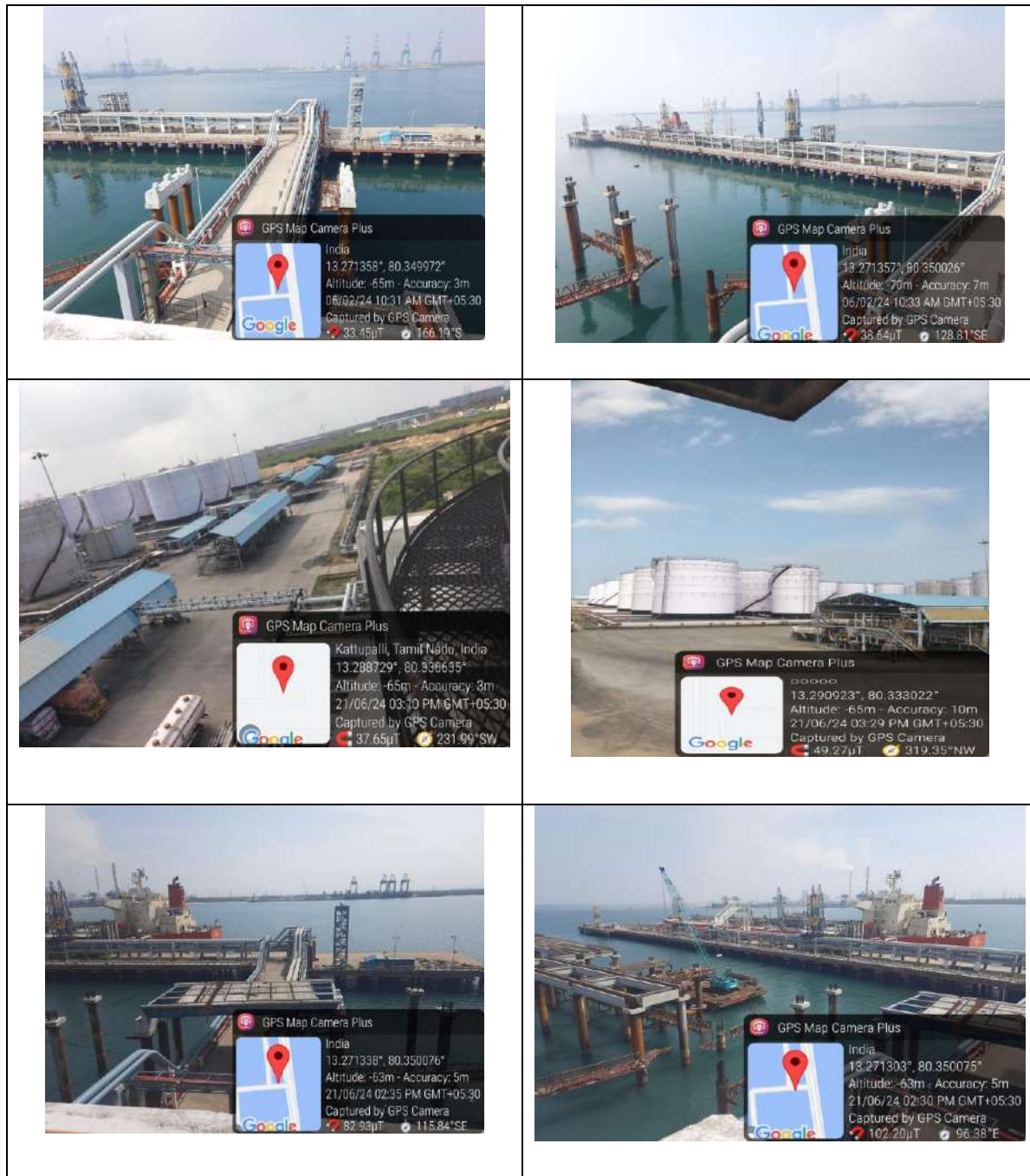


Figure 1-1 ETPL Tank forms, Pipeline and Jetty Photographs

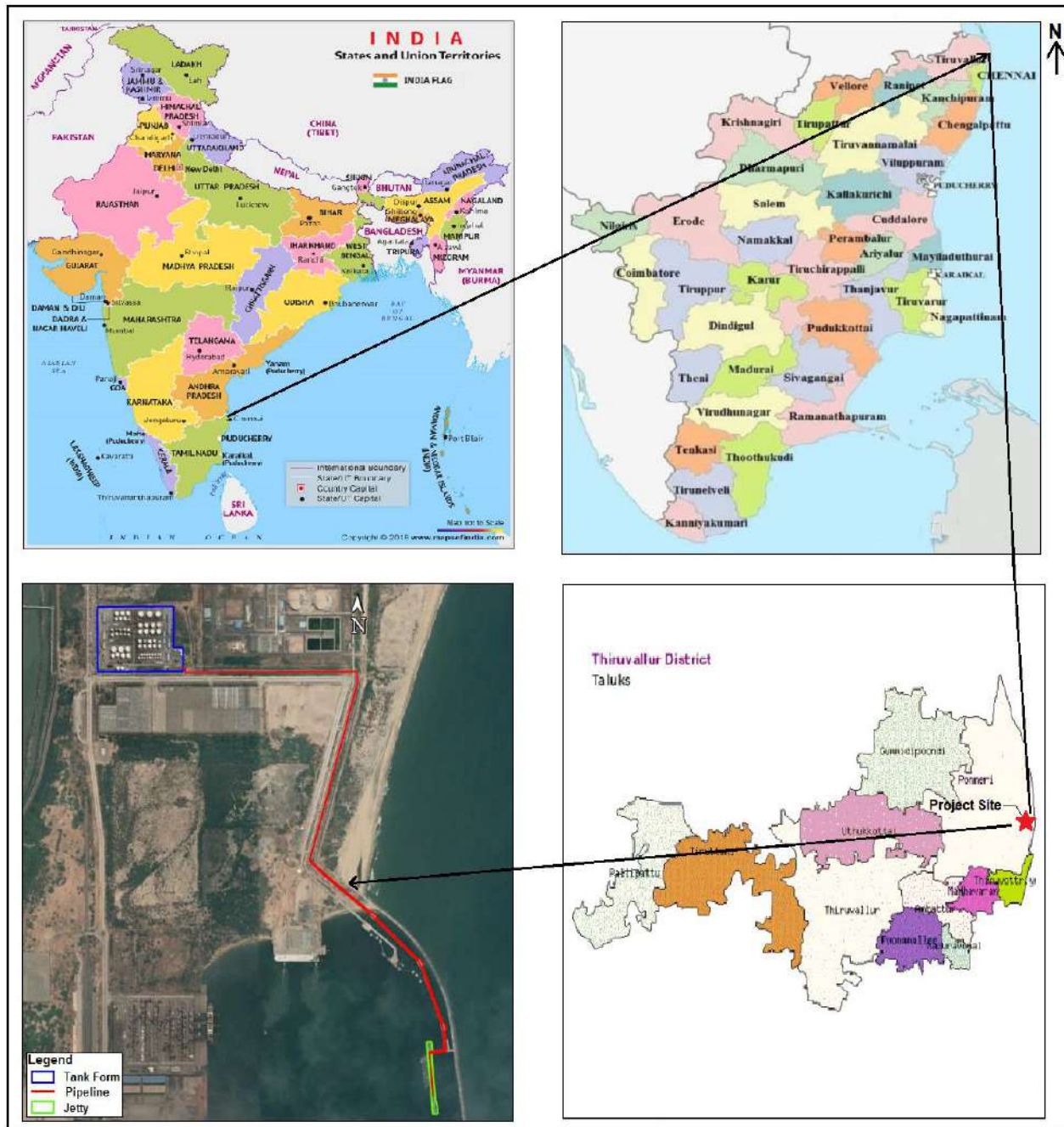


Figure 1-2 Location map of project site

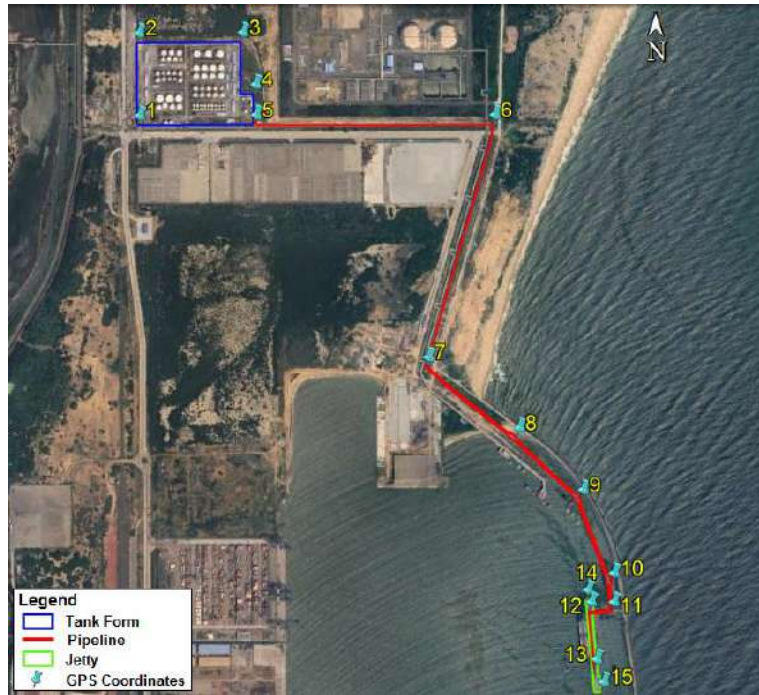


Figure 1-3 Coordinates of project site

Table 1-3 Coordinates of site

S.No	Latitude	Longitude
1	8°46'35.48"N	78°11'57.15"E
2	8°45'35.64"N	78°12'33.77"E
3	8°45'23.80"N	78°13'3.46"E
4	8°45'20.07"N	78°13'16.52"E
5	8°45'16.93"N	78°13'25.17"E
6	8°44'54.67"N	78°13'44.79"E
7	8°44'59.73"N	78°13'38.88"E
8	8°44'57.53"N	78°13'36.61"E
9	8°41'12.31"N	78°17'49.63"E
10	8°41'6.88"N	78°17'44.76"E
11	8°44'51.09"N	78°13'27.72"E
12	8°44'41.67"N	78°13'37.58"E
13	8°44'21.27"N	78°12'55.55"E
14	8°44'28.95"N	78°12'50.34"E
15	8°44'51.83"N	78°12'5.36"E
16	8°44'58.06"N	78°12'7.21"E
17	8°45'12.97"N	78°11'34.66"E

18	8°45'54.39"N	78°11'52.86"E
19	8°45'44.65"N	78°12'13.85"E
20	8°46'21.45"N	78°11'55.26"E

1.5 Scope of the Study

The study is limited to the established site, covering 10 km radius around this stretch. Thus in the current EIA the Capacity Augmentation of existing operational Marine Liquid Terminal (MLT) from 3 MMTPA TO 6 MMTPA and the surrounding 10 km radius are considered in this impact assessment study.

This EIA is prepared for the EC based on EIA notification 2006 and also for CRZ clearance as per CRZ notification 2011 and its amendments, it mainly consists of baseline study of project site covering 10km radius of the site, anticipated environmental impacts, risk assessment, disaster management plan and the environmental management plan.

The scope of the study has been based on EIA notification 2006, Generic Structure of Environmental Impact Assessment Document. Work mentioned includes an assessment study of and their impact on the region. This study puts forward the most effective ways to protect the environment from increasing pollution caused by the burgeoning industrial development and recommendations for environmental-friendly development initiatives in the region.

This EIA report presents the existing baseline scenario and the assessment and evaluation of the environmental impacts that may rise during the construction and operational phases of the project. This report also highlights the Environmental Monitoring Program of the project and the post project monitoring program.

1.6 Structure of the Report

The EIA report comprises of 12 chapters as under complying of EIA notification 2006 & its amendments.

Chapter 1: Introduction

Introductory information is presented in this Chapter. The introduction chapter provides background of the project, project proponent and describes the objective of this document. The purpose and organization of the report is also presented in this chapter.

Chapter 2: Project Description

This Chapter includes project Description and Facilities in detail.

Chapter 3: Description of the Environment

This Chapter provides baseline environmental status of Environmental Components (Primary data) delineating meteorological details of the project site and surrounding area.

Chapter 4: Anticipated Environmental Impacts & Mitigation Measures

This Chapter presents the analysis of impacts on the environmental and social aspects of the project because of the establishment of the plan and thereby suggesting the mitigation measures.

Chapter 5: Analysis of Alternatives

This chapter includes the justification for the selection of the project site from Environmental point of view as well as from economic point of view so that the technology will be affordable.

Chapter 6: Environmental Monitoring Program

This chapter will include the technical aspects of monitoring the effectiveness of mitigation measures, which will include the measurement methodologies, frequency, location, data analysis, reporting schedules etc.

Chapter 7: Additional Studies

This chapter will go through the public consultation that was requested for the project. During the consultation it will also identify the project's hazards to the public and the surrounding environment, and will offer a Disaster Management Plan, a Social Impact Assessment, and R&R action plans.

Chapter 8: Project Benefits

This chapter deals with the improvement in physical and social infrastructures, employment potential and other tangible benefits.

Chapter 9: Environmental cost Benefit Analysis

Not recommended during scoping stage

Chapter 10: Environmental Management Plan

This is the key Chapter of the report and presents the mitigation plan, covers the institutional and monitoring requirements to implement environmental mitigation measures and to assess their adequacy during project implementation.

Chapter 11: Summary and Conclusion

This chapter summarizes the information given in Chapters in this EIA/EMP report and the conclusion based on the environmental study, impact identification, mitigation measures and the Environmental Management Plan.

Chapter 12: Disclosure of consultant

Disclosure of Consultant Engaged presents the declaration by the EIA consultant organisation as per the NABET requirements

1.7 Methodology adopted for the study

The Environmental Impact Assessment is a management tool to identify, frame and prioritize the environmental issues in such a way so as to work out the mitigation measures to allow the negative impacts to be minimized or to be avoided during actual operation of the established project. To conduct the Environmental Impact Assessment study, it is necessary to plan and execute the study in a scientific manner.

The REIA has been comprehended with detailed Environmental Baseline Monitoring (EBM) and Environmental Management Plan (EMP) for scientific implementation of the existing project for water and wastewater management to have the operations in an environmentally compatible way.

The process followed for this EIA report is composed of the following stages:

- Study of project information.
- Collection of detailed project management plan/report.
- Secondary & Baseline data collection.
- Impact identification, Prediction & Evaluation.
- Mitigation measures & delineation of EMP.
- Risk assessment, safety & disaster management plan.
- Review & finalization of REIA Report.
- Submission of REIA report for implementation of mitigation measures & EMP as well as necessary clearances from relevant Authority.

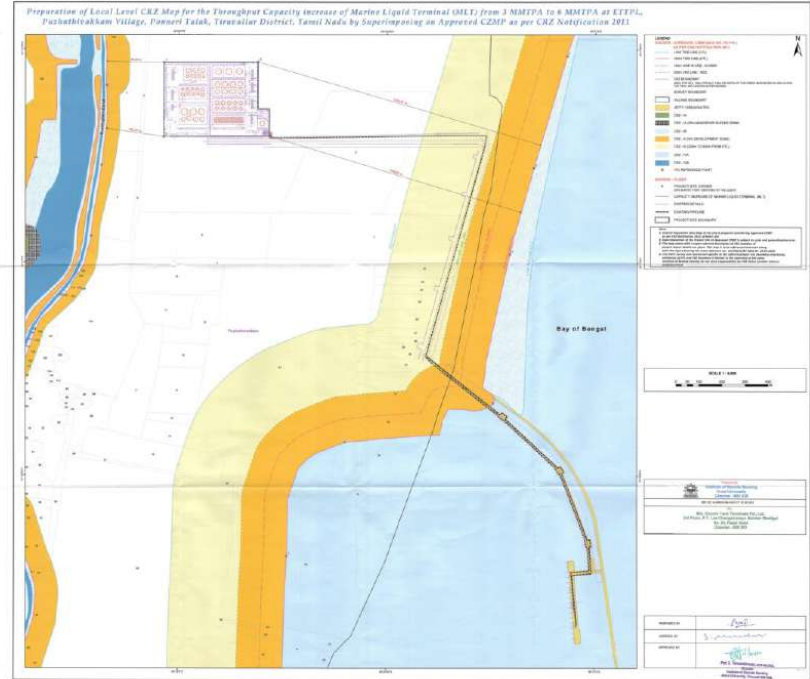
The distinct features of methodology for the EMP are as follows,

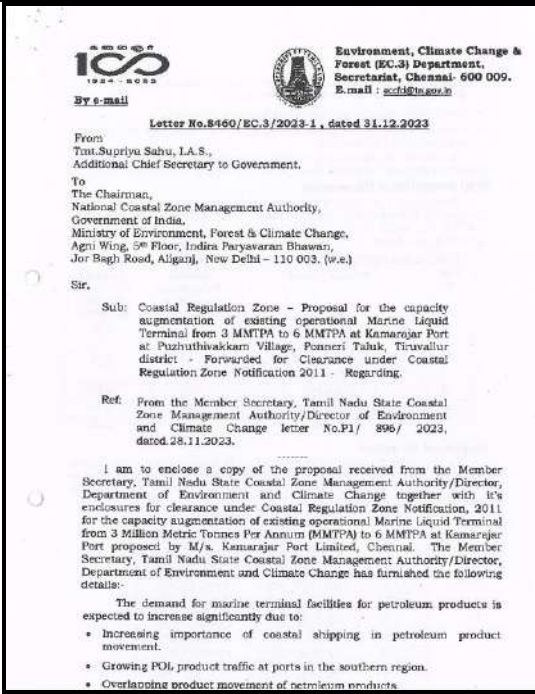
- The existing environmental quality was assessed based on primary and secondary data.
- Potential environmental impacts including potential benefits were identified and assessed.
- An EMP, comprising environmental management strategies was formulated to maintain and enhance the environmental quality around the project site.
- Risk Assessment (RA) to identify the risk involved in the project.
- A scheduled Disaster Management Plan (DMP) to enunciate a sequence of emergency response to preserve life and property which may be threatened in accidental damage of the which may result in fire to environment etc.

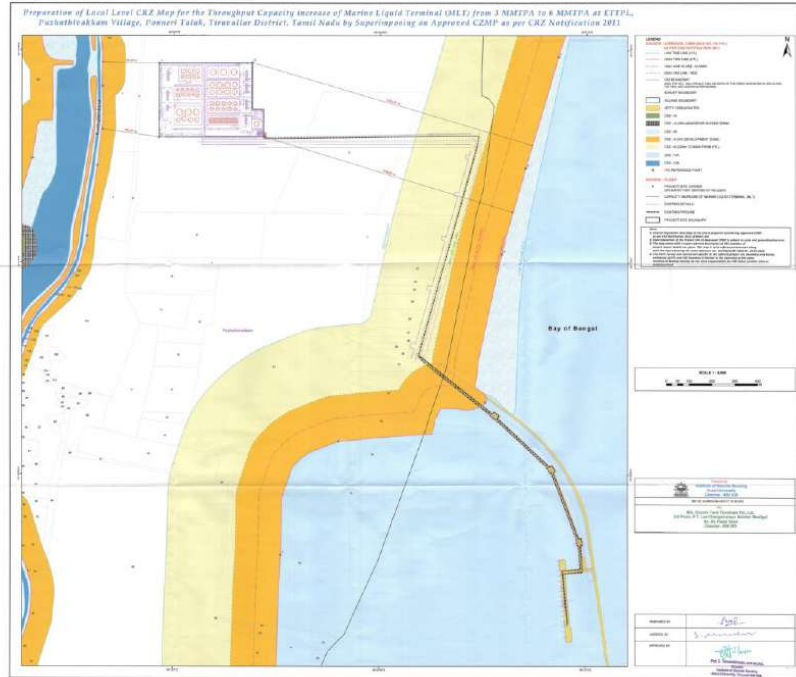
Keeping in view the nature of activities envisaged and the various environmental guidelines available, it was decided to cover an area of 10 km radius from the center of the existing project site for the purpose of Environmental Management Studies (EMS).

1.8 ToR Compliance

1.8.1 Special ToR compliance – EAC – ToR issued at 06.09.2024

S.No	Special ToR Points	Compliance
1.	Submit a copy of layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 Scales.	Layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 Scales. 
2.	Recommendation of the Tamilnadu CZMA shall be obtained and submitted.	Recommendation from Tamilnadu CZMA is obtained and it is attached as annexure 17 Letter No :8460/EC.3/2023-1 dated 31.12.2023

			
3.	Submit superimposing of latest CZMP as per CRZ(2011) on the CRZ map	Superimposing of latest CZMP as per CRZ(2011) on the CRZ map	

		
4.	Submit a complete set of documents required as per par 4.2(i) of CRZ Notification, 2011.	A complete set of documents required as per par 4.2(i) of CRZ Notification, 2011 is attached as Appendix A. In this Appendix A the below listed documents are attached. List of documents 1. CRZ Form – I 2. Rapid EIA 3. CRZ Map 1:4000 Scale 4. CRZ Map 7km Radius 5. CRZ Report

		6. NOC from State Board 7. SCZMA Recommendation 8. EMP
5.	Location of the dredge material, if any will be disposed shall be indicate in the KML file and the layout maps overly on the approved CZMP map shall be submitted and site suitability study shall be conducted.	Not Applicable, since the proposed augmentation project does not involve any dredging activities
6.	Total load carrying capacity of the port and complete environmental impact assessment study including Boiling Liquid Vapour Explosion (BLEVE) for petroleum product to be undertaken.	Draft BLEVE Report has been attached as Annexure 23.
7.	Hydrodynamics study on impact of dredging on flow characteristics shall be carried out.	Not Applicable, since the proposed augmentation project does not involve any dredging activities
8.	A Cumulative impact assessment on pollution load shall be carried out by taking into consideration of all activities and capacities of the existing projects, including spillage during transshipment, loading/unloading operation at both jetties. A suitable material handling system to be designed to minimize pollution.	A Cumulative impact assessment on pollution load report has been attached as Annexure 24.
9.	A detailed study on the impact of proposed activity on marine ecology and marine biodiversity with specific focus on the corals, mangroves and mud flats in the	Detailed marine ecology has been NABL & MoEF&CC recognised Laboratory conducted and the result is mentioned in the section 3.9.1

	proximity of the site should be conducted and required mitigation plan be submitted by a nationally reputed institute.	Details of marine biodiversity of the port region has been conducted by NABL & MoEF&CC recognised Laboratory and it is authorised by Tamil Nadu Biodiversity Board. It is attached Annexure 20. Coral Reefs As per the report coral reefs are not observed in the study area. Mangroves: Mangroves are observed in the backwater areas in the habitats of reduced fresh water and sea water Exchange and with high salinities. Due to this project no Mangroves will be affected. Impact on marine Environment due to this proposed project The major impact on marine water during the operation of the facility will be due to the spillage of material in land and sea. During the operational phase of the project, frequency of incoming and outgoing ships will increase and hence the chances of spillages and leakages of oil into the sea will be more. This will affect the sea water quality and appropriate care must be taken to ensure that discharges are made to appropriate drainage lines etc. which lead to appropriate treatment facilities. Oily wastes from machinery, spillages and leakages of oil from incoming and outgoing ships into the sea will affect the water quality. This water will have a chance to either drain into the water body, or will seep through the land and contaminate the ground water. This will have floating material on the water surrounding the port. The discharge of bilge water and/or ballast water from the ship may also cause negative impacts on the marine
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		water. The leaks, accidental release of the materials during the transport of the materials through the pipelines may cause serious soil contamination and will seep through the land and affect the ground water quality. As the area is a reclaimed land and the available groundwater will be affected by the salt intrusion and sea water incursion, it cannot be used for drinking without treatment. However contaminating the available groundwater /marine water with oil or any other materials shall be taken as very serious and all the possible measures to be taken to avoid any kind of spillage of materials during the operations like ship to ship transfer, shift to shore transfer, shore to shore transfer and vice versa. Mitigation Measure of Marine Environment To mitigate the impacts due to marine water pollution, the following measures would be adopted: • All the operational areas will be connected with a network of liquid waste collection corridor comprising of storm water, oily wastes, and sewage collection pipelines. • Oily wastes which are generated from the operational areas would be collected in the effluent network and further treated at the treatment plant. • Vessels calling at the Terminal would not be permitted to dump the wastes / bilge water during the berthing period. • Required pollution control facilities for treatment of waste water, solid waste management, etc. will be setup for the terminal. • Measures would be taken to contain, control and recover the accidental spills of fuel, oil and other product handled.
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		ETTPL and KPL has prepared Oil Spill Contingency Plan and is attached as Annexure 16 .				
10.	The type of Cargoes proposed to be handled at the port shall be submitted product wise and quantity wise.	The type of Cargoes proposed to be handled at the port with product and its quantity is given in below table:				
		S. No	Details of EC/CTE/CTO	Description of the cargo	Capacity in Million Tons Per Annum (as per EC)	Present operating consent capacity
		Terminals under operation/Consent To Operate obtained:				
		1	Coal Berths 1 & 2	Port facility for handling coal for TANGEDCO	16	16
		2	General Cargo Berth	Port facility for handling Automobiles & RoRo	2lakhs cars/year and project cargo & finished cargo of 0.5 Million Tons/year (Total 3MTPA)	2lakhs cars/year and project cargo & finished cargo of 0.5 Million Tons/year (Total 3MTPA)
		3	Ennore Coal Terminal Pvt. Ltd., (Common user coal)	Port facility for handling coal for common users	9.6	9.6
		4	Marine Liquid Terminal	Handling and storage of marine liquids, POL and LPG	3.0	3.0
		5	Adani Ennore Container Terminal	Port facility to handle	16.8	11.68

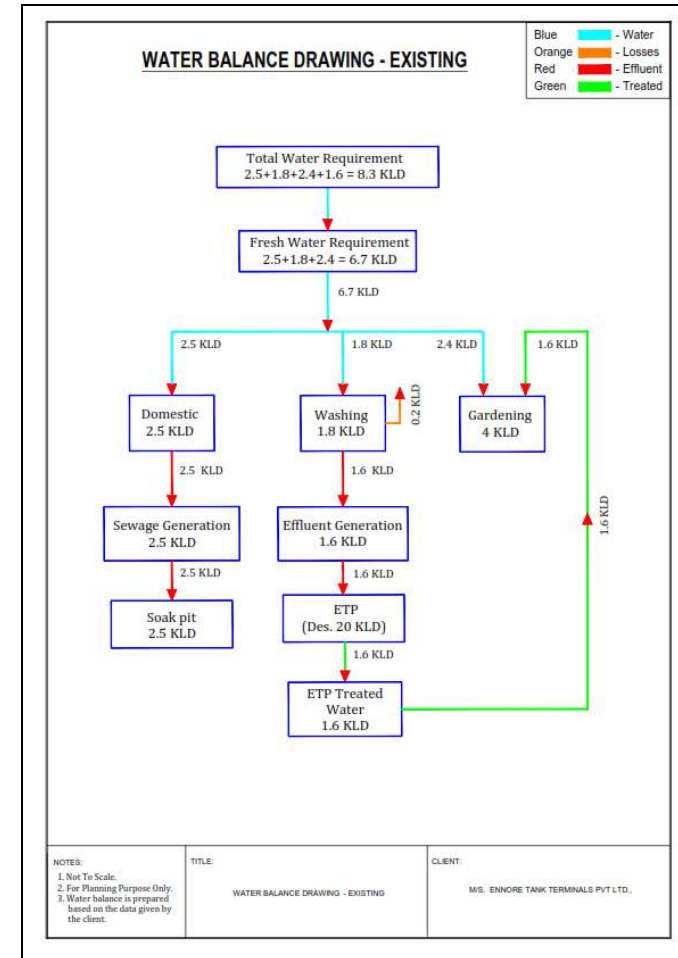
			Pvt. Ltd.,	containers		
		6	Ennore Bulk Terminal Pvt. Ltd.,	Multi cargo container terminal for handling cargoes like granite, timber logs, grains, bagged cargoes including sugar, cobble stone, steel cargoes, project cargo	2.0	2.0
		7	Indian Oil LNG terminal	Terminal for transfer of Regasified Liquefied Natural Gas (R-LNG) through Common Corridor from LNG terminal	5.0	5.0
		8	Automobile Export/Import Terminal-II	Port facility for handling Automobiles	3.0	3.0
		Total			55.40	50.28
		Terminals under implementation/Consent To Establish (CTE) obtained:				
		7	Coal Berths 3 & 4	Port facility for handling coal (TANGEDCO)	18	18
		9	IOCL captive Jetty	Jetty facility for handling of POL & LPG products	5	5
		10	Conversion of Iron Ore Terminal into common user coal	Coal handling - unloading, transfer, storage and loading of Coal)	12	12

		terminal			
		Total		35	35
		Terminals yet to undertake/implement/Consent To Establish yet to obtain (but EC obtained):			
		11	Automobile Export/Import Terminal-III	Port facility for handling Automobiles	3 -
		12	Container Terminals-3nos of 1000m quay length	Port facility to handle containers	24 -
		13	Marine Liquid Terminal-II	Handling and storage of marine liquids, POL and LPG	5 -
		14	Bulk Terminal-2berths	Port facility to handle coal/ore/other bulk cargo)	18 -
		15	Multi Cargo Berth	Port facility to handle bulk & break bulk cargoes	2 -
		Total		52	-
11.	The impact study on the hazardous materials handling and storage in worst case scenario shall be submitted along with the EIA/EMP report.	Detailed impact study on hazardous materials handling and storage in worst case scenario as been prepared and attached as Annexure 22 .			
12.	Public hearing shall be conducted as per laid down procedure and all the commitments made by the PP during PH and action required to be taken along with budgetary provisions shall be reflected in the EMP.	The Public Hearing will be conducted in accordance with the provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public will be addressed with budgetary allocations along with the action plan			

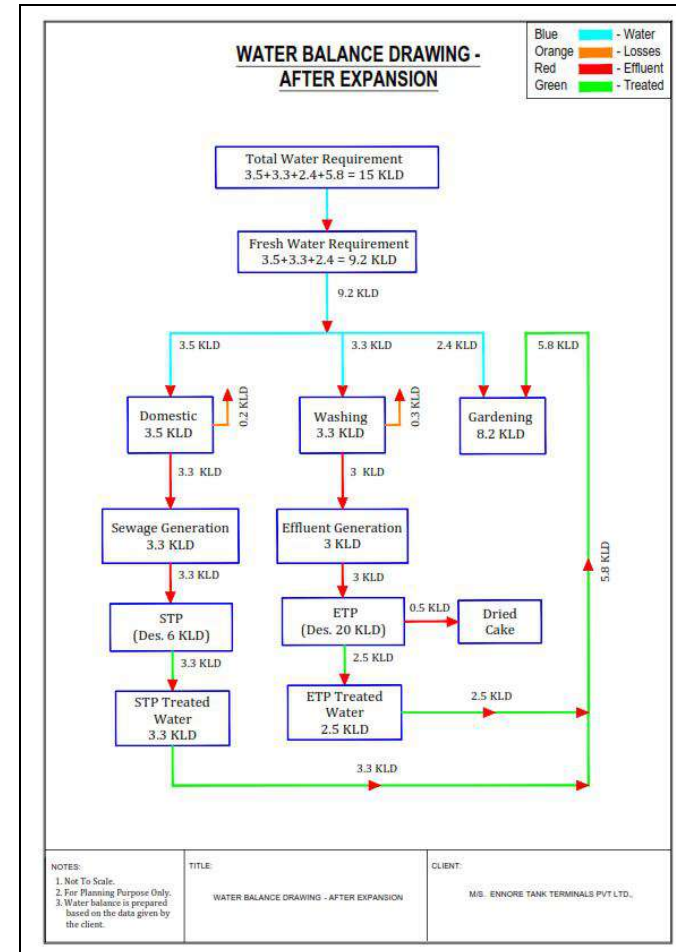
13.	Requirement of water, power, with source of supply of approval, water balance diagram, man power requirement (regular and contract).	Water Requirement :						
		S.No	Water Requirement	Qty (KLD)				
				Existing	Proposed	After Expansion		
		1	Fresh water Requirement	6.7	2.5	9.2		
		2	Recycled Water	1.6	4.2	5.8		
		Total Water Requirement		8.3	6.7	15		
		Total water Break up :						
		Water Requirement	Existing water Requirement(KLD)		Proposed water Requirement(KLD)		After Expansion water Requirement(KLD)	
			Fresh water	Recycled water	Fresh water	Recycled water	Fresh water	Recycled water
		Domestic	2.5	0	1	0	3.5	0
		Washing	1.8	0	1.5	0	3.3	0
		Gardening	2.4	1.6	0	4.2	2.4	5.8
		Total	6.7	1.6	2.5	4.2	9.2	5.8
For Fire fighting, sea water is being used and the same will be continued after expansion.								

Source of water: Out sourced through water tankers.

Existing Water balance diagram:



After Expansion Water balance diagram:



Man power requirement (regular and contract).

		<table><tr><th>Details</th><th colspan="2">Existing</th><th>Proposed</th><th>After Expansion</th></tr><tr><td rowspan="2">Manpower</td><td>Permanent</td><td>65</td><td>10</td><td>75</td></tr><tr><td>Temporary</td><td>13</td><td>15</td><td>28</td></tr><tr><td colspan="2">Total</td><td>78</td><td>25</td><td>103</td></tr></table> Power Requirement: <table><tr><th>Details</th><th>Existing</th><th>Proposed</th><th>After Expansion</th></tr><tr><td>Power Requirement</td><td>Terminal – 11KV(HT) MLT – 440 Volt (LT) DG SET: Terminal: 2 No of – 500 KVA and 1 No of – 250 KVA MLT: 1 No of – 180 KVA</td><td>No Additional Power is required Existing quantity will be sufficient</td><td>Terminal – 11KV(HT) MLT – 440 Volt (LT) DG SET: Terminal: 2 No of – 500 KVA and 1 No of – 250 KVA MLT: 1 No of – 180 KVA</td></tr></table> Power Source: TNEB	Details	Existing		Proposed	After Expansion	Manpower	Permanent	65	10	75	Temporary	13	15	28	Total		78	25	103	Details	Existing	Proposed	After Expansion	Power Requirement	Terminal – 11KV(HT) MLT – 440 Volt (LT) DG SET: Terminal: 2 No of – 500 KVA and 1 No of – 250 KVA MLT: 1 No of – 180 KVA	No Additional Power is required Existing quantity will be sufficient	Terminal – 11KV(HT) MLT – 440 Volt (LT) DG SET: Terminal: 2 No of – 500 KVA and 1 No of – 250 KVA MLT: 1 No of – 180 KVA
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14.	Disaster management plan for the project shall be prepared and submitted.	The ERDMP is prepared and it is attached as Annexure 9																											
15.	Risk analysis and its management plan for handling different types of liquid cargos(if handling) shall be	The QRA is prepared for handling of liquid cargo and the same is attached as Annexure 14 and Revised QRA has been attached as Annexure 22.																											

	conducted and submitted.	
16.	Detailed modelling studies to understand whether the selected site can withstand severe cyclones and develop design in accordance to due safety measures.	The project is only capacity Augmentation there will be no new construction is proposed . However,KPL port is having an existing Disaster Management plan which will be continued after capacity augmentation. Cyclone and disaster warning systems are well established in coordination with Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, and Department of Disaster Management. The ships berthed on the berth have to be taken offshore immediately on receiving the warning. The port has established an appropriate warning system in coordination with INCOIS and the Department of Disaster Management. Port is having Robust Disaster management plan which includes Emergency Response Action Plan to tackle natural as well as man made contingencies where in procedures and action plan has been elaborated. Disaster Management Plan is attached as Annexure 19
17.	Details and status of court case pending against the project the project, if any, shall be submitted.	No Litigation or court case is pending against the proposed project .
18.	A tabular chart with index for point-wise compliance of above ToRs. The specific ToRs as recommended above are in addition to all the relevant information as per the Generic Structure of EIA given in Appendix III and IIIA in the EIA Notification, 2006.	Noted Point-wise ToR Compliance is provided in Chapter 1, Section 1.7
19.	As per the Ministry's Office Memorandum F.No.22-	Will be complied after Public hearing

	65/2017-IA.III dated 30th September, 2020, the project proponent, based on the commitments made during the public hearing, shall include all the activities required to be taken to fulfil these commitments in the Environment Management Plan along with cost estimates of these activities, in addition to the activities proposed as per recommendations of EIA Studies and the same shall be submitted to the ministry as part of the EIA Report. The EMP shall be implemented at the project cost or any other funding source available with the project proponent.	
20.	In pursuance of Ministry's OM No stated above the project proponent shall add one annexure in the EIA Report indicating all the commitments made by the PP to the public during public hearing are fulfilled and submit it to the Ministry and the EAC.	Will be complied in after Public hearing

1.8.2 Standard ToR compliance – EAC – ToR issued at 22.07.2024

Sr.N o.	Terms of Reference		Compliance
Project details			
1.	Reasons for selecting the site with details of alternate sites examined/rejected/selected on merit with the comparative statement and	The proposed project site of Capacity Augmentation of existing operational Marine Liquid Terminal (MLT) from 3 MMTPA TO 6 MMTPA is the Augmentation project in the existing land of Kamarajar Port Limited.	

	reason/basis for selection.	
2.	The examination should justify site suitability in terms of environmental angle, resources sustainability associated with selected site as compared to rejected sites.	So, we will not consider the alternative site for this project.
3.	The analysis should include parameters considered along with weightage criteria for short-listing selected site.	
4.	Submit the status of shoreline changes at the project site	There are no major changes in shoreline activity due to the project site. As per the NCCR Report (2018), it is depicted as the low accretion region.

		
5.	A detailed EIA/EMP report should be prepared in accordance with the above TOR and should be submitted to the Ministry in accordance with Notification.	The detailed EIA/EMP report is prepared in accordance with ToR and it will be submitted to the Ministry in accordance with Notification.

6.

The cost of the project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out

Cost of the project :

S.No .	Details	Qty	Amount (INR, In Lakhs)	Remarks
1	Modification of Common Manifold to facilitate simultaneous discharge to BPCL	1	104.00	Hooking up lines to 2 x 24" lines of BPCL
2	Modification of 16" dock line to make it suitable for receipt of motor spirit from vessels	1	52.00	Modifications at jetty, common manifold and at exchange pit
3	Modification of 8" SS Dock Line for in line berthing of chemical vessel with POL vessels	1	8.00	Extension of 8" SS Dock line to south side of the jetty for in-line berthing of 2 vesssels
Total			164.00	

Cost of EMP :

		S. No	Component	Capital cost Rs.(lakh) (2024-25)	Recurring cost Rs.(lakhs) per Annum (2024-25)
		1	Hazardous waste Management	0	15
		2	Greenbelt Development	20.84	2.5
		3	Environmental monitoring	0	2.5
		4	STP of 6 KLD	15	1.5
		5	ETP of 20 KLD with UF and UV	0	4
		6	Total	35.84	25.5
7.	Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure , project proponent can refer model ToR available.	S.no	Impacts	Mitigation Measures	
		1	The major air pollution source is the DG set which emits flue gases containing Suspended Particulate Matters, Oxides of Sulphur and Nitrogen that may affect the ground level concentrations.	The DG set has been provided with stacks of adequate height so as to disperse the emanating flue gases containing Suspended Particulate Matters, Oxides of Sulphur and Nitrogen without affecting the ground level concentrations.	
		2	Combustion process such as diesel engines	Maintenance of diesel power generators to achieve efficient combustion, fuel efficiency and therefore reduce emissions	

		3	Air borne particulates from soil disturbance during expansion and from vehicle traffic such as trucks and trailers	Adequate sprinkling of water on soil surface will be carried out. Vehicle, equipment and machinery used for men and material transfers.
		4	Impact due to presence of VOC in the atmosphere	On-line VOC monitoring system has been installed and the same is connected to care air center of TNPCB for real time monitoring of VOC data.
		5	Noise pollution due to operation of machineries & equipment; Vehicular traffic; Operation of DG sets and machineries	Well maintained equipment and vehicles will be used; All DG sets would be provided with acoustic enclosures; and Appropriate PPEs (e.g. ear plugs) will be used for by workers while working near high noise generating equipment.
		6	Land use change may lead to impact on income and livelihood	Degraded land will be selected on long term lease and reinstate the land after project activity. Immediate restoration of land for pipeline and brought to its best achievable original state after completion of the buried pipeline laying activity.
Land use , Land Acquisition and R&R				

1. Details of the land use break-up for the proposed project. Details of land use around 10 km radius of the project site.

Details of the land use break-up for the proposed project

The land of about 33.26 Acres allotted initially by EPL is fully utilized for the development of Tank Farm, Administrative office building, TLF, internal roads, development of greeneries etc.,

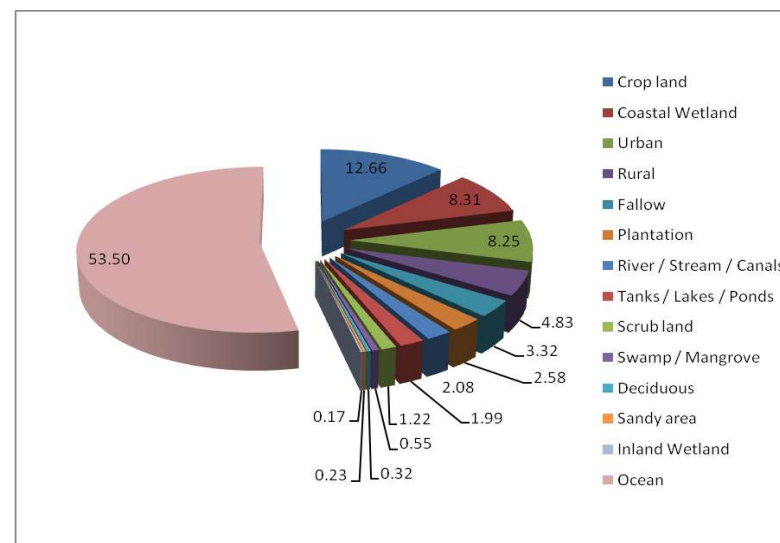
S. No.	Land use & land cover Sq.Mtrs	Area (ha)	%	Remarks if any
Tank farm area	56958.7928	5.69587928	42.3170823	
TLF area	2645.98	0.26459781	1.9658084	
Utilities & others	3649.46285	0.364946285	2.71133941	
Admin block	1129.5476	0.11295476	0.83918841	
Greeneries area	1617.2609	0.16172609	1.20153113	
Internal roads & empty area	68598.95775	6.859895775	50.9650503	
Total area	134600	13.46	100	
Total area in acre	33.26 Acre			

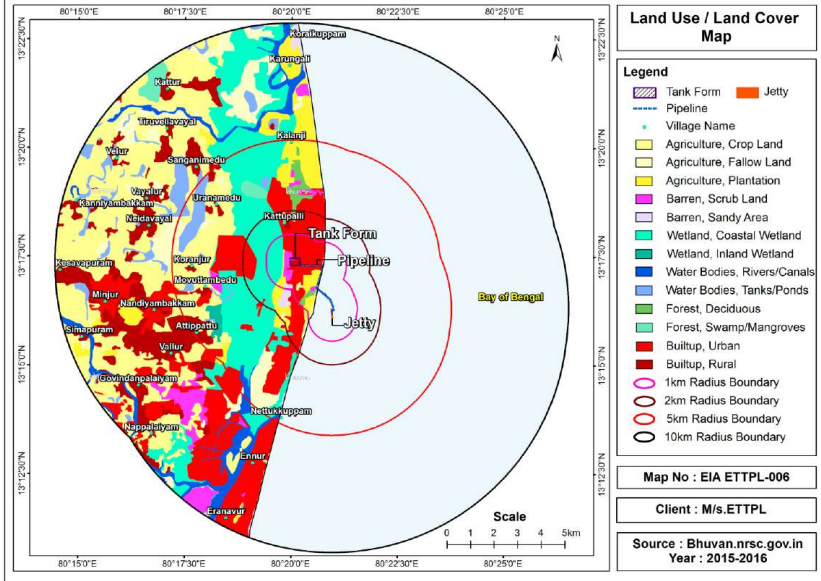
Details of land use around 10 km radius of the project site.

S.No.	Description	Area (Sq.Km)	Area (Acres)	Area (Hectares)	Area (%)
1	Crop land	48.95	12095.79	4895	12.66
2	Coastal	32.12	7937.01	3212	8.31
3	Urban	31.89	7880.18	3189	8.25
4.	Rural	18.68	4615.92	1868	4.83
5	Fallow	12.84	3172.83	1284	3.32
6	Plantation	9.97	2463.64	997	2.58
7	River / Stream	8.05	1989.20	805	2.08
8	Tanks / Lakes	7.69	1900.24	769	1.99
9	Scrub land	4.70	1161.39	470	1.22

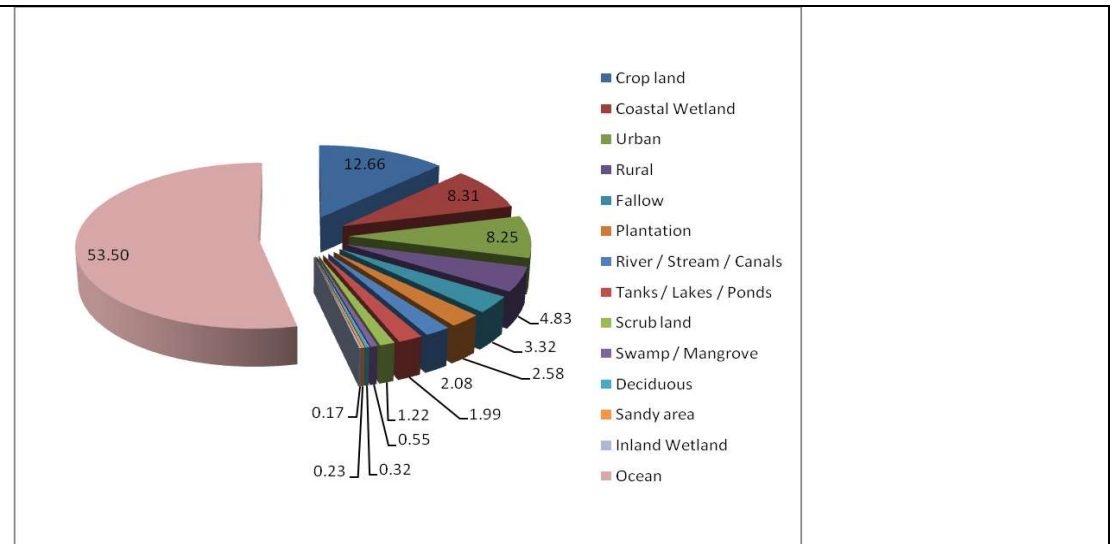
10	Swamp /	2.13	526.33	213	0.55
11	Deciduous	1.23	303.94	123	0.32
12	Sandy area	0.89	219.92	89	0.23
13	Inland	0.66	163.09	66	0.17
14	Ocean	206.86	51116.14	20686	53.50
Total		386.66	95545.62	38666	100.00

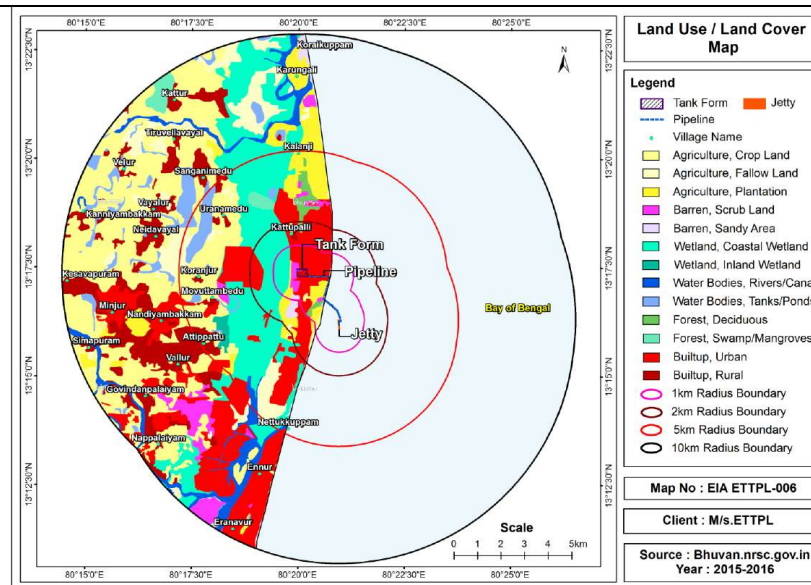
Land Use/Land Cover statistics of 10 km radius of the Study Area



		
2.	Submit the details regarding R&R involved in this project	No resettlement and rehabilitation (R&R) action plan are required; as the land already belongs to Kamarajar Port limited ; which is devoid of any forest or resident land.
ESZ,CRZ, International Boundary and Acts		

1.	Examine and submit detail of land use around 10 km radius of the project site and map of the project area and 10 km area from boundary of the proposed/existing project area, delineating Project areas notified under the wild life (Protection) Act, 1972/critically polluted areas as identified by the CPCB from time to time/notified eco-sensitive areas/interstate boundaries and international boundaries.	Land use around 10 km radius of the project site and map of the project area and 10 km area from boundary of the proposed/existing project area Details of land use around 10 km radius of the project site. <table><tr><th>S.No.</th><th>Description</th><th>Area (Sq.Km)</th><th>Area (Acres)</th><th>Area (Hectares)</th><th>Area (%)</th></tr><tr><td>1</td><td>Crop land</td><td>48.95</td><td>12095.79</td><td>4895</td><td>12.66</td></tr><tr><td>2</td><td>Coastal</td><td>32.12</td><td>7937.01</td><td>3212</td><td>8.31</td></tr><tr><td>3</td><td>Urban</td><td>31.89</td><td>7880.18</td><td>3189</td><td>8.25</td></tr><tr><td>4.</td><td>Rural</td><td>18.68</td><td>4615.92</td><td>1868</td><td>4.83</td></tr><tr><td>5</td><td>Fallow</td><td>12.84</td><td>3172.83</td><td>1284</td><td>3.32</td></tr><tr><td>6</td><td>Plantation</td><td>9.97</td><td>2463.64</td><td>997</td><td>2.58</td></tr><tr><td>7</td><td>River / Stream</td><td>8.05</td><td>1989.20</td><td>805</td><td>2.08</td></tr><tr><td>8</td><td>Tanks / Lakes</td><td>7.69</td><td>1900.24</td><td>769</td><td>1.99</td></tr><tr><td>9</td><td>Scrub land</td><td>4.70</td><td>1161.39</td><td>470</td><td>1.22</td></tr><tr><td>10</td><td>Swamp /</td><td>2.13</td><td>526.33</td><td>213</td><td>0.55</td></tr><tr><td>11</td><td>Deciduous</td><td>1.23</td><td>303.94</td><td>123</td><td>0.32</td></tr><tr><td>12</td><td>Sandy area</td><td>0.89</td><td>219.92</td><td>89</td><td>0.23</td></tr><tr><td>13</td><td>Inland</td><td>0.66</td><td>163.09</td><td>66</td><td>0.17</td></tr><tr><td>14</td><td>Ocean</td><td>206.86</td><td>51116.14</td><td>20686</td><td>53.50</td></tr><tr><td colspan="2">Total</td><td>386.66</td><td>95545.62</td><td>38666</td><td>100.00</td></tr></table> Land Use/Land Cover statistics of 10 km radius of the Study Area	S.No.	Description	Area (Sq.Km)	Area (Acres)	Area (Hectares)	Area (%)	1	Crop land	48.95	12095.79	4895	12.66	2	Coastal	32.12	7937.01	3212	8.31	3	Urban	31.89	7880.18	3189	8.25	4.	Rural	18.68	4615.92	1868	4.83	5	Fallow	12.84	3172.83	1284	3.32	6	Plantation	9.97	2463.64	997	2.58	7	River / Stream	8.05	1989.20	805	2.08	8	Tanks / Lakes	7.69	1900.24	769	1.99	9	Scrub land	4.70	1161.39	470	1.22	10	Swamp /	2.13	526.33	213	0.55	11	Deciduous	1.23	303.94	123	0.32	12	Sandy area	0.89	219.92	89	0.23	13	Inland	0.66	163.09	66	0.17	14	Ocean	206.86	51116.14	20686	53.50	Total		386.66	95545.62	38666	100.00
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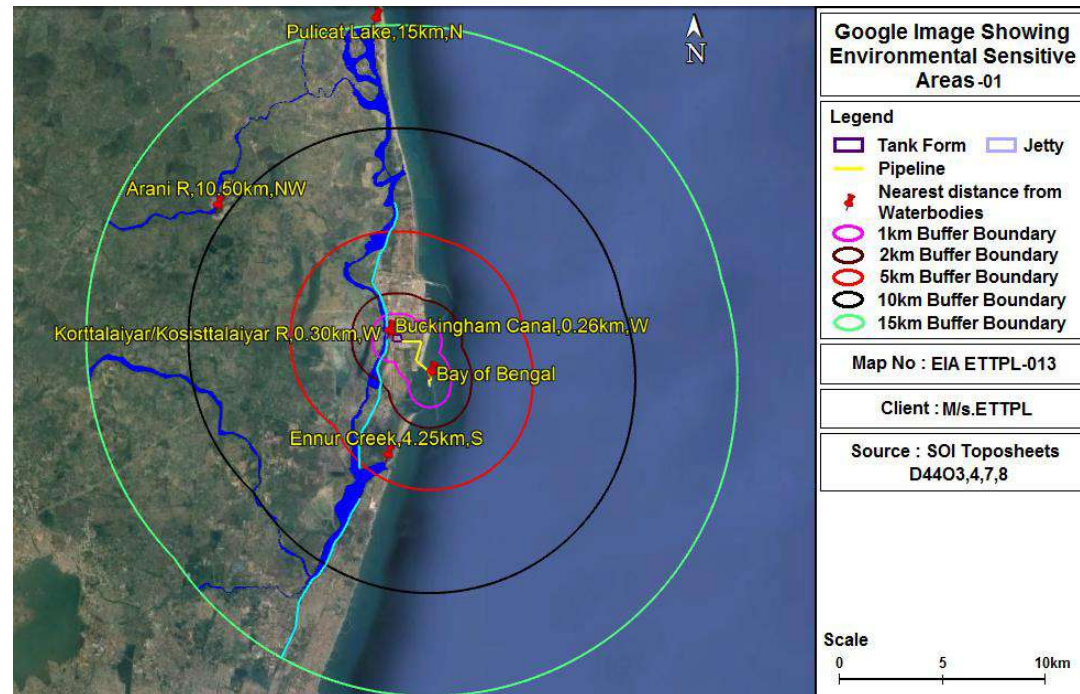


Project areas notified under the wild life (Protection) Act, 1972/critically polluted areas as identified by the CPCB from time to time/notified eco-sensitive areas/interstate boundaries and international boundaries

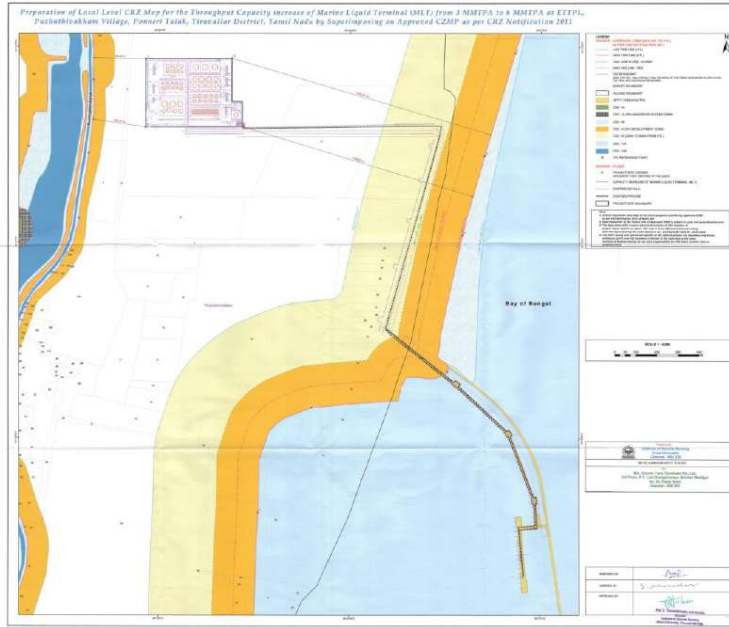
Areas	Distance & Direction from project boundary		
List of Reserve forest / National Park	Nil within 15 km radius		
List of Water Bodies	Water bodies		
	Description	Distance(km)	Direction
	Bay of Bengal	Site is within Bay of Bengal	
	Buckingham Canal	0.26	W
	Korttalaiyar/Kosisttalaiyar	0.30	W

			River				
			Ennur Creek	4.25	S		
			Arani River/Araniya Nadi	10.50	NW		
			Pulicat Lake	15	N		
			Lake near Uranamedu	3.97	WNW		
			Tiruvellavayal Lake	4.68	WNW		
			Perumbedu Lake	12.34	NW		
			Lake near Nayar	13.90	W		
		Nearest Highways	Description	Dist. (~km)	Dire.		
			SH-107(Minjur–Kattur–Thirupalaivanam Road)/SH-104(Chennai-Pulicat Rd)	6.58	WNW		
			NH-16(Chennai-Kolkata)	18.81	WSW		
		Defence installations	Nil within 15 km radius				
		Nearest Villages	Description	Distance(km)	Direction	Populations	
			Kattupalli	13.9	N	1,911	
			Sepakkam	3.19	W	200	
			Uranamedu	3.45	NW	700	
			Movuttambedu	3.58	W	400	

				Koranjur	4.06	W	200	
		Nearest Mangroves	Description	Distance(km)	Direction			
			Mangroves near Kattupalli	0.75	NNW			
			Mangroves near Ennur Port	0.75	W			
			Mangroves near Kattupalli	1.91	NNW			
			Mangroves near Attippattu	3.72	SW			
			Mangroves near Sanganimedu	4.05	NNW			
			Mangroves near Ennur	5.72	SSW			
		Areas susceptible to natural hazard which could cause the project to present environmental problems, (earthquakes, subsidence, landslides, erosion or extreme or adverse climatic conditions)	Earthquakes: The Study area falls in zone-III (Moderate Damage Risk Zone), according to Earthquake Hazard Map of India. Suitable seismic coefficients in horizontal and vertical directions respectively is adopted while designing the structures. Tsunami &Tidal waves: 1. Evacuation vehicles will be provided. 2. Disaster Management training will be provided for the operation team.					
		Critically polluted area	Nil within 10km radius (KPL port is located ~10.41 km away from crtically polluted area) (CPA- Manali as per CPCB)					
		Inter state Boundary	Nil within 10km radius					

Environmental Sensitivity map around 10 km radius

2.	Erosion and accretion study at the mouth of creek which is adjacent to the proposed site to be carried out and submitted	This project site is located at a distance ~ 4.25 km South away from the Ennore creek.
3.	Detailed modeling studies to understand whether the selected site can withstand severe cyclones	The project is only capacity Augmentation there will be no any new construction is proposed . However,KPL port is having a existing Disaster Management plan which will be continued after capacity augmentation.

	and develop design in accordance to due safety measures.	Cyclone and disasters warning systems are well established in coordination with Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, and Department of Disaster Management. The ships berthed on the berth have to be taken offshore immediately on receiving the warning. The port has established appropriate warning system in coordination with INCOIS and Department of Disaster Management. Port is having Robust Disaster management plan which includes Emergency Response Action Plan to tackle natural as well as man made contingencies where in procedures and action plan has been elaborated. Disaster Management Plan is attached as Annexure 18.
4.	Submit superimposing of latest CZMA as per CRZ Notification (2011) on the CRZ map. And also submit a copy of layouts superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 scales.	Layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 Scales. 

5.	Submit complete set of documents required as per para 4.2 of CRZ Notification , 2011	A complete set of documents required as per par 4.2(i) of CRZ Notification, 2011 is attached Appendix A and will be submitted. List of documents 1. CRZ Form – I 2. Rapid EIA 3. CRZ Map 1:4000 Scale 4. CRZ Map 7km Radius 5. CRZ Report 6. NOC from State Board 7. SCZMA Recommendation 8. EMP
6.	Hydrodynamics study on impact of dredging on flow characteristic shall be carried out.	Not Applicable, since this augmentation project does not involve any dredging activities
7.	A detailed study of impact of proposed activity on marine ecology and marine biodiversity with specific focus on the corals, mangroves and Mud flats in the proximity of the site should be conducted and required mitigation plan be submitted	Detailed marine ecology has been NABL & MoEF&CC recognised Laboratory conducted and the result is mentioned in the section 3.9.1 Details of marine biodiversity of the port region has been conducted by NABL & MoEF&CC recognised Laboratory and it is authorised by Tamil Nadu Biodiversity Board. It is attached Annexure 20. Coral Reefs As per the report coral reefs are not observed in the study area.

Mangroves:

Mangroves are observed in the backwater areas in the habitats of reduced fresh water and sea water Exchange and with high salinities. Due to this project no Mangroves will be affected.

Impact on marine Environment due to this proposed project

The major impact on marine water during the operation of the facility will be due to the spillage of material in land and sea. During the operational phase of the project, frequency of incoming and outgoing ships will increase and hence the chances of spillages and leakages of oil into the sea will be more. This will affect the sea water quality and appropriate care must be taken to ensure that discharges are made to appropriate drainage lines etc. which lead to appropriate treatment facilities. Oily wastes from machinery, spillages and leakages of oil from incoming and outgoing ships into the sea will affect the water quality. This water will have a chance to either drain into the water body, or will seep through the land and contaminate the ground water. This will have floating material on the water surrounding the port. The discharge of bilge water and/or ballast water from the ship may also cause negative impacts on the marine water.

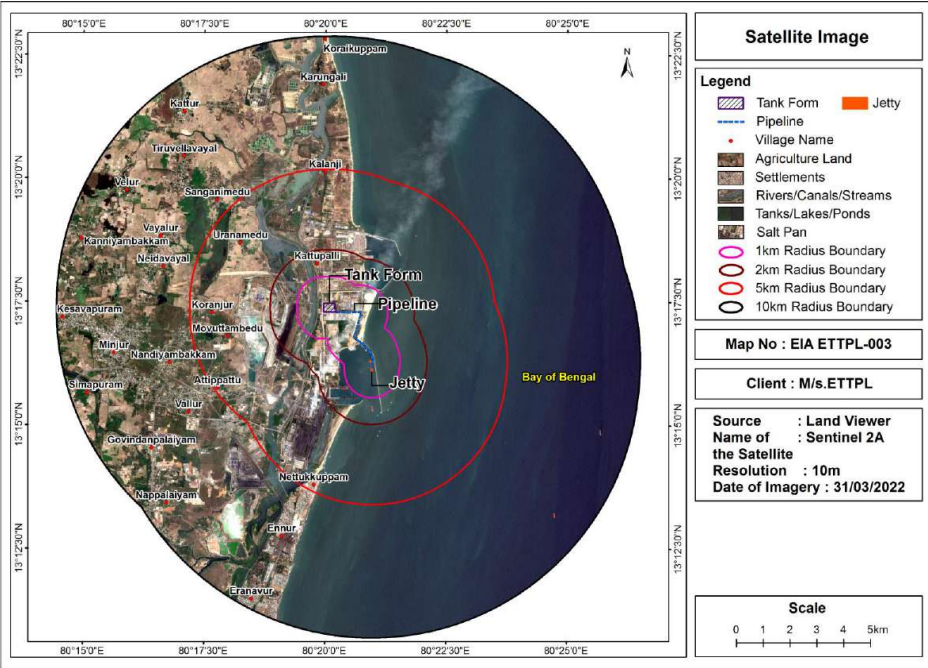
The leaks, accidental release of the materials during the transport of the materials through the pipelines may cause serious soil contamination and will seep through the land and affect the ground water quality. As the area is a reclaimed land and the available groundwater will be affected by the salt intrusion and sea water incursion, it cannot be used for drinking without treatment. However contaminating the available groundwater /marine water with oil or any other materials shall be taken as very serious and all the possible measures to be taken to avoid any kind of spillage of materials during the operations like ship to ship transfer, ship to shore transfer, shore to shore transfer and vice versa.

Mitigation Measure of Marine Environment

To mitigate the impacts due to marine water pollution, the following measures would be adopted:

- All the operational areas will be connected with a network of liquid waste collection corridor comprising of storm

		water, oily wastes, and sewage collection pipelines. • Oily wastes which are generated from the operational areas would be collected in the effluent network and further treated at the treatment plant. • Vessels calling at the Terminal would not be permitted to dump the wastes / bilge water during the berthing period. • Required pollution control facilities for treatment of waste water, solid waste management, etc. will be setup for the terminal. • Measures would be taken to contain, control and recover the accidental spills of fuel, oil and other product handled. ETTPL and KPL has prepared Oil Spill Contingency Plan and is attached as Annexure 16.
8.	A Management plan for the area under which mangroves are or likely to be removed and compensatory mangrove plantation plan be submitted.	No mangrove will be removed during this project
Remote Sensing & GIS		

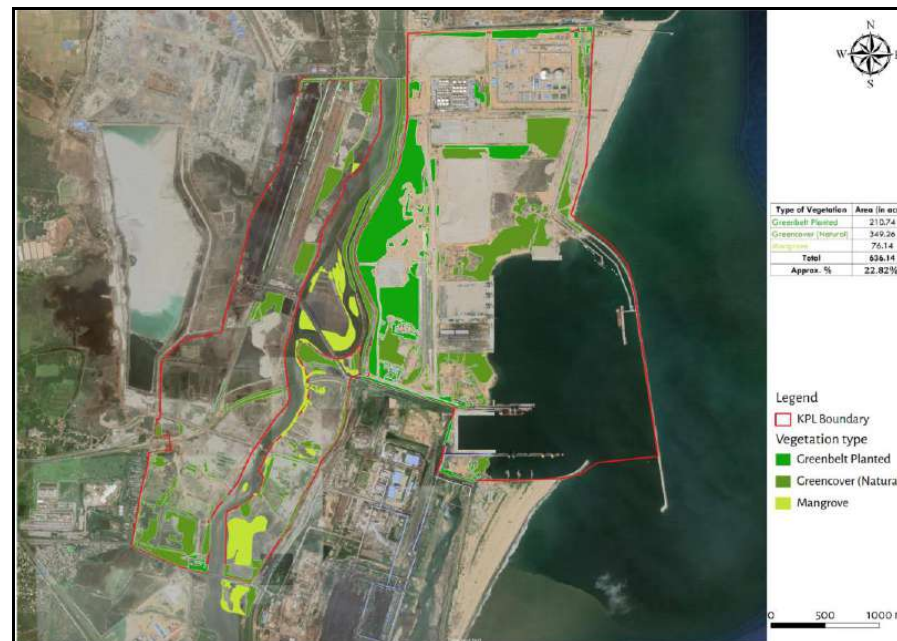
1.	Analysis should be made based on latest satellite imagery for the land use with raw images.	Latest satellite imagery for the land use with raw images  Satellite Image Legend - Tank Form - Pipeline - Village Name - Agriculture Land - Settlements - Rivers/Canals/Streams - Tanks/Lakes/Ponds - Salt Pan 1km Radius Boundary 2km Radius Boundary 5km Radius Boundary 10km Radius Boundary Map No : EIA ETTPL-003 Client : M/s.ETTPL Source : Land Viewer Name of the Satellite : Sentinel 2A Resolution : 10m Date of Imagery : 31/03/2022 Scale 0 1 2 3 4 5km
Forest & Wildlife		
1.	Submit the present land use and permission required for any conversion such as forest, agriculture etc.	Not applicable.The present land does not involve any forest, agriculture etc.
2.	Land acquisition status, rehabilitation of communities/ villages and present status of such	Not applicable.The present land does not involve any land acquisition and rehabilitation of communities/ villages.

	activities.	
3.	Submit the trees to be cut including their species and whether it is also involve any protected or endangered species.	Not applicable. The proposed project is augmentation of marine liquid terminal from 3 MMTPA to 6 MMTPA, which does not involve tree cutting or removal of trees.
4.	Measures taken to reduce the number of trees to be removed should be explained in details	
5.	Submit the details of compensatory plantation	
6.	Explore the possibilities of relocating the existing trees to be removed should be explained in detailed	
7.	Examine the details of afforestation measures indicating land and financial outlay.	

8. Landscape plan, green belts and open spaces may be described. A thick greenbelt should be palnted all around the nearest settlement to mitigate noise and vibrations.

Greenbelt details of the KPL Port

- In 1992, the Kamarajar Port was conceived as a satellite port to handle coal through two coal berths. The Port is continuously developing green belt area.
- The total area of the port is 2787.2 acres in that area total green belt is to an extend of 636.14 acres (22.82%) which includes inside and outside the custom bound area.
- Proposed Green belt of 5.01 acres will be developed inside and outside the Tank Farm area.
- The treated wastewater will be reused in the green belt areas to reduce the water requirements.
- The tree species to be used for the green belt development will be in line with the local ecology.



9. The identification of species / plant should be made based on the botanical studies.

The identification of species / plant should be made based on the botanical studies.

S. No.	Botanical Name	Family	Tree/Shrub
1	<i>Albizia amara</i> (Roxb.) B.Boivin i	Fabaceae	Tree
2	<i>Albizia lebbbeck</i> (L.) Benth.	Fabaceae	Tree
3	<i>Atalantia monophylla</i> DC.	Rutaceae	Tree
4	<i>Barringtonia acutangula</i> (L.) Gaertn.	Lecythidaceae	Tree
5	<i>Bauhinia tomentosa</i> L.	Leguminosae	Tree
6	<i>Borassus flabellifer</i> L.	Arecaceae	Tree
7	<i>Butea monosperma</i> (Lam.) Taub.	Leguminosae	Tree
8	<i>Caesalpinia crista</i> L.	Leguminosae	Shrub
9	<i>Calophyllum inophyllum</i> L.	Clusiaceae	Tree
10	<i>Capparis sepiaria</i> L.	Capparaceae	Tree
11	<i>Casearia tomentosa</i> Roxb.	Salicaceae	Tree
12	<i>Catunaregam spinosa</i> (Thunb.) Tirveng.	Rubiaceae	Shrub
13	<i>Cordia dichotoma</i> G.Forst.	Boraginaceae	Tree
14	<i>Crateva adansonii</i> DC	Capparaceae	Tree
15	<i>Crotalaria pallida</i> Aiton	Leguminosae	Tree
16	<i>Dalbergia lanceolaria</i> L.f.	Leguminosae	Tree
17	<i>Drypetes sepiaria</i> (Wight & Arn.) Pax & K.Hoffm.	Putranjivaceae	Tree
18	<i>Ehretia microphylla</i> Lam.	Boraginaceae	Tree
19	<i>Cassine glauca</i> (Rottb.) Kuntze	Celastraceae	Tree
20	<i>Erythrina variegata</i> L.	Leguminosae	Tree
21	<i>Eugenia roxburghii</i> DC	Leguminosae	Shrub
22	<i>Ficus amplissima</i> Sm.	Moraceae	Tree
23	<i>Ficus microcarpa</i> L.f.	Moraceae	Tree
24	<i>Flacourtia indica</i> (Burm.f.) Merr.	Salicaceae	Shrub
25	<i>Flueggea leucopyrus</i> Willd.	Phyllanthaceae	Shrub
26	<i>Garcinia spicata</i> Hook.f.	Clusiaceae	Tree
27	<i>Glycosmis mauritiana</i> (Lam.) Tanaka	Rutaceae	Shrub
28	<i>Gmelina asiatica</i> L.	Lamiaceae	Shrub
29	<i>Grewia orbiculata</i> Rottler	Malvaceae	Tree
30	<i>Grewia rhombifolia</i> Kaneh. & Sasaki	Malvaceae	Tree
31	<i>Gymnosporia emarginata</i> (Willd.) Thwaites	Celastraceae	Shrub
32	<i>Hibiscus tiliaceus</i>	Malvaceae	Shrub
33	<i>Lannea coromandelica</i> (Houtt.) Merr.	Anacardiaceae	Tree

S. No.	Botanical Name	Family	Tree/Shrub
34	<i>Memecylon umbellatum</i> Burm. f	Melastomataceae	Tree
35	<i>Morinda pubescens</i> Sm.	Rubiaceae	Tree
36	<i>Pamburus missionis</i> (Wight) Swingle	Rutaceae	Tree
37	<i>Pandanus odorifer</i> (Forssk.) Kuntze	Pandanaceae	Tree
38	<i>Phoenix sylvestris</i> (L.) Roxb.	Arecaceae	Tree
39	<i>Pongamia pinnata</i> (L.) Pierre	Leguminosae	Tree
40	<i>Premna serratifolia</i> L.	Lamiaceae	Shrub
41	<i>Pterospermum suberifolium</i> (L.) Willd.	Malvaceae	Tree
42	<i>Salvadora persica</i> L.	Salvadoraceae	Tree
43	<i>Scutia myrtina</i> (Burm.f.) Kurz	Rhamnaceae	Shrub
44	<i>Senna auriculata</i> (L.) Roxb.	Leguminosae	Shrub
45	<i>Spondias pinnata</i> (L. f.) Kurz	Anacardiaceae	Tree
46	<i>Strychnos nux-vomica</i> L.	Loganiaceae	Tree
47	<i>Strychnos potatorum</i> L.f.	Loganiaceae	Tree
48	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Tree
49	<i>Tarenna asiatica</i> (L.) Kuntze ex K.Schum.	Rubiaceae	Tree
50	<i>Thespesia populnea</i> (L.) Sol. ex Corrêa	Malvaceae	Tree
51	<i>Vachellia nilotica</i> (L.) P.J.H. Hurter & Mabb.	Leguminosae	Tree
52	<i>Vitex negundo</i> L.	Lamiaceae	Tree
53	<i>Volkameria inermis</i> L.	Lamiaceae	Shrub
54	<i>Ziziphus jujuba</i> Mill.	Rhamnaceae	Tree
55	<i>Avicennia marina</i> (Forssk.) Vierh.	Acanthaceae	Shrub

Water Environment /Quality/ Analysis/Hydrology and water bodies

Examine the details of water Requirement , impact on competitive user , treatment details, use of treated waste water. Prepare a water balance chart.

Details of water Requirement:

S.No	Water	Qty (KLD)		
		Existing	Proposed	After Expansion
1	Fresh water Requirement	6.7	2.5	9.2
2	Recycled Water	1.6	4.2	5.8
Total Water Requirement		8.3	6.7	15

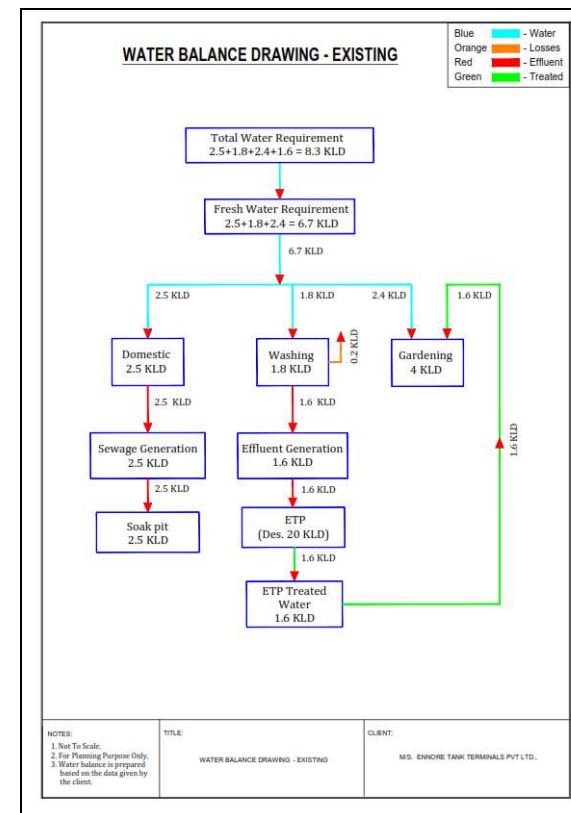
Water Requirement	Existing water Requirement(KLD)		Proposed water Requirement(KLD)		After Expansion water Requirement(KLD)	
	Fresh water	Recycled water	Fresh water	Recycled water	Fresh water	Recycled water
Domestic	2.5	0	1	0	3.5	0
Washing	1.8	0	1.5	0	3.3	0
Gardening	2.4	1.6	0	4.2	2.4	5.8

Total	6.7	1.6	2.5	4.2	9.2	5.8
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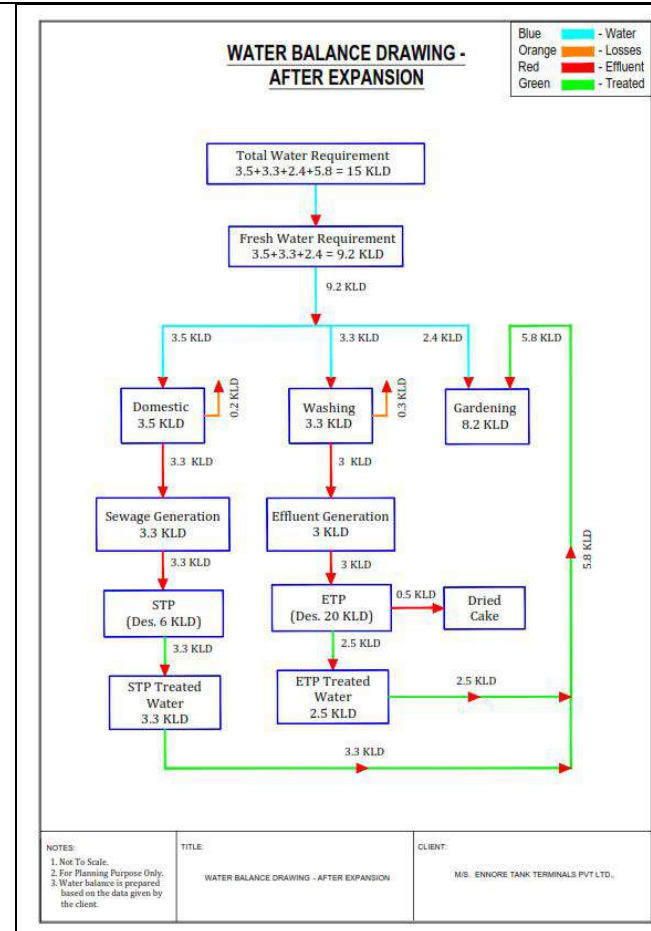
For Fire fighting, sea water is being used and the same will be continued after expansion.

Source of water: Out sourced through water tankers.

Water balance chart:



Existing Water balance diagram



After Expansion Water balance diagram

		Waste water generation and its Management :					
			Details	Existing (KLD)	Proposed (KLD)	After expansion (KLD)	Disposal method
			Sewage	2.5	0.8	3.3	Existing : Sewage Disposal: Septic Tanks and Sock Pit x 6 Nos. Dimension (Length -1.4 mts X width 0.9m, Depth – 2.2m) After Expansion: 6 KLD STP will be proposed and the treated sewage will be used for gardening
			Effluent	1.6	0.9	2.5	Will be treated in existing ETP (Capacity – 20 KLD) and reuse for gardening.
1.	Examine and submit the water bodies including the seasonal ones within the corridor of impacts along with their status, volumetric capacity, quality likely impacts on them due to the project.						

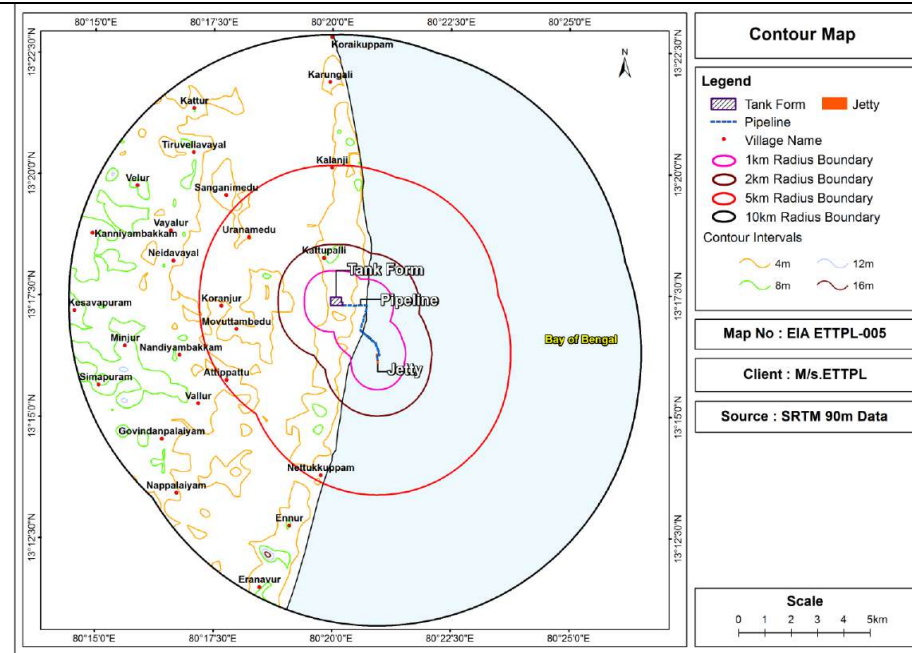


River/Canal/Creek				
S.No	Description	Dist(~km)	Direc	
1	Buckingham Canal	0.26	W	
2	Korttalaiyar/Kosisttalaiyar River	0.30	W	
3	Ennur Creek	4.25	S	
Lakes/Ponds				
S.No	Description	Dist(~km)	Direc	Area(Acres)
4	Lake near Kattupalli	3.14	NNW	25
5	Lake near Koranjur	3.37	W	10
6	Lake near Attippattu	3.38	W	13
7	Lake near Uranamedu	3.97	WNW	460
8	Movuttambedu Lake	4.09	W	47
9	Pond near Koranjur	4.56	W	3

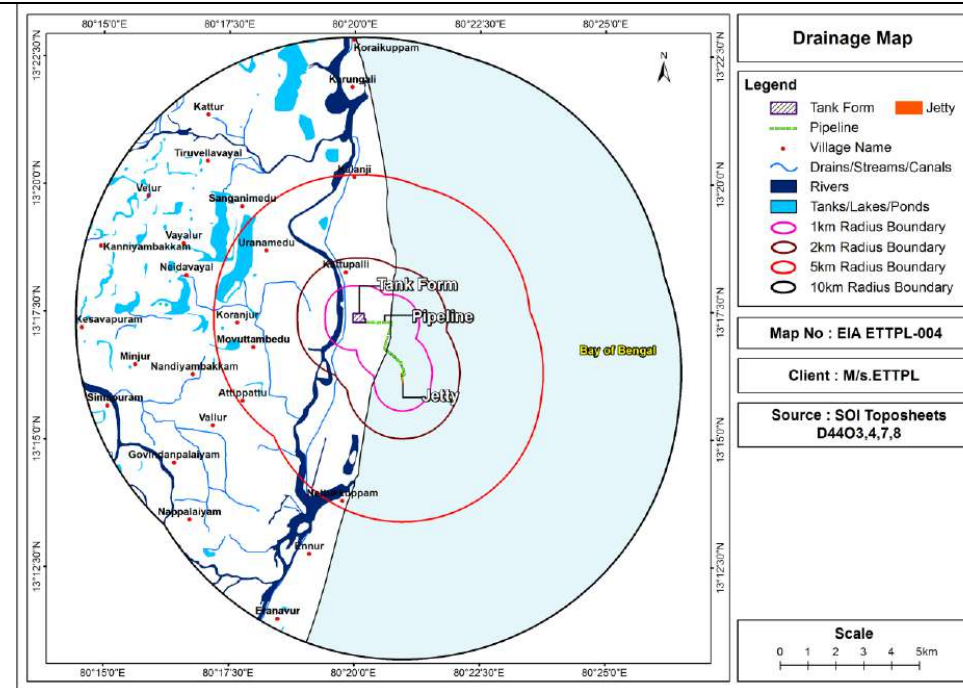
		<table><tr><td>10</td><td>Tiruvellavayal Lake</td><td>4.68</td><td>WNW</td><td>390</td></tr><tr><td colspan="5">Note-All Lakes/Ponds are non perennial</td></tr></table>	10	Tiruvellavayal Lake	4.68	WNW	390	Note-All Lakes/Ponds are non perennial				
10	Tiruvellavayal Lake	4.68	WNW	390								
Note-All Lakes/Ponds are non perennial												
		Impacts on the water bodies During the operational phase of the project, frequency of incoming and outgoing ships will increase and hence the chances of spillages and leakages of oil into the sea will be more. This will affect the sea water quality and appropriate care must be taken to ensure that discharges are made to appropriate drainage lines etc. which lead to appropriate treatment facilities. Oily wastes from machinery, spillages and leakages of oil from incoming and outgoing ships into the sea will affect the water quality. This water will have a chance to either drain into the water body, or will seep through the land and contaminate the ground water. This will have floating material on the water surrounding the port. The discharge of bilge water and/or ballast water from the ship may also cause negative impacts on the marine water. The leaks, accidental release of the materials during the transport of the materials through the pipelines may cause serious soil contamination and will seep through the land and affect the ground water quality. As the area is a reclaimed land and the available groundwater will be affected by the salt intrusion and sea water incursion, it cannot be used for drinking without treatment. However contaminating the available groundwater /marine water with oil or any other materials shall be taken as very serious and all the possible measures to be taken to avoid any kind of spillage of materials during the operations like ship to ship transfer, ship to shore transfer, shore to shore transfer and vice versa. Mitigation Measure To mitigate the impacts due to marine water pollution, the following measures would be adopted: • All the operational areas will be connected with a network of liquid waste collection corridor										

		comprising of storm water, oily wastes, and sewage collection pipelines. • Oily wastes which are generated from the operational areas would be collected in the effluent network and further treated at the treatment plant. • Vessels calling at the Terminal would not be permitted to dump the wastes / bilge water during the berthing period. • Required pollution control facilities for treatment of waste water, solid waste management, etc. will be setup for the terminal. • Measures would be taken to contain, control and recover the accidental spills of fuel, oil and other product handled. ETTPL and KPL has prepared Oil Spill Contingency Plan and is attached as Annexure 16.
2.	Submit the details of fishing activity and likely impacts on the fishing activity due to the project.	Details of fishing activity in the study area is given in chapter 3.10.1.11. Fishing activities are not permitted within the Port area. Additionally, this project is solely a capacity augmentation from 3 MMTPA to 6 MMTPA of MLT, so there will be no impact on fishing activities.
3.	Specific study on effects of construction activity and pile driving on marine life.	Not Applicable, Since this project does not involves any construction and pile driving activities
Waste Management, Drainage and STPs		

1. Submit a copy of the contour plan with slopes, drainage pattern of the site and surrounding area



Contour Map of the study area



Drainage Map of the study area

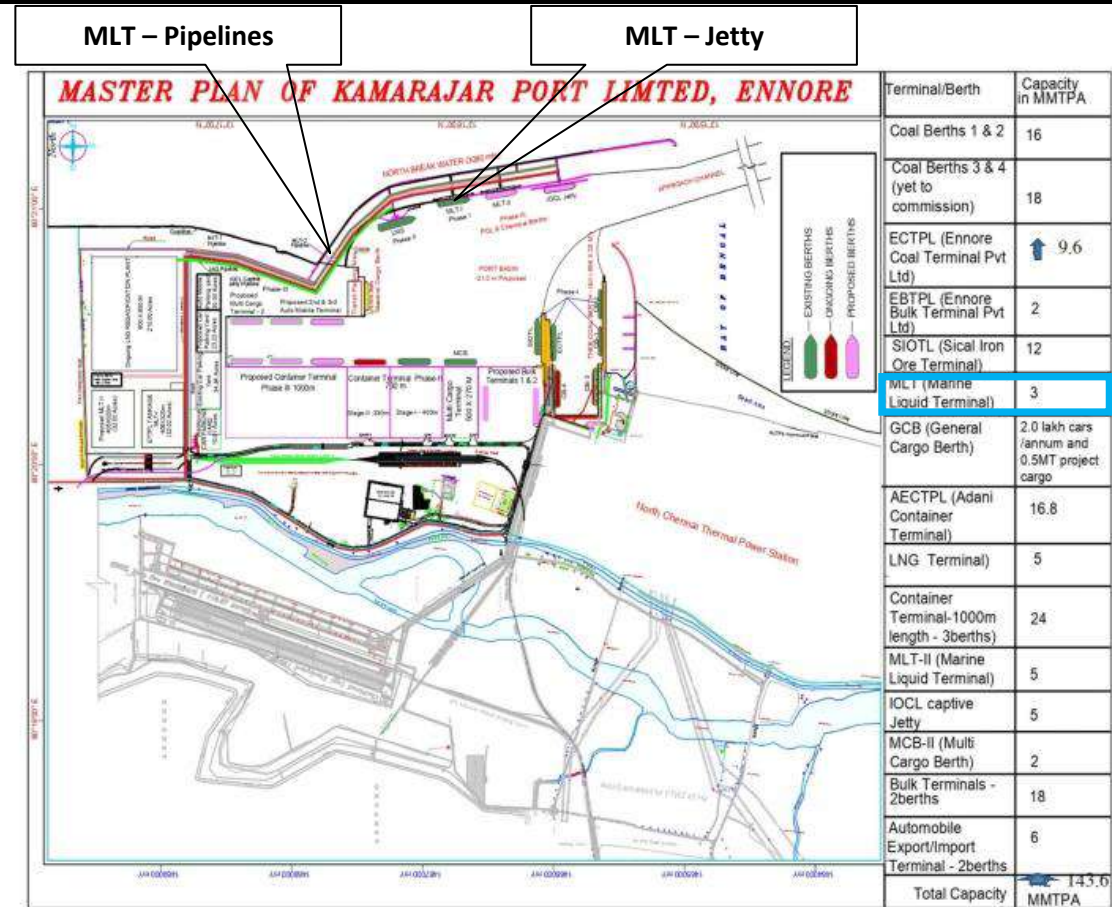
- Araniyar, Korattalayar, Cooum, Nagari and Nandhi are the important rivers. The drainage pattern, in general, is dendritic.
- All the rivers are seasonal and carry substantial flows during monsoon period. Korattaliar river water is supplied to Cholavaram and Red Hill tanks by constructing an Anicut at Vellore Tambarambakkam.
- After filling a number of tanks on its further course, the river empties into the Ennore creek a few kilometres north of Chennai.

		➤ The Cooum River, flowing across the southern part of the district, has its origin in the surplus waters of the Cooum tank in Tiruvallur taluk and also receives the surplus waters of a number of tanks. ➤ It feeds the Chembarambakkam tank through a channel.																									
2.	Examine the details solid waste generation treatment and its disposal	Details solid waste generation treatment and its disposal: Municipal Solid waste: The proposed project involves only a capacity augmentation from 3 MMTPA to 6 MMTPA of MLT, so no municipal solid waste will be generated during the construction phase, as no construction activities are required. <table><tr><th>Type of Wastes</th><th>Existing (kg/day)</th><th>Proposed (kg/day)</th><th>After Expansion (kg/day)</th><th>Treatment / Disposal Method</th></tr><tr><td>Inorganic</td><td>14.04</td><td>4.5</td><td>18.54</td><td>Disposed to authorized vendors and the same will be continued</td></tr><tr><td>Organic</td><td>21.06</td><td>6.75</td><td>27.81</td><td>Used as a Manure for Greenbelt.</td></tr><tr><td>Total</td><td>35.1</td><td>11.25</td><td>46.35</td><td>--</td></tr></table> Hazardous waste generation Hazardous Waste Generation and Management of existing <table><tr><th>Source</th><th>Name of the Hazardous</th><th>Quantity</th><th>Storage and</th><th>Method of disposal</th></tr></table>	Type of Wastes	Existing (kg/day)	Proposed (kg/day)	After Expansion (kg/day)	Treatment / Disposal Method	Inorganic	14.04	4.5	18.54	Disposed to authorized vendors and the same will be continued	Organic	21.06	6.75	27.81	Used as a Manure for Greenbelt.	Total	35.1	11.25	46.35	--	Source	Name of the Hazardous	Quantity	Storage and	Method of disposal
Type of Wastes	Existing (kg/day)	Proposed (kg/day)	After Expansion (kg/day)	Treatment / Disposal Method																							
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Source	Name of the Hazardous	Quantity	Storage and	Method of disposal																							

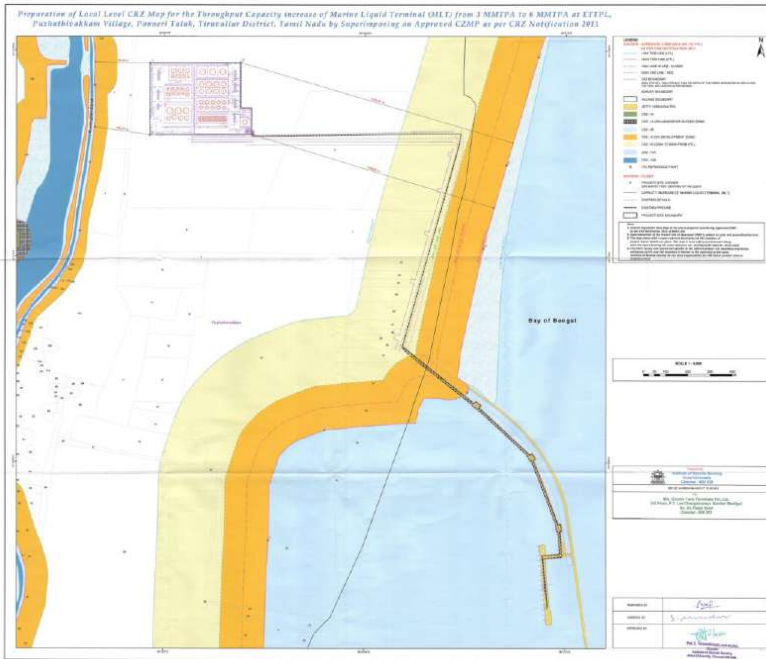
			waste and category		Handling		
		Cleaning, emptying and maintenance of petroleum oil storage tanks including ships	3.1-Cargo residue, washing water and sludge containing oil	0.4 T/Annum	Stored in barrels	Generation, Collection, Storage, Disposal to M/s. Tamilnadu Waste Management Ltd, Gummidipoondi for incineration	
		Handling of hazardous chemicals and wastes	33.2-Contaminated cotton rags or other cleaning materials	24 T/Annum	Stored in Pig disposal yard	Generation, Collection, Storage, Disposal to M/s. Tamilnadu Waste Management Ltd, Gummidipoondi for incineration to vendor	
		Engines/ Compressor used oil	5.1-Used or spent oil	0.3 T/Annum	Stored in steel barrels.	Generation, Collection, Storage and sent to authorized recyclers.	
		Handling of hazardous chemicals and wastes	33.1-Empty barrels/containers/liners contaminated with hazardous chemicals /wastes	21.6T/Annum	Empty barrels stored in hazardous waste storage rooms	Generation, Collection, Storage and sent to authorized recycler	

		Hazardous Waste Generation and Management of existing				
		Source	Name of the Hazardous waste and category	Quantity	Storage and Handling	Method of disposal
		Cleaning, emptying and maintenance of petroleum oil storage tanks including ships	3.1-Cargo residue, washing water and sludge containing oil	1MT/Annum	Stored in barrels	Will be Disposal to Tamilnadu Waste manag Ltd, Gummidipoondi incineration
3.	Details of oil spill contingency plan.	➤ KPL has Oil Spill Contingency Plan in place. The Tier-1 Oil Spill Response Equipment of KPL along with ETTPL as per NOS DCP guidelines. ➤ Oil Spill Response Management Plan keep the marine water free from pollutants/oil spills within the Port limits. ➤ Kamarajar Port Limited had procured Oil Spill Response (OSR) equipment in 2016. ➤ KPL has a dedicated Oil Spill Response team working 24 x 7. ➤ Vessels berthed at Kamarajar Port Limited are being garlanded by booms to prevent the spread of oil spills (if any) that occurs. Detailed Oil Spill contingency plan is attached as Annexure 16.				
4.	Details of Layout plan including details of	Layout of port				

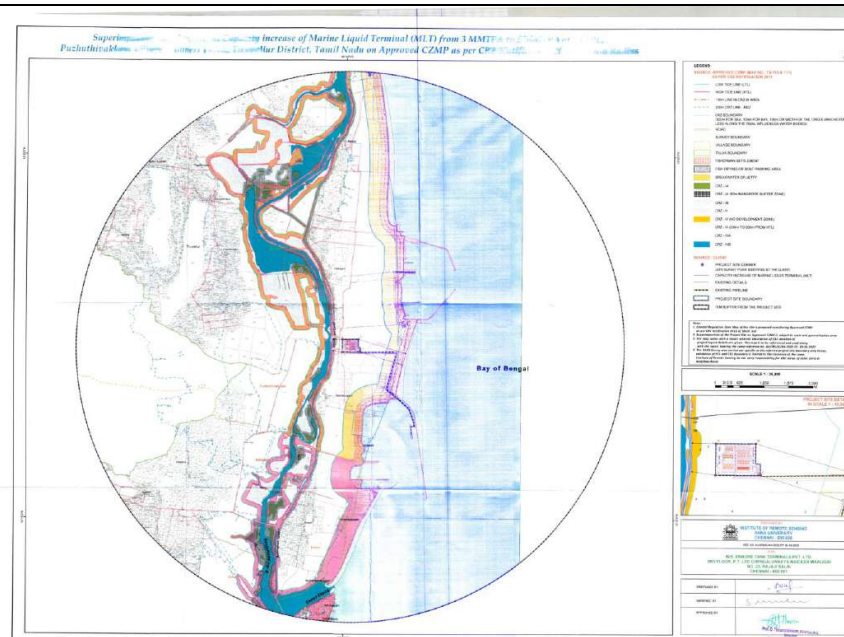
channel , breakwaters, dredging , disposal and reclamation



Terrain and Topograpy

1.	Submit the details of terrain, level with respect to MSL, filling required, source of filling materials and transportation details etc.	Not applicable
2.	Submit a copy of layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 scale along with the recommendation of the SCZMA.	
3.	Details of bathymetry study.	Not Applicable
4.	Details of ship tranquility study.	The proposed project is enhancement of 3 MMTPA to 6 MMTPA of MLT . so ship tranquility study are not required

5. The ecologically fragile area including CRZ IA area etc. shall be demarcated and superimposed on the layout plan and submitted.



Road/Transport connectivity and Traffic measures

1. Examine road/rail connectivity to the project site and impact on the existing traffic network due to the proposed project/activities.

It is well connected by roadways, railways and water ways.

Features	Description		
Nearest Railway station	Description	Dist. (~km)	Dire.
	Attipattu Railway station	5.51	WSW
Nearest Port	Description	Distance (~km)	Direction
	Kamarajar Port (Ennore port)	Site is within the port	

				Adani Kattupalli Port	0.45	N	
			Nearest Airport	Description	Dist. (~km)	Dire.	
				Chennai International Airport	34.59	SSW	
			Highway	Description	Dist. (~km)	Dire.	
				SH-107(Minjur-Kattur- Thirupalaivanam Road)/SH- 104(Chennai-Pulicat Rd)	6.58	WNW	
				NH-16(Chennai-Kolkata)	18.81	WSW	

A detailed traffic and transportation study should be made for existing and projected passenger and cargo traffic.

Traffic forecast

Traffic Forecast by KPL

Traffic forecast was made initially by Kamarajar Port Limited (KPL) during the tendering stage based on expressions of Interest received from the firms and information furnished by some of prospective users / traders / industry at that time and was estimated conservatively.

Traffic Forecast by ETPL

Following are the methods adopted for traffic survey by Ennore Tank Terminals Private Limited (ETPL):

a) Existing Users

Actual traffic volumes of previous period are considered in the projections. ETPL had extensive interactions with all major potential users of the jetty, pipelines and storage tank farm and various contracts entered into with customers.

S.No	Existing users	Products
	Indian Oil Petronas Pvt. Ltd (JV of IOCL & Petronas)	Propane/Butane/LPG
	Hindustan Petroleum Corporation Ltd	POL
	Bharat Petroleum Corporation Ltd	POL
	IOCL	POL
	Hi-Tech Carbon – A unit of SKI Carbon India Ltd	Carbon Black Feed Stock
	Shell India Marketing Pvt Ltd	POL
	Ponpure Logistics	Various chemicals

		Raj Lubricants	Base oils
		Manali Petrochemicals Ltd	Propylene Oxide
		Tamilnadu Petroproducts Ltd	Benzene/LAB
		Supreme Petrochem	Styrene Monomer
		Reliance Industries Ltd	POL
		SKS Logistics Private Limited	Petro Chemicals
		KLJ Group of Industries	Petro Chemicals
		Jesons Industries Limited	Styrene Monomer
		Philips Carbon Limited	CBFS
		Other Customers of Chemicals	

b)Market Study by IMaCS

ETTPL retained ICRA Management Consulting Services (IMaCS) to conduct an independent market assessment and risk analysis for this project in 2006, which was revalidated in 2009. ICRA interacted independently with the users and also carried out extensive secondary research to assess the demand at Ennore. The traffic demand was finalized after thorough research, analysis and verification with the users.

Basis of the study

Following parameters are the basis of the study which led to the traffic projection:

The need for a marine liquid jetty and tank farm at Kamarajar Port stems from the below mentioned factors:

	Growing demand for handling bulk liquids in and out of the Chennai and surrounding regions Limitations in infrastructure facilities for handling bulk liquids, especially hazardous class liquids and liquefied gases at Chennai Port. Potential of Kamarajar Port to be used as a hub port for crude oil, petroleum liquid & gas products and chemicals Identification of bulk liquids and liquefied gases that would be handled through the MLT based on demand-supply scenario pertinent to the region that can be served by ETTPL and the specific logistics of the potential users. The traffic study was based on review of the traffic volumes and facilities at competing ports such as Chennai, Mangalore, Krishnapatnam and Cochin. Hence, the demand estimation takes into account the potential traffic that would shift from other ports to Ennore due to logistical and cost advantages to the users. Traffic Projected The traffic volume for the proposed terminal expansion and storage tank farm would accrue from realization of the potential volumes due to the following factors: Shift of existing traffic by users in the immediate hinterland to Kamarajar Port, hitherto serviced from other Ports. New demand in the immediate and extended hinterland ETTPL has signed long term agreements with most of the identified potential users and is been handling these products during the last 10 years and above. While arriving at the traffic projections under chemicals and other liquids category, volumes accruing from existing users and demand likely due to expansion of select users have been considered. However, the projections do not include potential volumes that could possibly accrue on account of new green field projects in the region.
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The projections are presented in below **Table** considering existing contracts, traffic, etc. The estimates are conservative and it is possible that the traffic projected could be exceeded.

The projections of considering existing contracts, traffic, etc

Scenario →	Optimistic scenario						Base Case (Likely volume assumed for viability)					
Product →	Black oil	POL	Chemical	LPG	Crude	Total	Black oil	PO L	Chemical	LP G	Cru de	Total
Year ↓	MMTPA						MMTPA					
21-22	0.40	3.00	0.20	2.00		5.60	0.30	2.50	0.12	1.60		4.52
22-23	0.50	3.30	0.20	2.00		6.00	0.40	2.70	0.12	1.60		4.82
23-24	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
24-25	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
25-26	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
26-27	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
27-28	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
28-29	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
29-30	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
30-31	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
31-32	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
32-33	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
33-34	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
34-35	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
35-36	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98

		Scenario →	Pessimistic scenario					
		Product →	Black oil	POL	Chemical	LPG	Crude	Total
		Year ↓	MMTPA					
		21-22	0.24	2.00	0.10	1.28		3.62
		22-23	0.32	2.16	0.10	1.28		3.86
		23-24	0.32	2.24	0.10	1.32		3.98
		24-25	0.32	2.24	0.10	1.32		3.98
		25-26	0.32	2.24	0.10	1.32		3.98
		26-27	0.32	2.24	0.10	1.32		3.98
		27-28	0.32	2.24	0.10	1.32		3.98
		28-29	0.32	2.24	0.10	1.32		3.98
		29-300	0.32	2.24	0.10	1.32		3.98
		30-31	0.32	2.24	0.10	1.32		3.98
		31-32	0.32	2.24	0.10	1.32		3.98
		32-33	0.32	2.24	0.10	1.32		3.98
		33-34	0.32	2.24	0.10	1.32		3.98
		34-35	0.32	2.24	0.10	1.32		3.98
		35-36	0.32	2.24	0.10	1.32		3.98
			Details of handling of each cargo, storage, transport along with spillage control, dust preventive measures.	Cargo – Products				
				S.NO	Product Group	Existing Throughput Capacity in MMTPA	Proposed Throughput Capacity in MMTPA	After Expansion Throughput Capacity in MMTPA

1	LPG (Refrigerated Propane and Butane)	1.20	0.4	1.60
	Petroleum, Oil, and Lubricants.(POL)Products	1.45	1.75	3.20
	Black Oil	0.20	0.70	0.90
	Chemicals and Petro Chemicals	0.15	0.15	0.30
	Total	3.0	3.0	6.0
Cargo Handling Facilities - Summary of Cargo Handling Equipment – Jetty				
Sl.No	Cargo	Equipment Type	Nos.	Size
1	Unloading Arms			
	LPG	Unloading arms (Fixed)	2	12”
	POL	Unloading arms (Fixed)	3	12”
2	Pipelines of length 3700 Mtrs. (approx)			
	Black oil	Mild Steel Pipeline -- IS-3589	1	24”
	White petroleum product	Mild Steel Pipeline -- IS-3589	1	24”
	Chemicals	Mild Steel Pipeline -- IS-3589	1	12”
	POL / Lube	Mild Steel Pipeline -- IS-3589	1	12”

			Chemicals	Stainless Steel Pipeline -- 316L	1	8"
			LPG	LTCS	2	18"
			Propylene Oxide	Carbon Steel Pipeline – API 5L Gr B	2	10"
			White petroleum product	Mild Steel Pipeline – API 5L Gr.B / X32	1	24"
			White petroleum product	Mild Steel Pipeline – API 5L Gr.B / X32	1	16"
		3	Pumps			
			Hydraulic pumps	6 KW	6	
			Stripping pumps	10 KW	3	
		4	Other Equipments			
			Engine driven Fire fighting pumps	Fire fighting system for jetty as per OISD 156		
			Nitrogen system	40 cum / hr. capacity + 100 cum/ hr capacity	1 No each	
			Compressed air	910 cfm	2 Nos	
			ETP	20 cum. / day	1	
			Control room with emergency facilities	Safety and emergency equipment.		
		Summary of Cargo handling equipment- Terminal				

SLNo	Cargo	Equipment Type	Nos
1	Various sizes (Mild Steel and SS)		
2	Pumps		
		200 Cum/Hr-Twin Screw	1
		100 Cum /Hr-Twin Screw	1
		150 Cum /Hr- Twin Screw	1
		70 Cum/Hr – Centrifugal	33
		100 Cum/Hr – Centrifugal	4
		120 Cum/Hr – Centrifugal	4
		150 Cum/Hr – Centrifugal	8
		250 Cum/Hr – Centrifugal	3
		300 Cum/Hr – Centrifugal	3
3	TLF station		
	Loading arms	Various sizes	110
	Metering facilities	Flow metering Systems	50
Storage Details			

		Enclosure 1		
		Tank No	Capacity (KL)	Total (KL)
		101	12346	59904
		102	12328	
		103	10641	
		104	5080	
		105	6281	
		106	6288	
		107	6940	
		Enclosure 2		
		Tank No	Capacity (KL)	Total (KL)
		201	2591	23287
		202	1583	
		203	1569	
		204	2033	
		205	3539	
		206	3535	

			207	2596			
			208	1580			
			209	1178			
			210	3083			
			Enclosure 3				
			Tank No	Capacity (KL)	Total (KL)		
			301	5994	28253		
			302	6283			
			303	6283			
			304	2520			
			305	3083			
			306	3080			
			307	1010			
			Enclosure 4				
			Tank No	Capacity (KL)	Total (KL)		
			401	859	18370		
			402	1189			
			403	862			

			404	1188			
			405	859			
			406	1181			
			407	856			
			408	1179			
			409	860			
			410	1179			
			411	861			
			412	1182			
			413	859			
			414	1177			
			415	858			
			416	1180			
			417	860			
			418	1181			
			Enclosure 5				
			Tank No	Capacity (KL)	Total (KL)		
			501	3077	32097		

			502	3084		
			503	3085		
			504	3541		
			505	3089		
			506	4018		
			507	4031		
			508	3539		
			509	3083		
			510	1550		
			Enclosure 6			
			Tank No	Capacity (KL)	Total (KL)	
			601	6292	55520	
			602	6924		
			603	6290		
			604	7606		
			605	7608		
			606	6940		
			607	7613		

			608	6247	
			Enclosure 7		
			Tank No	Capacity (KL)	Total (KL)
			701	10627	31885
			702	10629	
			703	10629	
			Enclosure 8		
			Tank No	Capacity (KL)	Total (KL)
			801	5033	5033
			Enclosure 9		
			Tank No	Capacity (KL)	Total (KL)
			ET-101	21	2396
			ET-102	21	
			Slop tank -1	1175	
			Slop tank -2	1175	
			Grand Total		
			- 68 Tanks		
			2,56,636		

[illegible]

		1	2 wheelers	3235	2426	0	0	3235	0.75	2426
		2	3 wheelers	989	1978	0	0	989	2	1978
		3	4 wheelers/ cars	1170	1170	3	3	1173	1	1173
		4	Trucks/ Bus/HCV	3616	13379	300	1110	3916	2.2	8615
		5	Agricultural tractor	8	32	0	0	8	4	32
		6	Light emission vehicle-LCV	996	1394	0	0	996	2.0	1992
		Total		10014	20380	303	1113	10317	-	16216
		Traffic Volume after Implementation of the Project								
		For the Road	Volume of Traffic	Volume (V)	Road Capacity (C)	V/C Ratio	LOS Category*	Traffic Classification		
		Existing	10014	20380	35000	0.58	“C”	Restricted Flow		
		After implementation	10317	16216	35000	0.61	“C”	Restricted Flow		
		*LOS (Level of Service) categories are A-Free Flow, B- Stable Traffic Flow, C- Restricted Flow, D- High Density Flow, E- Unstable flow, F- Forced or breakdown flow								
		*LOS (Level of Service) categories are:								

Level of Service	V/C	Classification
A	<0.35	Free Flow Traffic
B	0.35 - 0.55	Stable Traffic Flow
C	0.55 - 0.77	Restricted Flow
D	0.77 - 0.92	High Density Flow
E	0.92 - 1.0	Unstable Flow
F	>1.0	Forced Traffic Flow

Due to propose project there will be slight increment in the vehicle movement but the level of service (LOS) anticipated will be “Restricted Traffic Flow”.

Impacts and Mitigation

The transportation of product Tank Farm will contribute to increase in traffic on the existing road network. The increase in traffic might lead to traffic congestion, increase in dust levels, noise levels and risk of accidents. In order to contain these impacts, the following measures would to be taken up.

- Transportation Management Plan will be prepared by ETTPL along with KPL and the movement of product will be planned in line with the same.
- Traffic density studies will be undertaken along the existing road network covering all the roads leading to Kamarajar Port. All the vehicles involved in transshipment of product inland would be checked for valid Pollution Under Control (PUC) certificates. A mobile task force will be formed in co-ordination with local Road Transport Authority (RTA) to check the compliance of vehicle

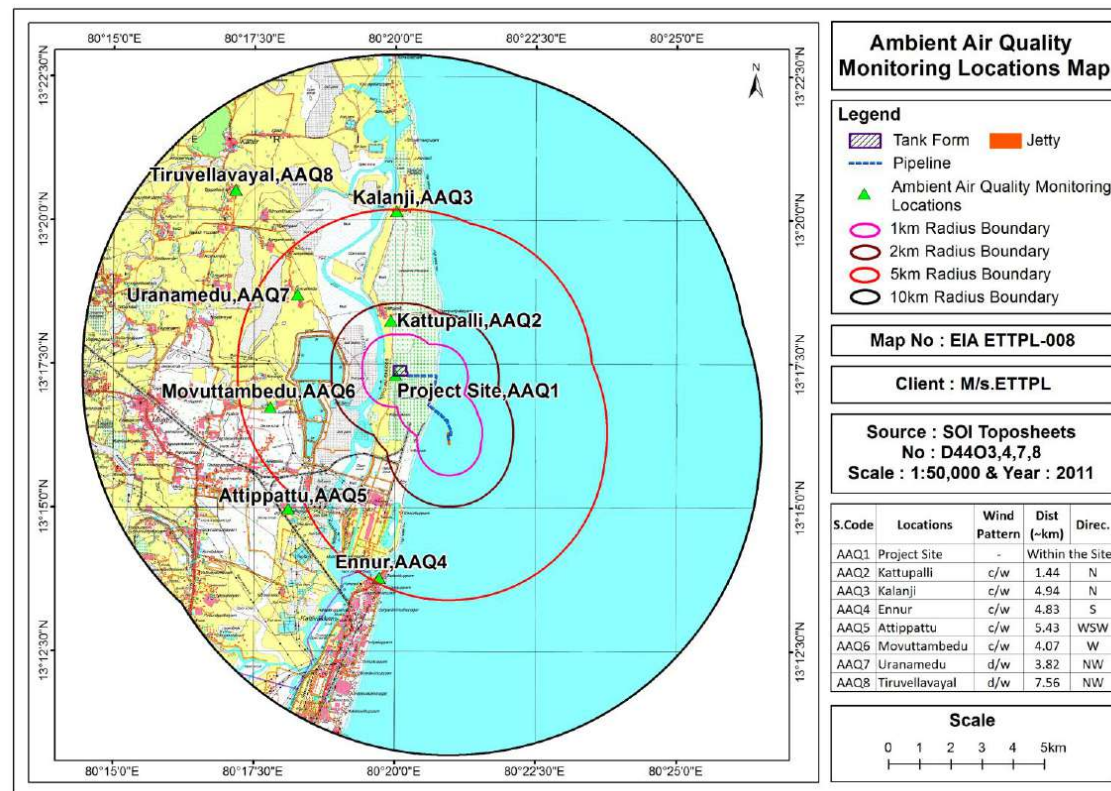
		emissions to norms/standards periodically during operation phase used for inland product movement.
Rain water harvesting		
1.	Details of Rain water harvesting and utilization of rain water.	The Port has Rainwater Harvesting System in its Administrative Building consists of Open well. The details of the same are furnished herewith as below: • Submerged RCC ring of diameter 3' - 0" into a pit of 3 m depth. • Filter chamber of size 0.6 x 0.6 x 0.9 m in brickwork CM 1:5. • River sand to a depth of 0.15 m • Pebbles to a depth of 0.15 m • Nylon mesh between river sand and Pebble stone. • PVC pipes of 110 mm dia connecting terrace, well and filter chamber have been laid.
Baseline data		
	Examine the Baseline environmental quality along with projected incremental load due to the proposed project / activities.	Baseline environmental quality along with projected incremental load due to proposed activities : 1. All the domestic sewage facilities will be treated with proposed 6 KLD STP. and effluent will be treated by existing ETP of 20 KLD capacity and will be utilized for the proposed project. 2.DG Stack- There is no new DG been proposed; Therefore, there will be only minor incremental load due to proposed activity.
Air Environment		

The air quality monitoring should be carried out according to the notification issued on 16th November ,2009.

To evaluate the baseline air quality of the study area, Eight (08) monitoring locations have been identified as per annual period wind predominance.

The annual wind predominance is from South East.

Station Code	Location	Type of Wind	Distance (~km) from Project boundary	Azimuth Directions
A1	Project site	-	Within site	
A2	Kattupalli	c/w	1.44	N
A3	Kalanji	c/w	4.94	N
A4	Ennur	c/w	4.83	S
A5	Attippattu	c/w	5.43	WSW
A6	Movuttambedu	c/w	4.07	W
A7	Uranamedu	d/w	3.82	NW
A8	Tiruvellavayal	d/w	7.56	NW



Parameters	Conc.	NAAQ Standards	Locations							
			Project Site	Kattupalli	Kalanji	Ennur	Attippattu	Movuttambedu	Uranamedu	Tiruvellavayal
			A1	A2	A3	A4	A5	A6	A7	A8
PM10 Conc. ($\mu\text{g}/\text{m}^3$)	Min.	100	54.29	51.94	44.38	59.45	52.94	46.76	47.76	42.59
	Max.	(24 Hours)	77.37	74.02	63.25	84.73	75.45	66.64	68.07	60.69
	Avg.		65.11	62.28	53.22	71.29	63.48	56.08	57.28	51.07

		98th 'tile		76.93	73.59	62.88	84.24	75.01	66.25	67.67	60.34
	PM2.5 Conc. (µg/m3)	Min.	60 (24 Hours)	30.96	28.82	25.89	27.2	27.25	25.76	23.63	22.79
		Max.		44.13	41.08	36.89	38.77	38.84	36.71	33.68	32.48
		Avg.		37.13	34.57	31.04	32.63	32.69	30.89	28.34	27.33
		98th 'tile		43.87	40.84	36.68	38.55	38.62	36.5	33.48	32.29
		Min.	80 (24 Hours)	13.5	11.84	9.74	11.24	12.94	10.1	7.43	7.24
	SO2 Conc. (µg/m3)	Max.		19.24	16.87	13.89	16.02	18.45	14.4	10.59	10.32
		Avg.		16.2	14.2	11.69	13.48	15.52	12.12	8.92	8.69
		98th 'tile		19.13	16.78	13.81	15.92	18.34	14.32	10.53	10.26
		Min.	80 (24 Hours)	24.29	23.61	17.45	21.03	20.25	19.27	17.6	16.95
	NO2 Conc. (µg/m3)	Max.		34.62	33.65	24.87	29.98	28.86	27.47	25.09	24.16
		Avg.,		29.13	28.32	20.93	25.23	24.29	23.11	21.11	20.33
		98th 'tile		34.42	33.46	24.73	29.8	28.69	27.31	24.94	24.02
		Avg.		BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)
	Lead (Pb) (µg/m3)	Avg.	1 (24 hour)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)
	Carbon monoxide (CO) (mg/m3)	Avg.	4 (1hour)	0.82	0.62	0.53	0.95	0.70	0.50	0.42	0.48
	Ozone O3 (µg/m3)	Avg.	180 (1hour)	10.53	10.21	10.09	10.08	10.98	12.72	10.07	10.68
	Benzene(C6H6) (µg/m3)	Avg.	5(Annual)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)
	Benzo (a) Pyrene(C20H11)	Avg.	1	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)

	2 (a) , (ng/m3)		(Annual)				0.1)	0.1)		0.1)	0.1)
	Arsenic (As) (ng/ m3)	Avg.	6 (Annual)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)
	Nickel as Ni (ng/m3)	Avg.	20 (Annual)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)
	Ammonia (NH3) (µg/m3)	Avg.	400 (24 hour)	8.21	7.12	BLQ(LOQ 5)	6.89	BLQ(LO Q 5)	BLQ(LOQ 5)	BLQ(L OQ 5)	BLQ(LO Q 5)
	TVOC (ppm)	Avg.	-	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)
	Methane HC (µg/m3)	Avg.	-	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)
	Non-Methane HC (µg/m3)	Avg.	-	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)

Environmental Management / Monitoring , Mitigation measures and Risk assessment

1.	Examine the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan with cost and parameters.	Construction Phase : Air pollution : Impacts : No increase in the existing concentrations of air pollutants is expected as the project does not involve any production activity but only Enhancement of the Capacity of the MLT through Augmentation of Existing Facilities.
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	Concentrations of pollutants in ambient air is expected to remain within the stipulated standards. Mitigation measure Following measures can be adopted to mitigate the impacts of pollutants on the ambient air quality: Vehicular speed will be limited to 20km/hr on areas of unconsolidated or unsealed soil associated with the immediate site work. Noise Pollution Impacts : In addition to the existing machineries, DG and Equipment/Vehicle movement is the primary source of Noise pollution. Mitigation measure: The DG set room, compressors and pump room will be isolated from the outside environment and proper acoustic arrangements will be made to control the noise generated. Use of well-maintained machinery and vehicles could considerably help in this matter. To prevent the hearing damage to the workers, they will be provided with ear plugs and muffs and job rotation will also be practiced. Water and waste water Management Impacts : During operation phase, water requirement of proposed project will be mainly for domestic use, greenbelt, etc. The required water quantity is met from the outsourced supply. Hence, no significant impacts are envisaged on the water supply in the region. The treated wastewater will be reused in the green belt areas to reduce the water requirements. Mitigation measure:
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	Sewage generated is 3.3 KLD during operation phase. The domestic waste water generated during operation phase will be routed to the proposed 6 KLD STP. And the effluent generated is 2.5 KLD and it will be treated through Existing ETP. The various impacts on the environmental attributes that are likely to arise due to the development and operation of Marine Liquid Terminal at Kamarajar Port are broadly presented. The major activities involved during operation of the Terminal encompass the following: <u>Marine-Side Activities</u> Product handling Movement of vessels <u>Land-Side Activities</u> Product storage Inland product movement. Mitigational Measures During Operational Phase Due to handling of the product impacts are envisaged in the harbour basin through discharge of sewage, ship waste, oil spills, runoffs from operational areas, etc. To mitigate these impacts, measures proposed are discussed in the following paragraphs. Marine Environment The major impact on marine water during the operation of the facility will be due to the spillage of material in land and sea. During the operational phase of the project, frequency of incoming and outgoing ships will increase and hence the chances of spillages and leakages of oil into the sea will be more. This will affect the sea water quality and appropriate care must be taken to ensure that discharges are made to appropriate drainage lines etc. which lead to appropriate treatment facilities. Oily wastes from machinery, spillages and leakages of oil from incoming and
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	outgoing ships into the sea will affect the water quality. This water will have a chance to either drain into the water body, or will seep through the land and contaminate the ground water. This will have floating material on the water surrounding the port. The discharge of bilge water and/or ballast water from the ship may also cause negative impacts on the marine water. The leaks, accidental release of the materials during the transport of the materials through the pipelines may cause serious soil contamination and will seep through the land and affect the ground water quality. As the area is a reclaimed land and the available groundwater will be affected by the salt intrusion and sea water incursion, it cannot be used for drinking without treatment. However contaminating the available groundwater /marine water with oil or any other materials shall be taken as very serious and all the possible measures to be taken to avoid any kind of spillage of materials during the operations like ship to ship transfer, shift to shore transfer, shore to shore transfer and vice versa. Mitigation Measure of Marine Environment To mitigate the impacts due to marine water pollution, the following measures would be adopted: All the operational areas will be connected with a network of liquid waste collection corridor comprising of storm water, oily wastes, and sewage collection pipelines. Oily wastes which are generated from the operational areas would be collected in the effluent network and further treated at the treatment plant. Vessels calling at the Terminal would not be permitted to dump the wastes / bilge water during the berthing period. Required pollution control facilities for treatment of waste water, solid waste management, etc. will be setup for the terminal. Measures would be taken to contain, control and recover the accidental spills of fuel, oil and other product handled. ETTPL and KPL has prepared Oil Spill Contingency Plan and is attached as Annexure 16. Noise Environment
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	The impacts of the project on the noise levels of the surrounding areas were assessed. All equipments in the ETTPL site has been designed/operated to have a noise level not exceeding 85 to 90 dB (A) as per the requirement of Occupational Health and Safety Administration Standard (OHSAS). In addition, since most of the noise generating equipment would be in closed structures, the noise transmitted outside would be still lower. Impacts Major sources of noise generation during operational phase are classified into two categories: Vehicles, DG sets etc. Mobile sources corresponding to mainly vehicular traffic for staff mobilization, material movement, material transportation, liquid fuel transportation to project site, etc. The impact of vibrations beyond the site would be negligible during normal operation phase. However, the impacts on workers engaged would be considerable due to occupational exposure. Mitigation Measures The major noise generating equipment like DG sets, water pumps etc. has been enclosed in an acoustic enclosure designed for an insertion loss of 25 dB (A) and silencers to other equipment etc. Major noise generating equipment was designed with 85 dB (A) ensuring cumulative noise at 1.0 m remains at 85 dB (A). Acoustic silencers are provided in equipments wherever necessary. Use of personal protective equipments/devices such as ear-muffs, ear plugs etc. will be strictly enforced for the workers engaged in high noise areas. Ambient noise levels are monitored at regular intervals during operational phase of the project. Water Requirement Impact due to Wastewater Generation
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	The untreated wastewater if discharged into nearby surface water may affect the surface water and/or if disposed off on land without treatment may pollute the ground and surface water. The other impact is water pollution due to disposal of rejects into the sea. Mitigation Measures ETP has already been installed to treat the generated effluent. . Appropriate drainage facilities have been developed within the site including proper disposal to drains. Impact due to intake, out fall point and marine disposal There is no marine disposal. So no impacts identified. Solid waste management Impacts During operation phase, the solid wastes generated and it can be broadly categorized as Hazardous Waste and Municipal Solid Waste. Further, the generated Municipal Solid Waste segregated into biodegradable, recyclable and inert compounds. If the solid waste generated is not properly managed and disposed in unauthorised manner, it will impact on soil quality, groundwater and air quality. Municipal Solid waste generated from operation phase is estimated as 11.25 kg/day. Port has given permission for disposal of solid waste. Mitigation Measures The Source of Municipal waste will be from the domestic use and strict guidelines will be put in place in order to manage the solid waste generation during operation phase. Solid wastes will be segregated into organic and inorganic categories. The organic waste will be disposed through
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village bins and inorganic waste will be sold to authorized vendors. The ship generated solid wastes will be collected, segregated and disposed to approved recyclers/industries for further beneficial use through port engaged contractor.

Hazardous waste generated will be stored in a separate hazardous waste storage area and properly disposed as per the Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2016.

Environmental Monitoring Program during Operation phase

S.No	Area of Monitoring	Number of Sampling Stations	Frequently of Sampling	Parameters to be Analyzed
1.	Ambient Air Quality	4 Stations	Twice a week: 24 hourly period	All the 12 parameters as per NAAQ Standards
2.	Noise	4 Stations	Once every season	Ambient Equivalent continuous Sound Pressure Levels (Leq) at day and Night time.
3.	Sewage	One at inlet & outlet	Monthly	pH, TSS, COD, BOD
4	Vehicular Emissions	Parking area in the Road side	Periodic monitoring of vehicles	Air emission and noise, PUC
5.	Soil	4 Stations	Monthly once	Physicochemical properties, Nutrients, Heavy metals

Environmental Monitoring Programme Budget–Operation Phase

	Number of Sampling Stations	Frequency of Sampling	Rate per sample (INR)	Total cost / year (INR)
Ambient Air	3 Stations (one in up wind and	Once in a month	3000	108000

		Quality	one in downwind and one at site)	24 hourly period		
		Noise	2 (one within site and one outside site)	Once in 3 months for 24 hours	1500	9000
		VOC	4 on the corners of the tank farm area	Once in 6 months	1000	2000
		Water	Two number of surface and ground water samples near the site	Once in 6 months	5000	40000
		Sea water	One at nearest sea point	Once in 6 months	4000	8000
		Solid waste	Municipal Solid and waste storage area	Twice in a month	600	14400
		Soil	Three locations (two within and one outside project site)	Once in 6 months	5500	33000
		Terrestrial and marine Ecology	Within 10km, around the project	Once in three years	6000	6000
2	Submit the comprehensive Risk Assessment and Disaster Management plan including emergency evacuation during natural and man made disaster.	The risk assessment plan is prepared and is attached as Annexure 14 The disaster management plan is prepared and is attached Annexure 9				
3	Details of desalination plant and the study for outfall and intake	Not applicable; because the quantity of water consumption would be very less.				

Court/ Litigation records

1	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	There is no litigation pending against the project.
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Environment Responsibility

As per the Ministry's Office Memorandum F. No. 22-65/2017-IA.III dated 30th September, 2020, the project proponent, based on the commitments made during the public hearing, specific studies shall include all the activities required to be taken to fulfill these commitments in the Environment Management Plan along with cost estimates of these activities, in addition to the activities proposed as per recommendations of EIA Studies and the same shall be submitted to the ministry as part of the EIA Report. The EMP shall be	Environmental management plan along with budgetary allocation and action plan for the issues raised during public hearing will be addressed in the Final EIA report.
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implemented at the project cost or any other funding source available with the project proponent	
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CHAPTER 2

PROJECT DESCRIPTION

2 PROJECT DESCRIPTION

2.1 Type of Project

The proposed project is “Capacity augmentation of existing operational Marine Liquid Terminal (MLT) from 3 MMTPA to 6 MMTPA at Kamarajar Port Limited, Chennai”. KPL falls under the category “A” Customers evinced interest to discharge multiple products from one or more vessels simultaneously to improve overall turn around time of the vessels and also intend to increase the throughput volumes through ETTPL to cater to the increased market demand. To facilitate this ETTPL is planning to augment its throughput capacity from 3 MMTPA to 6 MMTPA.

2.2 Project Background

- Ministry of Environment & Forests had accorded Environmental clearance for the development of satellite port at Ennore near Madras vide letter No. J16011/9/87-IA.III dated 28.9.1992. After commissioning of the satellite port in June 2001
- Initially M/s Ennore Port Limited obtained the EC vide letter no.10-28/2005-IA.III dated 19th May, 2006 by the Ministry for Expansion Proposals-development of Terminals for marine liquids, coal, Iron and containers in second phase and associated capital dredging at Ennore Port.
- Subsequently, Ennore Port obtained modification in EC by the Ministry vide letter dated 10th September, 2007, thereafter, PP obtained the Environmental and CRZ clearance vide letter no 11- 21/2009-IA.II dated 23rd July, 2009 for the construction of general Cargo berth at Ennore Port Cargo Terminal project, Ennore, Ponneri Taluk, District Tiruvallur, Tamilnadu, in the name of M/s Ennore Port Terminal.
- Thereafter the name of the Ennore port has changed from M/s Ennore port limited to M/s Kamarajar Port limited, after change of the name PP has submitted that the Kamarajar Port Ltd (formerly known as Ennore Port Ltd.) and obtained environmental and CRZ clearance for expansion and modernization of existing handling of Multicargo container terminal at Kamarajar Port, Tamil Nadu by M/s Kamarajar Port Limited (Formerly known as Ennore Port Ltd) subsequently obtained Environmental and CRZ clearance for construction of (CB3 and CB4) at Kamarajar Port, Tamilnadu vide letter dated 1 March, 2015. Subsequently M/s Kamarajar Port Ltd obtained the EC vide letter no F.No.11-51/2012-IA-II dated 30th October, 2018 for development of the facilities envisaged in the Port Master Plan (Phase III) by M/s. Kamarajar Port Limited.
- Further, the Kamarajar Port limited has applied in the Ministry for capacity optimisation of the ECTPL from present 8 MTPA to 9.6 MTPA, the proposal was considered by the Expert Appraisal Committee (EAC) in its 321st meeting during 28th February-1st March, 2023. The MoEF&CC granted Environment and CRZ Clearance under clause 7 (ii) of EIA Notification, 2006 vide letter no. 10-28/2005-IA.III dated 17/07/2023
- ETTPL has obtained Consent to operate vide 2208242865923 dated 22/08/2022 it is valid upto 31.03.2027.
- Kamarajar port has obtained CCR vide F.No.EP/12.1/2017-18/17/TN/1299 dated 26.08.2024.

- As per the obtained ToR vide 10/15/2024-IA.III dated: 06.09.2024 draft EIA report is prepared for Public hearing submission TNPCB, Gummindipoondi , Thiruvallur, for the Capacity Augmentation of Existing Operational Marine Liquid Terminal (MLT) from 3 MMTPA to 6 MMTPA at Kamarajar Port Limited, Chennai the project obtained recommendation from State Coastal Zone management Authority for the CRZ area.

2.2.1 Infrastructures and details

- Total area of the port is 2787.2 Acres which includes both customs and outside customs boundary
- Total manpower is 1500Nos. (KPL=155Nos. + Other BOT operators = 1345 Nos.)
- Water requirement is Presently drawing 269.46 KLD out of 1000KLD approved by CMWSSB.
- Power requirement is 650 KVA & 37342514 KWH per year (Including KPL and all other BOT Operators).

2.2.2 Compliance status of earlier EC's

S.No	EC Number	EC name	Total EC Condition	General Condition	Special condition	Complied	Not Complied	Partially complied	Refer Below	Agree to comply	Pertained to TNPCB
1	EC.No. J-16011/9/1987-IA.III, dated 28.09.1992	Construction of New Satellite Port at Ennore near Madras.	23	23	0	9	2	3	9	0	0
2	EC.No. 10-28/2005-IA-III dated 19.05.2006, 10.09.2007 & 18.12.2007.	Development of Terminals for marine liquids, coal, iron and containers in the second phase and associated capital dredging at Ennore Port	35	19	16	18	1	2	11	3	0
3	EC. No. 11-21/2009-IA.III dated 23.07.2009.	Construction of General Cargo Berth at Ennore Port cargo terminal project	27	21	6	12	0	1	9	4	1
4	EC.No. 10-28/2005-LA-III dated 24.12.2014.	Expansion and modernization of existing handling Multicargo container terminal at Kamarajar Port	26	20	6	16	0	0	7	3	0
5	EC.No.11-51/2012-IA.III, dated 12.03.2015	Development of additional coal berths (CB3 and CB4) at Kamarajar Port, Tamil Nadu	54	19	35	14	0	1	12	26	1
6	EC.No. 10-28/2005-IA.III dated 09.05.2018 & 10.07.2018	Modification of existing Iron ore terminal on 'as is where is basis to handle common user coal at Kamarajar Port	Present Status of the project: The project was accorded Environmental and CRZ Clearance for modification of the already approved iron ore terminal of 12 MTPA capacities to handle common user coal at Kamarajar Port vide letter date 0005.2018. The mod of the terminal was canned out by M/s. SICAL iron Ore Terminal Limned. The unit has Consent for Establishment under Air (Prevention and control of pollution) Act, 1981 and Water (Prevention and control of pollution) Act, 1974, vide order No. 18012102720/2 & 1801110272073, dated 20.07.2018, valid till 31.03.2025. The copy of the clearance is uploaded on the website of the Project Proponent: https://www.ennoreport.gov.in/content/innerpage/environment.php The lender of the project M/s. YES Bank Limited has given notice for event of financial default on the BOT operator to KPL on 07.11.2020: Accordingly, in line with the license agreement, KPL had served "Notice of intent to terminate" to								

S.No	EC Number	EC name	Total EC Condition	General Condition	Special condition	Complied	Not Complied	Partially complied	Refer Below	Agree to comply	Pertained to TNPCB
			M/s. SICAL Iron Ore Terminal Limited on 20.12.2020. Consequent to which, the project is stalled till now. Hence, the compliance of the conditions stipulated in the EC& CRZ clearance dated 09.05.2018 does not arise.								
7	EC.No. 11-51/2012-IA.III dated 30.10.2018	Development of facilities envisaged in the Port Master Plan (Phase-III).	54	19	35	15	0	1	11	26	1
8	EC.No. 11-10/2022-IA.III dated 22.04.2022	Establishment of 1MLD RO Desalination Plant	Present Status of the project: The Ministry had accorded CRZ Clearance for the establishment of 1 MLD desalination plant letter dated 22.04.2022 e unit had obtained for Establishment under Air (Prevention and control of pollution) Act, 1981 and Water (Prevention and control of pollution) Act, 1974, vide order No. 2201148160108 & 2201048160108, dated 03.11.2022, valid till 31.03.2026. The clearance details were advertised in English (The Indian Express) and Tamil (Dinamani) Newspapers on 05.05.2022. The copy of the clearance is uploaded on the website of the Project Proponent: https://www.ennoreport.gov.in/content/innerpage/environment.php However the project is yet to commence construction work. Tender work is in progress. Hence, the compliance of the conditions stipulated in the CRZ clearance dated 22.04.2022 does not arise.								
9	EC.No. 10-28/2005-IA-III dated 17.07.2023 & 14.11.2023.	Capacity Optimisation of Existing ECTPL Terminal from 8MTPA to 9.6 MTPA at Kamarajar Port Ltd	16	4	12	7	0	1	5	3	0

2.3 Need for the project

The demand for marine terminal facilities for petroleum products is expected to increase significantly due to:

- Increasing importance of coastal shipping in petroleum product movement
- Growing POL product traffic at ports in the southern region
- Overlapping product movement of petroleum products
- Demand serviced from refineries outside the region - Private sector players like RIL and Nayara Energy expect to rely substantially on coastal movements from their refineries in the western region to service their share of demand in the southern region
- Retail marketing plans of private sector oil companies
- CPCL expansion and capacity constraints at Chennai Port

In view of the advantages, a wide range of vessels ranging from large product tankers to small chemical tankers are expected to call at the MLT.

2.4 Project Location

The Project site is located inside the custom bond area at Ennore Port, Thiruvallur. The land documents are enclosed as **Annexure-2**. The project site falls in the 13.21°46' N Latitude and 80.32°03' E Longitude respectively. The Google satellite imageries covering 1 Km, 5 km & 10 km radius around the project area are appended in to **Figure 2-1, Figure 2-2, and Figure 2-3** respectively. CRZ delination map of 1:4000 scale and CRZ map of 7km radius is given in **Figure 2-4 & Figure 2-5**.

2.5 Size of the project

The terminal is being operated by M/s. Ennore Tank Terminals Pvt. Ltd., a subsidiary of IMC Limited on 30 years BOT basis. The terminal was commissioned in the year 2009 with a total Tankage capacity of about 2,56,636 KL with various Petroleum and Chemicals storage and handling, on a Plot of about 33.26 Acres.

2.6 Proposed schedule for approval and implementation

The time schedule for the completion of EC clearance for proposed project is February 2025.

Draft EIA Submission to PH	December 2024
Public hearing	January 2025
EC application submission	February 2025
EC Clearance	March 2025

2.7 Project cost

The expected total project cost is **Rs 1.64 crore**

Table 2-1 The project cost estimated for Enhancement

S.No.	Details	Qty	Amount (INR, In Lakhs)	Remarks
1	Modification of Common Manifold to facilitate simultaneous discharge to BPCL	1	104.00	Hooking up lines to 2 x 24" lines of BPCL
2	Modification of 16" dock line to make it suitable for receipt of motor spirit from vessels	1	52.00	Modifications at jetty, common manifold and at exchange pit
3	Modification of 8" SS Dock Line for in line berthing of chemical vessel with POL vessels	1	8.00	Extension of 8" SS Dock line to south side of the jetty for in-line berthing of 2 vessels
Total			164.00	

2.8 Existing Environmental Setup

The industries within 10 km radius from project site are given in **Table 2-2**. Industry near the project site is given in **Table 2-3**.

Table 2-2 Salient features of the proposed project

Features	Description		
Name of the Project	Capacity augmentation of existing operational Marine Liquid Terminal (MLT) From 3 MMTPA To 6 MMTPA at Kamarajar Port Limited, Chennai		
Inter State Boundary	Nil within 15km radius from the project boundary		
Nearest Railway station	Attipattu Railway station, 5.51km, WSW		
Nearest Highway	Highways	Distance (~km)	Direction
	SH-107(Minjur–Kattur–Thirupalaivanam Road)/SH-104(Chennai-Pulicat Rd)	6.58	WNW
	NH-16(Chennai-Kolkata)	18.81	WSW
Nearest Airport	Airport	Distance (~km)	Direction
	Chennai International Airport	34.59	SSW
Nearest city	City	Distance (~km)	Direction

	Chennai	5	WSW	
Nearest Port	Ports	Distance (~km)	Direction	
	Kamarajar Port (Ennore port)	Site is within the port		
	Adani Kattupalli Port	0.45	N	
Reserved Forest/Protected Forest/Notified Wildlife Sanctuary/Ecological ly sensitive areas	Environmental Sensitive Areas	Dist(km)	Direction	
	Mangroves near Kattupalli	0.75	NNW	
	Mangroves near Ennore Port	0.75	W	
	Mangroves near Kattupalli	1.91	NNW	
	Mangroves near Attippattu	3.72	SSW	
	Mangroves near Sanganimedu	4.05	NNW	
	Mangroves near Ennur	5.72	SSW	
	Mangroves near Kalanji	6.08	N	
	Mangrove Swamp near Kattur	8.69	NW	
	Mangroves near Tangal	11.20	N	
Water Bodies	Waterbodies			
	Description	Distance(km)	Direction	
	Bay of Bengal	Site within the Bay of Bengal		
	Buckingham Canal	0.26	W	
	Korttalaiyar/Kosisttalaiyar	0.3	W	
	Lake near Uranamedu	3.97	WNW	
	Ennur Creek	4.25	S	
	Tiruvellavayal Lake	4.68	WNW	
	Arani River/Araniya Nadi	10.5	NW	
	Perumbedu Lake	12.34	NW	
	Lake near Nayar	13.9	W	
	Pulicat Lake	15	N	
Monuments	Environmental Sensitive Areas	Distance(km)	Direction	
	Dutch Cemetery	14.23	N	
Nearest Tourist Places	Nil within 15km radius			
Defence Installations	Nil			
Seismic Zone	Zone- III (least active) according to Seismic Map of India			



Figure 2-1 Google image of Project site around 1 km

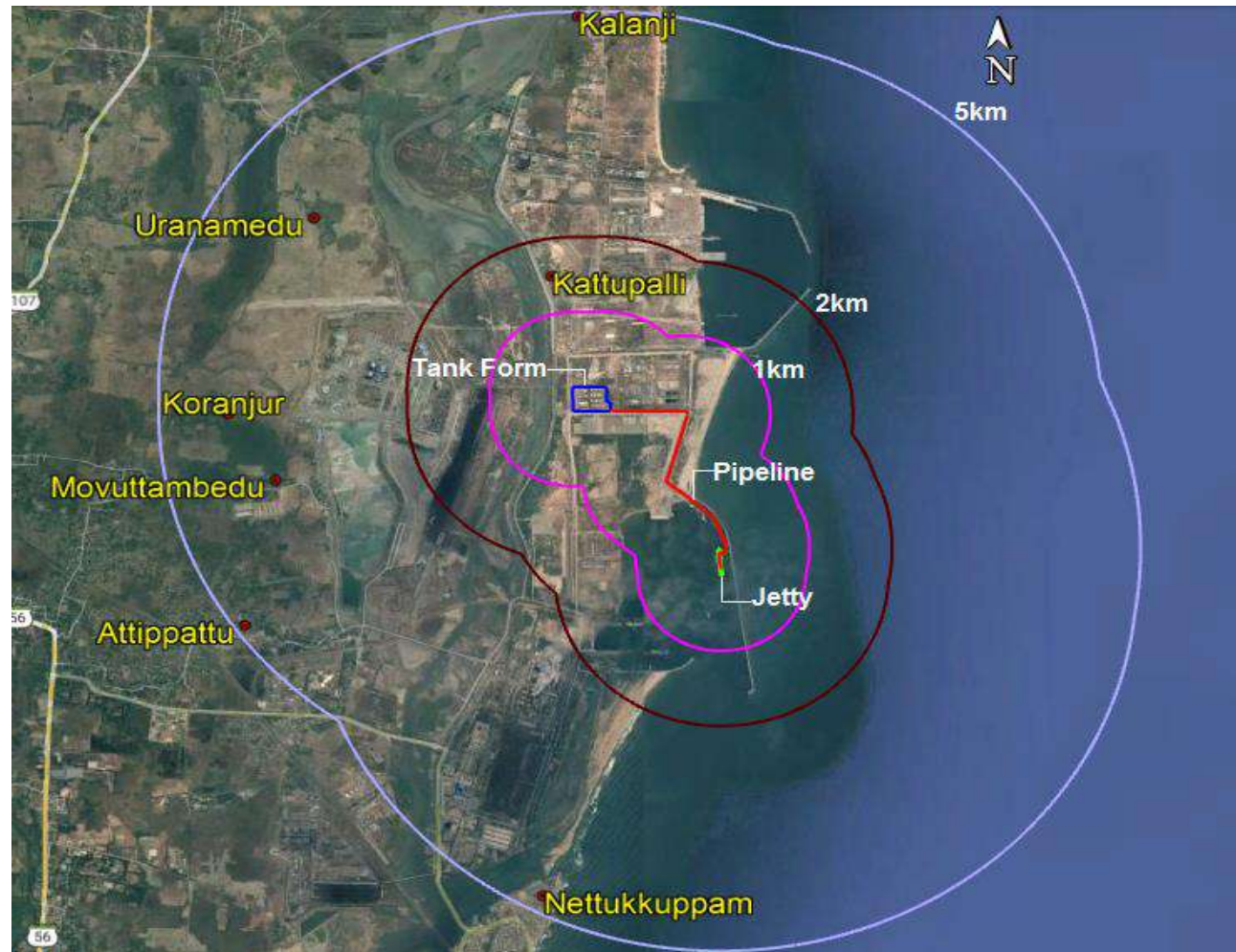


Figure 2-2 Google image of Project site around 5 km

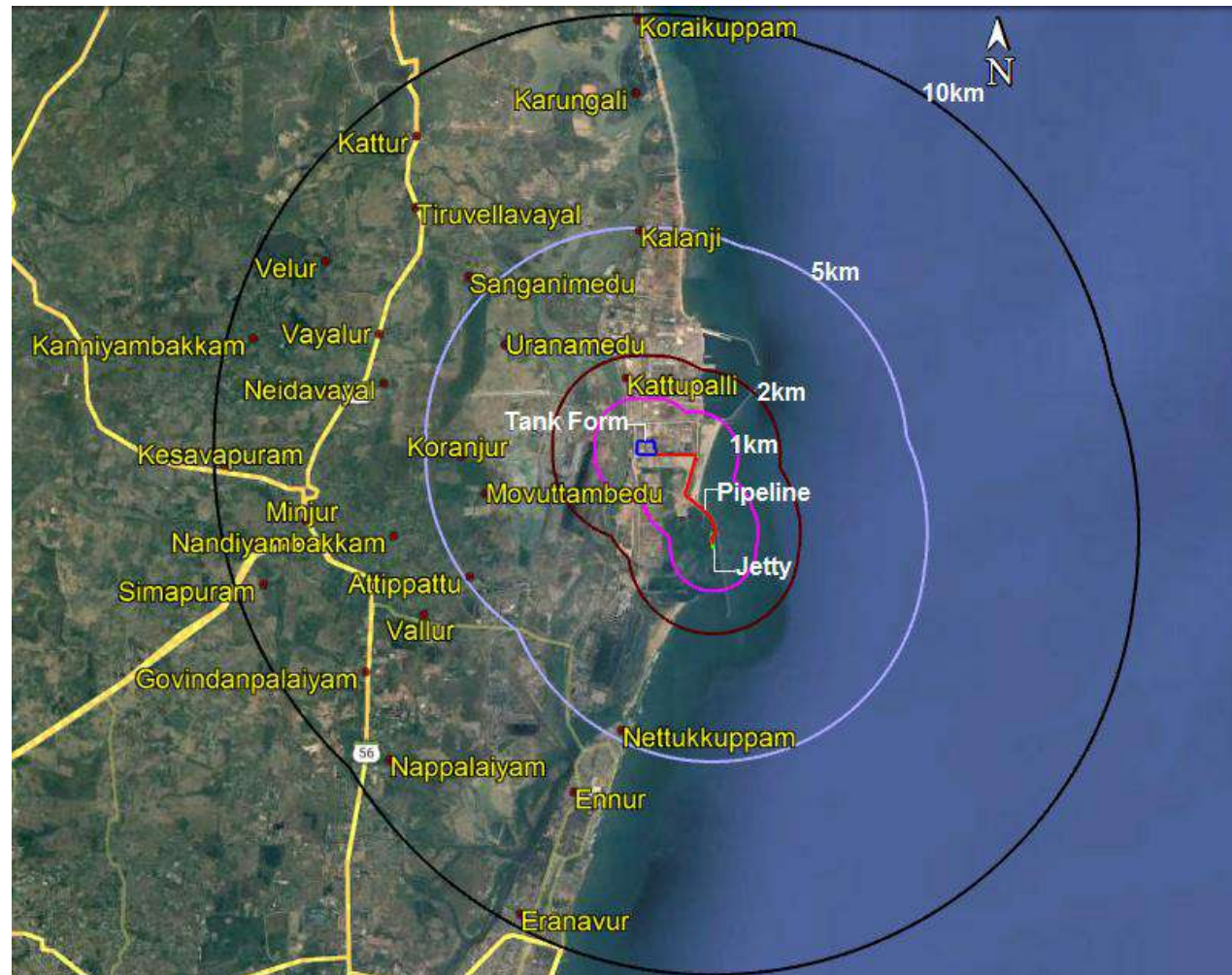


Figure 2-3 Google image of Project site around 10 km

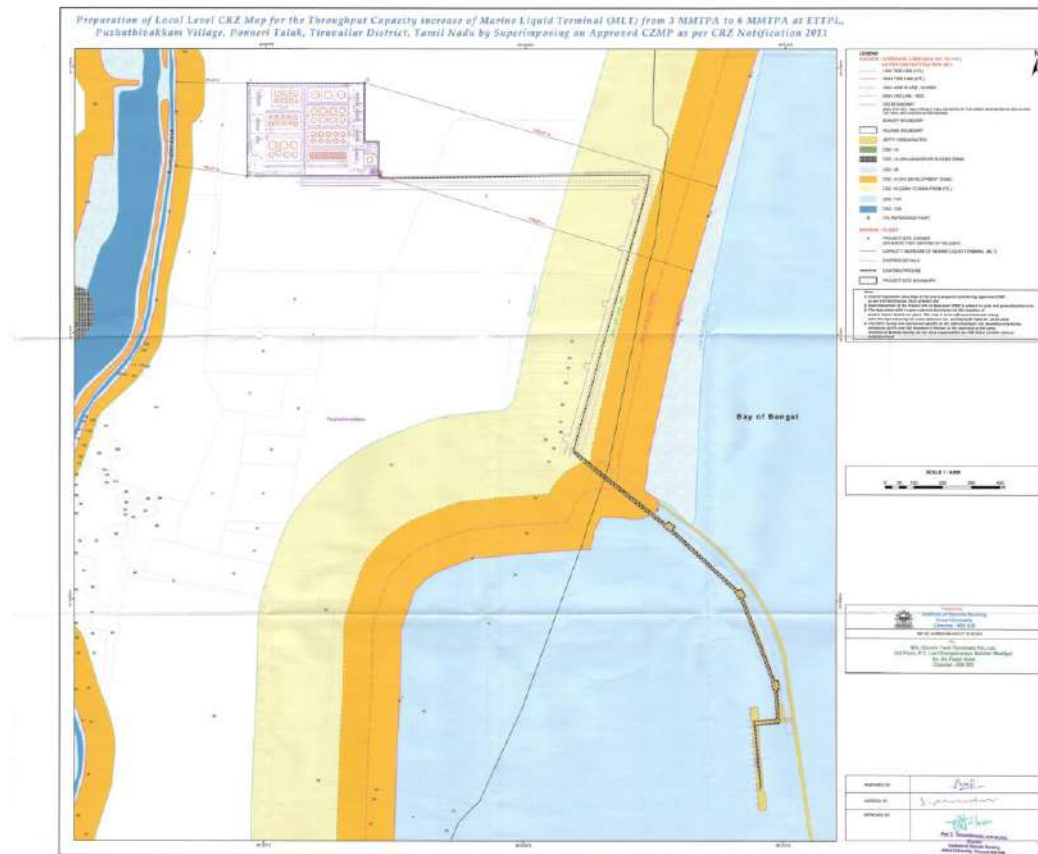


Figure 2-4 CRZ map of project site

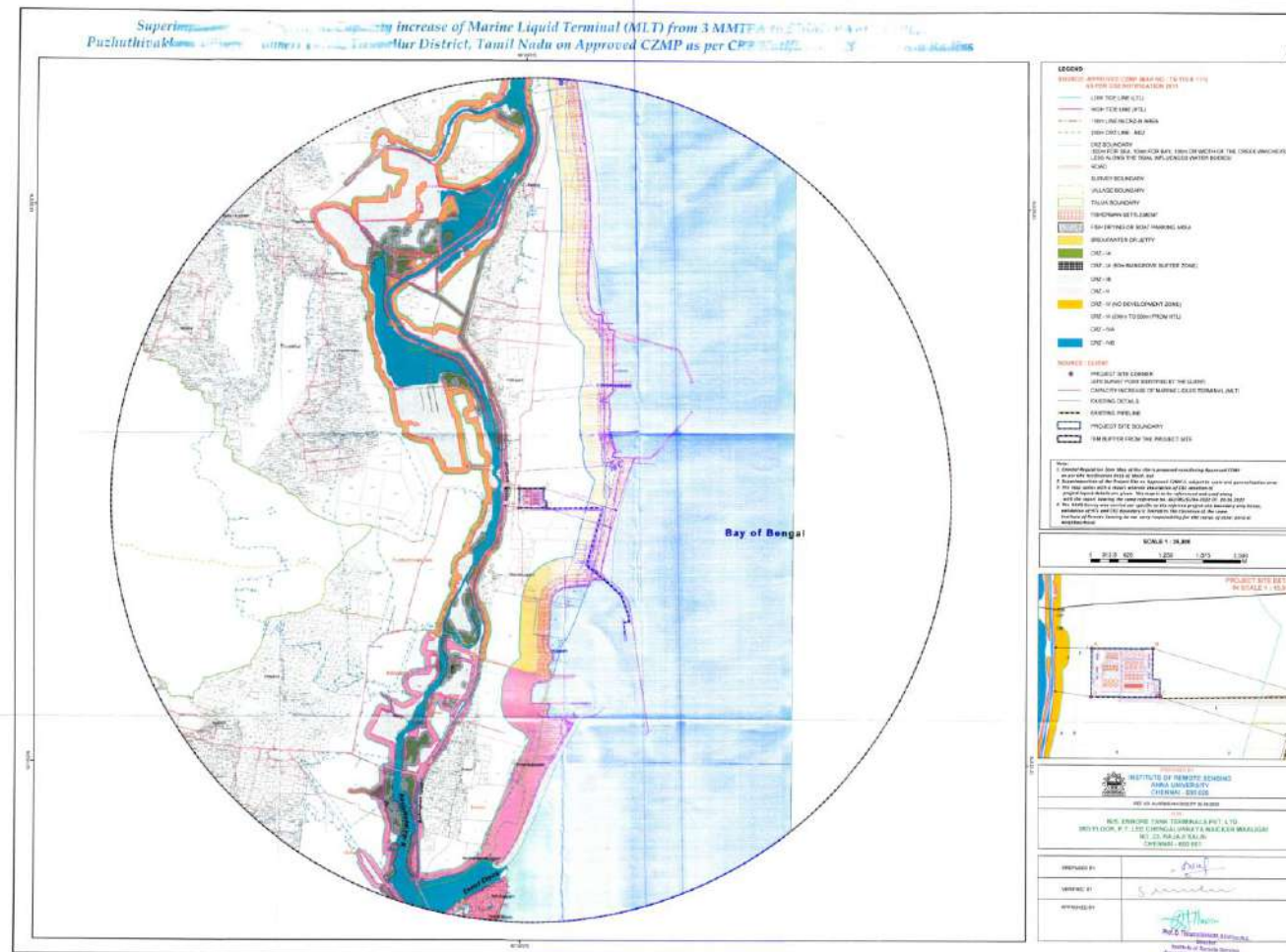


Figure 2-5 CRZ map 7 km radius of project site

Table 2-3 Industry near project site

Industry	Dist(km)	Dire.
IndianOil LNG Terminal	0.11	E
L&T MFFK Katupalli Ware house	0.46	N
SICAL Iron Ore Terminals Limited	0.59	W
JSW Ennore Coal Terminal Pvt Ltd	0.92	W
CPCL Desalination Plant	0.92	W
Ennore SEZ Thermal Power Project	1.47	W
North Chennai Thermal Power Station	2.68	S
ABENGOA Seawater Desalination Plant	2.77	N
L&T Hydro carbon Engineering	3.22	N
Zuari Cement Grinding Unit	3.9	SW
IOCL LPG Bottling Plant	4.44	SW
BPCL Terminal Ennore	5.32	SSW
HPCL Terminal Ennore	5.57	SSW
The India Cements Ltd	6.33	SW
Kences Container Terminal Ltd	6.74	SW
Empezar Global Container Terminal	6.95	SW
MSA Global Logistics (Chennai) Private Limited	7.1	SW
Reliance Industries ltd	7.45	SW
German Express Shipping Agency (India) Private Limited	7.54	SW
Lenovo	7.57	S
ECCT - CFS	7.72	SW
COROMANDEL INTERNATIONAL LTD	7.82	S
Farm Implements (India) Pvt Ltd Factory	7.9	SW
Hinduja Foundries Ltd	8.31	S
Ashok Leyland Limited	8.65	S
Ennore Thermal Power Station	9.25	SSW
Triway Container Freight Station	9.63	SW
Piramal Pharma Limited	10.62	S
Chandra CFS and Terminal Operator Pvt Ltd	10.77	W
Sri Balaji Engineering Works	11.22	SW
Shri Sabhari smelters pvt ltd	11.32	SW
Chennai Emulsifiers	11.35	SW
Vichur Sundar Chemicals	11.38	SW

Sriram Cold Forgings Pvt. Ltd	11.41	SW
Sri Sai Ram Hair Industries	11.43	SW
Mirra and Mirra Industries Private Limited	11.48	SW
Sumit pipe Industries	11.5	SW
Mangal Industries	11.52	SW
Modern Age Metal Processors P Ltd	11.64	SSW
ITC limited	11.68	SSW
Kailash Shipping Container Freight Station	11.91	SW
Ocean Star Container Solutions	11.94	SW
Metals & Scrap Traders	11.98	SW
VEL CONTAINERS Terminus Pvt Ltd	12.03	SW
Manas warehousing Pvt LTD	12.14	SW
Gateway Distriparks South Private Limited	12.4	SSW
Olympic Wearhouse	12.66	SW
CMG Steels Private Limited	12.71	SW
Raj Petro Specialities	12.775	SW
SUN MUTIARA ENGINEERING PVT LTD	12.78	SSW
Royal Enfield Motor Factory	12.82	SSW
Toshiba JSW Power Systems Pvt. Ltd	12.85	SW
Natco Pharma Limited	12.9	SW
Southern Tubes	12.92	SSW
Sattya Publicbonded WH	12.99	SSW
Carborundum Universal Ltd CUMI	13.03	SSW
Mahalakshmi Bright Steel Industries Pvt Ltd	13.04	SSW
Crayon Roofings and Structures	13.1	SSW
TPL	13.2	SSW
CPCL LPG Bottling And Bulk Terminal	13.21	SW
Sattva Hitech CFS	13.23	SSW
Petro Araldite Private Limited	13.3	SSW
GG Steels	13.34	SW
Tamilnadu Petroproducts Limited	13.4	SSW
Indian Additives Limited	13.54	SSW
Inox Air Products	13.55	SSW
Madras Fluorine Private Ltd	13.59	SSW
Madras Fertilizer Limited	13.78	SSW

Sicgil India	13.8	SSW
CPCL	14.06	SSW
Manali Petrochemical Ltd Plant-I	14.08	SSW
SRF Limited	14.18	SW
Supreme Petrochem Limited	14.25	SW
The KCP Limited	14.43	SSW

2.9 Project Description with Process Details

This project is to augment the capacity of Marine Liquid Terminal operated by ETTPPL from 3MTPA to 6MTPA. Enhancement of the Capacity Facilities which fall **under CRZ IV(A), CRZ III, CRZ III(NDZ)** and while tank farm area falls outside CRZ area. The CRZ Report is attached as **Annexure 12** has well established infrastructure like road, rail, water connectivity and airport facilities. The planning augmentation and its throughput capacity is given in the **Table 2-4**.

Table 2-4 Planning augmentation and its throughput capacity

S.No.	Details	Remarks
1	Modification of Common Manifold to facilitate simultaneous discharge to BPCL	Hooking up lines to 2 x 24" lines of BPCL
2	Modification of 16" dock line to make it suitable for receipt of motor spirit from vessels	Modifications at jetty, common manifold and at exchange pit
3	Modification of 8" SS Dock Line for in line berthing of chemical vessel with POL vessels	Extension of 8" SS Dock line to south side of the jetty for in-line berthing of 2 vessels

The Augmentation layout of Hooking up lines to 2 x 24" lines of BPCL is given in **Figure 2-6**, layout of Modification of 16 inch ATF Dock line from jetty and common manifold **Figure 2-7** and Modification of 16 inch ATF Dock line from jetty and common manifold **Figure 2-8**.

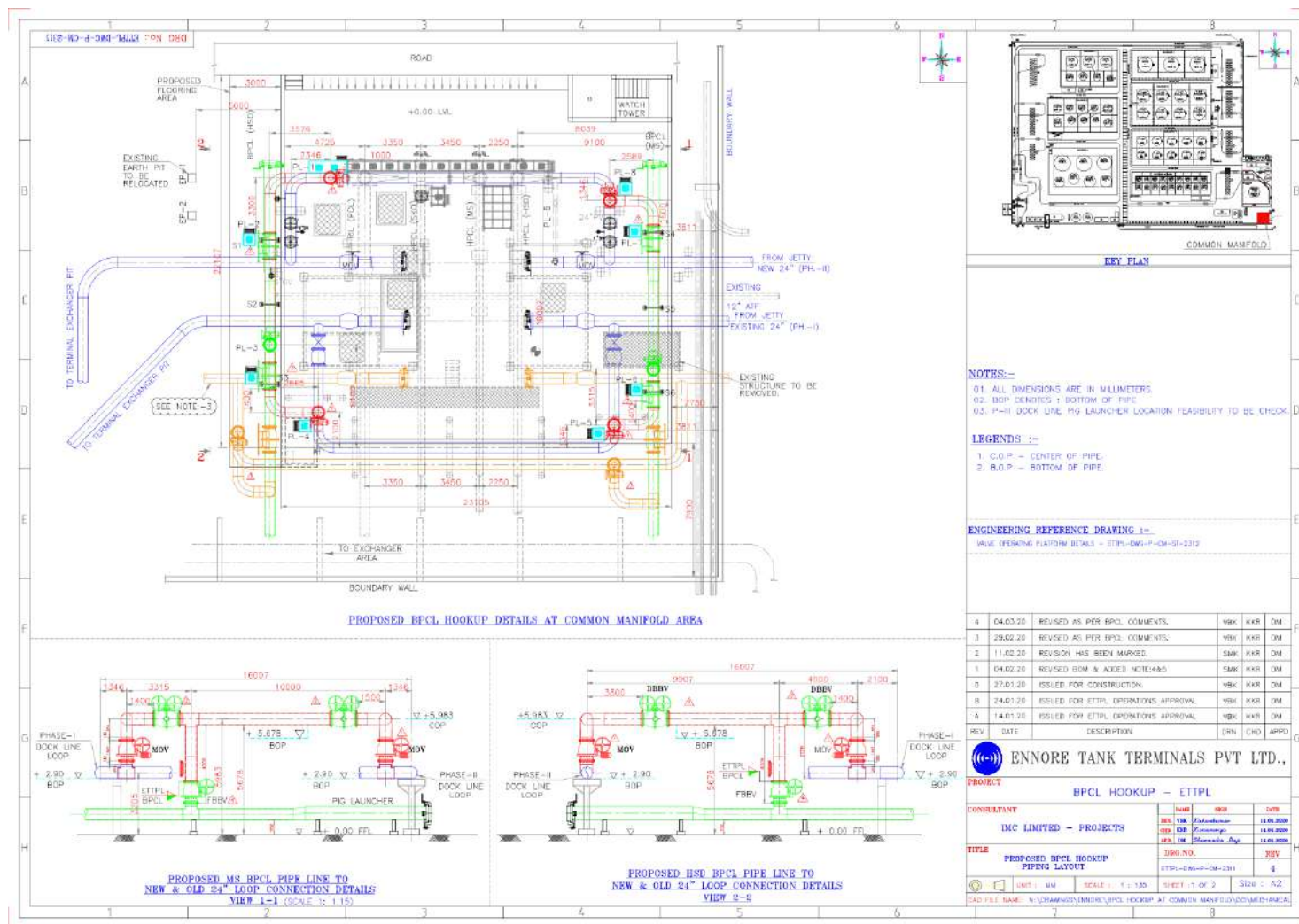


Figure 2-6 Proposed Hook up Piping Layout

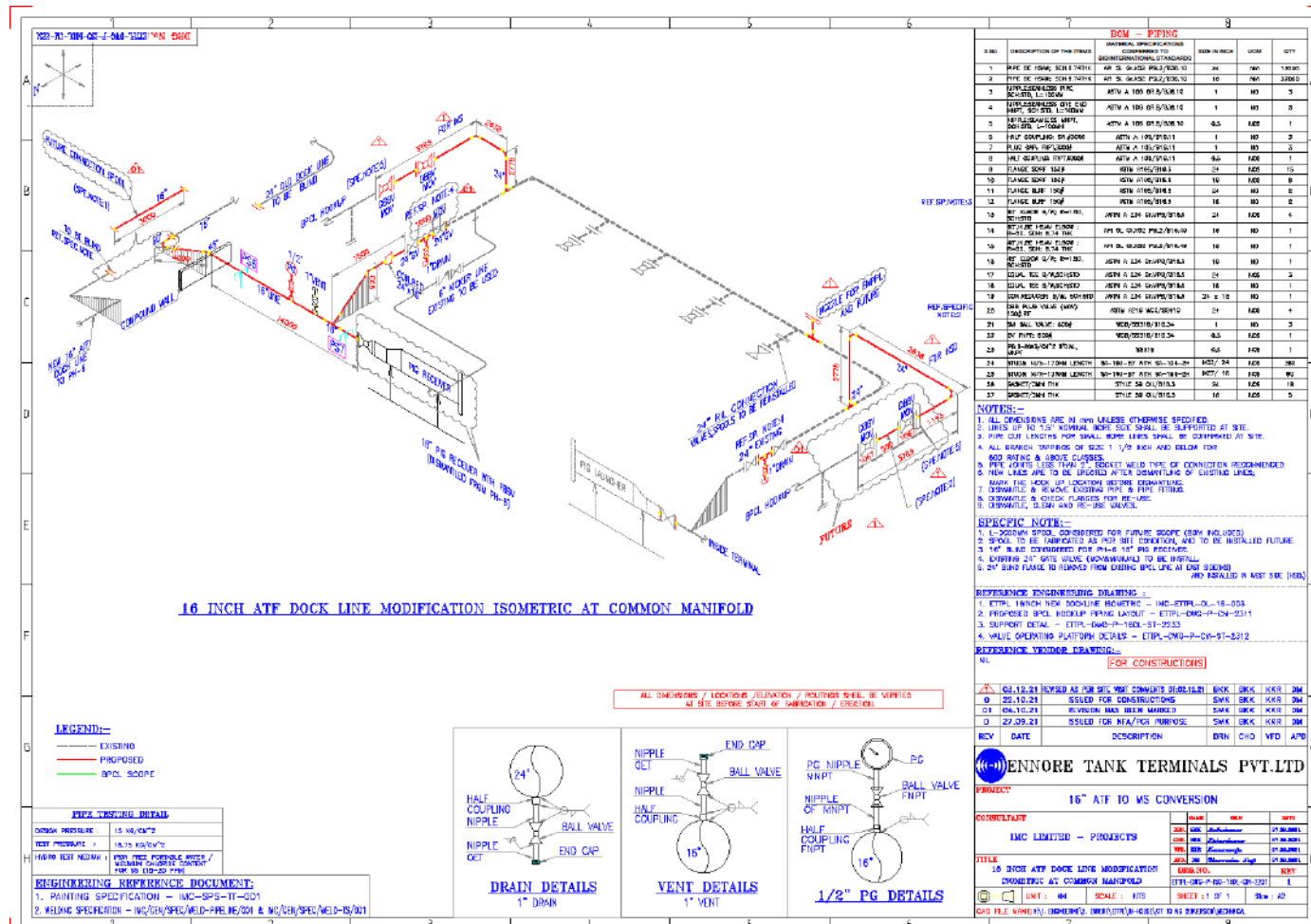


Figure 2-7 layout of Modification of 16 inch ATF Dock line from jetty and common manifold

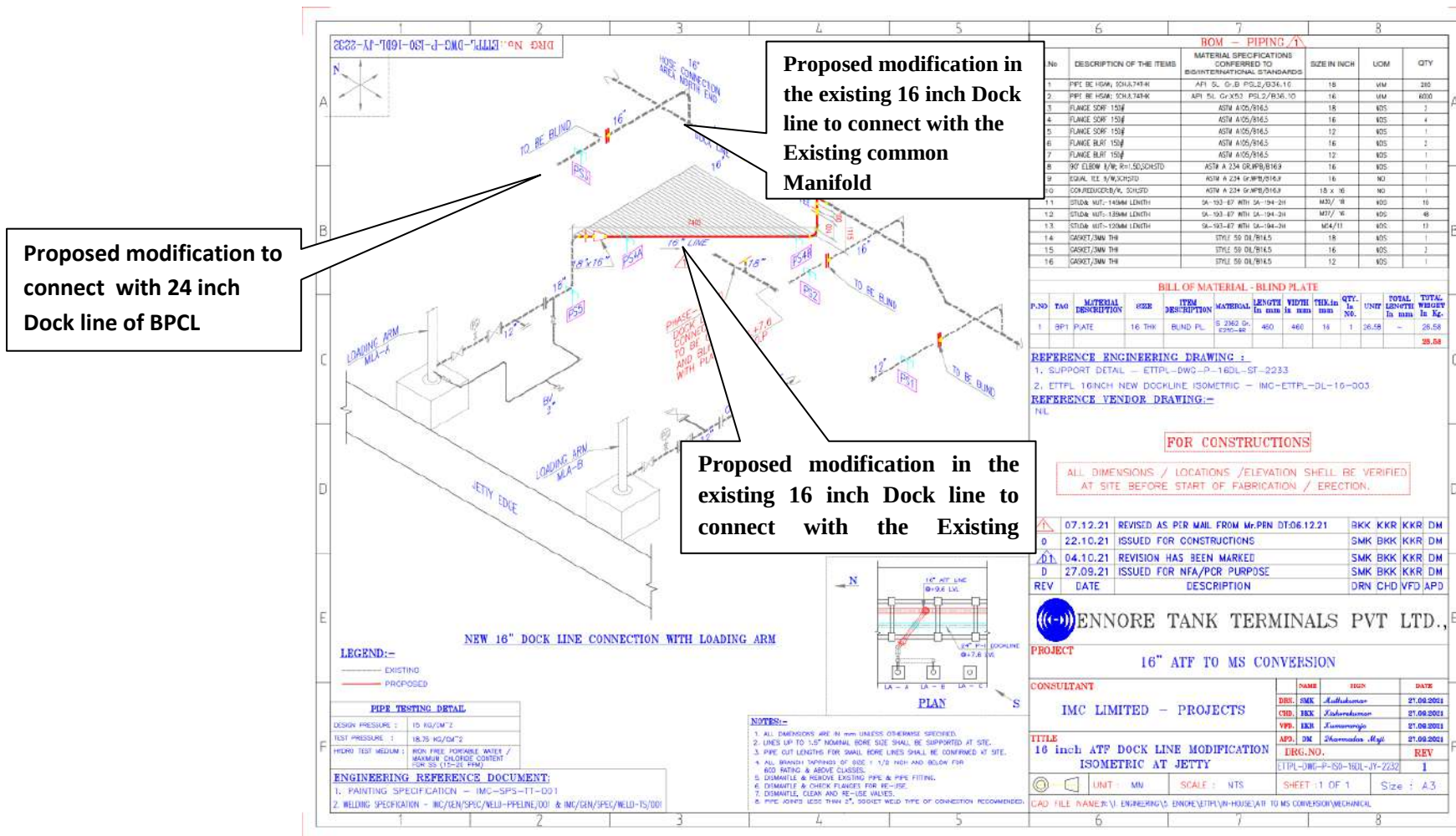


Figure 2-8 layout of Modification of 16 inch ATF Dock line from jetty and common manifold

2.9.1 Vessel Size Analysis

General

Selection of optimal vessel size for planning port facilities is vital as it influences the size of the facilities required. Further it may also be possible that vessels carrying POL products, LPG and hemicals could be of different sizes in actual practice. Hence selection of the design vessel is essential for optimum utilization of available area for future expansion. The design vessel that could call at proposed terminal at Kamarajar Port has been evaluated based on the following:

- Global Trends
- Facility at Indian Major Ports in India
- Analysis of vessels handled by ETTPL at Ennore
- Profile of vessels likely to call at Kamarajar Port and requirements of terminal users.

The various aspects as identified above are examined in detail in the following paragraphs. While doing so, reference is drawn not only to the global scenario and trends but also to the prevailing conditions at Indian ports and at Ennore

Global Trends in Sea Borne Trade -Tankers

The general range of tanker sizes handled globally is presented in **Table 2.5**

Table 2-5 General range of tanker sizes

Vessel class	DWT Range	Vessel class	DWT Range
General purpose tanker	10,000-24,999	Product Tanker	10,000-60,000
Medium Range tanker	25,000-44,999	Panamax	60,000-80,000
LR1(Large range 1)	45,000-79,999	Aframax	80,000-1,20,000
LR2(Large range 2)	80,000-1,59,999	Suezmax	1,20,000-2,00,000
VLCC (Very large crude carrier)	1,60,000-3,19,999	ULCC(Ultra large crude carrier)	3,20,000-5,49,999
MGC(Medium Gas Carriers)	10,000	Very Large Gas Carriers	40,000-5,00,000

The tanker market deals mainly with transportation of crude petroleum oil and products which represent one-third of global sea-borne trade.

Tanker Types

The main tanker types are:

- Crude Oil Tankers
- Product tankers
- Gas carriers
- Chemical Tankers

Crude Oil Tankers

These are mainly tankers transporting crude oil from origin to the refinery in areas where pipeline facilities do not exist. As such long distances are involved and economies of scale dictate the employment of very large crude carriers & ultra large crude carriers which are tanker vessels above 200,000 DWT.

Product Tankers

These are specialized cargo vessels that carry chemicals such as naphtha, jet fuel, kerosene, petrol, diesel, fuel oil, etc. Unlike crude oil tankers which transfer cargo from its origin to the refinery, this sector deals with processed cargo from the refinery to centers of consumption or distribution.

Product tankers fall mainly within the Handy size tanker classification. Handy size tankers are those of less than 50,000 DWT with draft of around 10 m. Most suited for destinations with depth & length constraints.

Chemical Tankers

The chemical tanker fleet is divided into three specifications in accordance with IMO.

1. The smallest sector (3%) is IMO-1 which trades in most hazardous cargoes used in pharma & pesticides, etc.
2. The largest sector about 67% of the fleet known as IMO-2 trades primarily in pure chemical cargoes such as styrene, xylene, etc.
3. Almost 30% of the fleet comprises IMO-3 which are double hull product tankers trading only in chemicals & vegetable oils.

According to Lloyd's Register of shipping, Marine 'Global Trends 2030' Report, total tonnage & vessel numbers will increase for all major ship types. World seaborne trade grew by an estimated 7 per cent in 2021. However, oil trade has not been as buoyant. The increase for tankers will be at a slower rate.

Around the beginning of 2011 the combined tonnage of sea going ships was 1396 million DWT. Oil tankers accounted for around 33% of this fleet and the annual increase in tanker fleet was around 5.5 percent compared to about 16 percent for dry bulk carriers. The total tonnage of tankers is expected to grow only 1.7 to 1.8 times over the next 2 decades compared to containers, dry bulk & LNG which are expected to grow between 1.8 and 3.0 times.

The growth of oil trade from 2018 to 2023 as indicated **Table 2.6** below shows only an average 2.5% increase per annum.

Table 2-6 International Seaborne Trade (Oil & Gas)

Year	Oil and Gas (In Million Ton)
2018	2846
2019	2931
2020	3004
2021	3080
2022	3110
2023	3204

Volumes of Crude oil and refined petroleum products grew marginally at 1.5 per cent in 2022. Though the economic slowdown, high oil price levels and new technologies have damped demand for crude oil, petroleum-product trade fared better in comparison.

Oil tankers and chemical & product tankers comprise only about 25% deliveries in terms of tonnage while the bulk of new orders & deliveries constitute dry bulk carriers and container vessels. The average vessel sizes of new orders for liquid bulk vessels are given in **Table 2.7**.

Table 2-7 Average vessel sizes of new orders for liquid bulk vessels

Type	DWT
Crude Oil Tankers	200,000
Chemical/Product Tankers	24,000
Product Tankers	34,000
LPG Tankers	45,000

The average size and break-up of the world fleet are presented in **Table 2.8**.

Table 2-8 Age distribution of World Merchant Fleet (Oil Tankers)

	0-4 years DWT	5-9 years DWT	10-14 years DWT	20+ years DWT
World	57,414	67,739	69,451	11,322
Developing Countries	58,677	73,757	62,818	12,441
Developed Countries	54,561	58,280	70,009	6,061
Countries with economies in transition	39,610	32,848	24,281	4,470

The above indicates that 60,000 to 70,000 DWT vessels are the significant carriers in the world oil tanker fleet.

2.9.2 LP Vessels calling at Major ports along the East Coast of India

The vessels calling at Indian ports for cargo like POL products, LPG and Chemicals, facilities at each port and details of the vessels called at major ports along the East Coast of India are studied in the following sections.

Table 2-9 Bulk Liquid Handling Facilities along the East Coast of India

PORT	Cargo Type	No of Berths	Vessel Size in DWT
Kolkata	POL Products	7	Upto 38,000
Haldia	Crude/POL	3	89,000 – 150,000
Paradip	POL	1	70,000
	Crude	1 SPM	320,000
Visakhapatnam	Crude Oil	1	150,000
	POL	2	50,000
	LPG	1	50,000
	Other Liquids	4	45,000
Ennore	LPG/POL Products	1	15,000 – 70,000
Chennai	Crude/POL	2	140,000
Tuticorin	POL Products	1	65,000

Source: Indian Ports Association

Though the commodity composition of the total traffic at Indian ports has changed marginally over the years, POL and its products continue to be the single largest commodity handled by ports as seen from **Table 2.10** below

Table 2-10 POL Traffic handled at Major Ports along East Coast

PORT	TRF Apr-Mar 2021	TRF Apr-Mar 2022	TRF Apr-Mar 2023	TRF Apr-Mar 2024
Kolkata	35.581	35.679	10005	9913
Paradip	34360	34561	37421	37477
Visakhapatnam	69.84 MT	80MT	15821	18449
Ennore	2297	2419	2387	2582
Chennai	10230	11850	12456	13307
Tuticorin	454	353	299	467

Source: Indian Ports Association

2.9.3 Review of Tanker& Product Vessels at Kamarajar Port

The present composition of the Product vessels was reviewed along with the requirements of the IPPL and PSU oil companies with regard to their plans to bring larger vessels in future.

Table 2-11 No of Tankers and Product Vessels Called at Ennore

FY 2022-23&FY 2023-24						
DWT Range	Black oil	POL	LPG	CHEM	Total	%
0-5000			-	1	1	0.2
5001-10000			-	39	39	8.1
10001-15000	3		-	34	37	7.6
15001-20000			-	6	6	1.2
20001-25000			-	2	2	0.4
25001-30000			-	2	2	0.4
30001-35000		17	-	2	19	3.9
35001-40000	1	5	-	-	6	1.2
40001-45000		23	-	-	23	4.8
45001-50000	21	159	3	-	183	37.8
50001-55000		1	106	-	107	22.1
55001-60000			25	-	25	5.2
70001-75000		8	-	-	8	1.7
75001-80000		26	-	-	26	5.4
95000-100000	25	239	134	86	484	100

Table 2-12 Tankers at Ennore

DWT Range	%
0-5000	0.2
5001-10000	8.1
10001-15000	7.6
15001-20000	1.2
20001-25000	0.4
25001-30000	0.4
30001-35000	3.9
35001-40000	1.2
40001-45000	4.8
45001-50000	37.8
50001-55000	22.1
55001-60000	5.2
70001-75000	1.7
75001-80000	5.4
95000-100000	100

It may be seen from **Table 2.11** that POL tankers in the range of 40000 to 60000 DWT constitute 33% of the total number of vessels called at Kamarajar Port in 2023.

2.9.4 Parcel sizes

Petroleum products – The parcel sizes are expected to be wide, in the range of 10,000 MT to 75,000 MT. The private oil marketing companies are expected to bring in smaller tankers initially. Changes in the government control pricing policy of POL products and reduction in gap due to under recovery are likely to result in more business for these firms. The parcel size and vessel size are likely to increase substantially thereafter.

Chemicals – From 500 MT to 40,000 MT. Size of Chemical vessels will be reduced to below 8000 DWT wherein the LoA of the vessels will be lesser than 120 metres. This is to facilitate berthing of these vessels along with MR Size POL vessels to maximize the throughput volumes

The parcel size of CBFS is expected to be relatively steady – 40,000 to 50,000 MT initially and is expected to increase subsequently due to higher demand from existing and new plants.

A significant proportion of chemicals and petroleum products are expected in smaller parcel lots and hence the number of shipments would be higher. There are multiple oil companies and traders who would be moving several types of petroleum products through Ennore and significant coastal shipping activity is also expected. A significant proportion of the parcel sizes could be on the lower side (< 10000 MT) and this would lead to higher number of ships.

A wide range of petroleum products – Petrol, Diesel, Naphtha, Kerosene, Aviation Turbine Fuel, Fuel Oils, etc. are expected to be handled. Several of these products are shipped in different grades. In such an event, the different grades would have to be received/discharged separately and hence shipment times may actually take longer than predicted.

Petroleum, CBFS, Crude and other chemicals are usually discharged at multiple ports. Hence, even if the vessels are larger in size, the actual parcel sizes may be lower.

The berthing facility must therefore be flexible to handle a large range of vessels so that the market requirements can be met satisfactorily without bunching and demurrage.

Crude – VLCCs around 300,000 DWT subject to depth availability. The existing MLT can berth VLCCs and depending upon the customers' requirements, berthing of VLCCs will be planned.

2.9.5 Conclusion

- 60,000 DWT to 70,000 DWT oil tankers will also be calling the terminal as against 20,000 to 30,000 DWT vessels calling presently.
- POL Vessels will invariably be berthed along with a chemical vessel as in-line berthing whereby berth efficiency will be increased and throughput volumes will be higher.
- POL Vessels will start discharging 2 products namely Motor Spirit and HSD simultaneously through 2 pipelines as against single product discharge being done currently. This is expected to enhance the throughput significantly.
- With regard to LPG vessels, 45-50,000 DWT vessels will arrive and medium range vessels will be discouraged to achieve higher volumes.
- ETTPPL expects large POL/Crude tankers including Panamax to Suezmax vessels to call at Kamarajar Port in future and on a long-term basis.
- In view of the above, ETTPPL plans to achieve higher throughput volumes by optimizing the existing facilities without much of investments except as mentioned earlier.

2.9.6 Traffic forecast

2.9.6.1 Traffic Forecast by KPL

Traffic forecast was made initially by Kamarajar Port Limited (KPL) during the tendering stage based on expressions of Interest received from the firms and information furnished by some of prospective users / traders / industry at that time and was estimated conservatively.

2.9.6.2 Traffic Forecast by ETTPPL

Following are the methods adopted for traffic survey by Ennore Tank Terminals Private Limited (ETTPPL):

a) Existing Users

Actual traffic volumes of previous period are considered in the projections. ETTPPL had extensive interactions with all major potential users of the jetty, pipelines and storage tank farm and various contracts entered into with customers.

S.No	Existing users	Products
1.	Indian Oil Petronas Pvt. Ltd (JV of IOCL & Petronas)	Propane/Butane/LPG
2.	Hindustan Petroleum Corporation Ltd	POL
3.	Bharat Petroleum Corporation Ltd	POL
4.	IOCL	POL
5.	Hi-Tech Carbon – A unit of SKI Carbon India Ltd	Carbon Black Feed Stock
6.	Shell India Marketing Pvt Ltd	POL
7.	Ponpure Logistics	Various chemicals
8.	Raj Lubricants	Base oils
9.	Manali Petrochemicals Ltd	Propylene Oxide
10.	Tamilnadu Petroproducts Ltd	Benzene/LAB
11.	Supreme Petrochem	Styrene Monomer
12.	Reliance Industries Ltd	POL
13.	SKS Logistics Private Limited	Petro Chemicals
14.	KLJ Group of Industries	Petro Chemicals
15.	Jesons Industries Limited	Styrene Monomer
16.	Philips Carbon Limited	CBFS
17.	Other Customers of Chemicals	

b)Market Study by IMaCS

ETTPL retained ICRA Management Consulting Services (IMaCS) to conduct an independent market assessment and risk analysis for this project in 2006, which was revalidated in 2009. ICRA interacted independently with the users and also carried out extensive secondary research to assess the demand at Ennore. The traffic demand was finalized after thorough research, analysis and verification with the users.

Basis of the study

Following parameters are the basis of the study which led to the traffic projection:

- i) The need for a marine liquid jetty and tank farm at Kamarajar Port stems from the below mentioned factors:
 - Growing demand for handling bulk liquids in and out of the Chennai and surrounding regions
 - Limitations in infrastructure facilities for handling bulk liquids, especially hazardous class liquids and liquefied gases at Chennai Port.

- Potential of Kamarajar Port to be used as a hub port for crude oil, petroleum liquid & gas products and chemicals
- ii) Identification of bulk liquids and liquefied gases that would be handled through the MLT based on demand-supply scenario pertinent to the region that can be served by ETTPL and the specific logistics of the potential users.
- iii) The traffic study was based on review of the traffic volumes and facilities at competing ports such as Chennai, Mangalore, Krishnapatnam and Cochin. Hence, the demand estimation takes into account the potential traffic that would shift from other ports to Ennore due to logistical and cost advantages to the users.

Advantages of ETTPL

- Kamarajar Port is designed with higher dredged depths of 15 to 18.5 meters and large tankers (150,000 DWT) can be berthed at present. Users thus have the option to import/export in higher parcel sizes and benefit from lower freight costs.
- Kamarajar Port is located on the international shipping route. Kamarajar Port is a major port of call for Products, chemicals and vegetable oil tankers. Hence, Ennore is an ideal port of call for ships from the west and from Singapore, Malaysia, Korea and other far-east countries.
- The terminal is planned for handling and storage of a wide range of liquid bulk including low flash liquids, which makes Ennore an attractive option for users and shipping companies.
- In view of the higher draught, there is potential for Kamarajar Port to be used as a hub port. Large parcels may be imported at Kamarajar Port and then moved to the consumption points either by road, rail or coastal shipping.
- Chennai Port does not have storage facility for handling LPG. Also, there is no storage infrastructure for Class A/B products, which is forcing importers in the hinterland of Chennai to route their import through other ports such as Cochin and Mangalore. Ennore would therefore be an automatic choice for importers and exporters.

Assumptions of the study

Basic assumptions behind the traffic study are explained in the following paragraphs:

- IPPL has set up the LPG import terminal at Ennore. ETTPL has also put up LPG handling facilities and entered into a long term contract with IPPL for its entire business requirements. The terminal became operational in July 2012. From IPPL's viewpoint, there is strong need for this LPG terminal as Tamil Nadu is facing a deficit in LPG. The increase in demand for LPG is estimated to grow at a rapid pace. The demand projections of LPG import at Kamarajar Port have been made after taking into account CPCL's expansion of capacity. There are no major refinery projects coming up in the region and hence this assumption is well justified.
- Users located closer to Chennai and Ennore who are presently using other ports will shift to ETTPL's MLT due to safety, cost and logistical advantages.

- Products such as CBFS, methanol, etc., which are likely to be handled at Ennore are currently imported as India is deficit in these products. The study is based on the assumption that these products will continue to be imported in future as there is no evidence that import substitution would affect the import volumes.
- Currently, the public sector oil companies are in the process of shifting their operations from thickly populated areas like Tondiarpet and Korukkupet in Chennai to Ennore. HPCL has already set up a POL storage terminal near Kamarajar Port and their entire requirements will be handled through this MLT. The volumes are likely to exceed 1.0 MMTPA in the year 2016-17.
- Traffic projections are based on current consumption and growth in demand of the relevant products as per information obtained from secondary sources and potential users. Care has been taken to ensure that estimated projections are conservative.

2.9.6.3 Potential users of the Marine Liquid Terminal

Based on the above the following potential users have been identified:

S.No	Potential users	Products
1.	Chennai Petroleum Corporation	Petroleum Crude Oil/MS/HSD/SKO/Furnace Oil
2.	Philips Carbon/Birla Carbon	Carbon Black Feed Stock
3.	ONGC/BPCL/IOCL/HPCL/Nayara Energy/Shell India/RIL	POL
4.	Other International / national users	Bulk handling of products with Kamarajar Port as Hub.
5.	IOCL/BPCL/HPCL/IPPL	Refrigerated Propane and Butane

2.9.6.4 Demand Drivers

1. Petroleum products

The demand for marine terminal facilities for petroleum products is expected to increase significantly due to:

Increasing importance of coastal shipping in petroleum product movement

- Growing POL product traffic at ports in the southern region
- Overlapping product movement of petroleum products
- Demand serviced from refineries outside the region - Private sector players like RIL and Nayara Energy expect to rely substantially on coastal movements from their refineries in the western region to service their share of demand in the southern region
- Retail marketing plans of private sector oil companies
- CPCL expansion and capacity constraints at Chennai Port

In view of the advantages, a wide range of vessels ranging from large product tankers to small chemical tankers are expected to call at the MLT.

2. Liquid Petroleum Gas

Traffic in LPG is expected at Ennore in view of the potential demand-supply gap in the immediate hinterland of Kamarajar Port. The requirement of domestic and industrial and auto LPG of entire North TN will be catered through

the IPPL's LPG storage terminal at Athipattu Pudhunagar and the products will be handled through the ETTPL's MLT.

The demand is likely to grow at 5-8% on annual basis with Pradhan Mantri Ujjwala Yojana scheme being implemented across the country for supply and distribution of domestic LPG.

3. Chemicals/other liquids

MLT is well placed to service the chemical cluster in and around Chennai, in its immediate hinterland. Manali Industrial Belt is well connected to Ennore for any import of their raw materials and finished goods as Chennai Port Authority will not be in a position to handle hazardous products and also traffic congestion outside the Ports will encourage the importers to prefer Ennore to Chennai.

2.9.6.5 Petroleum Crude Oil

Presently CPCL is handling around 10 MMTPA of Petroleum Crude Oil through Chennai Port. The existing pipeline runs through thickly populated areas and is old, necessitating frequent repairs and very low discharge rate. Hence, it is felt by the industry that an alternative pipeline needs to be provided from Kamarajar Port in order to ensure uninterrupted supply of Crude oil at a faster discharge rate at the same time minimizing the environmental hazards.

2.9.6.6 Ship To Ship (STS) Operations

Kamarajar Port has a potential to tap the demand for transshipment of products in the east coast either through onshore storage or directly from one ship to the other by being berthed alongside the Jetty, one behind the other. ETTPL's Marine Liquid Terminal (MLT) provides a readymade solution for such operations. This operation is required among other reasons for lighterage also. The products which need in-line berthing for Ship to Ship ("STS") transfer facilities include Chemicals, CBFS, POL, LPG, etc.

At present there are inadequate port facilities to address demand in immediate hinterland.

2.9.7 Traffic Projected

The traffic volume for the proposed terminal expansion and storage tank farm would accrue from realization of the potential volumes due to the following factors:

- Shift of existing traffic by users in the immediate hinterland to Kamarajar Port, hitherto serviced from other Ports.
- New demand in the immediate and extended hinterland
- ETTPL has signed long term agreements with most of the identified potential users and is been handling these products during the last 10 years and above.

While arriving at the traffic projections under chemicals and other liquids category, volumes accruing from existing users and demand likely due to expansion of select users have been considered. However, the projections do not include potential volumes that could possibly accrue on account of new green field projects in the region.

The projections are presented **Table 2.13** considering existing contracts, traffic, etc. The estimates are conservative and it is possible that the traffic projected could be exceeded.

Table 2-13 The projections of considering existing contracts, traffic, etc

Scenario →	Optimistic scenario						Base Case (Likely volume assumed for viability)					
Product →	Black oil	POL	Chemical	LPG	Crude	Total	Black oil	POL	Chemical	LPG	Crude	Total
Year ↓	MMTPA						MMTPA					
21-22 ↓	0.40	3.00	0.20	2.00		5.60	0.30	2.50	0.12	1.60		4.52
22-23	0.50	3.30	0.20	2.00		6.00	0.40	2.70	0.12	1.60		4.82
23-24	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
24-25	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
25-26	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
26-27	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
27-28	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
28-29	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
29-300	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
30-31	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
31-32	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
32-33	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
33-34	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
34-35	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98
35-36	0.50	3.40	0.20	2.00		6.10	0.40	2.80	0.13	1.65		4.98

Scenario →	Pessimistic scenario					
Product →	Black oil	POL	Chemical	LPG	Crude	Total
Year ↓	MMTPA					
21-22	0.24	2.00	0.10	1.28		3.62
22-23	0.32	2.16	0.10	1.28		3.86
23-24	0.32	2.24	0.10	1.32		3.98
24-25	0.32	2.24	0.10	1.32		3.98
25-26	0.32	2.24	0.10	1.32		3.98
26-27	0.32	2.24	0.10	1.32		3.98
27-28	0.32	2.24	0.10	1.32		3.98
28-29	0.32	2.24	0.10	1.32		3.98
29-300	0.32	2.24	0.10	1.32		3.98
30-31	0.32	2.24	0.10	1.32		3.98
31-32	0.32	2.24	0.10	1.32		3.98
32-33	0.32	2.24	0.10	1.32		3.98
33-34	0.32	2.24	0.10	1.32		3.98
34-35	0.32	2.24	0.10	1.32		3.98
35-36	0.32	2.24	0.10	1.32		3.98

Table 2-14 List of Products

1	Aviation Fuel	45	Di ethyl Acetone	89	MDI (methylene diphenyl di isocyanate)
2	Acetone	46	Diocetyl Phthalate	90	Mono Ethylene Glycol (MEG)

3	Acetic Acid	47	n- Octanol	91	MTBE
4	Acetylene	48	Di Butyl Alcohol	92	Methyl Acrylate
5	Acrylonitrile (ACN)	49	Diesel Oil (Sour)	93	Molasses
6	AHE 70	50	Diesel Oil (Light)	94	Motor Spirit
7	Ammonia Liquid	51	Dicyclopentadiene (DCPD)	95	Molten Sulphur
8	Aniline Oil	52	Ethyl Alcohol	96	Neem Oil
9	Alpha Olefin C14	53	Ethylene Dichloride (EDC)	97	Naphtha
10	Aromatic Feed Stocks (AFS)	54	Ethylene Di Amine (EDA)	98	N Paraffin
11	Base Oil	55	Ethanol	99	N Hexane
12	Black Oil	56	Ethane (Cryogenic)	100	Nitric Acid
13	Butyl Acrylate	57	Mono Ethylene Glycol	101	Nonane
14	Butane	58	2 Ethyl Hexanol	102	Octanol
15	Butene- 1, Butene-2	59	Ethyl Acetate	103	Ortho Xylene
16	Benzene	60	Exxsol D-80	104	Ortho Toluidine
17	Butyl Acetate	61	Di-Ethylene Glycol	105	Phenol
18	Bio Diesel	62	Furnace Oil	106	Propylene Glycol
19	Butanol	63	Formaldehyde	107	Phosphoric Acid
20	1 Butanol	64	Glycerine	108	Polyether Polyols
21	Butadiene 1,3 (Liquefied Gas)	65	High Speed Diesel	109	Paraffin Oil
22	Bitumen (AC Asphalt/Asphalt Cement)	66	Hydro Fluo Silicic Acid	110	Palmolein Oil
23	N-Butanol	67	Hexane	111	Propane
24	2-Butane (Mixer Isomer)	68	Isopropyl Alcohol	112	Paraxylene
25	2-Butanone	69	ISO Butanol	113	Palm Fatty Oil/Acid Distillate (PFAD)
26	Carbon Tetra Chloride	70	Isobutyl Alcohol	114	Propylene Oxide
27	Cumene	71	Isononyl Alcohol	115	Propylene

28	Castor oil	72	Isopar L(S)	116	Polyisobutene
29	Crude oil	73	ISO Butylene	117	Py- gas
30	Cyclohexanol	74	ISO Butyl Acetate	118	Rubber processing Oil
31	Cyclohexanone	75	Ink Oil / Base oil 240	119	Styrene Monomer
32	Carbon Black Feed Stock	76	Kerosene	120	Superior Kerosene Oil
33	Caustic Soda Lye	77	LSHS Heating	121	Sulphuric Acid
34	Crude Glycol	78	Lubricating Oils	122	Solvent C9 (Shellcal A100/Solvensso 150 etc)
35	Crude Palm Styrene	79	Liquefied Petroleum Gas	123	Solvent C10
36	Cyclohexane	80	Low Sulphur Heavy Stock	124	THF (Tetra Hydro Furan)
37	Chloroform	81	Linear Alkyl Benzene (LAB)	125	Toluene
38	C4 (Liquefied gas)	82	Methyl Alcohol	126	TDI (Toluene Diisocyanate)
39	Cresol	83	Maleic Anhydride	127	Trans - 2 Butene
40	Cis-2-Butene	84	Mixed Xylene	128	Vegetable oil
41	Coal Tar Pitch	85	Methylene Di Chloride	129	Vinyl Acetate Monomer (VAM)
42	Diethylene Glycol	86	Methyl Isobutyl Ketone	130	White Oil
43	Dipropylene Glycol	87	Methyl Ethyl Ketone	131	Gum Turpentine
44	Di Octonol	88	Methane (Cryogenic)		

2.9.8 Preliminary design

2.9.8.1 Planning of Marine Liquid Terminal

The planning for the Marine Liquid Terminal is as such to enable future expansions conveniently keeping in view the maximum vessel size and cargo traffic projections which may be envisaged in future. The various facilities available at the MLT are as follows:

2.9.8.2 Marine liquid jetty

The jetty is located at about 1300 meters from the landfall point of the Northern Breakwater on the western side. The berthing face is at a distance of about 160 meters from the North Breakwater. The jetty is an integrated structure consisting of 360 meters length of service/berthing platform and mooring facilities for handling smaller as well as larger vessels. The jetty is designed for berthing of 6000 DWT vessels to 150000 DWT and above vessels. To meet the market demands in future, the MLT is designed in such a way that with suitable modifications/additions/expansions larger vessels can be handled. The detailed design & drawings are approved and released for construction by the Independent Engineer. The Cargo handling equipment of the Jetty given in **Table 2-15**.

This jetty is fully equipped with fire fighting facility as per OISD 156 norms. The necessary tower monitors, jumbo curtains and foam monitors is provided catering to the largest vessel. The water requirement for the entire system is tapped from the sea. Necessary environmental protection system shall be provided such as spill management system conforming to the requirements of various statutory authorities.

Table 2-15 Summary of Cargo Handling Equipment – Jetty

Sl. No	Cargo	Equipment Type	Nos.	Size
1	Unloading Arms			
	LPG	Unloading arms (Fixed)-Hydraulic	2	10"
	POL	Unloading arms (Fixed)- Hydraulic	3	12"
	POL- White Oil	Unloading Arms Manual	1	10"
	Black Oils	Unloading Arm – Manual	1	12"
2	Pipelines of length 3700 Mtrs. (approx)			
	Black oil	Mild Steel Pipeline -- IS-3589	1	24"
	White petroleum product	Mild Steel Pipeline -- IS-3589	1	24"
	ATF	Mild Steel Pipeline -- IS-3589	1	12"
	POL / Lube	Mild Steel Pipeline -- IS-3589	1	12"
	Chemicals	Stainless Steel Pipeline -- 316L	1	8"
	LPG	ASTM A 333-Gr-6 seamless LTCS	2	18"

	Propylene Oxide	Carbon Steel Pipeline – API 5L Gr B PSL-2	2	10"
	White petroleum product	Mild Steel Pipeline – API 5L Gr.B / X52	1	24"
	White petroleum product	Mild Steel Pipeline – API 5L Gr.B / X52	1	16"
3	Pumps			
	Hydraulic pumps	6 KW	6	
	Stripping pumps	10 KW	3	
4	Other Equipments			
	Engine driven Fire fighting pumps	Fire fighting system for jetty as per OISD 156		
	Nitrogen system	40 cum / hr. capacity + 100 cum/ hr capacity	1 No each	
	Compressed air	910 cfm	2 Nos	
	ETP	20 cum. / day		
	Control room with emergency facilities	Safety and emergency equipment.		

2.9.8.3 Approach Trestle & Pipeline Trestle

An Approach Trestle is connecting the jetty head from NBW and fire pump room. The jetty control building is located adjoining the Trestle. The 1300m (approx) long pipeline trestle running almost parallel to the breakwater will carry the pipelines, on both sides, from the main jetty to the tank farm area.

2.9.8.4 Tank Farm

The tank storage terminal is developed in phases and as per the OISD 118. It comprises 8 enclosures consisting of 64 nos. of storage tanks to store liquid products like petroleum products, chemicals, petrochemicals and non-class products. The Tank Farm Fire Fighting system has been designed as per OSD 117 consisting of Hydrant System, Medium Velocity Spray System & Foam System. The detailed design & drawings for the Fire Fighting System are approved by the Independent Engineer.

2.9.8.5 Land

The land of about 33.26 Acres allotted initially by EPL is fully utilized for the development of Tank Farm, Administrative office building, TLF, internal roads, development of greeneries etc.

2.9.9 Equipment Available/Required

2.9.9.1 Cargo Handling Equipment

The existing cargo handling equipment consists of:

- Jetty Sub Structure
- Jetty Super Structure
- Fixtures
- Walk way – connection
- Pipe Trestle & Pipe-Bridges
- Marine Loading arm structures
- 3 Nos _12" Hydraulic Marine Loading arm for POL
- 2 Nos of 10" Hydraulic Marine Unloading Arms for Butane and Propane
- 1 No of 12" Manual Marine unloading Arm for black oils
- 1 No of 10" Manual Marine Unloading Arm for POL
- 3 x 24" White POL and black oil Pipelines
- 1 x 16" White POL Pipeline
- 2 x 18" LTCS insulated pipelines for Refrigerated propane and butane
- 2 x 12" Lube oils and white POL
- 1 x 8" Chemical pipeline
- 2 x 10" Propylene Oxide Liquid and vapour Pipelines
- Hose Towers
- Tower Monitors
- Computers & Software

2.9.9.2 Storage Requirement

The total Storage capacity available is 2, 54,349 KL in 64 Tanks with Phase I, II with in the land already allotted land.

2.10 Mitigation measures

2.10.1 Air pollution

The emissions from the operations to the atmosphere shall be from the diesel engines and power generator. Emissions from the generator will consist of mainly CO₂, traces of NO_x, SO₂ and particulate matter.

The concentration of SO₂ from the emitted gas will depend on the fuel source, which in this case shall be diesel containing little sulphur. The DG set emissions shall be through a narrow vent at approximately 6 m above ground level. No flaring is envisaged as this is heavy oil reservoir devoid of any associated gas.

2.10.1.1 Mitigation measures

The DG set has been provided with stacks of adequate height so as to disperse the emanating fuel sources containing Suspended Particulate Matters, Oxides of Sulphur and Nitrogen without affecting the ground level concentrations.

2.10.2 Noise pollution

Noise pollution might be caused due to operation of machineries & equipment; Vehicular traffic; Operation of DG sets and machineries

2.10.2.1 Mitigation measures

- Well maintained equipment and vehicles will be used;
- All DG/GG sets would be provided with acoustic enclosures; and
- Appropriate PPEs (e.g. ear plugs) will be used by workers while working near high noise generating equipment.

2.10.3 Solid waste management

2.10.3.1 Impacts

During operation phase, the solid wastes generated can be broadly categorized as Hazardous Waste and Municipal Solid Waste. Further, the generated Municipal Solid Waste segregated into biodegradable, recyclable and inert compounds.

If the solid waste generated is not properly managed and disposed in unauthorised manner, it will impact on soil quality, groundwater and air quality. Municipal Solid waste generated from operation phase is estimated as 11.25 kg/day. Port has given permission for disposal of solid waste.

2.10.3.2 Mitigation Measures

- The Source of Municipal waste will be from the domestic use and strict guidelines will be put in place in order to manage the solid waste generation during operation phase.
- Solid wastes will be segregated into organic and inorganic categories. The organic waste will be disposed through village bins and inorganic waste will be sold to authorized vendors. The ship generated solid wastes will be collected, segregated and disposed to approved recyclers/industries for further beneficial use through port engaged contractor.

- Hazardous waste generated will be stored in a separate hazardous waste storage area and properly disposed as per the Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2016.

2.11 Green Belt Details

In 1992 the port was conceived as a satellite port to handle coal through two coal berths. Port is continuously developing green belt area.

- In 1992, the Kamarajar Port was conceived as a satellite port to handle coal through two coal berths. The Port is continuously developing green belt area.
- The total area of the port is 2787.2 acres in that area total green belt is to an extend of 636.14 acres (22.82%) which includes inside and outside the custom bound area.
- Proposed Green belt of 5.01 acres will be developed inside and outside the Tank Farm area.
- The treated wastewater will be reused in the green belt areas to reduce the water requirements.
- The tree species to be used for the green belt development will be in line with the local ecology.

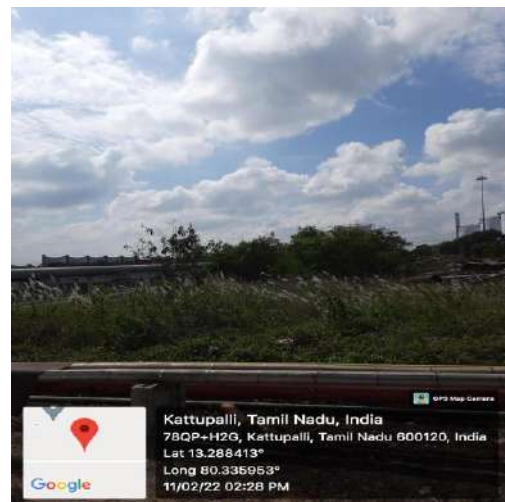




Figure 2-9 Green Belt Development

2.12 Resources required for the Project

2.12.1 Power and Fuel Requirement

As the power requirements of the Terminal are met from TNEB by taking necessary assistance from KPL, no significant impacts are envisaged. A detail power and fuel requirement is given in the Table 2-16.

Table 2-16 Power and Fuel Requirement of existing and proposed

Details	Existing	Proposed	After Expansion
Power Requirement	Terminal – 11KV(HT) MLT – 440 Volt (LT) DG SET: Terminal: 2 No of – 500 KVA and 1 No of – 250 KVA MLT: 1 No of – 180 KVA	No Additional Power is required Existing quantity will be sufficient	Terminal – 11KV(HT) MLT – 440 Volt (LT) DG SET: Terminal: 2 No of – 500 KVA and 1 No of – 250 KVA MLT: 1 No of – 180 KVA
Fuel	Diesel for DG set purpose. Transportation of fuel- 200 liters barrels received from local retailers by using load vehicle. Hazardous material storage facility- Not Applicable Maximum quantity stored below 900 liters in Diesel storage shed.	Nil Existing quantity will be sufficient	No change

2.12.2 Water Requirement

The existing ,proposed and After Expansion water requirement is given in the **Table 2-172-17**.

Table 2-17 Water Requirement

S.No	Water	Qty (KLD)		
		Existing	Proposed	After Expansion
1	Fresh water Requirement	6.7	2.5	9.2
2	Recycled Water	1.6	4.2	5.8
Total Water Requirement		8.3	6.7	15

Table 2-18 Total water Break up

Water Requirement	Existing water Requirement(KLD)		Proposed water Requirement(KLD)		After Expansion water Requirement(KLD)	
	Fresh water	Recycled water	Fresh water	Recycled water	Fresh water	Recycled water
Domestic	2.5	0	1	0	3.5	0
Washing	1.8	0	1.5	0	3.3	0
Gardening	2.4	1.6	0	4.2	2.4	5.8
Total	6.7	1.6	2.5	4.2	9.2	5.8

For Fire fighting, sea water is being used and the same will be continued after expansion.

Source of water: Out sourced through water tankers.

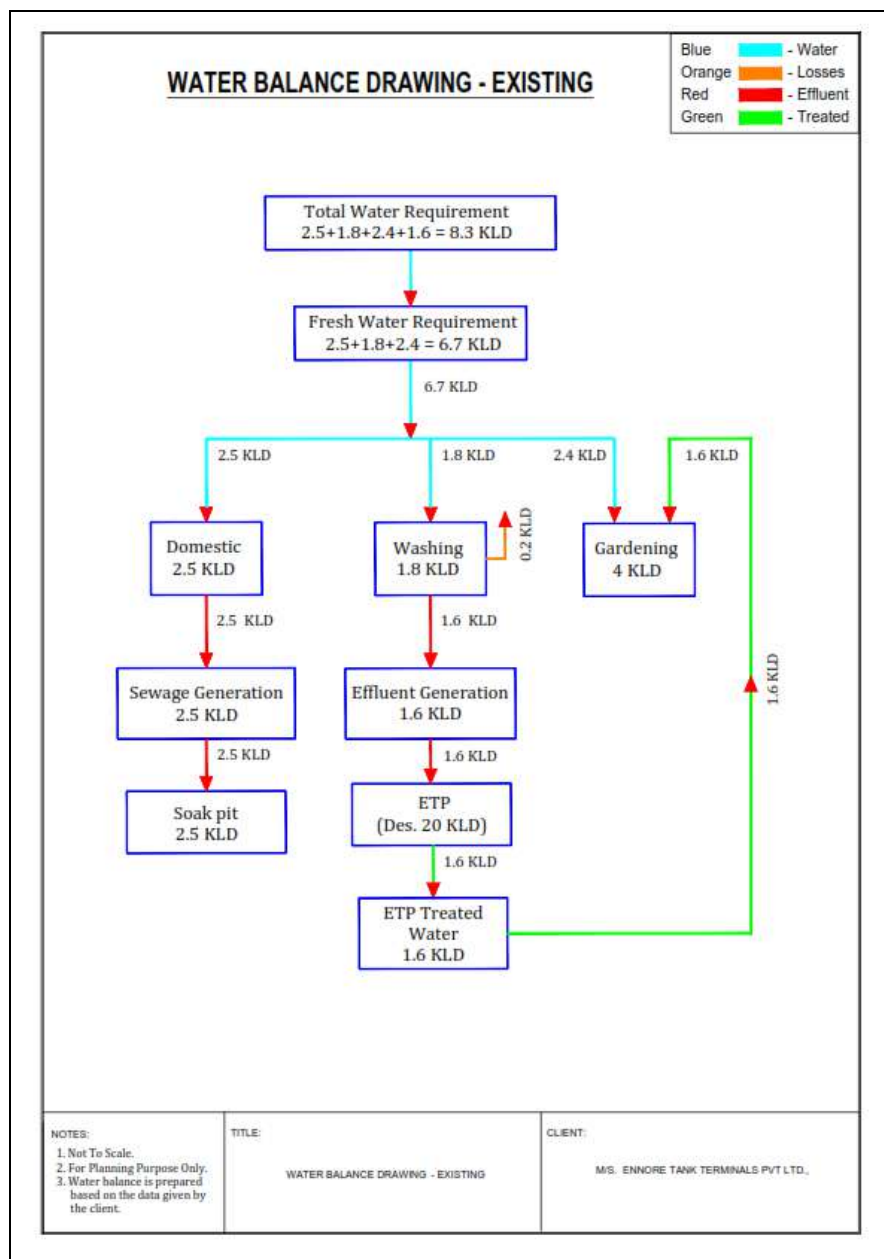


Figure 2-10 Existing Water balance diagram

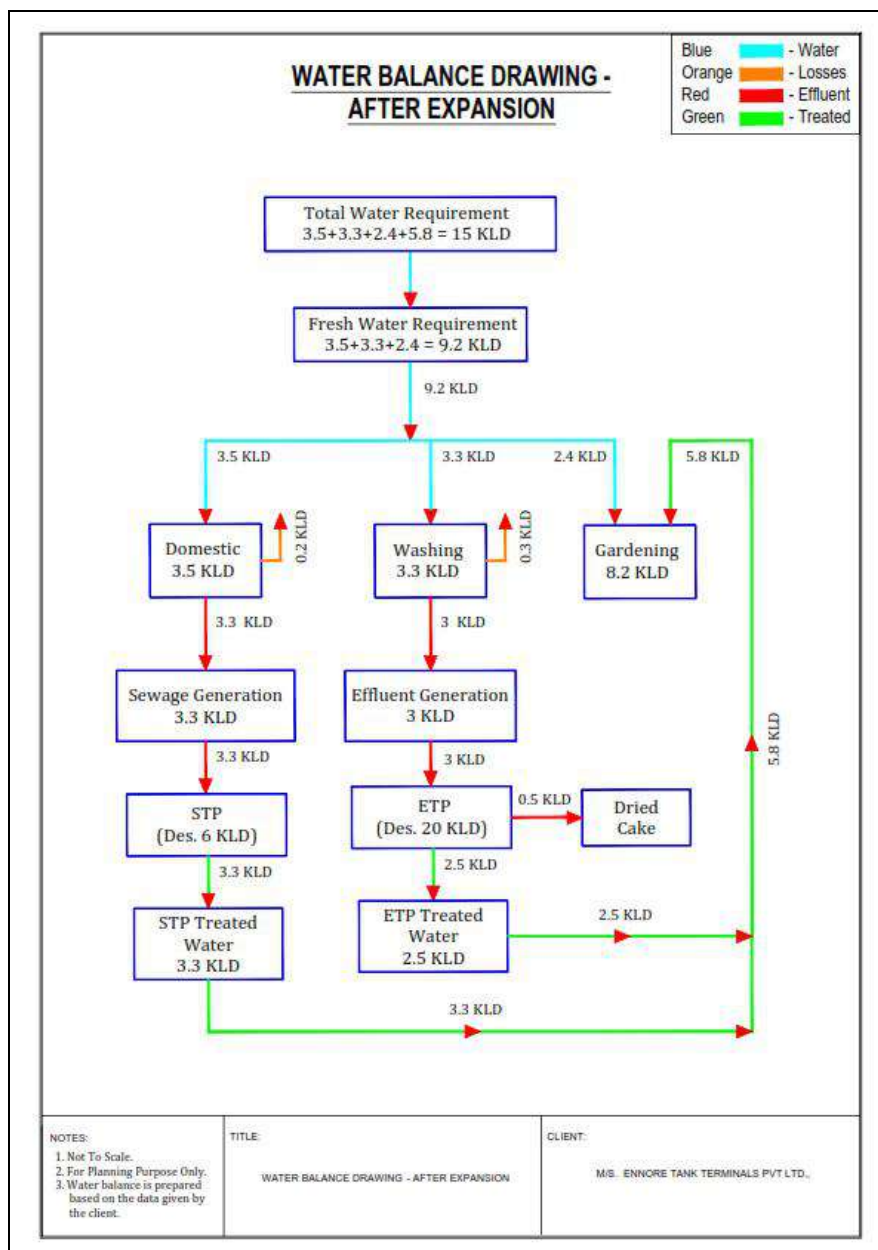


Figure 2-11 After Expansion Water balance diagram

2.12.3 Manpower requirement

The existing and proposed manpower is given in the **Table 2-19**.

Table 2-19 Manpower of existing and proposed

Details	Existing		Proposed	After Expansion
Manpower	Permanent	65	10	75
	Temporary	13	15	28
Total		78	25	103

2.13 Wastewater Treatment

2.13.1 Sewage and Effluent Treatment

The existing sewage will be treated in existing septic tank and the proposed sewage will be treated in the Proposed STP. The existing and proposed effluent will be treated in Existing ETP of Ennore Tank Terminals Pvt Ltd is given in the **Table 2-20**.

Table 2-20 Sewage and ETP of existing and proposed

Details	Existing	Proposed	After expansion	Disposal method
Sewage	2.5	0.8	3.3	Existing : Sewage Disposal: Septic Tanks and Sock Pit x 6 Nos. Dimension (Length -1.4 mts X width 0.9m, Depth – 2.2m) After Expansion: 6 KLD STP will be proposed and the treated sewage will be used for gardening
Effluent	1.6	0.9	2.5	Will be treated in existing ETP (Capacity – 20 KLD) and reuse for gardening.

2.13.2 Solid Waste Generation and Management

The existing and proposed solid waste generation of Ennore Tank Terminals Pvt Ltd is given in the **Table 2-21**.

Table 2-21 Solid Waste Generation and Management

Type of Wastes	Existing (kg/day)	Proposed (kg/day)	After Expansion (kg/day)	Treatment / Disposal Method
Inorganic	14.04	4.5	18.54	Disposed to authorized vendors and the same will be continued

Organic	21.06	6.75	27.81	Used as a Manure for Greenbelt.
Total	35.1	11.25	46.35	--

➤ All the solid waste generated are collected in bins and disposed.

➤ The same will be followed after Expansion.

Note: Calculated as per CPHEEO Guidelines, 0.45kg/capita/day

2.13.3 Hazardous Waste Generation and Management

The existing and proposed hazardous waste generation of Ennore Tank Terminals Pvt Ltd is given in the **Table 2-22 and Table 2-23**.

Table 2-22 Hazardous Waste Generation and Management of existing

Source	Name of the Hazardous waste and category	Quantity	Storage and Handling	Method of disposal
Cleaning, emptying and maintenance of petroleum oil storage tanks including ships	3.1-Cargo residue, washing water and sludge containing oil	0.4 T/Annum	Stored in barrels	Generation, Collection, Storage, Disposal to M/s. Tamilnadu Waste Management Ltd, Gummidipoondi for incineration
Handling of hazardous chemicals and wastes	33.2-Contaminated cotton rags or other cleaning materials	24 T/Annum	Stored in Pig disposal yard	Generation, Collection, Storage, Disposal to M/s. Tamilnadu Waste Management Ltd, Gummidipoondi for incineration to vendor
Engines/ Compressor used oil	5.1-Used or spent oil	0.3 T/Annum	Stored in steel barrels.	Generation, Collection, Storage and sent to authorized recyclers.

Handling of hazardous chemicals and wastes	33.1-Empty barrels/containers/liners contaminated with hazardous chemicals /wastes	21.6T/Annum	Empty barrels stored in hazardous waste storage rooms	Generation, Collection, Storage and sent to authorized recycler
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Table 2-23 Hazardous Waste Generation and Management of existing

Source	Name of the Hazardous waste and category	Quantity	Storage and Handling	Method of disposal
Cleaning, emptying and maintenance of petroleum oil storage tanks including ships	3.1-Cargo residue, washing water and sludge containing oil	1MT/Annum	Stored in barrels	Will be Disposal to M/s. Tamilnadu Waste management Ltd, Gummidipoondi for incineration

CHAPTER 3

DESCRIPTION OF ENVIRONMENT

3 DESCRIPTION OF ENVIRONMENT

This chapter depicts the establishment of baseline for valued environmental components, as identified in and around the proposed project located at **M/s Kamarajar Port Limited**, Capacity Augmentation Of Existing Operational Marine Liquid Terminal (MLT) From 3 MMTPA To 6 MMTPA At Kamarajar Port Limited, Chennai, Tamilnadu. The primary baseline data monitoring covered three month i.e., **March – May 2024** and secondary data was collected from government and semi-government organization's published data. The primary baseline data has been generated by M/s. Hubert Enviro Care Systems (P) Ltd, Chennai, a MoEF&CC approved and National Accreditation Board for Testing and Calibration Laboratories (NABL) accredited environmental testing laboratory for the following terrestrial environmental components.

3.1 Study Area and Period

A 10 Km radial distance from the proposed project site boundary has been identified as the General study area for assessing the baseline environmental status. The core study area is the project area and its immediate surroundings to the tune of 1.0 Km radius from the boundary. Further the Project Impact/Influence Area (PIA) is 10Km from the boundary of the project site which covers parts of Tiruvallur district District, Tamil Nadu State. The primary baseline data monitored covered three (3) months i.e., from **March – May 2024**

3.2 Description of Study Area and components

As described in Chapter 1, the proposed project is M/s Kamarajar Port Limited, Capacity Augmentation Of Existing Operational Marine Liquid Terminal (MLT) From 3 Mmtpa To 6 Mmtpa At Kamarajar Port Limited, Chennai. Traffic in LPG is expected at Ennore in view of the potential demand-supply gap in the immediate hinterland of Kamarajar Port. The requirement of domestic and industrial and auto LPG of entire North TN will be catered through the IPPL's LPG storage terminal at Athipattu Pudhunagar and the products will be handled through the ETTPL's MLT. An overall idea of the study area with reference to the physical conditions are presented for better understanding in the following sections before proceeding into the section on the prevailing environmental conditions of the study area. The map showing the satellite image of the study area is given in **Figure 3-1** and Topo Map of the study area is given in **Figure 3-2**.

- **Meteorology:** Temperature, Relative Humidity, Rainfall, Wind Speed & Direction- **Refer Section - 3.5.2.**
- **Ambient Air Quality:** Particulate matter <10 micron size (PM10), Particulate matter <2.5 micron size (PM2.5), Sulphur Dioxide (SO2), Nitrogen Dioxide (NO2), Carbon Monoxide (CO), Lead (Pb), Ozone (O3), Benzene (C6H6), Benzo (a) pyrene (C20H12), Arsenic (As), Nickel (Ni) and Ammonia (NH3)- **Refer Section - 3.5.8**
- **Ambient Noise Levels:** Day equivalent noise levels, Night equivalent noise levels - **Refer Section - 3.6.**
- **Water Quality:** Groundwater Quality, Surface Water Quality - **Refer Section - 3.7**
- **Soil Quality** - **Refer Section - 3.8**

- **Ecology - Refer Section - 3.10**
- **Social Economic Status - Refer Section - 3.11**

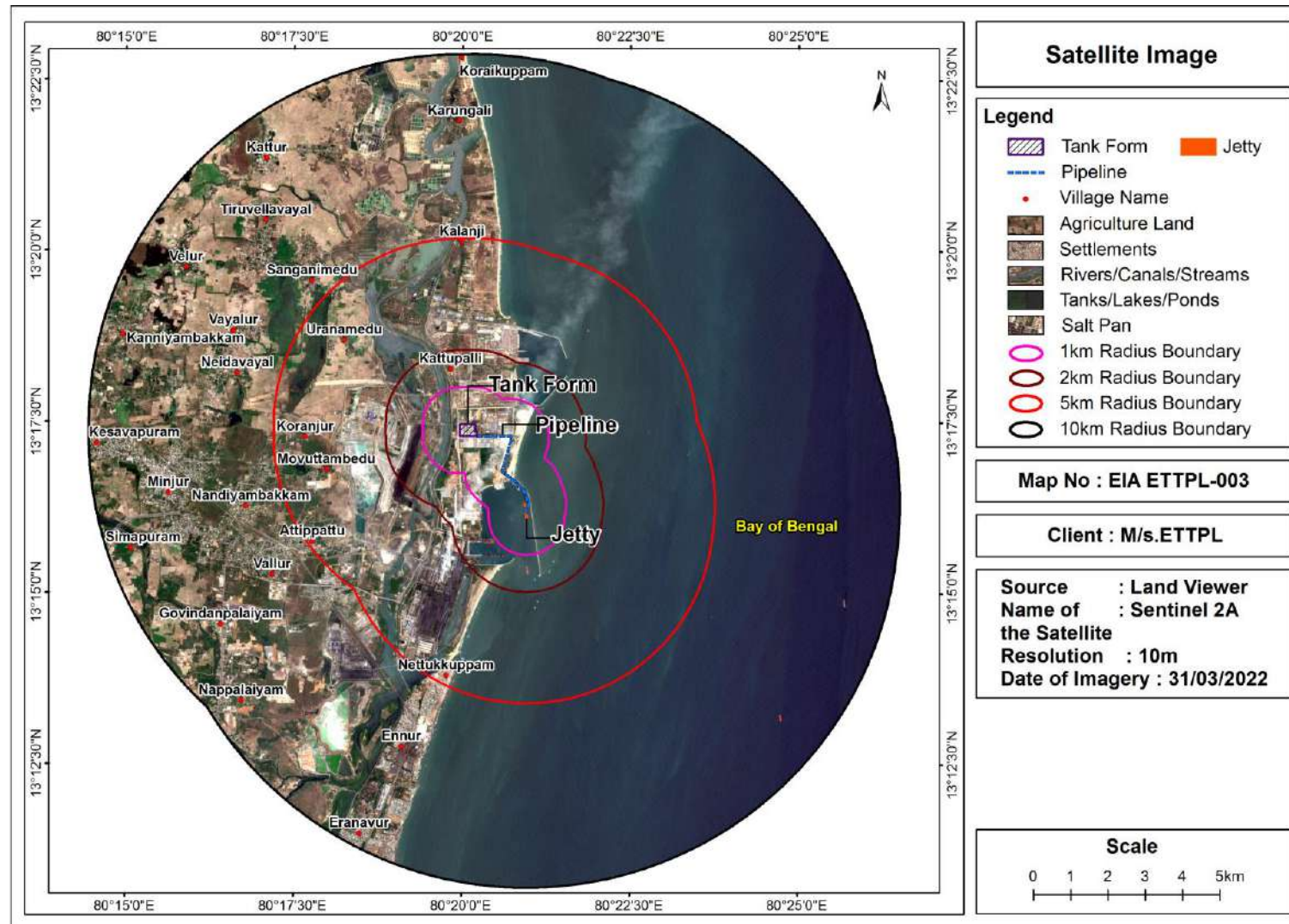


Figure 3-1 Map showing the Satellite Image of the study area of Project

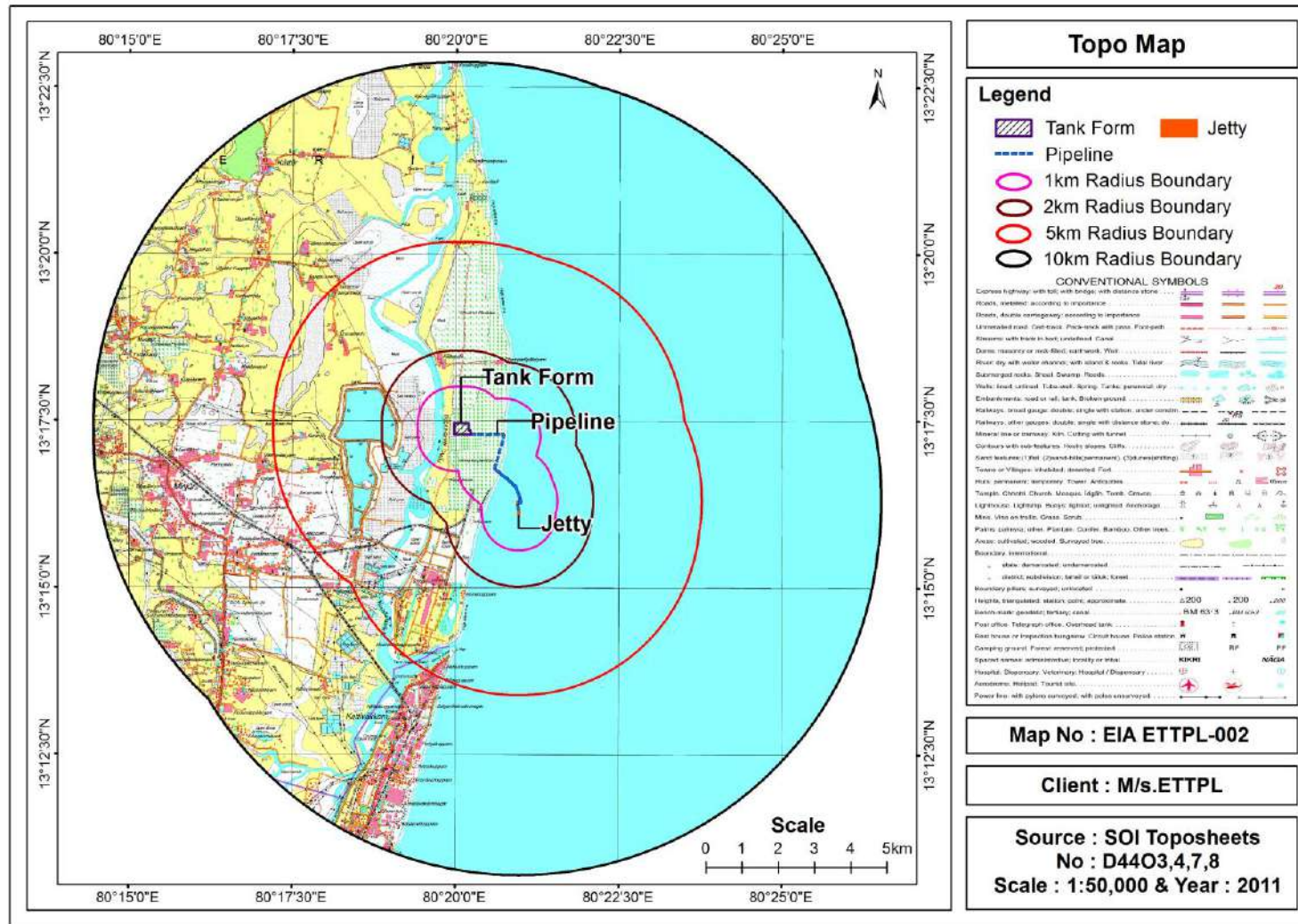


Figure 3-2 Topo Map of the Study area

3.3 Environmentally/Ecologically Sensitive areas

This section details with the environmentally sensitive areas present within the project site and surrounding environs. It included national parks, state forest, essential habitats etc. The environmental sensitive areas covering an aerial distance of 15 km from the project boundary is given in **Table 3-1**.

Table 3-1 Environmentally Sensitive Areas within 15 km from Project Boundary

S.No	Areas	Proposed project location boundary																																						
1	Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value	<table><tr><th colspan="3">Monuments</th></tr><tr><th>Description</th><th>Distance(km)</th><th>Direction</th></tr><tr><td>Dutch Cemetery</td><td>14.23</td><td>N</td></tr></table>			Monuments			Description	Distance(km)	Direction	Dutch Cemetery	14.23	N																											
Monuments																																								
Description	Distance(km)	Direction																																						
Dutch Cemetery	14.23	N																																						
2	Areas which are important or sensitive for ecological reasons – Wetlands, Watercourses or other water bodies, coastal zone, biospheres, mountains, forests	<table><tr><th colspan="3">Waterbodies</th></tr><tr><th>Description</th><th>Distance(km)</th><th>Direction</th></tr><tr><td>Bay of Bengal</td><td colspan="2">Site within the Bay of Bengal</td></tr><tr><td>Buckingham Canal</td><td>0.26</td><td>W</td></tr><tr><td>Korttalaiyar/Kosisttalaiyar</td><td>0.3</td><td>W</td></tr><tr><td>Lake near Uranamedu</td><td>3.97</td><td>WNW</td></tr><tr><td>Ennur Creek</td><td>4.25</td><td>S</td></tr><tr><td>Tiruvellavayal Lake</td><td>4.68</td><td>WNW</td></tr><tr><td>Arani River/Araniya Nadi</td><td>10.5</td><td>NW</td></tr><tr><td>Perumbedu Lake</td><td>12.34</td><td>NW</td></tr><tr><td>Lake near Nayar</td><td>13.9</td><td>W</td></tr><tr><td>Pulicat Lake</td><td>15</td><td>N</td></tr></table>			Waterbodies			Description	Distance(km)	Direction	Bay of Bengal	Site within the Bay of Bengal		Buckingham Canal	0.26	W	Korttalaiyar/Kosisttalaiyar	0.3	W	Lake near Uranamedu	3.97	WNW	Ennur Creek	4.25	S	Tiruvellavayal Lake	4.68	WNW	Arani River/Araniya Nadi	10.5	NW	Perumbedu Lake	12.34	NW	Lake near Nayar	13.9	W	Pulicat Lake	15	N
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Lake near Nayar	13.9	W																																						
Pulicat Lake	15	N																																						
3	State, National boundaries	Nil																																						
4	Routes or facilities used by the public for access to	<table><tr><th>Description</th><th>Distance(km)</th><th>Direction</th></tr><tr><td>SH-107(Minjur–Kattur–Thirupalaivanam</td><td>6.58</td><td>WNW</td></tr><tr><td>NH-16(Chennai-Kolkata)</td><td>18.81</td><td>WSW</td></tr></table>			Description	Distance(km)	Direction	SH-107(Minjur–Kattur–Thirupalaivanam	6.58	WNW	NH-16(Chennai-Kolkata)	18.81	WSW																											
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NH-16(Chennai-Kolkata)	18.81	WSW																																						

	recreation or other tourist, pilgrim areas	<table><tr><td>Nearest Railway Station-Attipattu</td><td>5.51</td><td>WSW</td></tr><tr><td>Chennai International Airport</td><td>34.59</td><td>SSW</td></tr></table>			Nearest Railway Station-Attipattu	5.51	WSW	Chennai International Airport	34.59	SSW
Nearest Railway Station-Attipattu	5.51	WSW								
Chennai International Airport	34.59	SSW								
5	Defence installations	Nil								
6	Areas occupied by sensitive manmade land uses(hospitals, schools, places of worship, community facilities)	Hospitals								
		Description	Distance(km)	Direction						
		Athipattu Government Primary Health Centre	5.19	SW						
		Ennore Urban Primary Health Centre	7.86	S						
		Minjur Government Primary Hospital	8.11	W						
		Kattoor Government PHC	9.15	NW						
		Manali New Town Government Primary Health Center	11	SW						
		Jothi Nagar Urban Primary Health Center	12.4	SSW						
		Pulicat Annai Health Care Centre	14.41	N						
		Tiruvottiyur Government Hospital	14.82	SSW						
		Budur Upgraded Government PHC	14.86	WSW						
		Industry								
		Description	Dist(km)	Dire.						
		Indian Oil LNG Terminal	0.03	N						
		L&T MFFK Katupalli Ware house	0.46	N						
		SICAL Iron Ore Terminals Limited	0.59	W						
		JSW Ennore Coal Terminal Pvt Ltd	0.91	W						
		CPCL Desalination Plant	0.92	W						
		Ennore SEZ Thermal Power Project	1.47	W						
		North Chennai Thermal Power Station	1.67	S						
		ABENGOA Seawater Desalination Plant	2.77	N						
		L&T Hydro carbon Engineering	3.29	N						
		Zuari Cement Grinding Unit	3.90	WSW						
		IOCL LPG Bottling Plant	4.44	WSW						
		BPCL Terminal Ennore	4.59	SW						
		HPCL Terminal Ennore	4.84	SW						
		KICL	5.98	S						
		COROMANDEL INTERNATIONAL LTD	6.15	S						
		The India Cements Ltd	6.33	SW						
		Ashok Leyland Limited	6.73	SSW						
		Kences Container Terminal Ltd	6.74	SW						
		Hinduja Foundries Ltd	6.74	S						
Empezar Global Container Terminal	6.95	WSW								

	MSA Global Logistics (Chennai) Private Limited	7.10	SW
	Reliance Industries ltd	7.45	SW
	German Express Shipping Agency (India) Private	7.54	SW
	ECCT - CFS	7.72	SW
	Ennore Thermal Power Station	7.79	SSW
	Farm Implements (India) Pvt Ltd Factory	7.90	WSW
	Piramal Pharma Limited	8.93	SSW
	Triway Container Freight Station	9.47	SW
	ITC limited	10.22	SSW
	Modern Age Metal Processors P Ltd	10.33	SSW
	Chandra CFS and Terminal Operator Pvt Ltd	10.76	W
	Sri Balaji Engineering Works	10.98	SW
	Chennai Emulsifiers	11.05	SW
	Shri Sabhari smelters pvt ltd	11.09	SW
	Mirra and Mirra Industries Private Limited	11.13	SW
	Vichur Sundar Chemicals	11.18	SW
	Sriram Cold Forgings Pvt. Ltd	11.20	SW
	Sri Sai Ram Hair Industries	11.23	SW
	Sumit pipe Industries	11.25	SW
	Mangal Industries	11.26	SW
	Royal Enfield Motor Factory	11.29	SSW
	Carborundum Universal Ltd CUMI	11.50	SSW
	Kailash Shipping Container Freight Station	11.63	SW
	Ocean Star Container Solutions	11.67	SW
	Gateway Distriparks South Private Limited	11.73	SW
	Metals & Scrap Traders	11.80	SW
	Vel Containers Terminus Pvt Ltd	11.81	SW
	Manas warehousing Pvt LTD	11.96	SW
	CMG Steels Private Limited	12.05	SW
	Sun Mutiara Engineering Pvt Ltd	12.07	SW
	Mahalakshmi Bright Steel Industries Pvt Ltd	12.14	SSW
	Crayon Roofings and Structures	12.20	SSW
	Southern Tubes	12.21	SW
	Raj Petro Specialities	12.21	SW
	Olympic Wearhouse	12.24	SW
	Sattva Hitech CFS	12.26	SSW
	TPL	12.29	SSW
	Natco Pharma Limited	12.32	SW
	Toshiba JSW Power Systems Pvt. Ltd	12.35	SW
	Petro Araldite Private Limited	12.36	SSW

		Indian Additives Limited	12.45	SSW
		CPCL	12.45	SSW
		ICBC CFS	12.49	SW
		GG Steels	12.59	SSW
		TPL-Lab Plant	12.62	SSW
		Madras Fluorine Private Ltd	12.65	SSW
		Inox Air Products	12.65	SSW
		Sicgil India	12.73	SSW
		TPL-HCD Plant	12.76	SSW
		Manali Petrochemical Ltd Plant-I	12.76	SSW
		CPCL LPG Bottling And Bulk Terminal	12.94	SW
		The KCP Limited	13.00	SSW
		Madras Fertilizer Limited	13.03	SSW
		SRF Limited	13.52	SW
		Supreme Petrochem Limited	13.68	SW
7	Areas already subjected to pollution or environmental damage (those where existing legal environmental standards are exceeded)	Nil		
8	Areas susceptible to natural hazard which could cause the project to present environmental problems, (earthquakes, subsidence,	Earthquakes: The Study area falls in zone-III (Moderate Damage Risk Zone), according to Earthquake Hazard Map of India. Suitable seismic coefficients in horizontal and vertical directions respectively is adopted while designing the structures. Tsunami & Tidal waves: 1. Evacuation vehicles will be provided. 2. Disaster Management training will be provided for the operation team.		

	landslides, erosion or extreme or adverse climatic conditions)	
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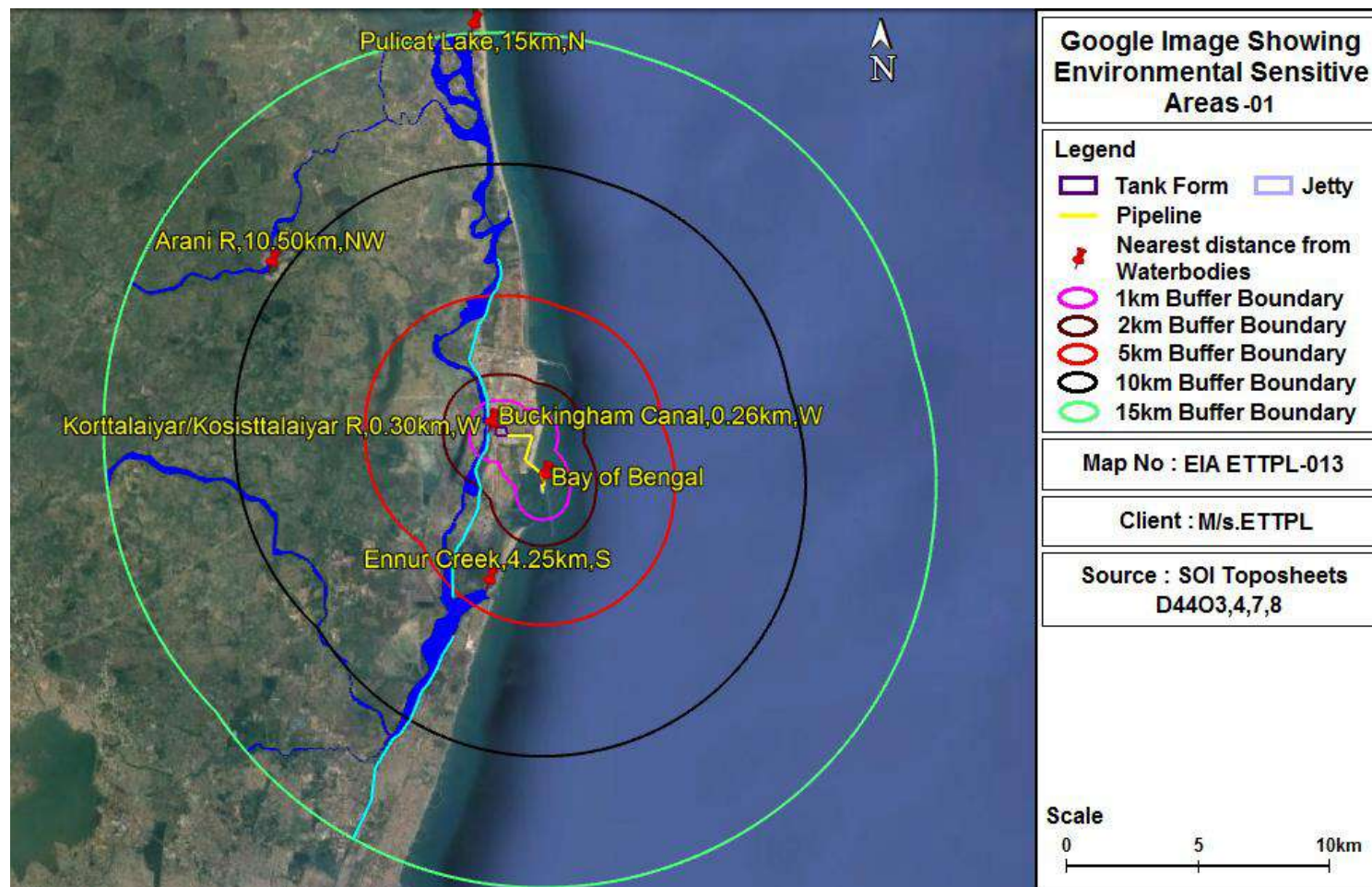


Figure 3.3 Environmental sensitive areas (1) covering within 15 km from project boundary

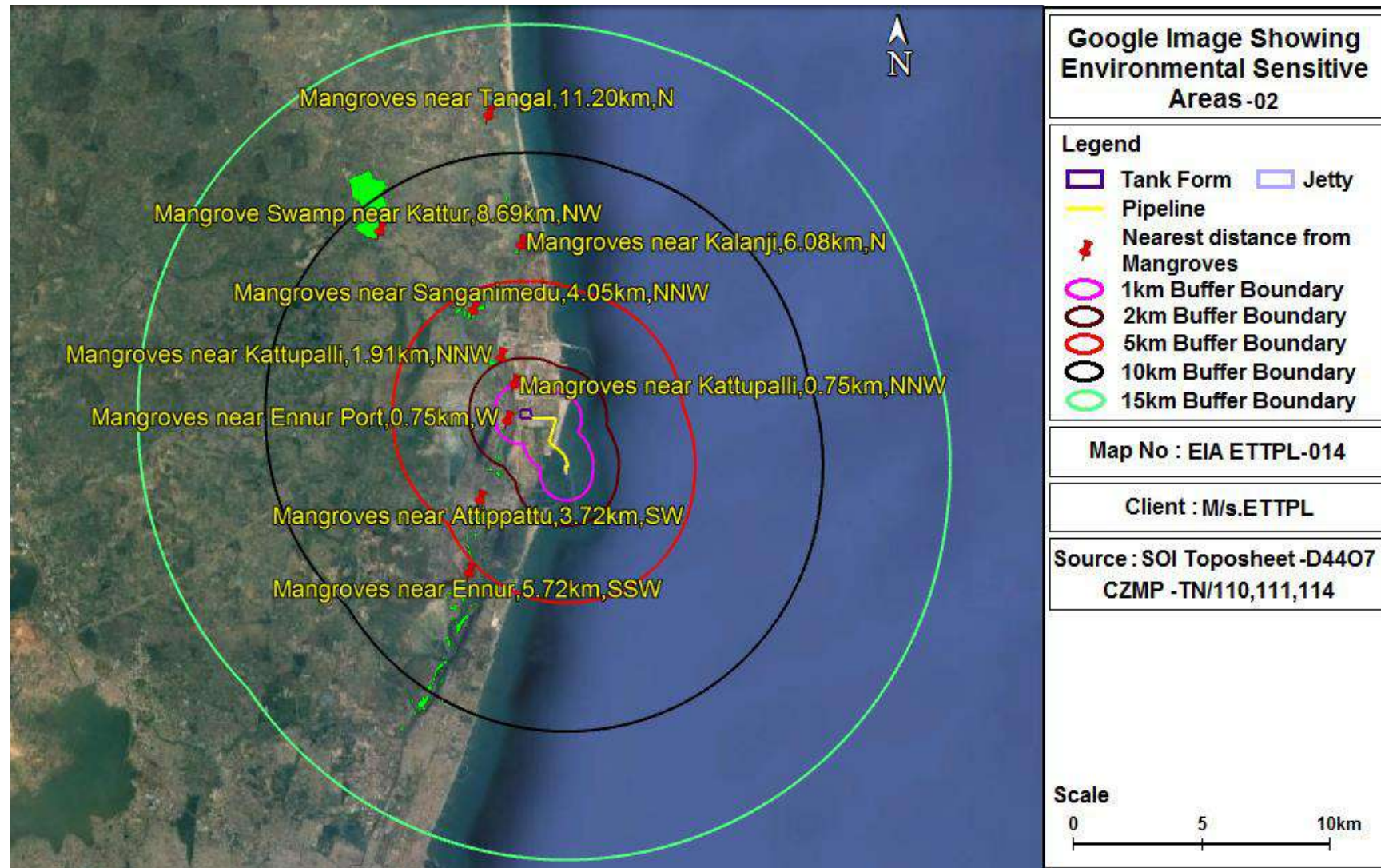


Figure 3-4 Environmental sensitive areas covering within 15 km from project boundary

3.4 Physical Conditions of PIA district

In this section, the physical conditions of PIA district are discussed in general and wherever possible references to the conditions prevailing in the study area in particular are also provided. The physical conditions are discussed as under:

- District profile
- Drainage, land use, geology, Physiographic profile
- Natural resources
- Climatic conditions, seismic zone characteristics and natural hazard.

3.4.1 PIA District Profile

Tiruvallur district is situated on the North Eastern part of Tamil Nadu and is surrounded by Kancheepuram district in the South, Vellore district in the West, Bay of Bengal in the East and Andhra Pradesh State in the North. The district spreads over an area of about 3422 Sq.km. This district consists of 1 Corporation, 9 taluks, 14 blocks, 4 Municipalities and 10 town Panchayats. Thiruvallur district is one of the fastest developing districts in Tamil Nadu in terms of Industrial Development as the district is adjacent to Chennai district. The district has 10 Industrial Estates which are developed by the Government of Tamilnadu.

Source: <https://tnrtp.org/wp-content/uploads/2020/07/TIRUVALLUR-FINAL.pdf>

(Ref: TIRUVALLUR DISTRICT DIAGNOSTIC REPORT)

3.4.2 Climatic Conditions

It may be noted that the district gets more rainfall during the North East Monsoon though it gets the influence of South West Monsoon (June - September) and North West Monsoon (October - December). During the year 2009-10, there was a rainfall of 589.9 mm in the district due to the influence of North East Monsoon as against the normal rainfall of 604.1 mm. The South West Monsoon has contributed to the extent of 331.7 mm during the year, the normal rainfall being 449.5 mm.

Source: <https://cdn.s3waas.gov.in/s39431c87f273e507e6040fcb07dcb4509/uploads/2018/05/2018050814.pdf>

(Ref: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Thiruvallur District", Series-34 Part XII-A)

3.4.3 Natural Resources of PIA District

3.4.3.1 Flora & Fauna

Thiruvallur coast has a very vast coastal plain, which extends from North of Toppala Palayam to South of Sattangadu. There are three strand lines, with intervening broad tidal flats occurring in the coastal plains. Lagoons, mangrove swamps, salt marshes, estuaries, creeks, sand dunes, and beach terraces represent the marine landforms. The Pulicate brackish water lake of Bay of Bengal in Ponneri block is a potential hot spot along the coast. It was

the site of old Dutch settlement. Migratory birds from various countries flock here every year between December and February. Pulicate Lake was identified as a site of international importance by the International Union for the Conservation of Nature (IUCN) and is rich in mangroves. Flora and fauna of PIA are discussed in section 3.11.

Source: <http://tnenvis.nic.in/files/THIRUVALLUR%20%20.pdf>

3.4.3.2 Forest Resources

The district has scattered forest area of 18748.82 hectares of the total area of 290785.61 hectares. The forest types available in the district are tropical in nature and they fall under dry thorn and dry evergreen types. Much of the natural forests have been converted in to man made forests since the late 1950s. However, chunks of natural forests still exist. These pieces of reserved forest consists of trees of poor height and deciduous type, fuel trees and low scrub jungle and do not have any valuable resources.

Source: <https://cdn.s3waas.gov.in/s39431c87f273e507e6040fcb07dcb4509/uploads/2018/05/2018050814.pdf>

(Ref: Directorate of Census Operations-Tamil Nadu, “District Census Handbook-2011, Thiruvallur District”, Series-34 Part XII-A)

3.4.3.3 Irrigation

Apart from seasonal rivers like Kosasthalaiyar, Araniar, Nandi, Kallar, Coovum and Buckingham canal, there is no perennial river in the district. The agricultural operations in the district depends mainly on tanks and lakes.

Table 3-2 Irrigation source

S.No	Irrigation Source	Number/Length
1	Canals	17/189
2	Irrigation Wells	30126
3	Tube Wells	17245
4	Reservoirs	1
5	Tanks	1895

Source: <https://cdn.s3waas.gov.in/s39431c87f273e507e6040fcb07dcb4509/uploads/2018/05/2018050814.pdf>

(Ref: Directorate of Census Operations-Tamil Nadu, “District Census Handbook-2011, Thiruvallur District”, Series-34 Part XII-A)

3.4.3.4 Agricultural Resources

Though industrially well developed, residents of Thiruvallur district continues to be involved in the agricultural sector also. But, the extent of dependency on agriculture appears to be declining in this district as seen from previous years. Only 8.5% of the total workers of its residents are occupied in agriculture, 37.41% of the total area of the district is utilised for cultivation of various food and non-food crops and 73444 persons in this district are engaged in agriculture as cultivators. The major crops grown in the district are paddy, corn, maize, ragi, green gram, black gram, sugar cane and ground nut.

Source: <https://cdn.s3waas.gov.in/s39431c87f273e507e6040fcb07dcb4509/uploads/2018/05/2018050814.pdf>

(Ref: Directorate of Census Operations-Tamil Nadu, “District Census Handbook-2011, Thiruvallur District”, Series-34 Part XII-A)

3.4.3.5 Mineral Resources

The district does not contain any precious mineral. However, it has a few varieties of major/minor minerals which are given in **Figure 3-5**.

Minor minerals

The district does not contain any precious mineral. However it has a few varieties of major and minor minerals.

Minor Minerals

Lime Shell: Pulicut Lake, Sunnambukulam, Annamalaicherry

Silica Sand: Elavoor, Eravanoor, Ennore, Gummidipoondi and Ponneri.

Stoneware Clay: Adhigathur, Odhapal, Gudapakkam Kandigai

Major Minerals

River Sand: Kosasthalaiyar, Araniar, Kallar, Nandi, Coovam

Blue Metal: Pallipattu and Tiruttani Taluks

Gravel: Ponneri and Gummidipoondi Taluks

Brick Clay: Tiruvallur and Ponneri Taluks

Source:http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3301_PART_A_DCHB_THIRUVALLUR.pdf

(Ref: Directorate of Census Operations-Tamil Nadu, “District Census Handbook-2011, Thiruvallur District”, Series-34 Part XII-A)

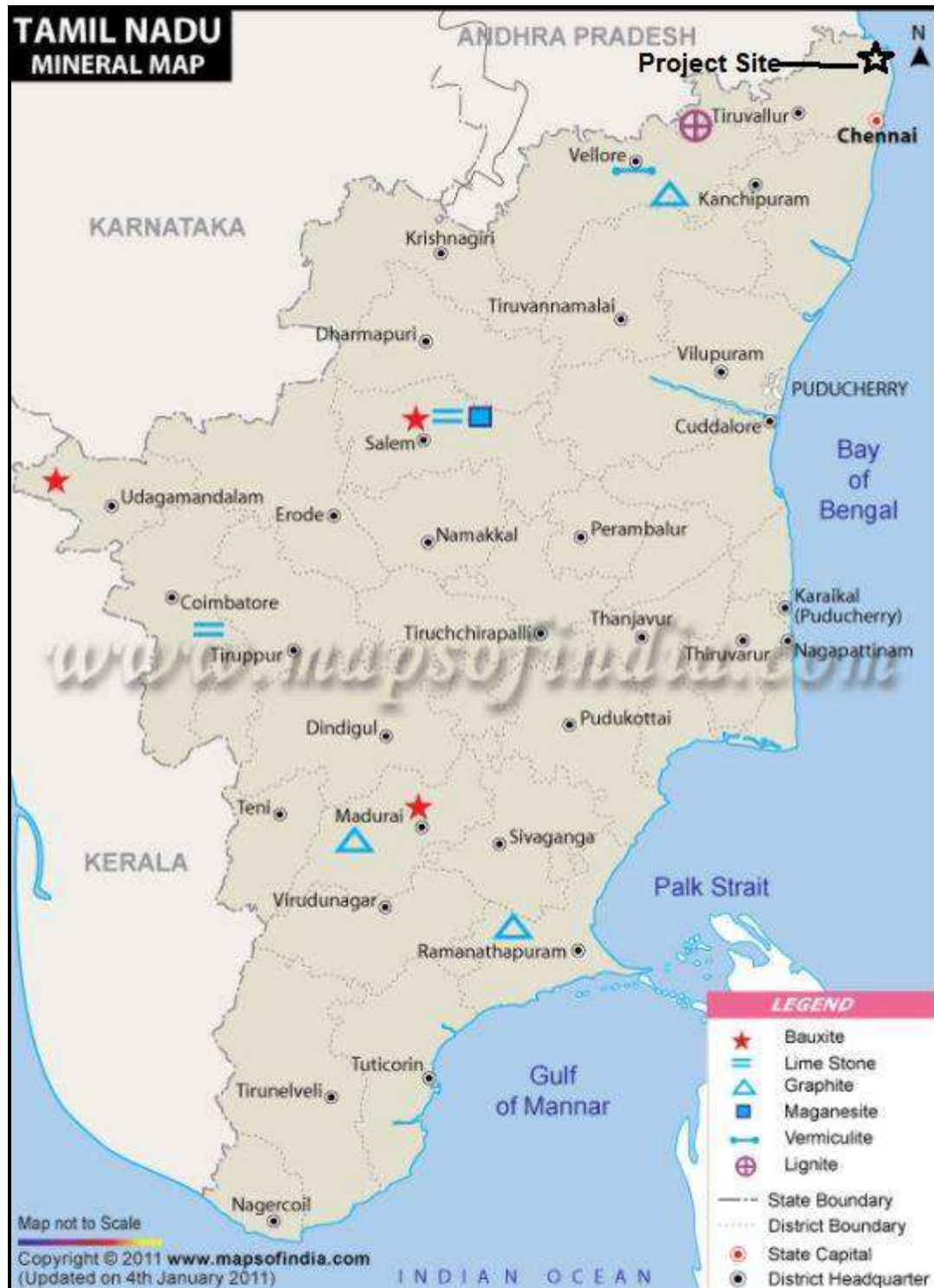


Figure 3-5 Mineral Map of Tamil Nadu

3.4.4 Land Use & Land Cover

Total geographic area of Thiruvallur district is 3423 Sq. Km. Urban Built up area is 295.16 Sq.km and Rural Built up area is 272.76 Sq.km. Details of land use/land cover 4 statistics for Thiruvallur district were given in **Table 3-3** and Land Use pattern of Thiruvallur district is given in **Figure 3-6** and Land use map of Thiruvallur district is given in **Figure 3-7**

Table 3-3 Land Use & Land Cover

S.No.	Division of Land Use/Land Cover	Area in Sq.Km.	Area in acres	Area in Ha	Area (%)
1.	Builtup, Urban	295.16	72935.51	29516	8.623
2.	Builtup, Mining	7.54	1863.17	754	0.220
3.	Agriculture, Plantation	87.77	21688.41	8777	2.564
4	Forest, Evergreen/ Semi evergreen	18.22	4502.25	1822	0.532
5	Forest, Forest Plantation	10.57	2611.90	1057	0.309
6	Forest, Swamp/ Mangroves	3.03	748.73	303	0.089
7	Barren/unculturable/ Wastelands, Gullied/Ravinous Land	0.11	27.18	11	0.003
8	Barren/unculturable/ Wastelands, Sandy area	12.83	3170.36	1283	0.375
9	Wetlands/Water Bodies, Inland Wetland	0.65	160.62	65	0.019
10	Wetlands/Water Bodies, River/Stream/canals	67.33	16637.58	6733	1.967
11	Builtup, Rural	272.76	67400.36	27276	7.968
12	Agriculture, Crop land	1834.25	453252.35	183425	53.586
13	Agriculture, Fallow	115.92	28644.41	11592	3.387
14	Forest, Deciduous	68.13	16835.26	6813	1.990
15	Forest, Scrub Forest	0.03	7.41	3	0.001
16	Barren/unculturable/ Wastelands, Salt Affected land	7.42	1833.52	742	0.217
17	Barren/unculturable/ Wastelands, Scrub land	190.58	47093.27	19058	5.568
18	Barren/unculturable/ Wastelands, Barren rocky	2.39	590.58	239	0.070
19	Wetlands/Water Bodies, Coastal Wetland	86.74	21433.89	8674	2.534
20	Wetlands/Water Bodies, Reservoir/Lakes/Ponds	341.57	84403.65	34157	9.979
Total		3423	845840.4	342300	100.000

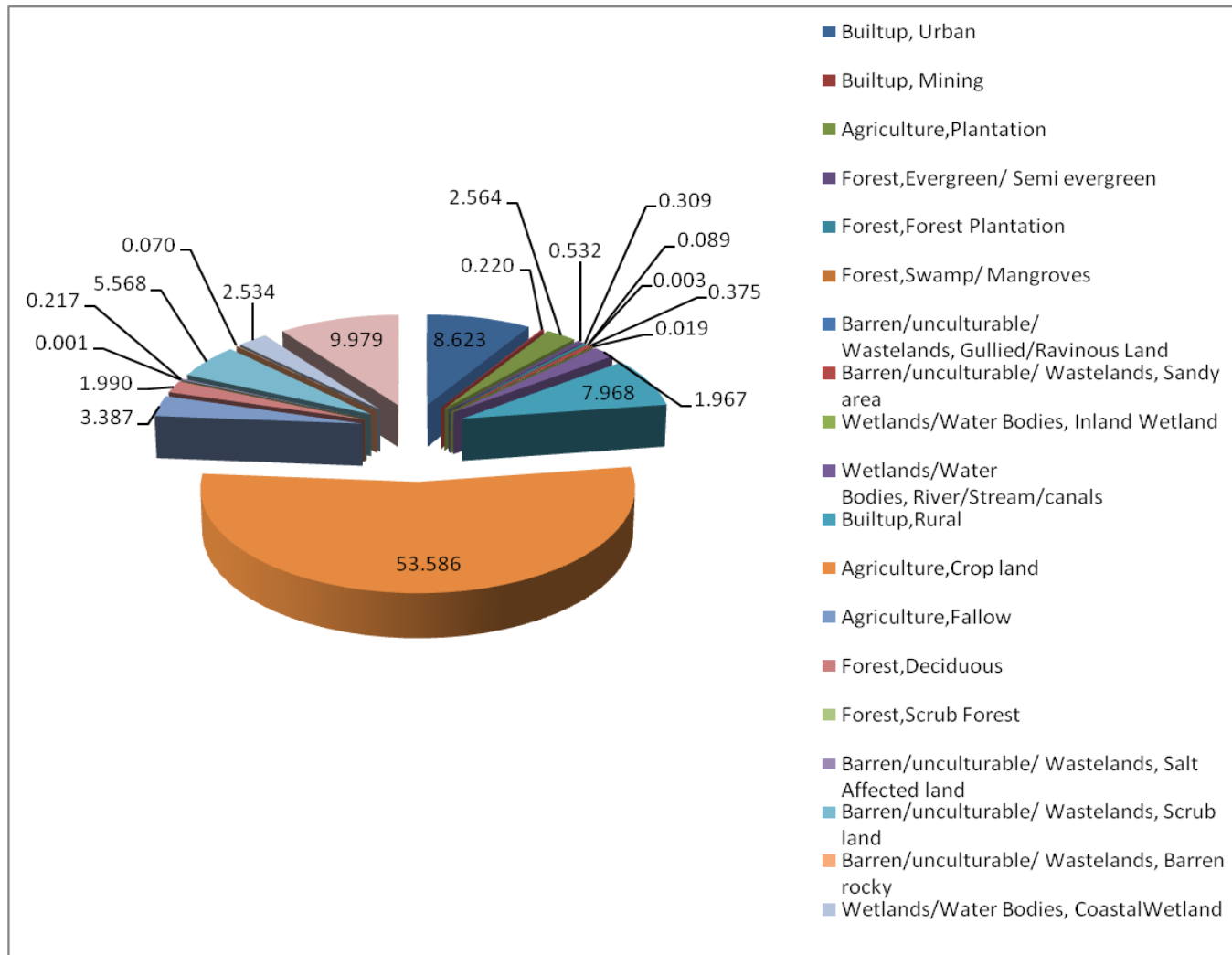


Figure 3-6 Land use pattern of the Thiruvallur District

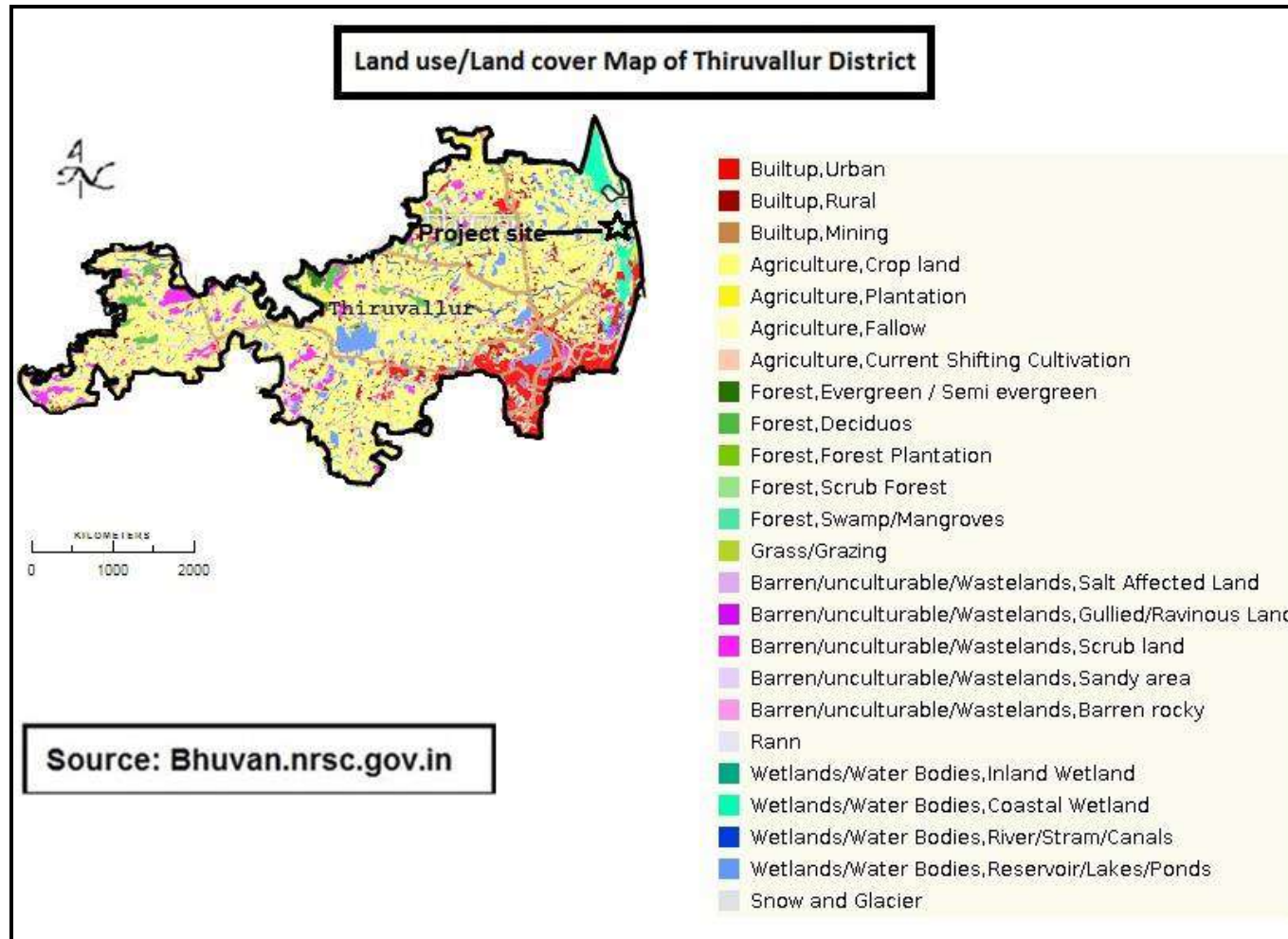


Figure 3-7 Land use map of the Thiruvallur District

3.4.4.1 Land Use and Land Cover of the Study Area

Total Project Study area is **386.66 Sq.Km**. The Land Use Pattern is given in **Figure 3-8**. The Land Use Map of the Study area are given in **Figure 3.9**. Land use pattern of the study area is given in **Table 3-4**

Table 3-4 Land Use Pattern of the Study Area

S.No.	Description	Area (Sq.Km)	Area (Acres)	Area (Hectares)	Area (%)
1	Crop land	48.95	12095.79	4895	12.66
2	Coastal Wetland	32.12	7937.01	3212	8.31
3	Urban	31.89	7880.18	3189	8.25
4.	Rural	18.68	4615.92	1868	4.83
5	Fallow	12.84	3172.83	1284	3.32
6	Plantation	9.97	2463.64	997	2.58
7	River / Stream / Canals	8.05	1989.20	805	2.08
8	Tanks / Lakes / Ponds	7.69	1900.24	769	1.99
9	Scrub land	4.70	1161.39	470	1.22
10	Swamp / Mangrove	2.13	526.33	213	0.55
11	Deciduous	1.23	303.94	123	0.32
12	Sandy area	0.89	219.92	89	0.23
13	Inland Wetland	0.66	163.09	66	0.17
14	Ocean	206.86	51116.14	20686	53.50
Total		386.66	95545.62	38666	100.00

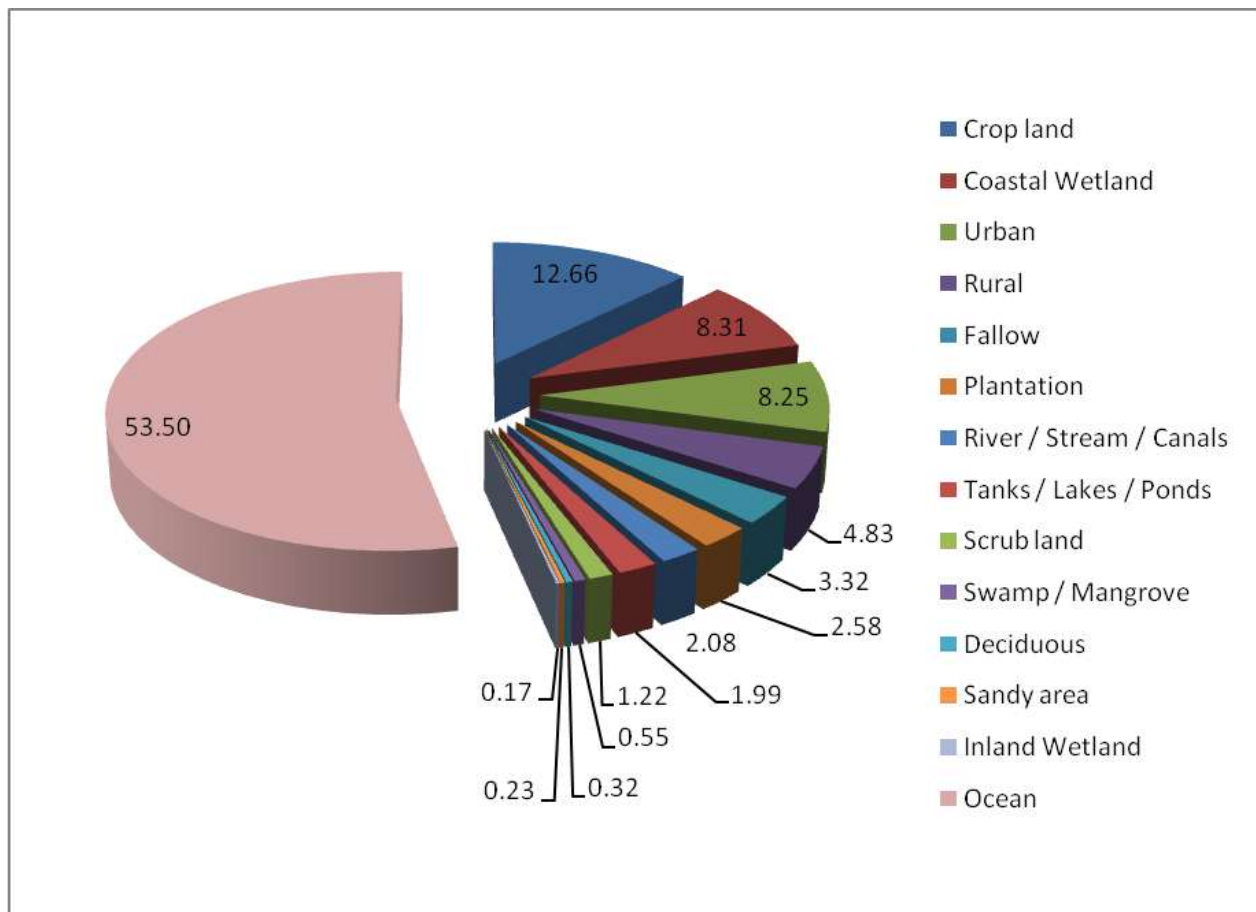


Figure 3-8 Land Use Pattern of the Study Area

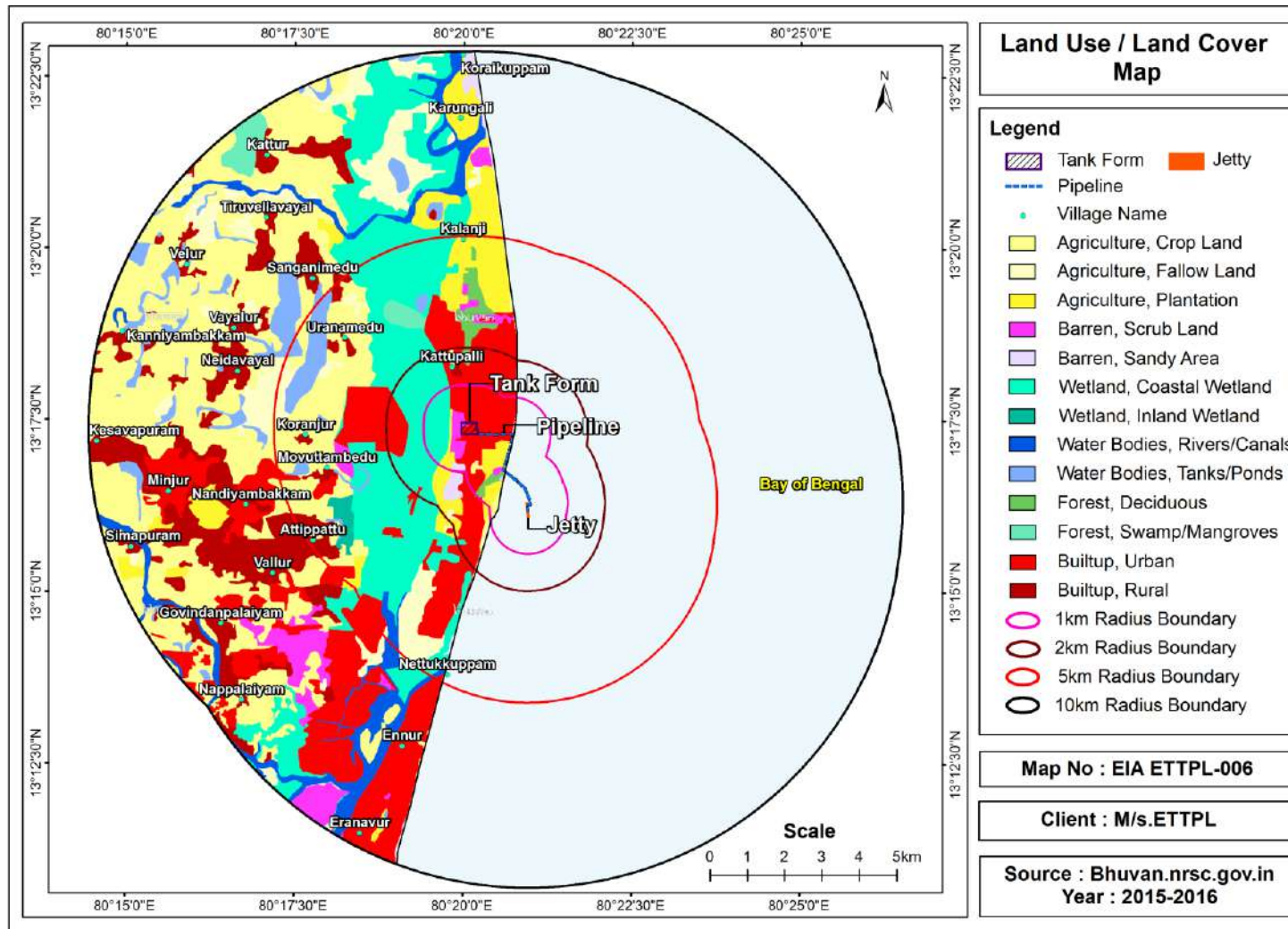


Figure 3-9 Land Use Map of the Study Area

3.4.5 Topography

The coastal region is mostly flat while certain areas in Tiruttani and Pallipet taluks are undulated and even hilly. However, there are not many hills of any considerable height in this district. There are a few conical hills or ridges of small elevation, like the St. Thomas Mount. Most of the hills and hillocks are rocky and no verdant vegetation is seen in the slopes of these hills. The area under forests, all of 19,736 sq. km., is only 5.8 % of the total geographical area of the district. Physical map of Tamilnadu is given as **Figure 3-10** and Topo map of study area is given as **Figure 3-2** and contour map of the study area is given as **Figure 3-11**

Source: http://www.spc.tn.gov.in/Exe_Summary_DHDR/Thiruvallur.pdf

(Ref: State planning Commission –Tamil Nadu, “District Human Development Report-2017, Thiruvallur District”)



Figure 3-10 Physical Map of Tamil Nadu

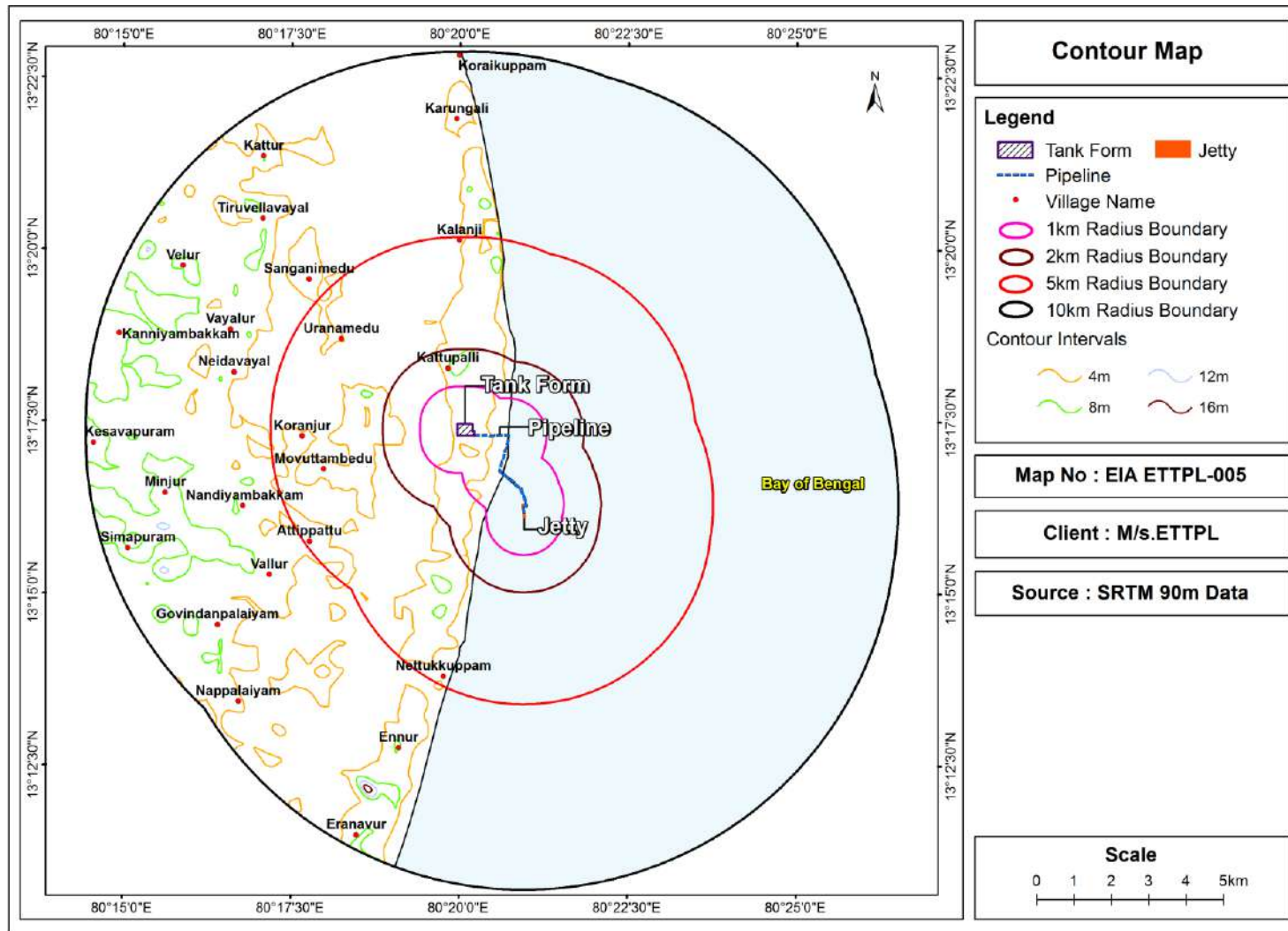


Figure 3-11 Contour Map of Study Area

3.4.6 Geomorphology of PIA district

The prominent geomorphic units identified in the district through interpretation of Satellite imagery are Alluvial Plain, Old River Courses, Coastal plains, Shallow & deep buried Pediments, Pediments and Structural Hills. The elevation of the area ranges from 183 m amsl in the west to sea level in the east. Four cycles of erosion gave rise to a complex assemblage of fluvial, estuarine and marine deposits. The major part of the area is characterised by an undulating topography with innumerable depressions which are used as irrigation tanks. The coastal tract is marked by three beach terraces with broad inter-terrace depressions. The coastal plains display a fairly lower level or gently rolling surface and only slightly elevated above the local water surfaces or rivers. The straight trend of the coastal tract is resultant of development of vast alluvial plains. There are a number of dunes in the coastal tract. The Geomorphology Map of the Thiruvallur District is shown as **Figure 3-13**.

Source:http://cgwb.gov.in/District_Profile/TamilNadu/TIRUVALLUR.pdf

(Ref:Government of India Ministry of Water Resources Central Ground Water Board South Eastern Coastal Region Chennai, “District Ground Water Brochure Tiruvallur District”)

3.4.7 Geomorphology of the Study Area

The total Geographical area of the study area is **386.66** Sq.Km. The Geomorphology of the study area is given in **Figure 3.14** and Geomorphology pattern is given in **Figure 3.12**

Table 3-5 Geomorphology of the Study Area

S.No.	Description	Area (Sq.Km)	Area (Acres)	Area (Hectares)	Area (%)
1	Coastal Origin-Older Deltaic Plain	83.56	20648.09	8356	21.61
2	Coastal Origin-Younger Coastal Plain	78.89	19494.11	7889	20.40
3	Waterbodies	15.03	3713.99	1503	3.89
4	Fluvial Origin-Active Flood Plain	2.71	669.65	271	0.70
5	Coastal Origin-Younger Deltaic Plain	2.51	620.23	251	0.65
6	Ocean	203.96	50399.54	20396	52.75
Total		386.66	95545.62	38666	100.00

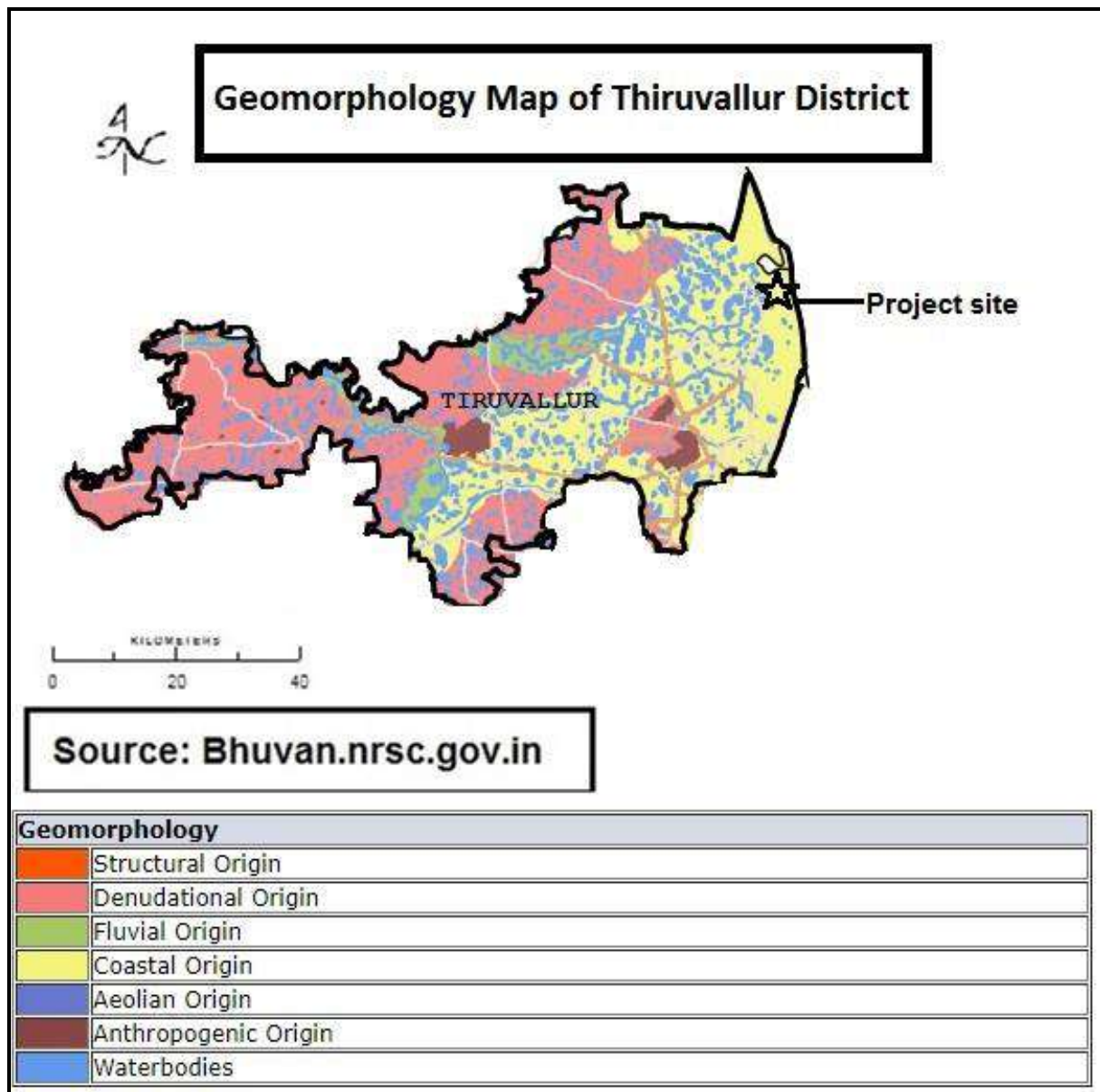


Figure 3-12 Geomorphology Map of Thiruvallur District

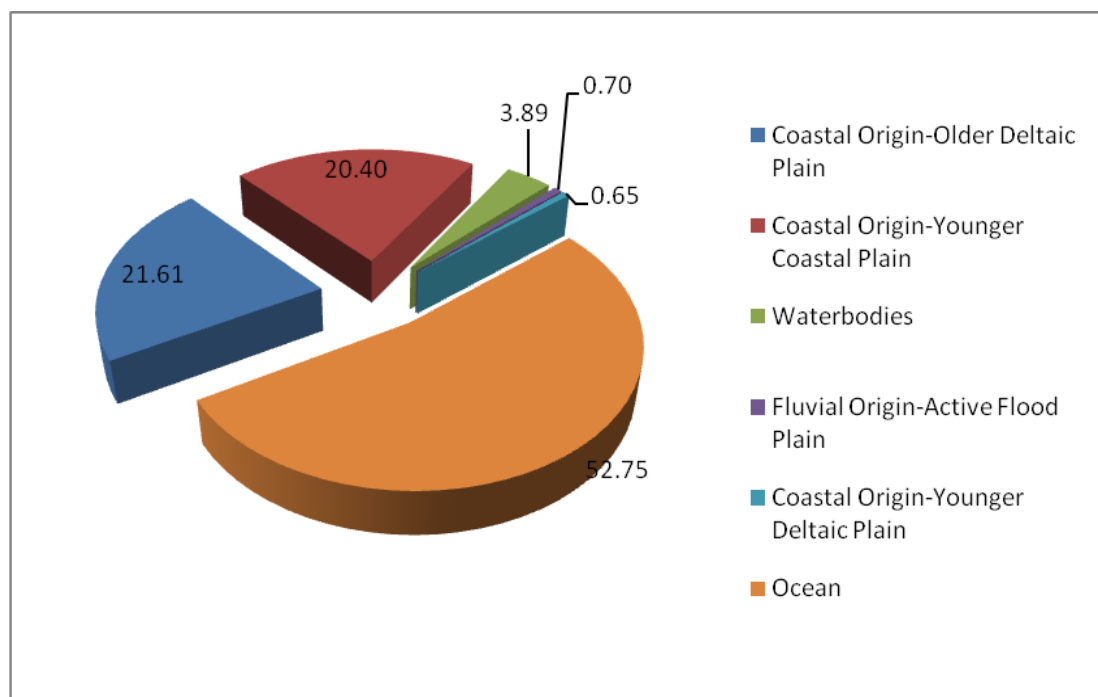


Figure 3-13 Geomorphology Pattern of the Study Area

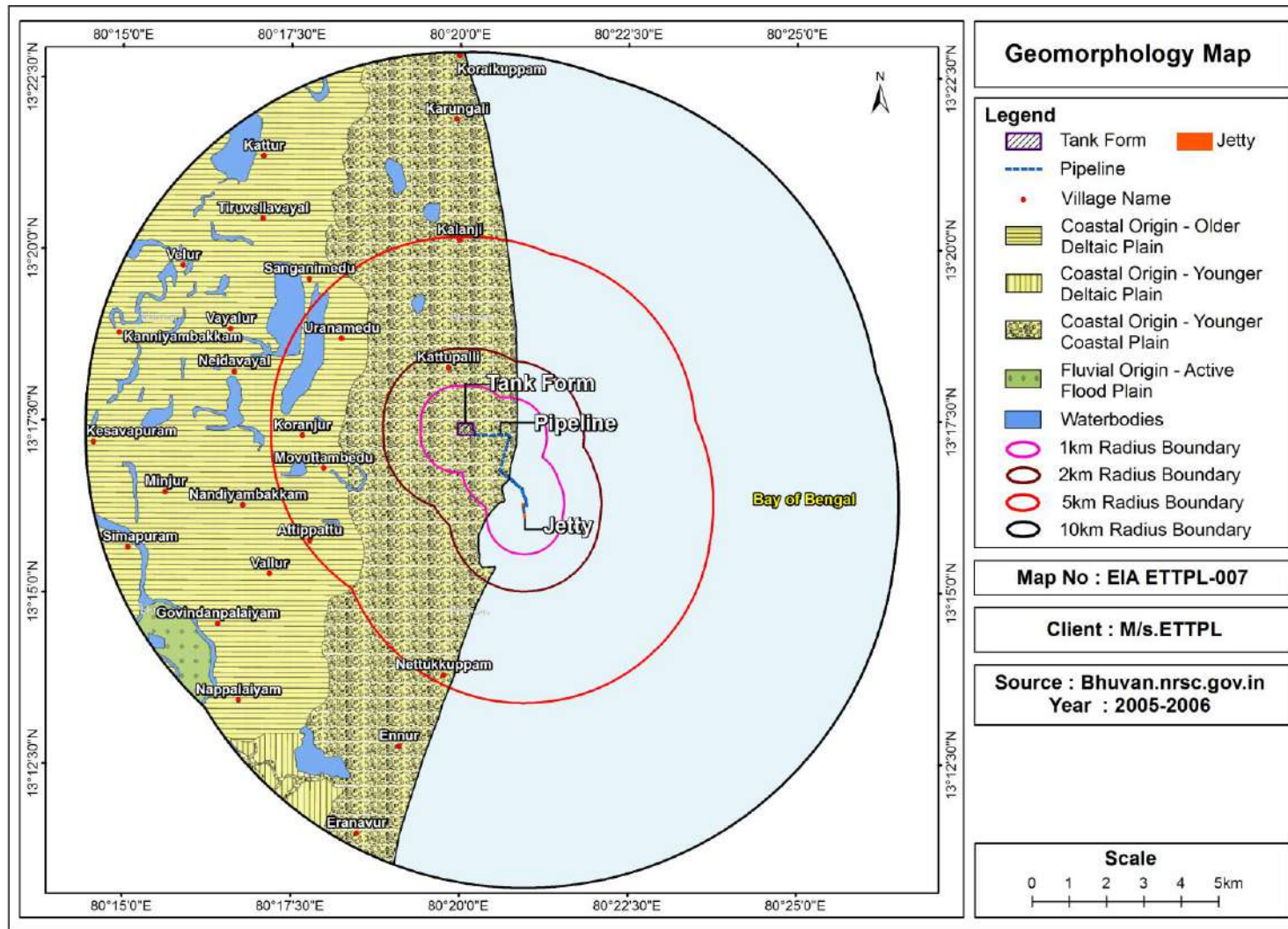


Figure 3-12 Geomorphology Map of the Study Area

3.4.8 Hydrogeology of PIA district

The district is underlain by both porous and fissured formations. The important aquifer systems in the district are considered by Unconsolidated & semi-consolidated formations and Weathered, fissured and fractured crystalline rocks. The porous formations in the district include sandstones and clays of Jurassic age (Upper Gondwana), marine sediments of Cretaceous age, sandstones of Tertiary age and recent alluvial formations. As the Gondwana formations are well-compacted and poorly jointed, the movement of ground water in these formations is mostly restricted to shallow levels. Ground water occurs under phreatic to semi-confined conditions in the inter-granular pore spaces in sands and sandstones and the bedding planes and thin fractures in shales. In the area underlain by Cretaceous sediments, ground water development is rather poor due to the rugged nature of the terrain and the poor quality of the formation water. Quaternary formations comprising mainly sands, clays and gravels are confined to major drainage courses in the district. The maximum thickness of alluvium is 30.0 m. whereas the average thickness is about 15.0m. Ground water occurs under phreatic to semi-confined conditions in these formations and is being developed by means of dug wells and filter points. Alluvium which forms a good aquifer system along Araniyar and Korattalaiyar river bed which is one of the major sources of water supply to urban areas of Chennai city and also to the industrial units. Ground water generally occurs under phreatic conditions in the weathered mantle and under semi-confined conditions in the fissured and fractured zones at deeper levels. The thickness of weathered zone in the district is in the range of 2 to 12 m. The depth of the wells ranged from 8.00 to 15.00 mbgl. The yield of large diameter wells tapping the weathered mantle of crystalline rocks ranges from 100 to 500 lpm and are able to sustain pumping for 2 to 6 hours per day. The yield of bore wells drilled down to a depth of 50 to 60 m ranges from 20 to 400 lpm. The yield of successful bore wells drilled down to a depth of 150 m bgl during the ground water exploration programme of Central Ground Water Board ranged from 1.2 to 7.6 lpm. The depth to water level in the district varied between 2.38 – 7.36 m bgl during pre-monsoon (May 2006) and 0.79 – 5.30 m bgl during post monsoon (Jan 2007). The seasonal fluctuation shows a rise between 0.28 and 4.80 mbgl. The piezometric head varied between 2.20 to 10.30 m bgl (May 2006) during premonsoon and 2.72 to 8.55 m bgl during post monsoon. The hydrogeology map of Thiruvallur District is given in **Figure 3-13**.

Source:http://cgwb.gov.in/District_Profile/TamilNadu/TIRUVALLUR.pdf

(Ref:Government of India Ministry of Water Resources Central Ground Water Board South Eastern Coastal Region Chennai, “District Ground Water Brochure Tiruvallur District”)

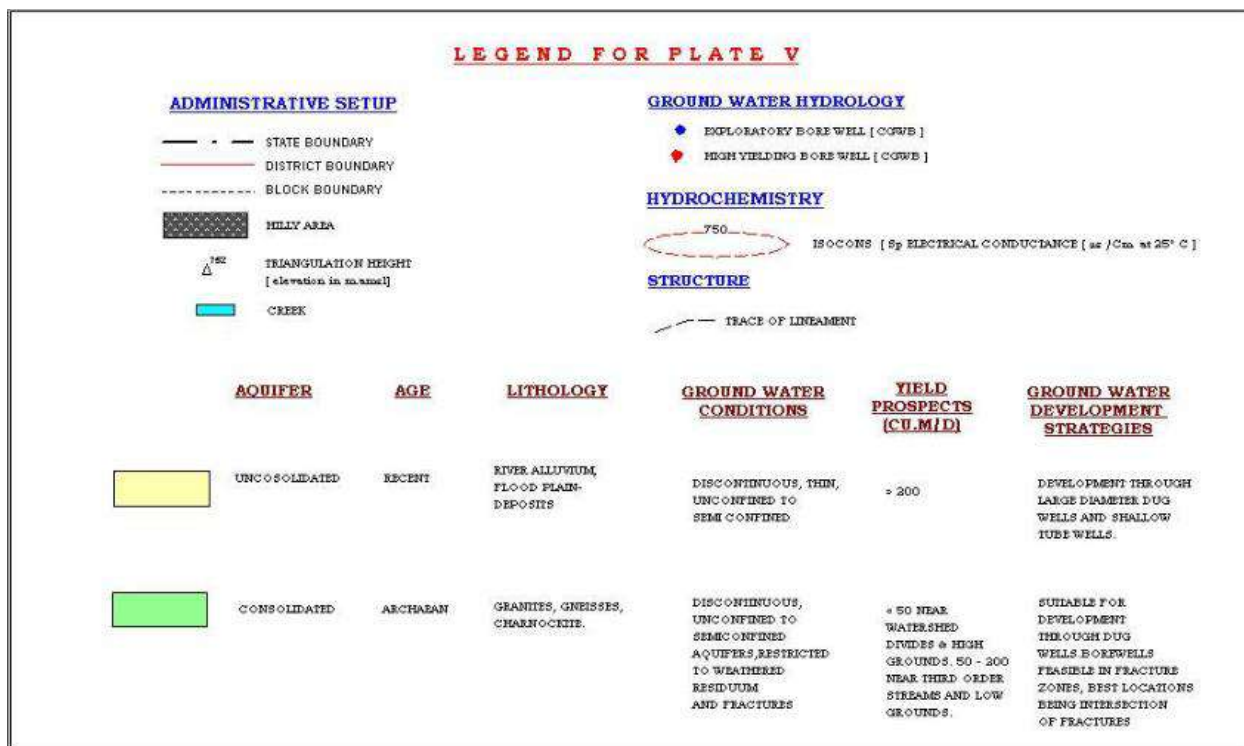
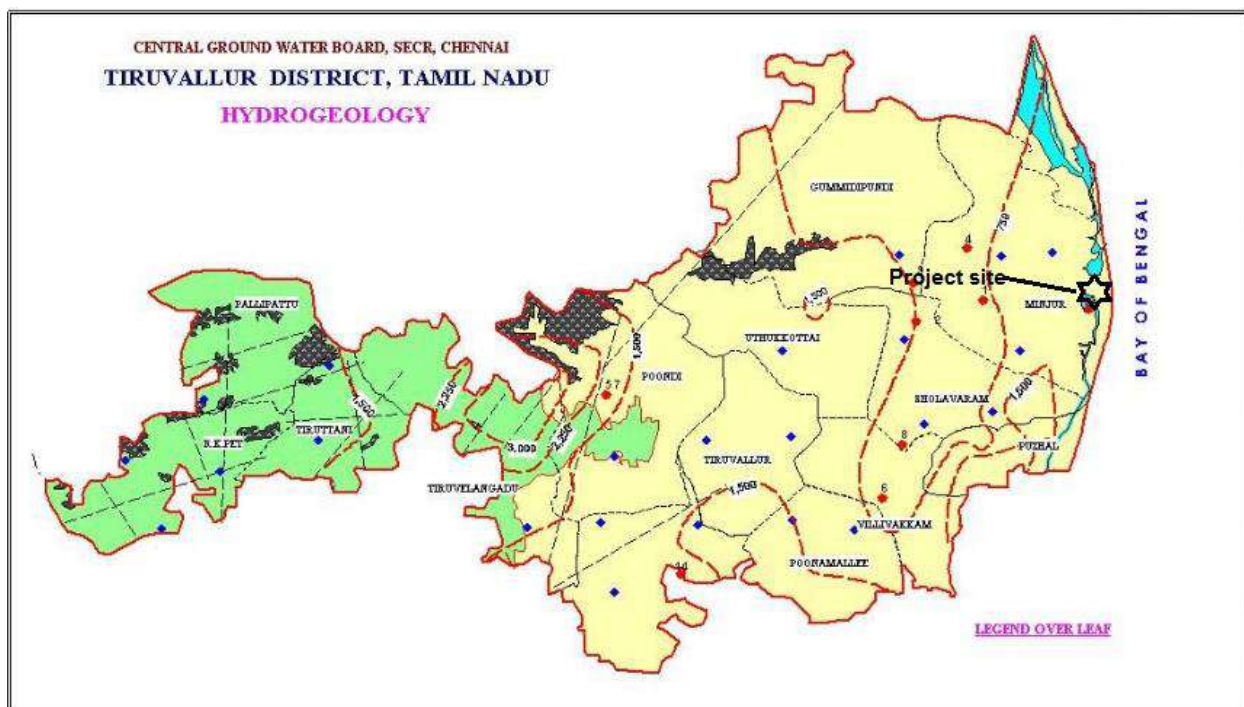


Figure 3-13 Hydrogeology Map of Tiruvallur District

3.4.9 Drainage Pattern in PIA district

Araniyar, Korattalayar, Cooum, Nagari and Nandhi are the important rivers. The drainage pattern, in general, is dendritic. All the rivers are seasonal and carry substantial flows during monsoon period. Korattaliar river water is supplied to Cholavaram and Red Hill tanks by constructing an Anicut at Vellore Tambarambakkam. After filling a number of tanks on its further course, the river empties into the Ennore creek a few kilometres north of Chennai. The Cooum River, flowing across the southern part of the district, has its origin in the surplus waters of the Cooum tank in Tiruvallur taluk and also receives the surplus waters of a number of tanks. It feeds the Chembarambakkam tank through a channel. It finally drains into the Bay of Bengal. The drainage map of the Study Area is given as **Figure 3.16**.

Source:http://cgwb.gov.in/District_Profile/TamilNadu/TIRUVALLUR.pdf

(Ref:Government of India Ministry of Water Resources Central Ground Water Board South Eastern Coastal Region Chennai, “District Ground Water Brochure Tiruvallur District”)

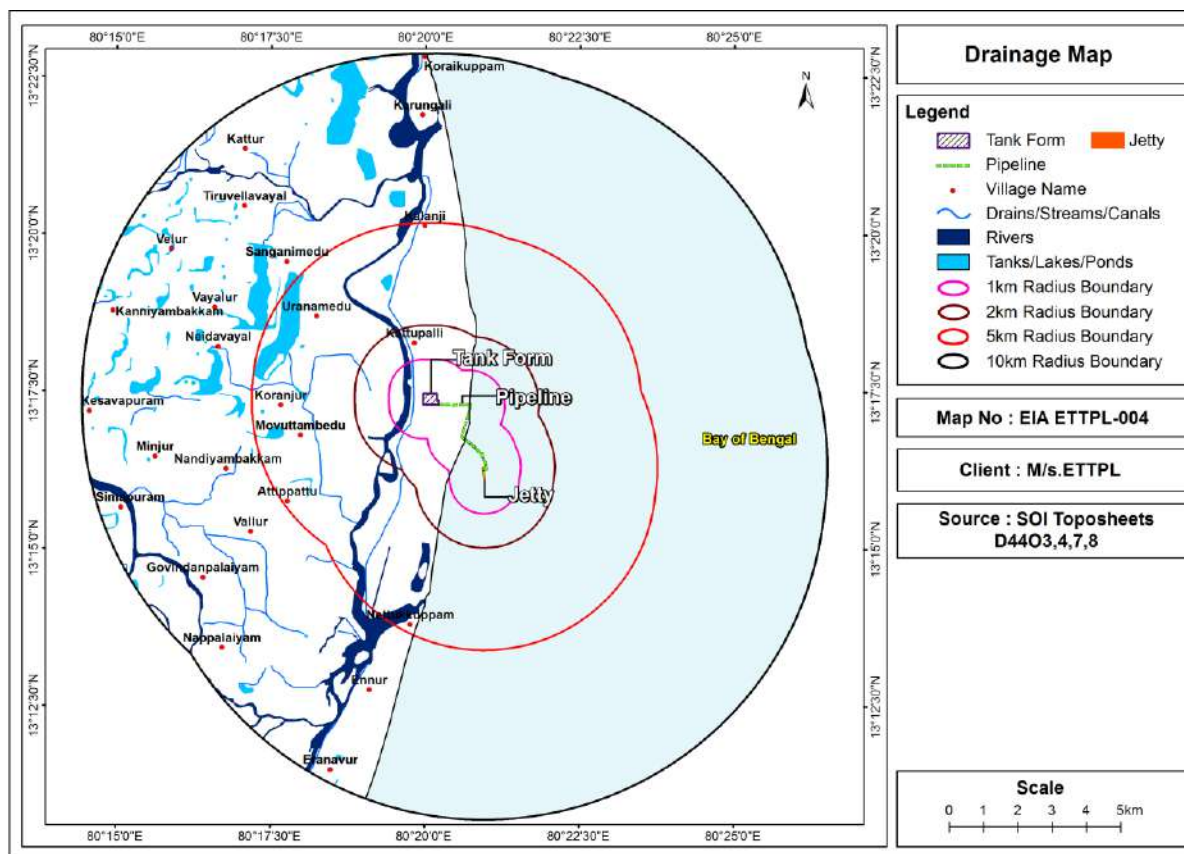


Figure 3-14- The drainage map of the Study Area

3.4.10 Geology

The Thiruvallur district can be geologically classified into hard rock and sedimentary (alluvial) formation. This district is principally made up of Archaean, upper Gondwana and the tertiary formations. These are overlaid by laterites and alluvium. The oldest of the crystalline rocks of Archaean age are of Biotite and Hornblende Gneiss, Charnockite and granite. These are intruded by Amphibole dykes, and occasionally with veins of quartz and pegmatites. Granites and gneisses of Archaean age are mainly seen in Tiruthani taluk. Geological map of Tamilnadu is given as **Figure 3-15**.

Source: <http://nwm.gov.in/sites/default/files/Notes%20on%20Thiruvallur%20District.pdf>

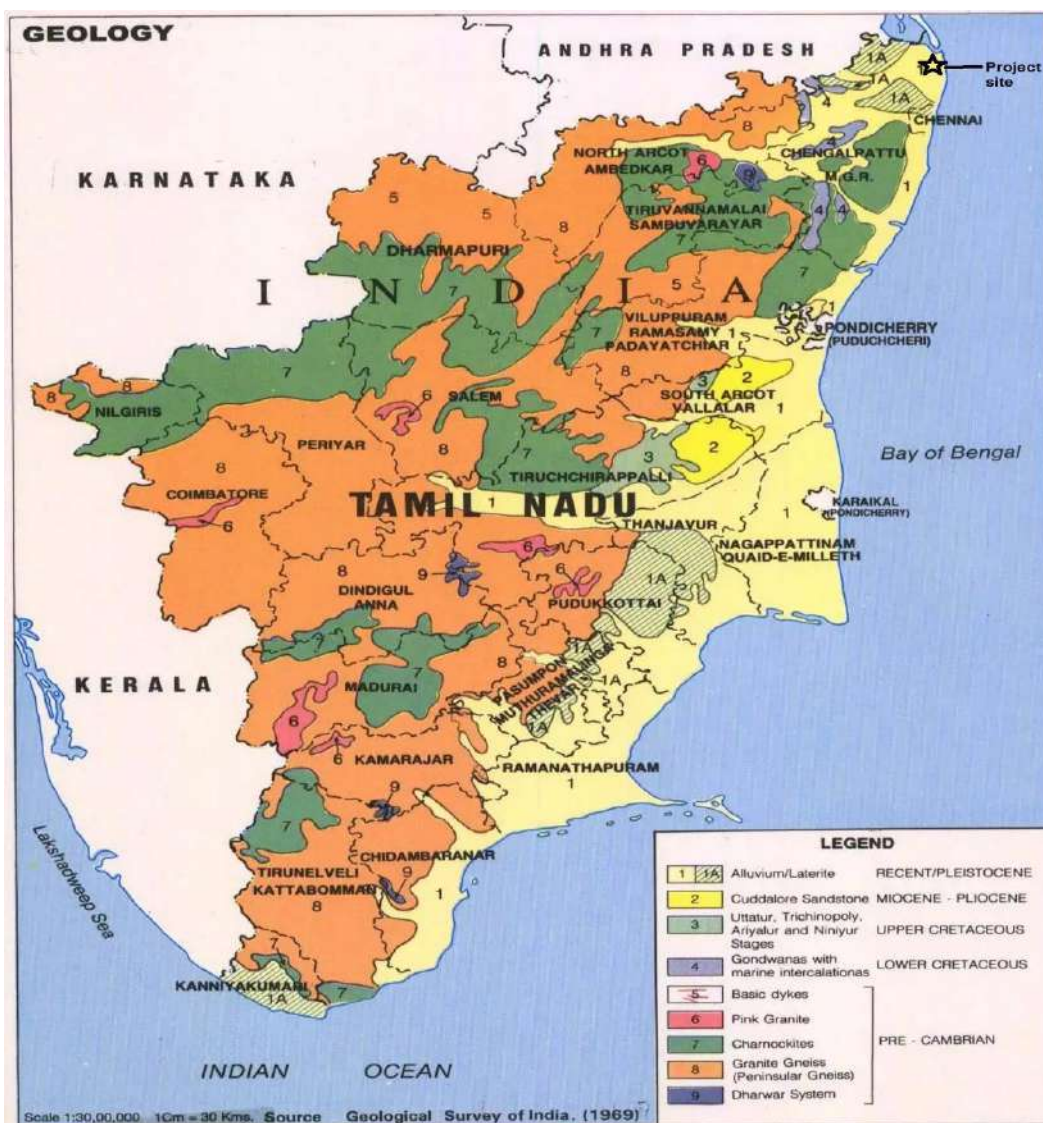


Figure 3-15 Geology Map of India

As per Earthquake hazard map of Tamil Nadu , The project location/study area falls in Zone III, which is categorized as a Moderate Damage Risk Zone. The Earthquake hazard map of Tamil Nadu is shown in **Figure 3-16.**



3.4.12 Soils in PIA District

Soils in the area have been classified into Red soil, Black soil, Alluvial soil and colluvial soil. The major part is covered by Red soil of red sandy/clay loam type. Ferruginous red soils are also seen at places. Black soils are deep to very deep and generally occurs in the depressions adjacent to hilly areas, in the western part. Alluvial soils occur along the river courses and eastern part of the coastal areas. Sandy coastal alluvium (arenaceous soil) are seen all along the sea coast as a narrow belt. Soil map of India is given in **Figure 3-17**.

Source:http://cgwb.gov.in/District_Profile/TamilNadu/TIRUVALLUR.pdf

(Ref:Government of India Ministry of Water Resources Central Ground Water Board South Eastern Coastal Region Chennai, “District Ground Water Brochure Tiruvallur District”



Figure 3-17 Soil map of India

3.4.13 Natural Hazards in PIA District

The coastline is mainly accreting with noticeable erosional effects particularly near Ennore. Development of offshore bars and shoals are observed near Ennore and Pulicat. Madras Thermal Power Station (MTPS) has been located near the Pulicat Lake. Boulders and Groynes were laid along a continuous stretch in this area. The

strip of land between the Bay of Bengal and Pulicat Lake faces sea erosion. Generally floods occur during north east monsoon when there is heavy rainfall coupled with cyclonic storm in Bay of Bengal. Floods often occur in the basins of Kosasthalaiyar, Araniar, Coovum and Adyar and its tributaries. The entire coastal length of the district is prone to tsunami. The Natural Hazard Map of India is given in **Figure 3-18**.

Source: <http://tnenviis.nic.in/files/THIRUVALLUR%20%20.pdf>

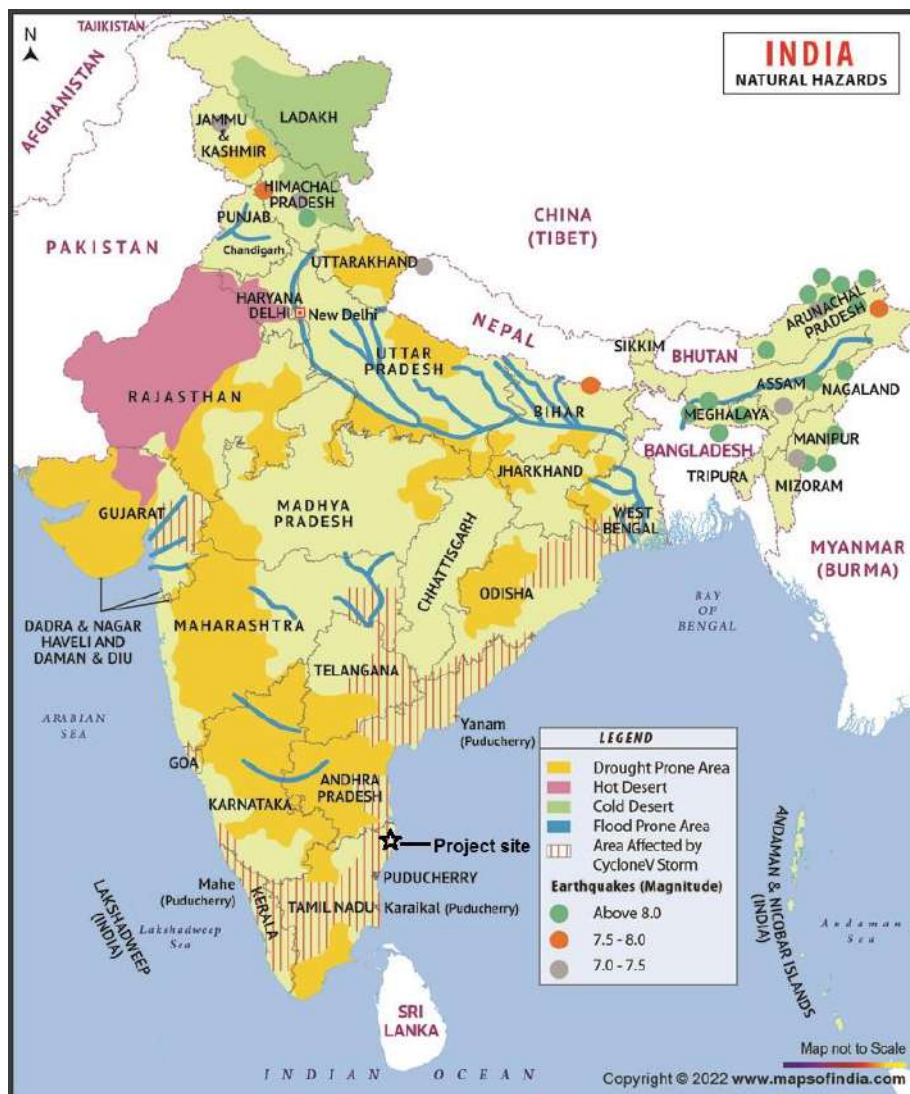


Figure 3-18 Natural hazard Map of India

3.5 Establishment of Baseline for valued environmental components

3.5.1 Air Environment

Baseline ambient air quality assessment gives the status in the vicinity of site and is an indispensable part of environmental impact assessment studies. Significant changes, in predominant winds and weather conditions are observed in winter, summer and post-monsoon seasons apart from the local topographic influences by using secondary data and also the baseline status of air environment in the study area is assessed for one season through a systematic air quality surveillance programme as a primary data generation.

3.5.2 Meteorological Conditions

The regional air quality is influenced by the meteorology of that region. The principal weather parameters that influence the concentration of the air pollutants in the surroundings are wind speed, wind direction and temperature. The meteorological data is useful for proper interpretation of the baseline data. It is used as input for air quality dispersion models for predicting the post project environmental scenario.

3.5.3 Meteorological Data Collection

Available secondary data pertaining to the meteorological parameters was obtained from the IMD Climatological tables. In addition, baseline meteorological data was generated during the study period **March – May 2024**. The methodology adopted for monitoring surface observations is as per the standard norms laid down by Bureau of Indian Standards (BIS) i.e. IS:8829 and India Meteorological Department (IMD).

3.5.4 General Meteorological Scenario based on IMD Data

The nearest India Meteorological Department (IMD) station located to project site is **Chennai (Minambakkam)**. The Climatological data of **Chennai (Minambakkam)** (13° 00' N and 80° 11' E), published by the IMD, based on daily observations at 08:30 and 17:30 hour IST for a 30 year period (1991-2020), is presented in the following sections on the meteorological conditions of the region. The monthly variations of the relevant meteorological parameters are reproduced in **Table 3-6**.

Table 3-6 Climatological Summary– Chennai (Minambakkam) (1991-2020)

Month	Temp (°C)		Rainfall (mm)		Relative Humidity		Vapour Pressure		Mean Wind Speed	Predominant Wind Directions	
										08:30	17:30
	Daily	Daily	Total	No.of days	08:30	17:30	08:30	17:30			
Jan	29.9	20.9	20.0	1.4	8	6	24.6	22.8	4.8	NW	NE
Feb	31.7	21.8	4.7	0.6	8	6	25.6	23.8	5.7	NW	E

Mar	34.0	23.8	3.4	0.2	7	6	25.4	26.7	7.2	S	SE
Apr	35.9	26.2	17.5	1.0	7	6	31.4	30.5	8.7	S	SE
May	38.3	27.7	49.7	1.8	6	6	30.1	31.2	9.2	SW	SE
Jun	37.5	27.4	75.4	4.5	6	5	27.4	28.9	9.1	W	SE
Jul	35.8	26.4	113.1	6.7	6	5	27.5	28.4	8.1	W	SE
Aug	34.9	25.7	141.4	8.8	7	6	28.1	29.4	7.5	W	SE
Sep	34.4	25.4	143.9	7.4	7	6	29.3	29.8	6.4	W	SE
Oct	32.6	24.6	278.3	10.6	8	7	30.1	29.7	4.9	W	E
Nov	30.4	23.2	377.3	11.5	8	7	28.5	27.4	4.6	N	NE
Dec	29.4	21.7	183.7	5.7	8	6	25.7	24.1	5.0	N	NE
Max.	38.3	27.7	377.3	11.5	8	7	31.4	31.2	9.2	Annual predominant wind pattern is SOUTH EAST	
Min.	29.4	20.9	3.4	0.2	6	5	24.6	22.8	4.6		
Avg/Total	33.7	24.6	1408.4	60.2	75	65	28.1	27.7	6.8		

As per the **Table 3-6** Climatological data provided observations drawn for the study period are the following. As per the above IMD Climatological the observations drawn are the following.

- Daily maximum temperature is 38.3°C and the daily minimum temperature is 20.9°C were recorded in the months of May and January respectively.
- Maximum and minimum relative humidity of 83% and 58% were recorded in the months of January, November, December and June respectively.
- Maximum and minimum rainfall of 377.3mm and 3.4mm was recorded in the months of November and March respectively.
- Maximum and minimum Mean wind speed is 9.2 Km/hr and 4.6 Km/hr was recorded in the months of May and November respectively. According to the above IMD data, Annual predominant wind pattern is from **South west**.

3.5.5 Meteorological Scenario during Study Period

The meteorological scenario in and around the project site is an essential requirement during study period for proper interpretation of baseline air quality status. Meteorological data was collected during the study period (**March – May 2024**) and is presented in **Table 3-7**. The wind rose for the study period is given as **Figure 3-19**.

Table 3-7 Meteorological Data for the Study Period (March – May 2024)

S. No	Parameter	Observation
-------	-----------	-------------

1.	Temperature	Max Temperature : 41 °C Min Temperature : 24°C Avg Temperature : 31.15°C
2.	Average Relative Humidity	73.36%
3.	Average Wind Speed	3.61 m/s
4.	Predominant Wind Direction during study period	South East to North West

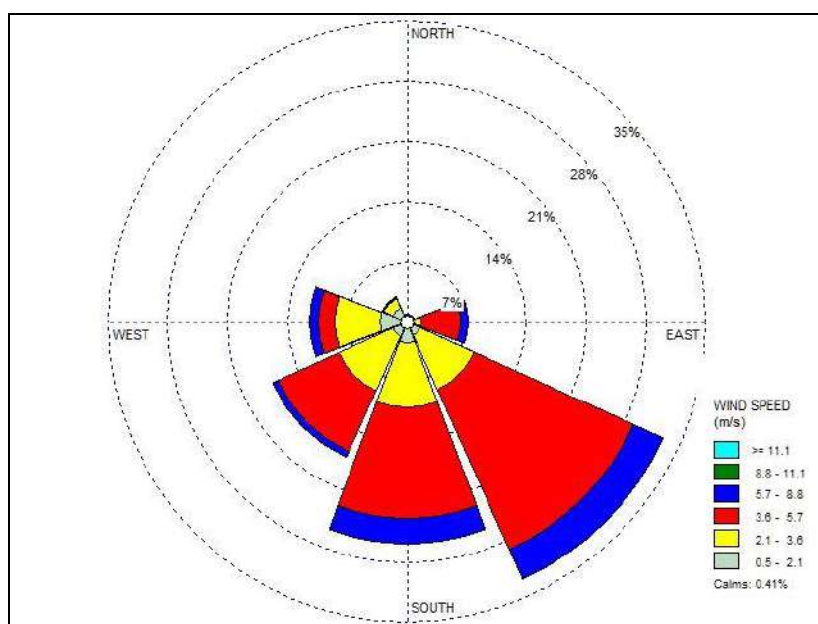


Figure 3-19 Wind rose during study period (March – May 2024)

3.5.6 Atmospheric Inversion

Atmospheric inversion level at the project site was monitored; the results observed at the site during the study period are as follows

Average atmospheric temperature: 31.15°C

- Average Relative humidity: 73.36 %
- Average Wind speed: 3.61 m/s

The daily inversion level calculated based on the average temperature and average wind speed at the project site and the maximum inversion height is derived by the graph plotted based on the average temperature and average wind speed. The daily inversion level at the project site varies from 842 to 3858 m on 2nd April 2024, the maximum recorded on March - May 2024. This is shown in **Figure 3-20**.

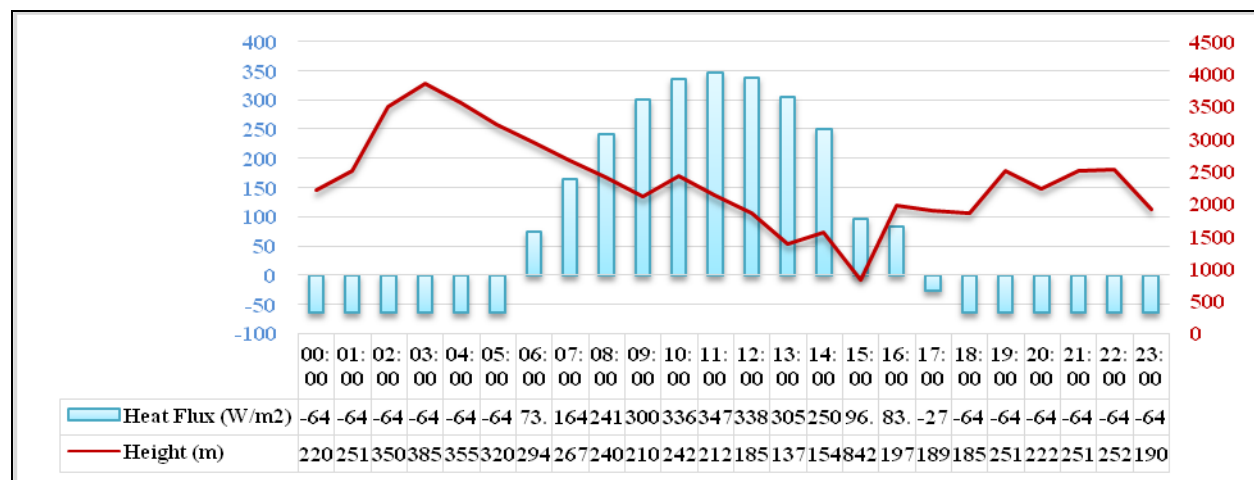


Figure 3-20 Atmospheric inversion level at the project site

3.5.7 Ambient Air Quality

The selection criteria for monitoring locations are based on the following:

- Topography/Terrain
- Meteorological conditions – Upwind and Downwind locations
- Residential and sensitive areas within the study area
- Representatives of regional background air quality/pollution levels and
- Representation of likely impacted areas

3.5.8 Ambient Air Quality Monitoring Stations

To evaluate the baseline air quality of the study area, Eight (08) monitoring locations have been identified as per Meteorological data during the study period (**March – May 2024**). The Annual wind predominance is from South East to North West. AAQ monitoring locations are selected based on Annual wind predominance, map showing the air monitoring locations is given in **Figure 3-21** and the details of the locations are given in

Table 3-8.

Table 3-8 Details of Ambient Air Quality Monitoring Locations

Station Code	Location	Type of Wind	Distance (~km) from Project boundary	Azimuth Directions
A1	Project site	-	Within site	
A2	Kattupalli	c/w	1.44	N
A3	Kalanji	c/w	4.94	N
A4	Ennur	c/w	4.83	S
A5	Attippattu	c/w	5.43	WSW
A6	Movuttambedu	c/w	4.07	W
A7	Uranamedu	d/w	3.82	NW
A8	Tiruvellavayal	d/w	7.56	NW

*As per the IMD (India Meteorological Department), the prevailing wind direction is from the South-East, which is typically regarded as the upwind direction. In our study area, the upwind side corresponds to the seaside. Consequently, monitoring couldn't be effectively carried out on the upwind side.

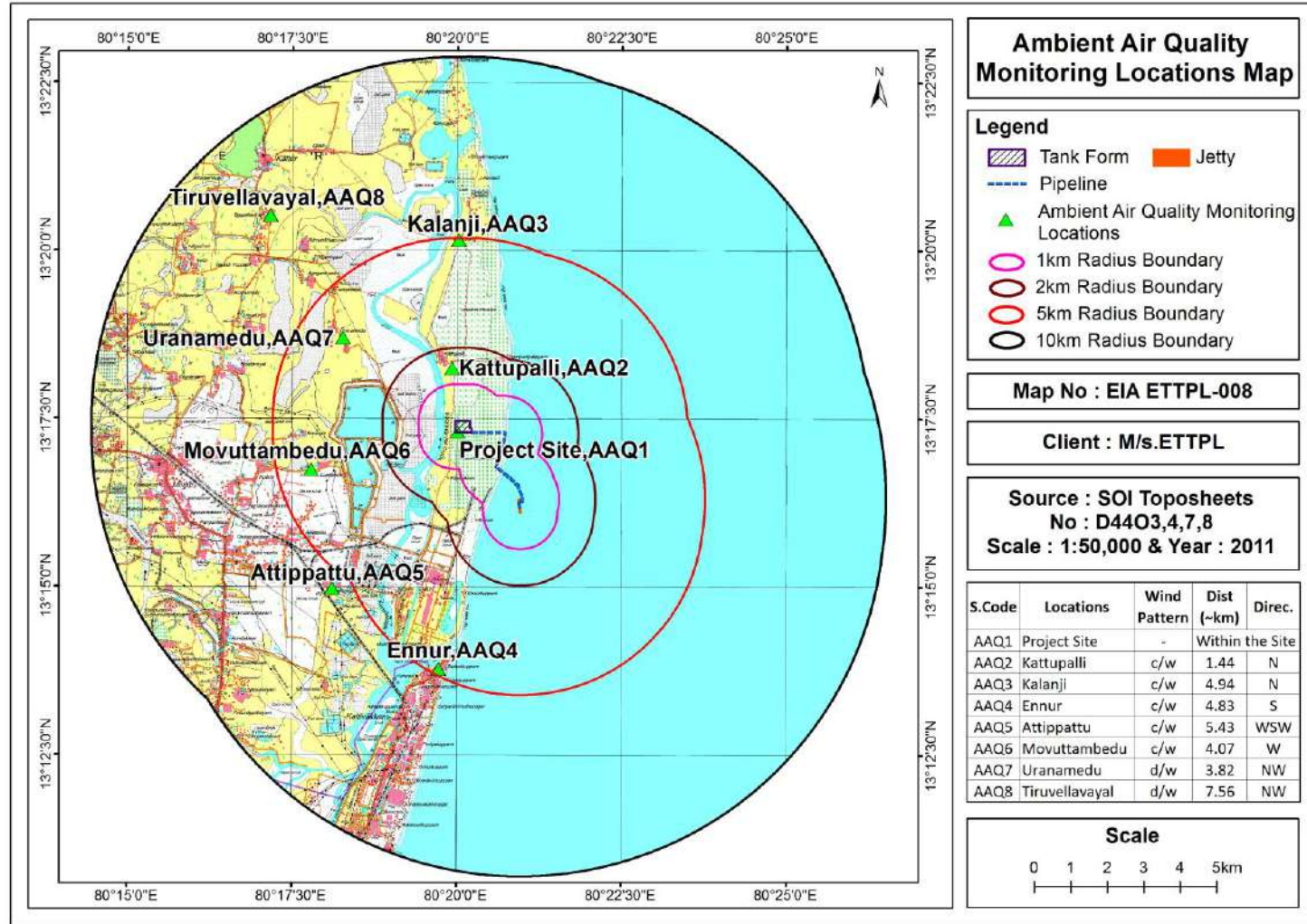


Figure 3-21 Map showing the Air monitoring locations

3.5.9 Ambient Air Quality Monitoring Techniques, Frequency and Methodology

Ambient air quality was monitored twice in a week for One (1) month (shall cover 4 weeks), i.e. (**March – May 2024**). PM10, PM2.5, SO2, NOx, CO, Pb, O3, NH3, C6H6, C20H12, As and Ni were monitored. Sampling was carried out as per Central Pollution Control Board (CPCB) monitoring guidelines at each location. Analytical methods used for analysis of parameters are given in **Table 3-9**.

Table 3-9 Analytical Methods for Analysis of Ambient Air Quality Parameters

S. No	Parameters	Analytical method	NAAQ standards: 2009		Sampling Time
1	Sulphur Dioxide (SO2), µg/m3	IS:5182(Part-2):2001	50 (Annual)	80(24 Hours)	24 Hours
2	Nitrogen Dioxide (NO2), µg/m3	IS: 5182 (Part - 6): 2006	40 (Annual)	80 (24 Hours)	24 Hours
3	Particulate Matter (PM2.5), µg/m3	IS: 5182 (Part - 23): 2006	40 (Annual)	60 (24 hours)	24 Hours
4	Particulate Matter (PM10), µg/m3	IS:5182 (Part– 23): 2006	60 (Annual)	100 (24 hours)	24 Hours
5	CO, mg/m3	IS:5182(Part–10):1999	2 (8 hours)	4 (1hour)	8 Hours
6	Pb, µg/m3	IS:5182(Part–22):2004	0.5(Annual)	1(24 hours)	24 Hours
7	O3, µg/m3	In house method (Spectrophotometric method) based on CPCB guidelines Volume1	100(8hours)	180 (1hour)	8 Hours
8	NH3, µg/m3	IS 5182 Part 25: 2018	100(Annual)	400(24 hours)	8 Hours
9	Benzene, µg/m3	IS 5182 Part 11: 2006	5 (Annual)	5 (Annual)	24 Hours

S. No	Parameters	Analytical method	NAAQ standards: 2009		Sampling Time
10	Benzo (a) pyrene, ng/m ³	IS 5182 Part 12: 2004	1 (Annual)	1 (Annual)	24 Hours
11	Arsenic, ng/ m ³	HECS-G/INS/SOP/ 041 Issue No.:01 Issue Date:01.03: 2021	6 (Annual)	6 (Annual)	24 Hours
12	Nickel, ng/ m ³	HECS-G/INS/SOP/ 041 Issue No.:01 Issue Date:01.03: 2021	20(Annual)	20 (Annual)	24 Hours
13	TVOC , ppmv	HECS-G/ENV/AAQ/SOP/005 Issue No.:01 Issue Date:02:07:2020	-	-	-
14	Methane Hydrocarbon	IS 5182 (Part 17)	-	-	8 Hours
15	Non-Methane Hydrocarbon	IS 5182 (Part 17)	-	-	8 Hours

3.5.9.1 Results and Discussions

The variations of the pollutant concentrations of PM₁₀, PM_{2.5}, SO₂, NO₂, CO, Pb, O₃, NH₃, C₆H₆, C₂₀H₁₂, As and Ni are compared with National Ambient Air Quality Standards (NAAQS), MoEF&CC Notification, November, 2009. Ambient Air Quality Monitoring Data (**March – May 2024**) for the study area is given in **Table 3-10** and trends of measured ambient concentration in the study area were graphically represented in **Figure 3-22**.

Table 3-10 Summary of the average baseline concentrations of pollutants

Parameters	Conc.	NAAQ Standards	Locations							
			Project Site	Kattupalli	Kalanji	Ennur	Attippattu	Movuttambedu	Urana medu	Tiruvellavayal
			A1	A2	A3	A4	A5	A6	A7	A8
PM10 Conc. ($\mu\text{g}/\text{m}^3$)	Min.	100 (24 Hours)	54.29	51.94	44.38	59.45	52.94	46.76	47.76	42.59
	Max.		77.37	74.02	63.25	84.73	75.45	66.64	68.07	60.69
	Avg.		65.11	62.28	53.22	71.29	63.48	56.08	57.28	51.07
	98th 'tile		76.93	73.59	62.88	84.24	75.01	66.25	67.67	60.34
PM2.5 Conc. ($\mu\text{g}/\text{m}^3$)	Min.	60 (24 Hours)	30.96	28.82	25.89	27.2	27.25	25.76	23.63	22.79
	Max.		44.13	41.08	36.89	38.77	38.84	36.71	33.68	32.48
	Avg.		37.13	34.57	31.04	32.63	32.69	30.89	28.34	27.33
	98th 'tile		43.87	40.84	36.68	38.55	38.62	36.5	33.48	32.29
SO2 Conc. ($\mu\text{g}/\text{m}^3$)	Min.	80 (24 Hours)	13.5	11.84	9.74	11.24	12.94	10.1	7.43	7.24
	Max.		19.24	16.87	13.89	16.02	18.45	14.4	10.59	10.32
	Avg.		16.2	14.2	11.69	13.48	15.52	12.12	8.92	8.69
	98th 'tile		19.13	16.78	13.81	15.92	18.34	14.32	10.53	10.26
NO2 Conc. ($\mu\text{g}/\text{m}^3$)	Min.	80 (24 Hours)	24.29	23.61	17.45	21.03	20.25	19.27	17.6	16.95
	Max.		34.62	33.65	24.87	29.98	28.86	27.47	25.09	24.16
	Avg.,		29.13	28.32	20.93	25.23	24.29	23.11	21.11	20.33
	98th 'tile		34.42	33.46	24.73	29.8	28.69	27.31	24.94	24.02
Lead (Pb) ($\mu\text{g}/\text{m}^3$)	Avg.	1	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ	BLQ (LOQ	BLQ (LOQ	BLQ (LOQ	BLQ (LOQ	BLQ (LOQ

Parameters	Conc.	NAAQ Standards	Locations							
			Project Site	Kattupalli	Kalanji	Ennur	Attippattu	Movuttambedu	Urana medu	Tiruvellavayal
			A1	A2	A3	A4	A5	A6	A7	A8
		(24 hour)			0.05)	0.05)	0.05)	0.05)	0.05)	0.05)
Carbon monoxide (CO) (mg/m ³)	Avg.	4 (1hour)	0.82	0.62	0.53	0.95	0.70	0.50	0.42	0.48
Ozone O ₃ (µg/m ³)	Avg.	180 (1hour)	10.53	10.21	10.09	10.08	10.98	12.72	10.07	10.68
Benzene(C ₆ H ₆) (µg/m ³)	Avg.	5(Annual)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)
Benzo (a) Pyrene(C ₂₀ H ₁₂) (a) , (ng/m ³)	Avg.	1 (Annual)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)
Arsenic (As) (ng/ m ³)	Avg.	6 (Annual)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)
Nickel as Ni (ng/m ³)	Avg.	20 (Annual)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)
Ammonia (NH ₃) (µg/m ³)	Avg.	400 (24 hour)	8.21	7.12	BLQ(LOQ 5)	6.89	BLQ(LOQ 5)	BLQ(LOQ 5)	BLQ(LOQ 5)	BLQ(LOQ 5)
TVOC (ppm)	Avg.	-	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)

Parameters	Conc.	NAAQ Standards	Locations							
			Project Site	Kattupalli	Kalanji	Ennur	Attippattu	Movuttambedu	Urana medu	Tiruvellavayal
			A1	A2	A3	A4	A5	A6	A7	A8
Methane HC (µg/m ³)	Avg.	-	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)
Non-Methane HC (µg/m ³)	Avg.	-	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)

Note: BLQ (Below Limit of Quantification), LOQ (Limit Of Quantification)

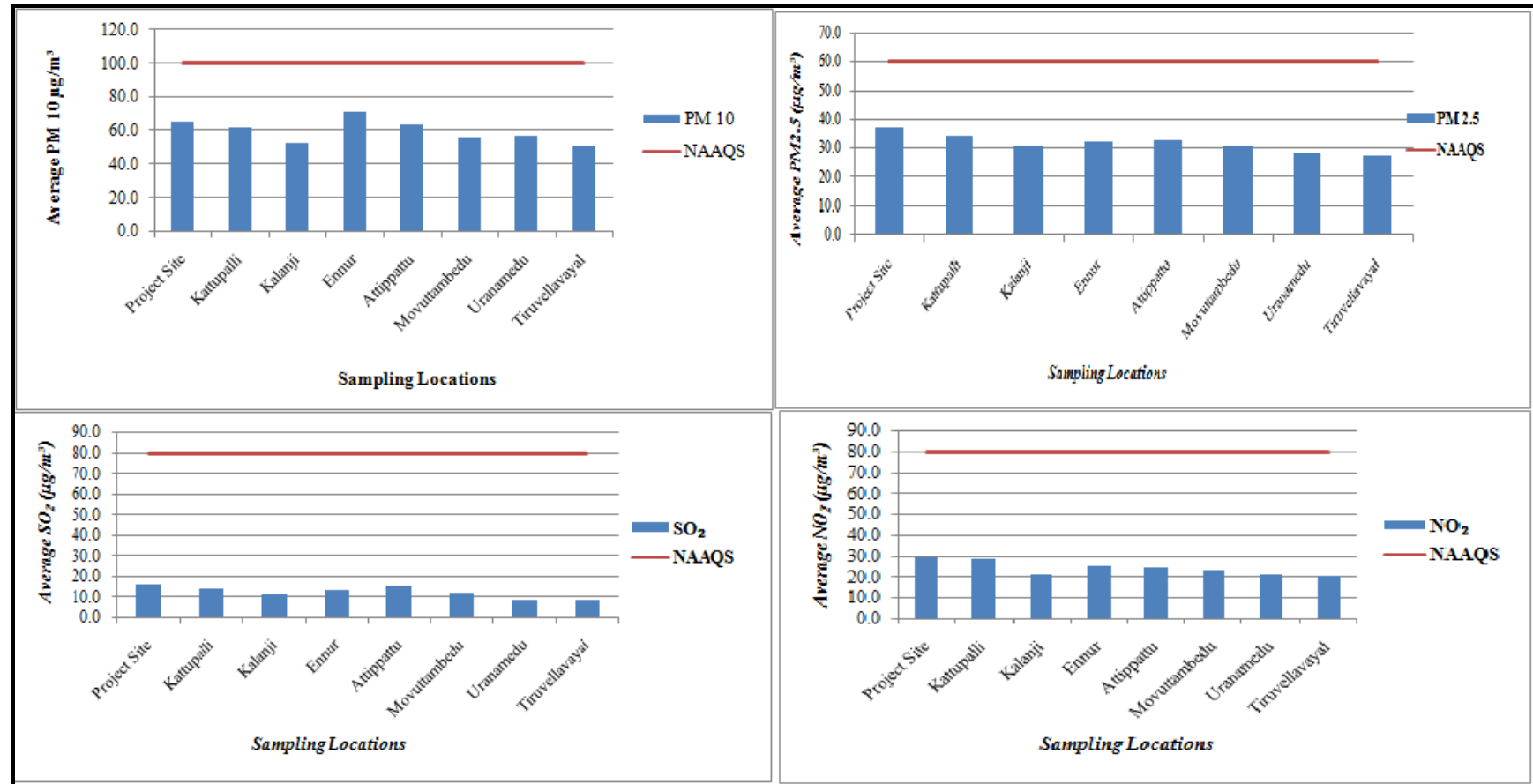


Figure 3-22: Trends of Measured Ambient Concentrations in the Study Area

3.5.10 Observations

. The average baseline levels of PM10 is **51.07 $\mu\text{g}/\text{m}^3$ to 71.29 $\mu\text{g}/\text{m}^3$** , PM2.5 is **27.33 $\mu\text{g}/\text{m}^3$ to 37.13 $\mu\text{g}/\text{m}^3$** , SO2 is **8.69 $\mu\text{g}/\text{m}^3$ to 16.20 $\mu\text{g}/\text{m}^3$** , NO2 is **20.33 $\mu\text{g}/\text{m}^3$ to 29.13 $\mu\text{g}/\text{m}^3$** , all the parameters are well within the National Ambient Air Quality at all monitoring locations during the study period **March – May 2024**.

3.6 Noise Environment -components and methodology

The prevailing ambient noise level at a particular location is nothing but the resultant (total) of all kinds of noise sources existing at various distances around that location. The ambient noise level at a location varies continuously depending on the type of surrounding activities.

Ambient noise levels have been established by monitoring noise levels at Eight (08) locations in and around 10Km distance from project area during the study period using precision noise level meter. The noise monitoring locations in the study area were selected after giving due consideration to the various land use categories. The land use categories include commercial, residential, rural and sensitive areas. Noise levels were recorded on an hourly basis for one complete day at each location using pre- calibrated noise levels. Map showing noise monitoring locations is **Figure 3-25**.

3.6.1 Results and Discussions

Based on the recorded hourly noise levels at each monitoring location, the day equivalent (Ld) and night equivalent (Ln) were calculated;

Ld: Average noise levels between 6:00 hours to 22.00 hours.

Ln: Average noise levels between 22:00 hours to 6.00 hours.

The comparison of day equivalent noise levels (Ld) and night equivalent noise levels (Ln) with the respective CPCB stipulated noise standards for various land use categories are shown in the **Table 3-11**.

Table 3-11 Day and Night Equivalent Noise Levels

S. No	Location	Location Code	Distance (km) from Project boundary	Azimuth Direction	Noise level in dB(A) Leq		CPCB Standard		Environmental Setting
					Day	Night	Lday (Ld)	LNight (Ln)	
1	Project site	N1	Within site		63.2	52.8	75	70	Industrial
2	Kattupalli	N2	1.44	N	54.3	43.2	55	45	Residential
3	Kalanji	N3	4.94	N	48.8	41.5	55	45	Residential
4	Ennur	N4	4.83	S	49.5	41.9	55	45	Residential
5	Attippattu	N5	5.43	WSW	61.6	51.8	75	70	Industrial
6	Movuttambedu	N6	4.07	W	51.3	43.7	55	45	Residential
7	Uranamedu	N7	3.82	NW	46.1	42.4	55	45	Residential
8	Tiruvellavayal	N8	7.56	NW	47.8	43.6	55	45	Residential

3.6.2 Observations

The observations of day equivalent and night equivalent noise levels at all locations are given below

In Industrial area's, noise levels varied from 61.6 to 63.2 dB(A) during day time and 51.8 to 52.8 dB(A) during night time, which is within prescribed limit by



CPCB (75 dB(A) Day time & 70 dB(A) Night time) at the proposed site & attippattu location .

In residential area's, noise levels varied from 46.1 dB(A) to 54.3 dB(A)) during day time and night time noise levels varied from 41.5 dB(A) to 43.7 dB(A) across the sampling stations. The field observations during the study period indicate that the ambient noise levels is within the prescribed limit by CPCB (55 dB(A) Day time & 45 dB(A) Night time).

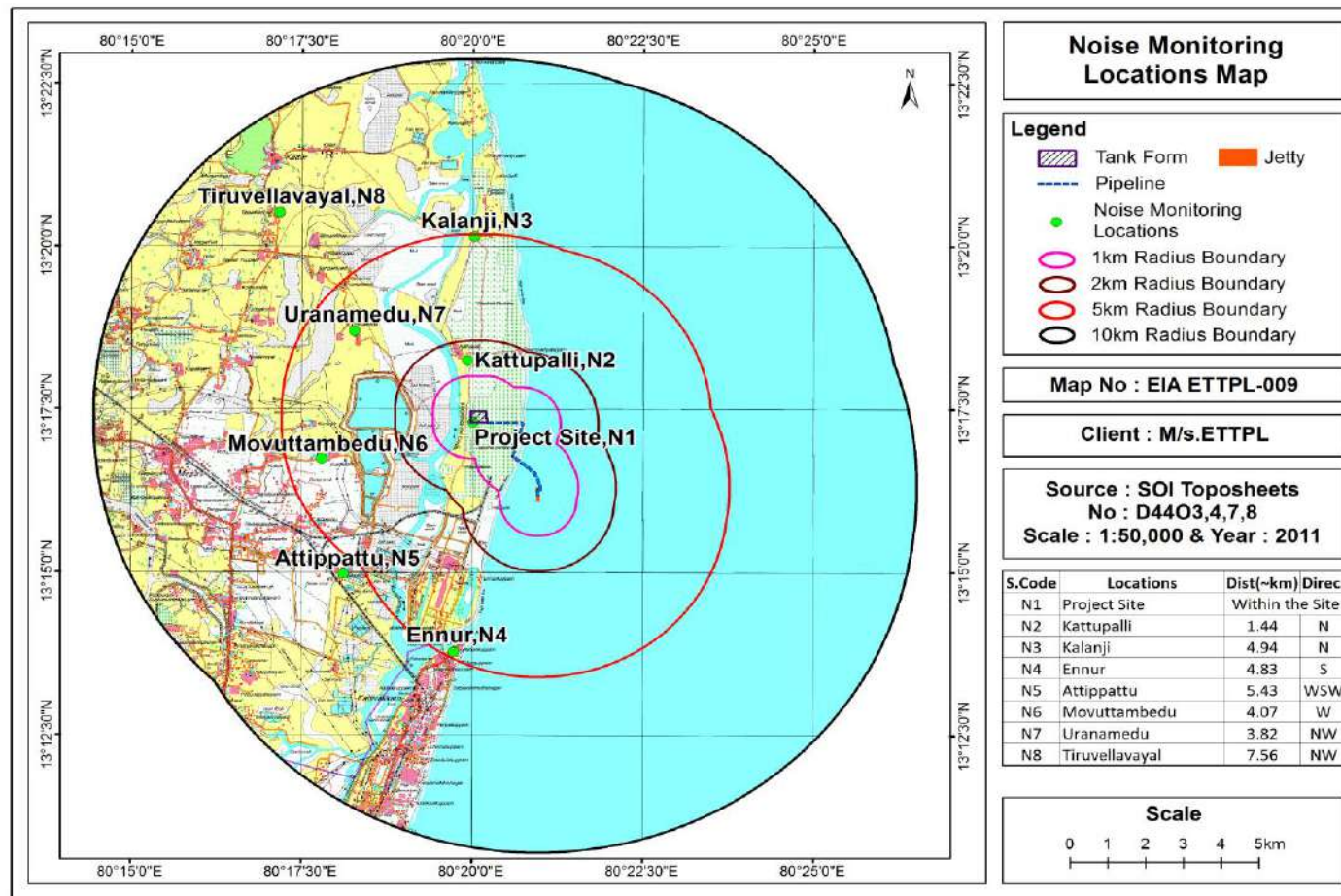


Figure 3-23 Map showing the Noise Monitoring locations

3.7 Water Environment components and methodology

3.7.1 Surface Water Resources

Araniyar, Korattalayar, Cooum, Nagari and Nandhi are the important rivers. The drainage pattern, in general, is dendritic. All the rivers are seasonal and carry substantial flows during monsoon period. Korattalayar river water is supplied to Cholavaram and Red Hill tanks by constructing an Anicut at Vellore Tambarambakkam. After filling a number of tanks on its further course, the river empties into the Ennore creek a few kilometres north of Chennai. The Cooum River, flowing across the southern part of the district, has its origin in the surplus waters of the Cooum tank in Tiruvallur Taluk and also receives the surplus waters of a number of tanks. It feeds the Chembarambakkam tank through a channel. It finally drains into the Bay of Bengal.

Source: http://cgwb.gov.in/District_Profile/TamilNadu/TIRUVALLUR.pdf

(Ref: Government of India Ministry of Water Resources Central Ground Water Board South Eastern Coastal Region Chennai, “District Ground Water Brochure Tiruvallur District”)

3.7.2 Surface Water Quality Assessment

Water quality monitoring and assessment can be used to determine ambient water quality, the extent and causes of a water quality problem, or to measure the effectiveness of best management practices being implemented in water system. Monitoring helps to determine the trends in the quality of the aquatic environment and the impact due to the release of contaminants, other anthropogenic activities, and/or by waste treatment operations (impact monitoring). To establish the baseline status of water environment, the representative sampling locations for surface water within a radial distance of 10Km from project site have been selected as per CPCB guidelines of Water Quality Monitoring through an adequate survey of the project area. Test methods used for the analysis of water quality parameters is given in **Table 3-12**. Water sampling location are given in **Table 3-13**.

Table 3-12 Test methods used for the analysis of water quality parameters

S. No	Parameter Measured	Test Method
1	Colour	IS:3025 (Part- 4) 1983
2	Turbidity	IS 3025(Part - 10):1984
3	pH	IS:3025 (Part - 11): 1983
4	Conductivity	IS:3025 (Part - 14): 1983
5	Total Dissolve Solids	IS:3025:1(Part - 16) 1984

S. No	Parameter Measured	Test Method
6	Total Suspended Solids	IS 3025 (Part - 17) 1984
7	Alkalinity as CaCO ₃	IS:3025,1 (Part - 23) 1986
8	Total Hardness as CaCO ₃	IS:3025 (Part - 21) 1983
9	Sodium	IS:3025,5(Part - 45) 1993
10	Potassium	IS:3025,5(Part - 45) 1993
11	Calcium as Ca	IS 3025 (Part - 40):1991
12	Magnesium as Mg	IS 3025 (Part - 46) 1994
13	Chloride	IS 3025 (Part - 32):1988
14	Sulphate SO ₄	IS 3025(Part - 24):1986
15	Nitrate as NO ₃	ASTM(Part - 31)1978
16	Phosphate	IS 3025 (Pt 45) 1993
17	Fluorides as F	IS 3025 (Part - 60):2008
18	Arsenic	IS 3025:(Part-37):1988
19	Boron	IS:3025 (Part - 57):2003
20	Cadmium	IS 3025 (Part - 41)1991
21	Chromium, Total	IS:3025 (Part - 52) 2003
22	Copper	IS:3025 (Part - 42)1992
23	Lead	IS:3025 (Part - 47) 1994
24	Manganese	IS 3025:(Part - 59):2006
25	Mercury	IS 3025 (Part48):1994
26	Nickel	IS 3025:(Part-54):2003
27	Selenium	IS 3025 Part (56)2003
28	Zinc	IS:3025 (Part - 49) 1994

S. No	Parameter Measured	Test Method
29	Dissolved Oxygen	IS:3025 (Part - 38)1989
30	BOD	5210B APHA22nd Edn 2012
31	COD	IS:3025 (Part-58)-2006
32	Total Coliform	IS 1622: 2019

The prevailing status of surface water quality has been assessed during the study period. Surface water quality results are provided in **Table 3-14**. A map showing the surface water monitoring locations is given in **Figure 3-24**.

Table 3-13 Details of Surface water sampling locations

S.No	Water bodies	Location code	Distance from project boundary (~Km)	Direction from project boundary
1	Kosisttalaiyar R u/s	SW1	5.72	N
2	Marine sample near Kalanji	SW2	4.99	N
3	Marine sample near Ennore	SW3	5.91	S
4	Kosisttalaiyar R d/s	SW4	4.33	SW
5	Buckingham Canal d/s	SW4	1.75	W
6	Tiruvellavayal	SW6	6.65	NW
7	Kattur Lake (Mangrove swamp)	SW7	8.69	NW
8	Buckingham Canal u/s	SW8	1.32	NNW

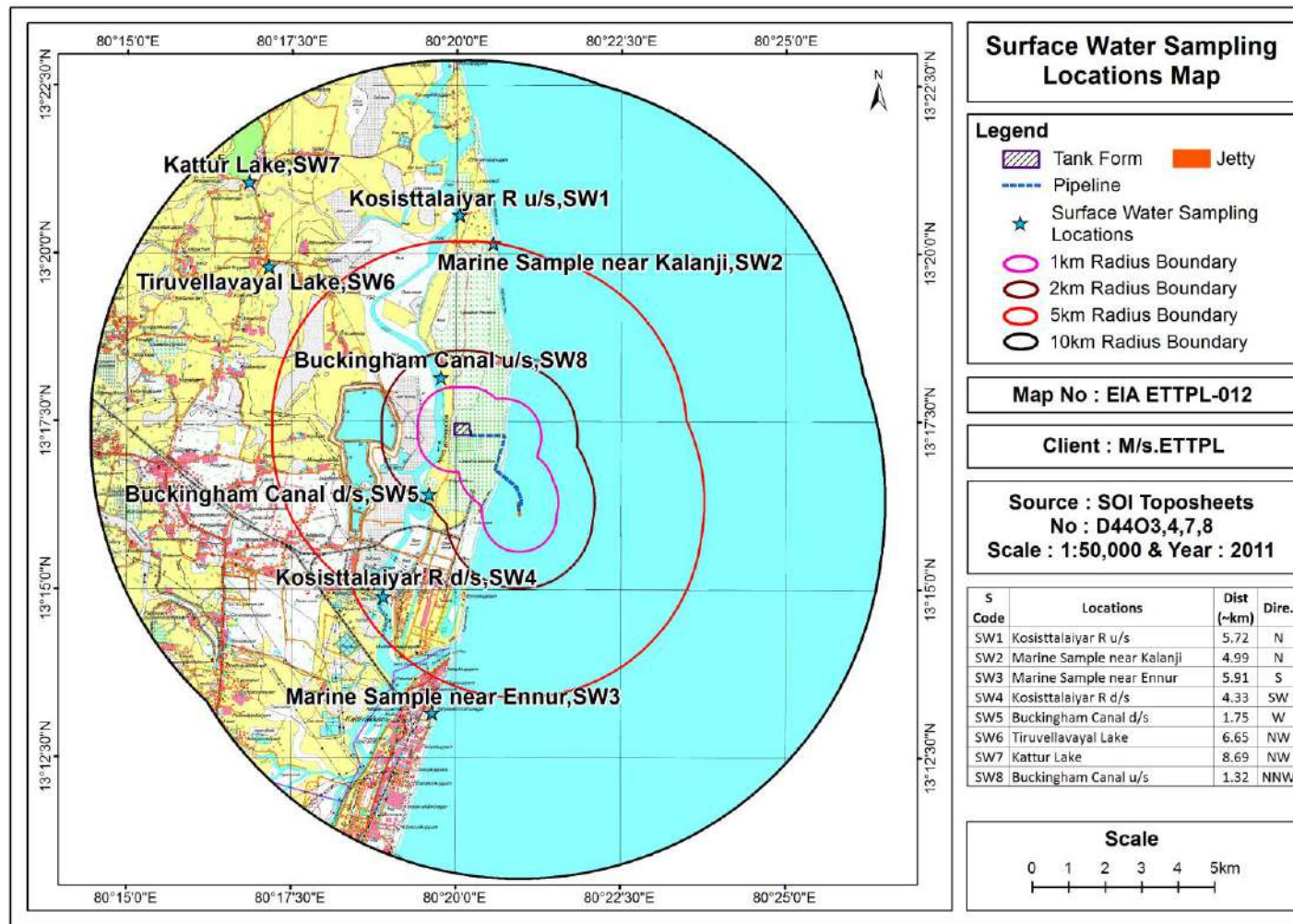


Figure 3-24: Map showing the surface water monitoring locations

Table 3-14: Surface water Monitoring Results

S. No	Parameter	Unit	Surface water standards (IS 2296 Class-A)	Kosisttalaiya r River u/s	Kosisttalaiyar River d/s	Buckingha m Canal d/s	Tiruvellavay al lake	Kattur lake (Mangrove Swamp)	Buckingha m Canal u/s
				SW 1	SW 4	SW 5	SW 6	SW7	SW 8
1	Turbidity	NTU	1	1.1	3.2	3.0	5.1	20.1	7.1
2	pH (at 25°C)	--	6.5-8.5	7.32	7.91	7.92	7.13	7.93	7.87
3	Electrical Conductivity	µS/cm	-	14320	14780	15376	2915	2970	14964
4	Total Dissolved Solids	mg/l	500	8000	8257	8495	1584	1611	8088
5	Total Suspended Solids	mg/l	-	7	24	21	36	143	23
6	Total Alkalinity as CaCO ₃	mg/l	-	90	154	142	231	173	158
7	Total Hardness as CaCO ₃	mg/l	300	1796	1885	1938	586	572	1965
8	Sodium as Na	mg/l	-	2155	2210	2278	358	379	2155
9	Potassium as K	mg/l	-	150.8	154.7	159.4	25.1	26.5	150.9
10	Calcium as Ca	mg/l	-	418.12	438.34	451.48	136.67	133.72	457.63
11	Magnesium as Mg	mg/l	-	183.3	192.4	197.8	59.8	58.4	200.5
12	Chloride as Cl	mg/l	250	3591.52	3684.76	3796.47	597.18	632.24	3592.37
13	Sulphate as SO ₄	mg/l	400	1416.85	1453.54	1497.73	235.55	249.36	1417.24
14	Nitrate as NO ₃	mg/l	20	3.80	5.90	4.10	6.20	2.90	4.20
15	Phosphate as PO ₄	mg/l	-	0.11	0.59	0.23	0.04	0.06	0.25
16	Fluorides as F	mg/l	1.5	0.71	0.78	0.73	0.72	0.77	0.73

S. No	Parameter	Unit	Surface water standards (IS 2296 Class-A)	Kosisttalaiya r River u/s	Kosisttalaiyar River d/s	Buckingham Canal d/s	Tiruvellavayal lake	Kattur lake (Mangrove Swamp)	Buckingham Canal u/s
				SW 1	SW 4	SW 5	SW 6	SW7	SW 8
17	Cyanide	mg/l	0.05	BLQ (LOQ 0.01)	BLQ (LOQ 0.01)	BLQ (LOQ 0.01)	BLQ (LOQ0.01)	BLQ (LOQ 0.01)	BLQ (LOQ0.01)
18	Arsenic	mg/l	0.05	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)
19	Boron as B	mg/l	-	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)
20	Cadmium as Cd	mg/l	0.01	BLQ (LOQ 0.001)	BLQ (LOQ 0.001)	BLQ (LOQ 0.001)	BLQ (LOQ 0.001)	BLQ (LOQ 0.001)	BLQ (LOQ 0.001)
21	Chromium, Total	mg/l	0.05	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
22	Copper as Cu	mg/l	1.5	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
23	Total Iron	mg/l	0.3	0.03	0.03	BLQ(LOQ 0.02)	0.05	0.04	0.03

S. No	Parameter	Unit	Surface water standards (IS 2296 Class-A)	Kosisttalaiya r River u/s	Kosisttalaiyar River d/s	Buckingha m Canal d/s	Tiruvellavay al lake	Kattur lake (Mangrove Swamp)	Buckingha m Canal u/s
				SW 1	SW 4	SW 5	SW 6	SW7	SW 8
24	Lead as Pb	mg/l	0.1	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
25	Manganese as Mn	mg/l	0.5	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)
26	Mercury	mg/l	0.001	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)
27	Nickel as Ni	mg/l	-	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)
28	Selenium as Se	mg/l	0.01	0.009	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	0.019	0.011	BLQ(LOQ 0.005)
29	Zinc	mg/l	15	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
30	Dissolved Oxygen	mg/l	6	6.1	5.4	5.5	6.0	5.8	5.6
31	Chemical Oxygen Demand as O ₂	mg/l	-	16	32	28	20	24	24
32	BOD, 3 days @ 27°C as O ₂	mg/l	2	2	4	4	2	3	3

(Note: BLQ – Below Limit of Quantification; LOQ – Limit Of Quantification)



Marine Water Under the Surface Water Samples

S. No	Parameter	Unit*	Marine sample near Kalanji	Marine sample near Ennore
			SW 2	SW 3
1	Turbidity	NTU	3.2	3.1
2	pH (at 25°C)	--	8.12	8.07
3	Electrical Conductivity	µS/cm	50743	49512
4	Total Dissolved Solids	mg/l	32116	31337
5	Total Suspended Solids	mg/l	18	19
6	Total Alkalinity as CaCO ₃	mg/l	114	137
7	Total Hardness as CaCO ₃	mg/l	6016	6153
8	Sodium as Na	mg/l	10369.2	10087.8
9	Potassium as K	mg/l	345.64	336.26
10	Calcium as Ca	mg/l	397.31	406.35
11	Magnesium as Mg	mg/l	1221.0	1248.8
12	Chloride as Cl	mg/l	17282	16813

S. No	Parameter	Unit*	Marine sample near Kalanji	Marine sample near Ennore
			SW 2	SW 3
13	Sulphate as SO ₄	mg/l		
14	Nitrate as NO ₃	mg/l	2419.48	2353.82
15	Phosphate as PO ₄	mg/l	1.9	2.1
16	Fluorides as F	mg/l	0.05	0.07
17	Cyanide	mg/l	1.3	1.4
18	Arsenic	mg/l	BLQ (LOQ 0.01)	BLQ (LOQ 0.01)
19	Boron as B	mg/l	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)
20	Cadmium as Cd	mg/l	BLQ (LOQ 0.1)	BLQ (LOQ 0.1)
21	Chromium, Total	mg/l	BLQ (LOQ 0.01)	BLQ (LOQ 0.01)
22	Copper as Cu	mg/l	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)
23	Total Iron	mg/l	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
24	Lead as Pb	mg/l	0.06	0.07
25	Manganese as Mn	mg/l	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)

S. No	Parameter	Unit*	Marine sample near Kalanji	Marine sample near Ennore
			SW 2	SW 3
26	Mercury	mg/l	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)
27	Nickel as Ni	mg/l	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)
28	Selenium as Se	mg/l	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
29	Zinc	mg/l	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
30	Dissolved Oxygen	mg/l	6.1	6.2
31	Chemical Oxygen Demand as O ₂	mg/l	52	48
32	BOD, 3 days @ 27°C as O ₂	mg/l	9	8

*water quality standards for coastal waters marine outfall-Primary Water Quality Criteria For Class SW-I Waters

MARINE WATER QUALITY STANDARDS FOR COASTAL WASTERS MARINE OUTFALL

S.No.	class	Designated best use
1.	SW-I (see Table 1.1)	Salt pans, Shell fishing, Mariculture and Ecologically Sensitive Zone.
2.	SW-II (see Table 1.2)	Bathing, Contact Water Sports and Commercial fishing.
3.	SW-III(see Table 1.3)	Industrial cooling, Recreation (non-contact) and Aesthetics.
4.	SW-IV (see Table 1.4)	Harbour
5.	SW-V (see Table 1.5)	Navigation and Controlled Waste Disposal.

3.7.3 Results and Discussions

Surface water sample results are discussed below:

- pH in the collected surface water samples varies between 7.13 to 7.93 and pH in the collected marine water samples varies between 8.07 to 8.12.
- The Total Dissolved Solids (TDS) value of collected surface water sample ranges from 1584 mg/l to 8495 mg/l and TDS value of collected marine water sample ranges from 31337 mg/l to 32116 mg/l.
- The Total hardness value of the collected surface water sample ranges between 572 mg/l to 1965 mg/l and Total hardness value of the collected marine water sample ranges between 6016 mg/l to 6153 mg/l
- BOD value of the collected surface water sample ranges from upto 4 mg/l and BOD in the marine water sample is upto 9 mg/l.
- COD value of collected surface water varies from upto 32 mg/l and COD of collected marine water sample ranges from upto 52 mg/l. Higher values of COD at Kosisttalaiyar River d/s, Buckingham Canal d/s may indicate organic Pollution.
- The concentration of heavy metals like As, Cd, Cr, Pb, Mn, Hg, Ni and Se are within the limits of IS 2296:1992.

3.7.4 Ground Water Resources

In view of the comparatively high level of ground water development in the major part of the district and the quality problems due to geogenic and anthropogenic factors, it is necessary to exercise caution while planning further development of available ground water resources in the district. The yields of dug wells in crystalline and Gondwana formations are improved at favourable locations by construction of extension bores varies from 20 to 40m. In recent years, a large number of bore wells have also been drilled by farmers for irrigation purposes. Dug wells with extension bores wherever necessary is ideal for hard rock areas whereas large diameter dug wells with radials is suitable for alluvial areas.

It is observed that ground water in the phreatic zone may cause high to very high salinity hazard and medium to high alkali hazard when used for irrigation.

The yield of dug wells range from Tiruvallur District Depth of Water Level on Pre Monsoon & post Monsoon is given in **Figure 3-25**.

Source: <blob:https://acrobat.adobe.com/abee91b2-ba50-4f7c-9aa7-3364614455a5>

(Ref: Government of India Ministry of Water Resources Central Ground water Board, District Ground Water Brochure Tiruvallur District, Tamil Nadu")

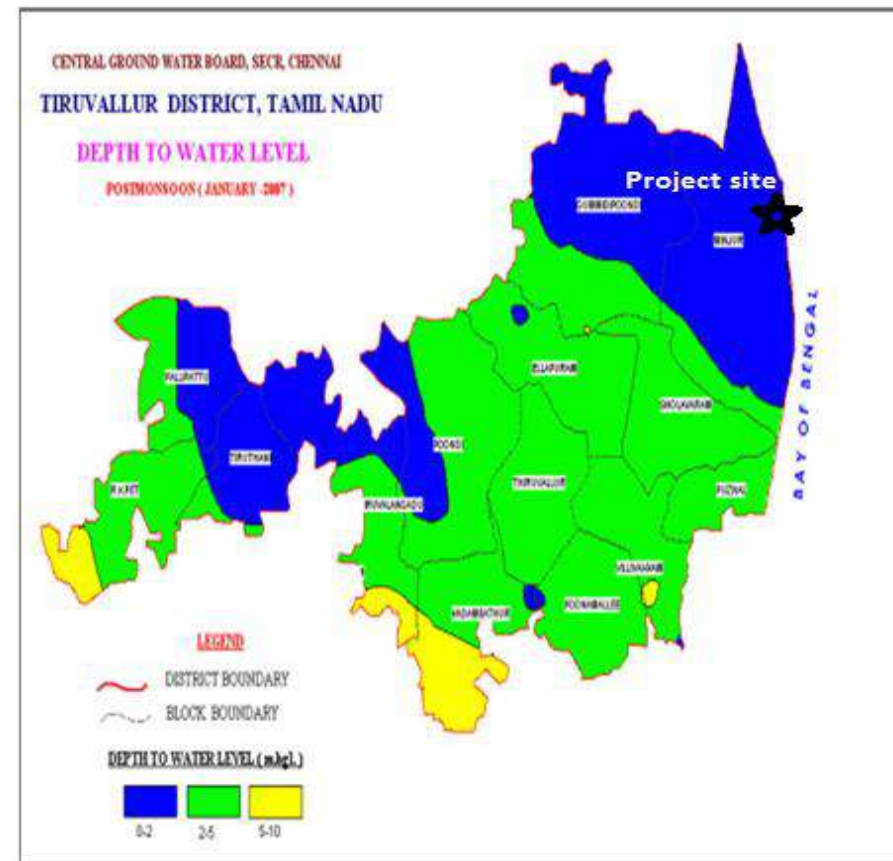
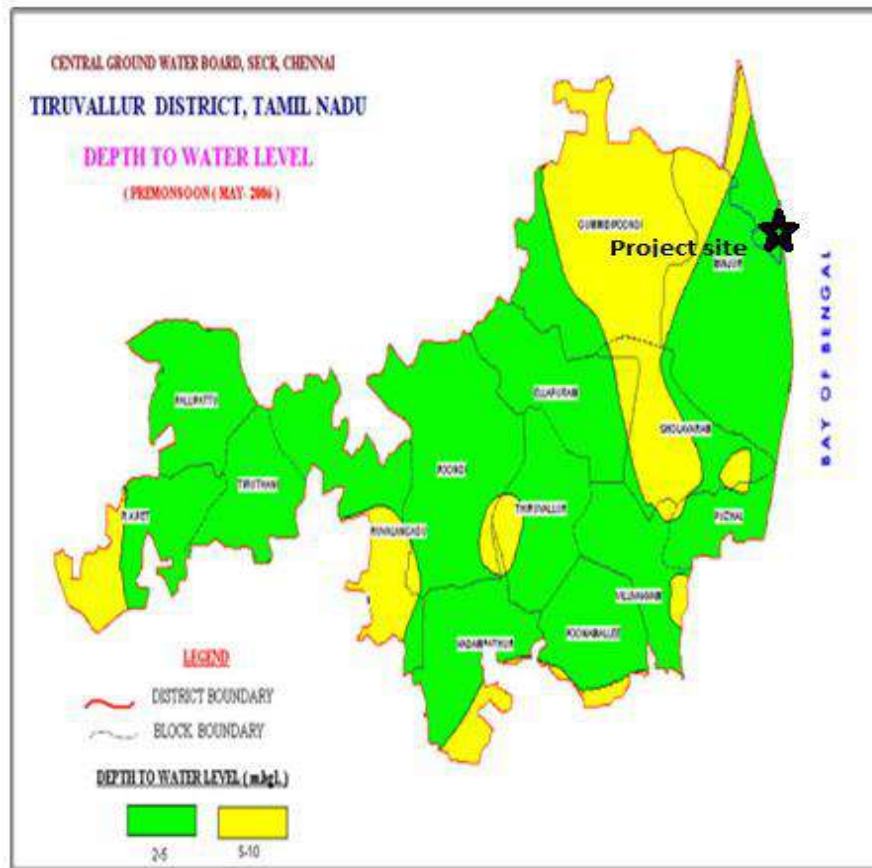


Figure 3-25 Depth to water level of Tiruvallur District

3.7.5 Ground Water Quality

Total Eight (08) ground water monitoring locations were identified for assessment in different villages around the project site based on the usage of sub surface water by the settlements/ villages in the study area. The groundwater results are compared with the acceptable and permissible water quality standards as per IS: 10500 (2012) for drinking water. Groundwater quality monitoring locations and results are given in **Table 3-15** and

Table 3-16 A map showing the groundwater monitoring locations is given in **Figure 3-26**.

Table 3-15 Details of Groundwater Quality Monitoring Locations

Station Code	Location	Distance (km) from Project boundary	Azimuth Directions
GW1	Project site	Within site	
GW2	Kattupalli	1.44	N
GW3	Kalanji	4.94	N
GW4	Ennur	4.83	S
GW5	Attippattu	5.43	WSW
GW6	Movuttambedu	4.07	W
GW7	Uranamedu	3.82	NW
GW8	Tiruvellavayal	7.56	NW

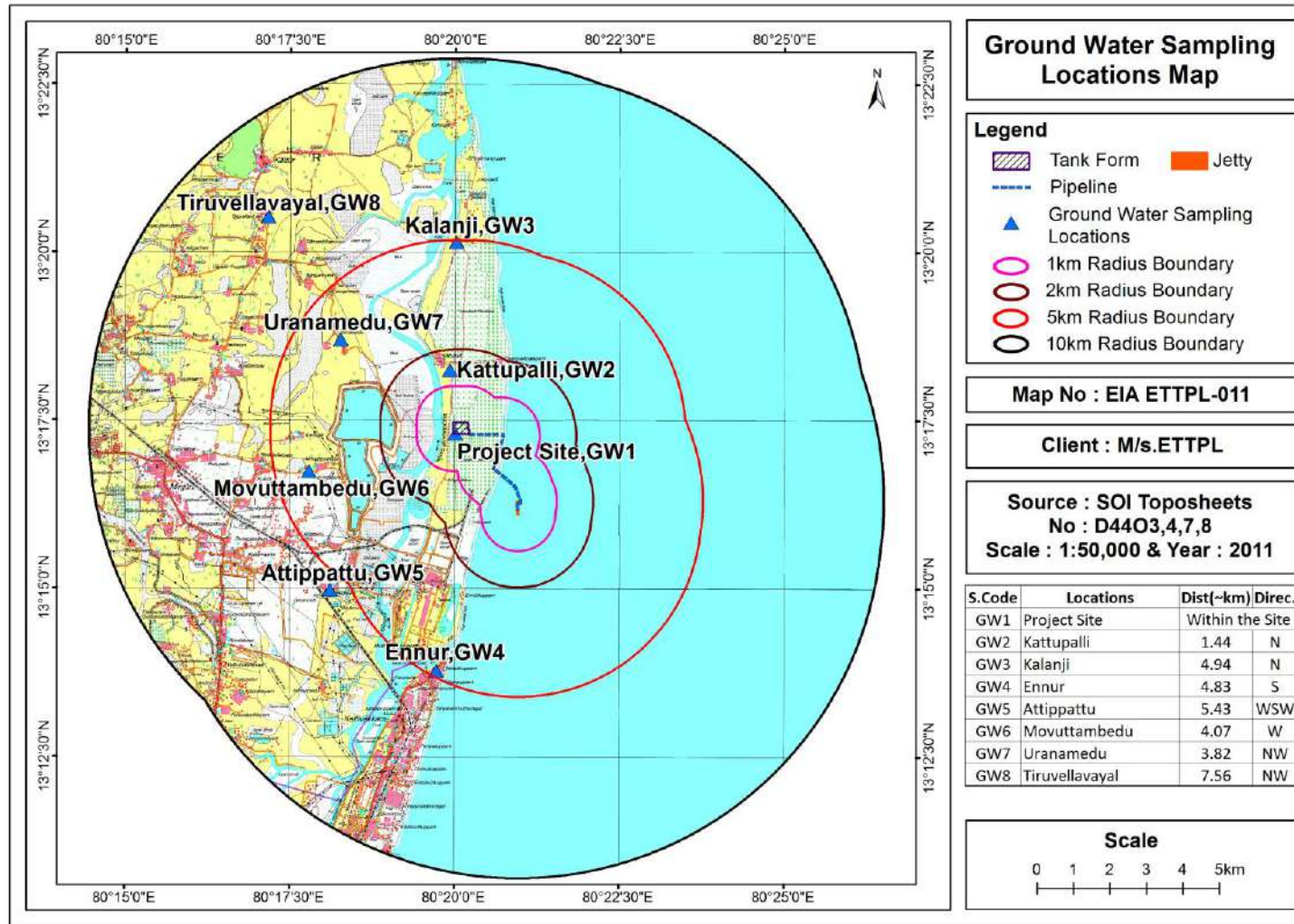


Figure 3-26 Map showing the groundwater monitoring locations

Table 3-16 Ground Water Monitoring Results

S. No	Parameters	Unit	Drinking water Standard (IS 10500: 2012) Acceptable Limit	Drinking water Standard (IS 10500: 2012) Permissible Limit	Project site	Kattupalli	Kalanji	Ennur	Attippattu	Movuttambu	Uranamedu	Tiruvellaval
					GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
1	Colour	Hazen	5	15	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)
2	Turbidity	NTU	1	5	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
3	pH	--	6.5-8.5	NR	7.12	7.89	7.91	7.85	7.62	7.75	7.23	7.21
4	Conductivity	µS/cm	-	-	994	975	734	741	705	716	804	619
5	Total Dissolve Solids	mg/l	500	2000	518	510	436	439	425	427	430	368



6	Total Suspended Solids	mg/l	-	-	BLQ(LOQ 1)	BLQ(LO Q 1)	BLQ(LO Q 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)
7	Alkalinity as CaCO3	mg/l	200	600	240	210	140	126	120	130	230	110
8	Total Hardness as CaCO3	mg/l	200	600	361	366	240	213	225	224	311	183
9	Sodium as Na	mg/l	-	-	51	41	62	75	63	65	42	60
10	Potassium as K	mg/l	-	-	5	4	5	6	3	6	3	5
11	Calcium as Ca	mg/l	75	200	83.92	85.08	55.79	49.51	52.3	52.07	72.3	42.54
12	Magnesium as Mg	mg/l	30	100	36.8	37.4	24.5	21.7	23.0	22.9	31.7	18.7
13	Chloride as Cl	mg/l	250	1000	118.5	132.8	124.6	127.8	127.8	128.4	85.6	108.7
14	Sulphate SO4	mg/l	200	400	47.4	54.45	47.35	57.2	50.79	51.56	34.05	46.78
15	Nitrate as NO3	mg/l	45	NR	4.3	3.05	3	4.9	5.8	2.6	2.2	3.1
16	Fluorides as F		1	1.5	0.52	0.41	0.32	0.31	0.37	0.2	0.36	0.28
17	Cyanide	mg/l	0.05	NR	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
18	Arsenic as As	mg/l	0.01	0.05	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
19	Boron as B	mg/l	0.5	1.0	BQL(LOQ 0.1)	BQL(LO Q 0.1)	BQL(LO Q 0.1)	BLQ(LOQ 0.1)	BQL(LOQ 0.1)	BQL(LOQ 0.1)	BQL(LOQ 0.1)	BLQ(LOQ 0.1)
20	Cadmium as Cd	mg/l	0.003	NR	BQL(LOQ 0.001)	BQL(LO Q 0.001)	BQL(LO Q 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)



21	Chromium as Cr	mg/l	0.05	NR	BQL(LOQ 0.01)	BQL(LO Q 0.01)	BQL(LO Q 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)
22	Copper as Cu	mg/l	0.05	1.5	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LO Q 0.01)	BQL(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BQL(LOQ 0.01)
23	Lead as Pb	mg/l	0.01	NR	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
24	Manganese as Mn	mg/l	0.1	0.3	BLQ(LOQ 0.05)	BLQ(LO Q 0.05)	BLQ(LO Q 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)
25	Mercury	mg/l	0.001	NR	BLQ(LOQ 0.0005)	BLQ(LO Q 0.0005)	BLQ(LO Q 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)
26	Nickel as Ni	mg/l	0.02	NR	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
27	Selenium as Se	mg/l	0.01	NR	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
28	Zinc as Zn	mg/l	5	15	BLQ(LOQ 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)

(Note: BLQ – Below Limit of Quantification; LOQ – Limit Of Quantification; NR – No Relaxation)

3.7.6 Results and Discussions

A summary of analytical results are presented below:

- The ground water results of the study area indicate that the pH range varies between 7.12 and 7.91. It is observed that the pH range is within the permissible limit of IS 10500:2012.
- The Total Dissolved Solids range of the collected ground water sample is varied between 368 mg/l – 518 mg/l. All the samples are within the permissible limit of IS 10500: 2012.
- The acceptable limit of the chloride content is 250mg/l and permissible limit is 1000 mg/l. The chloride content in the collected ground water samples in the study area ranges between 85.6 mg/l – 132.8 mg/l. It is observed that all the samples are within the permissible limit of IS 10500:2012.
- The acceptable limit of the sulphate content is 200mg/l and permissible limit is 400mg/l. the sulphate content in the collected ground water samples in the study area is varied between 34.05 mg/l – 57.2 mg/l. It is observed that all the samples are meeting the acceptable limit of the IS 10500: 2012.
- The Total hardness ranges is between 183 mg/l – 366 mg/l for ground water samples. It is observed that all the samples are within the permissible limit of the IS 10500: 2012.
- It is observed that all ground water sample collected within the study area are meeting the drinking water standards IS 10500:2012.

3.8 Soil as a resource and its quality

Soils in the area have been classified into i) Red soil ii) Black soil iii) Alluvial soil iv) colluvial soil. The major part is covered by Red soil of red sandy/clay\ loam type. Ferruginous red soils are also seen at places. Black soils are deep to very deep and generally occur in the depressions adjacent to hilly areas, in the western part. Alluvial soils occur along the river courses and eastern part of the coastal areas. Sandy coastal alluvium (arenaceous soil) are seen all along the sea coast as a narrow belt. Soil analysis was carried as per IS: 2720 methods. Soil quality monitoring locations & results are given in

Table 3-17 & Table 3-18 . Map showing the soil monitoring locations is given in Figure 3-27.

Source: blob:<https://acrobat.adobe.com/abee91b2-ba50-4f7c-9aa7-3364614455a5>

(Ref: Government of India Ministry of Water Resources Central Ground water Board, District Ground Water Brochure Tiruvallur District, Tamil Nadu”)

Table 3-17 Soil & Sediment Quality Monitoring Locations

Location Code	Location	Distance (Km) w.r.t project site	Direction w.r.t. project site
S1	Project site	Within site	
S2	Kattupalli	1.44	N
S3	Kalanji	4.94	N
S4	Ennur	4.83	S
S5	Attippattu	5.43	WSW
S6	Movuttambedu	4.07	W
S7	Uranamedu	3.82	NW
S8	Tiruvellavayal	7.56	NW

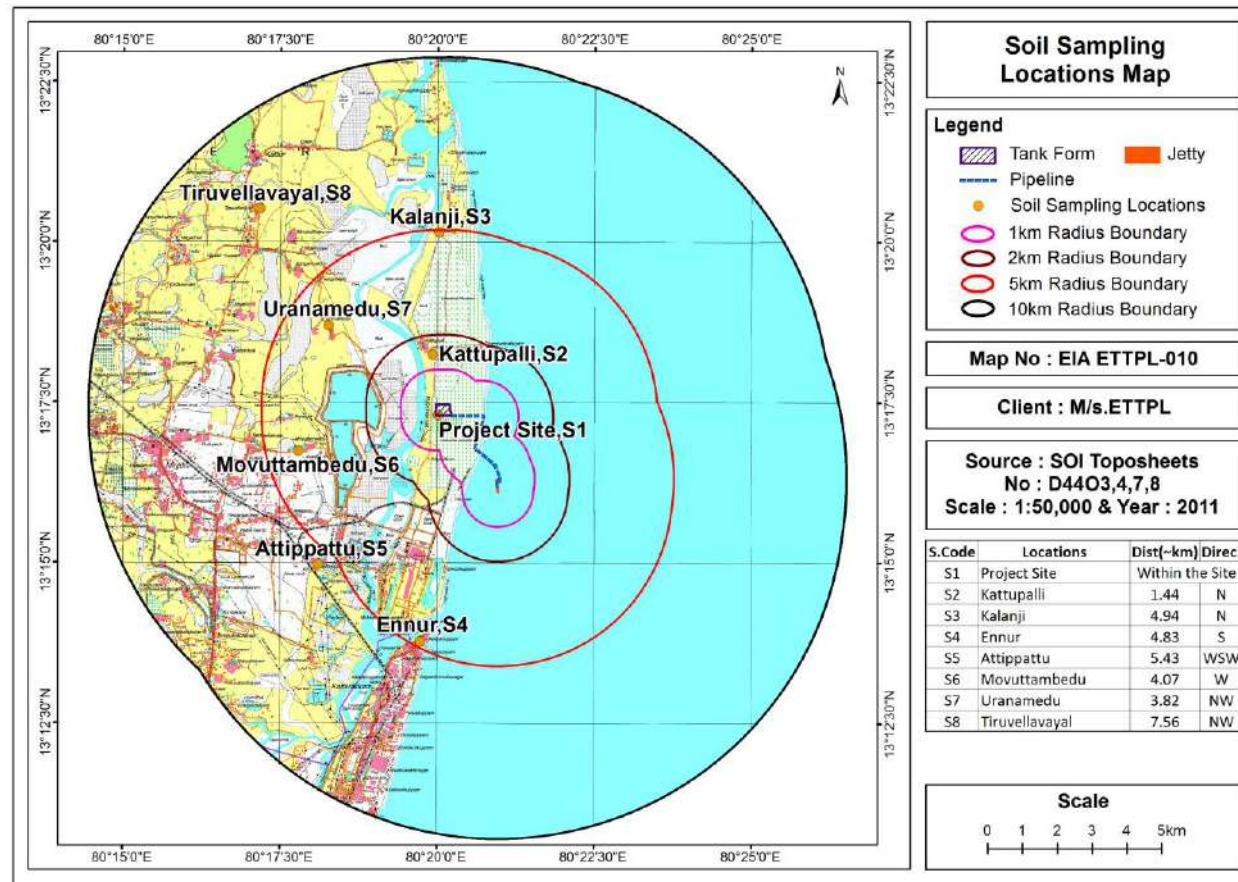


Figure 3-27 Map showing the soil monitoring locations

Table 3-18 Soil Results

S. No	Parameters	Units	Project site	Kattupalli	Kalanji	Ennur	Attipattu	Movuttam bedu	Uranam bedu	Tiruvellaval
			S1	S2	S3	S4	S5	S6	S7	S8
1	Soil Texture	-	Sand	Sand	Sandy loam	Sand	Sandy loam	Sandy loam	Sandy loam	Sandy Loam
2	Sand	%	90	91.32	65.37	89.56	60.89	54.55	68.33	69.1
3	Silt	%	8	7.29	16.69	6.3	22.8	17.89	23.08	24.4
4	Clay	%	2	1.39	17.94	4.14	16.31	27.56	8.59	6.5
5	pH	-	7.12	7.35	7.39	7.32	7.34	7.24	7.17	7.23
6	Electrical conductivity	µS/cm	1208	1052	1070	1089	947	916	854	756
9	Nitrogen as N	mg/kg	119.3	83.8	121.3	114	85.9	78.2	101.3	69.2
10	Phosphorus	mg/kg	17.0	12.0	17.3	16.3	12.3	11.2	14.5	9.9
11	Potassium	mg/kg	63.9	44.9	65.0	61.1	46.0	41.9	54.3	37.1
12	Boron	mg/kg	BLQ(LO Q 1)	BLQ(LOQ 1)	BLQ(LO Q 1)	1.33	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LO Q 1)	BLQ(LOQ 1)
13	Cadmium	mg/kg	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)
14	Porosity	-	0.39	0.38	0.43	0.38	0.43	0.45	0.44	0.43
15	Water Holding Capacity	%	4.1	4.3	20.5	15.5	20.3	20.7	19.8	19.5
16	Chromium	mg/kg	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)

Note: BLQ: Below Limit of Quantification; LOQ: Limit Of Quantification

3.8.1 Results and Discussions

Summary of analytical results

- The pH of the soil samples ranged from 7.12 to 7.39.
- Conductivity of the soil samples ranged from 756 to 1208 $\mu\text{S}/\text{cm}$.
- Nitrogen content in the collected soil samples ranged from 69.2 mg/kg to 121.3 mg/kg.
- Phosphorous content ranged from 9.9 mg/kg to 17.3 mg/kg.
- Potassium content ranges from 37.1 mg/kg to 65 mg/kg.

3.9 Marine Water Quality

Marine water analysis was carried as per IS: 3025 and APHA 23rd Ed methods. Marine water quality monitoring locations & results are given in

Table 3-17

Table 3-19 Marine water quality results

Parameters	Unit	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	Protocol	SW-class-IV
		Near GCB (surface)	Near GCB (Bottom 1.5 m)	Near MLT Berth (surface)	Near MLT Berth (Bottom 1.5 m)	Near Finger Jetty (surface)	Near Finger Jetty (Bottom 1.5 m)	Outer South-North Break water (surface)	Outer South-North Break water (Bottom 1.5 m)	Outer South-East Break water (surface)	Outer South-East Break water (Bottom 1.5 m)	Outer South-South Break water (surface)	Outer South-South Break water (Bottom 1.5 m)		Harbour standards
pH	-	8.02	8.26	7.89	8.05	8.14	8.18	7.91	8.03	7.79	8.01	7.6	7.82	IS:3025(P-11)	6.0-9.0
Temperature	°C	26.8	27	26.3	26.9	26.1	27	26.4	26.8	27.2	28.1	27	27.4	IS:3025(P-9)	-
Electrical conductivity	µS/cm	48560	49820	41960	42810	45280	45990	50680	51840	40620	40980	46420	46910	IS:3025(P-14)	-
Turbidity	NTU	2.3	1.5	<1	<1	2.5	2.9	3.7	3.2	2.7	2.9	2.8	3.2	APHA 23 rd Ed.	-

Parameters	Unit	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	Protocol	SW-class-IV
		Near GCB (surface)	Near GCB (Bottom 1.5 m)	Near MLT Berth (surface)	Near MLT Berth (Bottom 1.5 m)	Near Finger Jetty (surface)	Near Finger Jetty (Bottom 1.5 m)	Outer South-North Break water (surface)	Outer South-North Break water (Bottom 1.5 m)	Outer South-East Break water (surface)	Outer South-East Break water (Bottom 1.5 m)	Outer South-South Break water (surface)	Outer South-South Break water (Bottom 1.5 m)		Harbour standards
Total Dissolved solids	mg/l	31560	29890	27270	27820	29140	29620	32940	33660	26400	26650	30170	30490	IS:3025 (P-16)	-
Sulphate as SO ₄	mg/l	2360	2480	1980	2010	1860	2940	2400	2510	1790	1850	1900	1990	APHA 23 rd Ed.	-
Nitrate as NO ₃	mg/l	2.15	2.45	3.1	3.6	4.02	4.4	5.02	5.4	3.1	3.56	2.32	2.51	IS:3025 (P-34)	-
Total Ammonia	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.12	ND	IS:3025 (P-34)	-
Total Suspended Solids	mg/l	14	10	10	13	12	18	10	13	12	15	8	6	IS:3025 (P-17)	-
Dissolved oxygen as DO	mg/l	6.6	6.2	6.5	6.1	6.4	6	6.7	6.4	6.4	6.1	6.4	5.8	IS:3025 (P-38)	3
Biological Oxygen Demand	mg/l	10	11	9	12	6	9	5	7	4	6	6	8	IS:3025 (P-44)	5
Chemical Oxygen Demand	mg/l	50	60	40	50	40	50	32	42	24	32	30	40	IS:3025 (P-58)	-
Copper as Cu	mg/l	0.16	0.19	0.08	0.12	0.13	0.18	ND	ND	ND	ND	ND	ND	APHA 23 rd Ed.	-

Parameters	Unit	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	Protocol	SW-class-IV
		Near GCB (surface)	Near GCB (Bottom 1.5 m)	Near MLT Berth (surface)	Near MLT Berth (Bottom 1.5 m)	Near Finger Jetty (surface)	Near Finger Jetty (Bottom 1.5 m)	Outer South-North Break water (surface)	Outer South-North Break water (Bottom 1.5 m)	Outer South-East Break water (surface)	Outer South-East Break water (Bottom 1.5 m)	Outer South-South Break water (surface)	Outer South-South Break water (Bottom 1.5 m)		Harbour standards
Iron as Fe	mg/l	0.04	0.09	0.05	0.15	0.14	0.23	0.15	0.2	0.13	0.18	0.16	0.26	APHA 23 rd Ed.	-
Zinc as Zn	mg/l	0.11	0.16	ND	ND	0.22	24	0.09	0.13	0.15	0.21	0.16	0.19	APHA 23 rd Ed.	-
Mercury as Hg	mg/l	ND[D L-0.001]	ND[D L-0.001]	ND[D L-0.001]	ND[D L-0.001]	ND[D L-0.001]	ND[D L-0.001]	ND[D L-0.001]	ND[D L-0.001]	ND[D L-0.001]	ND[D L-0.001]	ND[D L-0.001]	ND[D L-0.001]	APHA 23 rd Ed.	-
Arsenic as As	mg/l	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	APHA 23 rd Ed.	-
Lead as Pb	mg/l	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	APHA 23 rd Ed.	-
Cadmium as Cd	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	APHA 23 rd Ed.	-
Petroleum hydrocarbon	mg/l	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	APHA 23 rd Ed.	-
Chlorophyll A	mg/l	1.1	1.3	1.8	1.4	1.26	1.6	1.26	1.6	1	1.02	1.1	1.55	APHA 23 rd Ed.	-

Parameters	Unit	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	Protocol	SW-class-IV
		Near GCB (surface)	Near GCB (Bottom 1.5 m)	Near MLT Berth (surface)	Near MLT Berth (Bottom 1.5 m)	Near Finger Jetty (surface)	Near Finger Jetty (Bottom 1.5 m)	Outer South-North Break water (surface)	Outer South-North Break water (Bottom 1.5 m)	Outer South-East Break water (surface)	Outer South-East Break water (Bottom 1.5 m)	Outer South-South Break water (surface)	Outer South-South Break water (Bottom 1.5 m)		Harbour standards
Phaeophytin	mg/m ³	16.2	15.8	16.2	16.9	15.8	16.7	15.8	16.7	17.2	17.5	16.2	16.7	APHA 23 rd Ed.	-
Salinity	PPT	33.2	31.6	29.8	30.1	30.2	30.7	30.2	30.7	28.3	28.9	31.6	31.95	EC Meter	-
Nitrite as NO ₂	mg/l	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	ND[D L-0.01]	IS:3025 (P-34)	-
Total Nitrogen as N	mg/l	2.42	2.85	3.95	4.1	4.42	4.8	4.42	4.8	3.38	3.91	2.65	2.69	IS:3025 (P-34)	-
Inorganic Phosphate	mg/l	0.13	0.19	0.06	0.04	0.16	0.2	0.16	0.2	0.15	0.14	0.07	0.09	IS:3025 (P-31)	-
Total Phosphate as P	mg/l	0.22	0.3	0.1	0.09	0.26	0.32	0.26	0.32	0.26	0.22	0.1	0.12	IS:3025 (P-31)	-
Faecal Coliform*	MPN/100ml	187	253	278	221	345	426	542	221	172	426	240	253	IS:1622	500/100 ml

ND-Not Detected

- pH in the collected seawater samples varies between 7.6 to 8.26.
- The Total Dissolved Solids (TDS) value of collected marine water sample ranges from 26400 mg/l to 33660 mg/l.

- The electrical conductivity value of the collected marine water sample ranges between 40620 mg/l to 51840 mg/l
- BOD value in the marine water sample is upto 12 mg/l.
- COD value of collected marine water sample ranges from 24 upto 60 mg/l.
- The concentration of heavy metals like As, Cd, Cr, Pb, Mn, Hg, Ni and Se are within the limits of APHA 23rd Ed.





Figure 3-28 Marine Monitoring Photographs

3.9.1 Marine Biology

Table 3-20 Marine Biology results

S. No	Parameter	Test Result												Protocol
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	

Draft EIA Report															R1003-R10	
		Near GCB (surface)	Near GCB (Bottom 1.5 m)	Near MLT Berth (surface)	Near MLT Berth (Bottom 1.5 m)	Near Finger Jetty (surface)	Near Finger Jetty (Bottom 1.5 m)	Outer South-North Break water (surface)	Outer South-North Break water	Near GCB (surface)	Near GCB (Bottom 1.5 m)	Outer South-South Break water (surface)	Outer South – South Break water (Bottom 1.5 m)			
1	Phytoplankton*(64 um Mesh)														APHA 23 rd Ed	
	Biomass	2.9	3.4	4.1	3.2	2.3	2.4	7.6	5.3	3.9	4.8	3.1	4.8			
	Diversity	2.1	2.4	3.1	2	2.7	3.6	2.4	1.9	1.7	3.2	2.2	2.3			
	Species	Farranula carinata , Peridinium elegans, Rhabdonema magnificum	Diploneis sinithii, Naviculla sigma, Guinardia delicatula	Thalassione manitzschioides, Ditylum brightwelli, Triceratium dublum	Coscinodiscus radiates, Guinardia delicatula	Actiniscus pentasterias, Ceratium furca, Dinophysisovum	Peridinium claudicans, Peridinium gracile, Fragilariopsis oceanica	Talassiosira pseudonana Bacteriastrum cosmosum , Skeletonema costatum	Bacteriastrum rhombus, Farranula carinata, Lauderiaannulata	Pyrocystis fusiformis Actiniscus cubita,,	Noctiluca miliaris, Bacteriastrum cosmosum, Amphora decussate	Thalassiosira subtilis, Triceratium dublum, Ornithocercusheteroporus	Eucampia cornuta, Thalassiosira favus, Chaetoceros diversus, Skeletonema costatum			
2	Zooplanktons *(200 um Mesh)														APH A 23 rd Ed	
	Biomass	0.036	0.053	0.018	0.038	0.081	0.064	0.058	0.088	0.052	0.084	0.09	0.058			
	Diversity	3.4	3.9	3.4	2.8	2.5	1.8	2.7	3.2	1.9	2.1	1.8	1.9			

	Species	Eucalanus calocalanus, Euchaeta marina, Metacalanus a rivilli	Farraula carinata, Eutintinnus tenuis, Oithona nana	Calocalanus, Metacalanus, Tortanus barbatus	Penilia avirostris, Eutintinnus tenuis, Cressia acicula, Undinula vulgaris	Paracandacia truncata, Labidocera aacuta, Corycaeus catus	Hyalocylus striata, Oncaea mediterranea, Aglaurahemistoma	Eucalanus, Copilia quadrata, Dosinia trigona	Subeucalanus, A. Longicornis, Farranula carinata	Globigerina bulloides, Pseudosagitta maxima, Salpa fusiformis,	Periclimenes imperator, Oncaea conifer, Miracia fferata,	Sagitta bedoti, Bathynomus doederleinii, Acartiida erythraea	Farranula carinata, Macrocypridin acastanea, Hyalocylus striata	
Benthos														
3	Species	Oikopleura dioica, Ancilla ampla, Syllis ferrugina, Cirratulus dasylophus	Tapes belcheri, Magelona cincta	Agaronia nebulosa, Dodecaceria capensis, Armandia intermedia	Sinumneriterum, Pinna bicolor, Mactramera, Pulliella armata,	Macoma bicanalic, Standella ciliaris, Roetapella, Jasmineira elegans,	Conus canonicus, Melinna cristata, Purgulina cochlidium, Anadara granosa, Prionospio cirrifera	Papthiasemirugata, isopods, Pitar albastum, Purgulina cochlidium	Cossura costata, Quadrivisio bioneri, Circarscripta, Anadara granosa, Laternula anatina	apolymeris dentula, Gastropods dentalium, Pisonioerstedii, Macoma candida	Saccostrea cucullata, Crassostrea cuttackensis, Lumbrineria simplex	Strombus luhuanus, Cossurecoaste, Maldanids. Solen brevis, Potamilaehleria	Nassarius dorsatus, Portulaca tubularia, Siliqua radiata, Laevicardium pertom	APH A 23 rd Ed

3.10 BIOLOGICAL ENVIRONMENT

3.10.1 Ecological Environment

3.10.1.1 Introduction

An ecological study of the ecosystem is essential to understand the impact of industrialization and urbanization on existing flora and fauna of the study area. Studies on various aspects of ecosystem play an important role in identifying sensitive issues for under taking appropriate action to mitigate the impact, if any. The biological study was under taken as a part of the EIA study report to understand the present status of ecosystem prevailing in the study area, to compare it with past condition with the help of available data, to predict changes in the biological environment as a result of present activities and to suggest measures for maintaining its health. Secondary source information was conducted to study the flora & fauna in 10 km radius. Some of the information was gathered from the local habitants. The entire secondary data were classified to interpret the impact of pollution on the flora and fauna of that region. Survey of the wild plants as well as cultivated crop plants was made and all the available information was recorded.

During the collection of secondary information, following aspects were considered for ecological studies:

Assessment of present status of flora and fauna;

Identification of rare and endangered species of plants and animals (if any);

Identification of ecologically sensitive areas within the study area;

Assessment of migratory route of wildlife (if any); and

Assessment of Aquatic Ecology with specific reference to aquatic birds and plankton resources.

3.10.1.2 Methodology

Terrestrial investigations for flora and fauna records were collected by secondary information like research article, periodicals, floras and forest checklist.

3.10.1.3 Floral Study

Plants species were identified based on their specific diagnostics characters of family, genus and species using available floral, other related literature. Besides the identification of plant species, information was collected on the vernacular names and uses of plants made by local inhabitants. Secondary information collected from published government data etc.

3.10.1.4 Floristic composition within the study area

For secondary information based on a total 46 species found in the study area.

List of Flora



For secondary information based on a total 51 species under 28 family found in the study area. The detailed list of plant species found in each quadrat provided in **Table 3-21**.

Table 3-21: Checklist of floral diversity in and around the area

S.No	Species	Vernacular Name	Habit	IUCN
Acanthaceae				
1	<i>Justicia simplex</i>	Water Willow	Herb	NA
Amaranthaceae				
2	<i>Achyranthes aspera</i>	Nayurivi	Herb	NA
3	<i>Aerva lanata</i>	Peelai	Shrub	NA
4	<i>Aerva persica</i>	Perumpeelai	Shrub	NA
Annonaceae				
5	<i>Annona squamosa</i>	Seetha	Tree	NA
Apocynaceae				
6	<i>Carissa carandas</i>	Kalaa, Perun kala	Shrub	NA
7	<i>Wrightia tinctoria</i>	Nilapaalai	Tree	LC
Asclepiadaceae				
8	<i>Calotropis gigantea</i>	Erukku, Arkkam	Shrub	NA
Bignoniaceae				
9	<i>Tecoma stans</i>	Sornapatti	Shrub	NA
Caesalpiniaceae				
10	<i>Cassia fistula</i>	Kondrai	Tree	NA
11	<i>Tamarindus indica</i>	Puliya maram	Tree	NA
12	<i>Cleome viscosa</i>	Nai kadugu	Herb	NA
Compositae				
13	<i>Acanthospermum hispidum</i>	--	Herb	NA
14	<i>Tridax procumbens</i>	Vettukkaaya-thazhai	Herb	NA
Convolvulaceae				
15	<i>Evolvulus alsinoides</i>	Vishnukarandi	Herb	NA
Cucurbitaceae				
16	<i>Citrullus colocynthis</i>	Peikkumatti	Herb	NA
17	<i>Coccinia grandis</i>	Kovai	Climber	NA
Euphorbiaceae				
18	<i>Acalypha indica</i>	Kuppaimeni	Herb	NA
Fabaceae				
19	<i>Alysicarpus monilifer</i>	--	Herb	NA
20	<i>Tephrosia purpurea</i>	Kozhinji	Undershrub	NA
Labiatae				
21	<i>Hyptis suaveolens</i>		Shrub	NA
22	<i>Leucas aspera</i>	Thumbai	Herb	NA

23	<i>Ocimum americanum</i>	Ganjaankorai	Herb	NA
Malvaceae				
24	<i>Abutilon indicum</i>	Perun thuthi	Shrub	NA
25	<i>Sida acuta</i>	Malai thangi	Herb	NA
26	<i>Sida cordifolia</i>	Nilatutthi	Herb	NA
Martyniaceae				
27	<i>Martynia annua</i>	Thael Kodukku	Herb	NA
Menispermaceae				
28	<i>Tinospora cordifolia</i>	Seendhil	Climber	NA
Mimosaceae				
29	<i>Acacia nilotica</i>	Karuvelam	Tree	LC
30	<i>Leucaena leucocephala</i>	Soundil	Tree	NA
31	<i>Prosopis juliflora</i>	Velikkaathan	Tree	NA
Moraceae				
32	<i>Ficus benghalensis</i>	Aala maram	Tree	NA
33	<i>Ficus religiosa</i>	Arasu	Tree	NA
Nyctaginaceae				
34	<i>Boerhavia diffusa</i>	Mookarattai	Herb	NA
35	<i>Boerhavia erecta</i>	Seemai mookarattai	Herb	NA
Pedaliaceae				
36	<i>Pedaliium murex</i>	Perunerunji	Herb	NA
37	<i>Sesamum indicum</i>	Ellu	Herb	NA
Poaceae				
38	<i>Alloteropsis cimicina</i>	bug-seed grass	Grass	NA
39	<i>Aristida adscensionis</i>	Cheevam pul	Grass	NA
40	<i>Aristida hystrix</i>	Pottapullu	Grass	NA
41	<i>Digitaria ciliaris</i>	southern crabgrass	Grass	NA
42	<i>Echinochloa colona</i>	Pullam payiru	Grass	NA
43	<i>Eragrostis tenella</i>	Feather Loveg rass	Grass	NA
Rhamnaceae				
44	<i>Ziziphus mauritiana</i>	Illandhai	Tree	NA
Rubiaceae				
45	<i>Morinda pubescens</i>	Manjanatti	Tree	NA
46	<i>Spermacoce hispida</i>	Nathaichoori	Herb	NA
Rutaceae				
47	<i>Citrus aurantifolia</i>	Elumichai	Tree	NA
Scrophulariaceae				
48	<i>Sconaria dulcis</i>	Sarakkotthini	Herb	NA
Solanaceae				
49	<i>Solanum torvum</i>	Chundai	Shrub	NA

Verbenaceae				
50	<i>Tectona grandis</i>	Thekku	Tree	NA
51	<i>Vitex negundo</i>	Nochi	Tree	NA

LC- Least Concern, NT- Near Threatened, EN- Endangered, NE-Not Evaluated, DD -Data Deficient, VU- Vulnerable, IUCN- International Union for Conservation of Nature.

Source:

Gamble, J.S. and C.E.C. Fischer. 1915-1935. Flora of Presidency of Madras, Adlard and Son, London. pp. 1-3.

Mathew, K. M. 1981. The Material for the Flora of the Tamilnadu Carnatic, Madras, India.

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Henry, A.N., Kumari, G.R. and Chitra, V. (1987) Flora of Tamil Nadu India. Series 1: Analysis. Vol. 2, Botanical Survey of India, Coimbatore.

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Henry, A.N., Chithra, V.N. and Balakrishnan, P. (1989) Flora of Tamil Nadu India. Series 1: Analysis. Vol. III. Botanical Survey of India, Coimbatore.

3.10.1.5 Fauna Diversity

List of the endangered and endemic species as per the schedule of The Wildlife Protection Act, 1972. Emphasis is given to identify avifauna and mammals to determine the presence and absence of Schedule-1 species, listed in The Wildlife Protection Act 1972, as well as in Red List of IUCN. Fauna diversity were collected from secondary information and cross check with relevant literatures (Smith 1933-43, Ali and Ripley 1983, Daniel 1983, Prater 1993, Murthy and Chandrasekhar 1988).

3.10.1.6 Birds species

A total of 40 species belonging to 27 families have been identified from Agricultural area. A comparative chart of the total bird species belonging to different families along with their feeding preference and abundance are provided in **Table 3-22**.

Table 3-22: Birds from the study site

S. No	Common Name	Scientific Name	IUCN	WPA
Phasianidae				
1	Indian peafowl	<i>Pavo cristatus</i>	LC	Sch -1
2	Grey francolin	<i>Francolinus pondicerianus</i>	LC	Sch-IV
Ardeidae				
3	Indian pond heron	<i>Ardeola grayii</i>	LC	Sch-IV
4	Cattle egret	<i>Bubulcus ibis</i>	LC	Sch-IV
Accipitridae				
5	Brahminy kite	<i>Haliastur indus</i>	LC	Sch -1
6	Black kite	<i>Milvus migrans</i>	LC	Sch-IV
Charadriidae				
7	Red wattled lapwing	<i>Vanellus indicus</i>	LC	Sch-IV
8	Common ringed plover	<i>Charadrius hiaticula</i>	LC	Sch-IV
Columbidae				
9	Common pigeon	<i>Columba livia</i>	LC	Sch-IV
Psittaculidae				
11	Rose ringed parakeet	<i>Psittacula krameri</i>	LC	Sch-IV
Cuculidae				
12	Common hawk cuckoo	<i>Hierococyx varius</i>	LC	Sch-IV
13	Asian koel	<i>Eudynamys scolopaceus</i>	LC	Sch-IV
Strigidae				
14	Spotted owlet	<i>Athene brama</i>	LC	Sch-IV
Upupidae				
15	Common hoopoe	<i>Upupa epops</i>	LC	Sch-IV
Coraciidae				
16	Indian roller	<i>Coracias benghalensis</i>	LC	Sch-IV
Alcedinidae				
17	White throated king fisher	<i>Halcyon smyrnensis</i>	LC	Sch-IV
18	Pied kingfisher	<i>Ceryle rudis</i>	LC	Sch-IV
Meropidae				
19	Green bee eater	<i>Merops orientalis</i>	LC	Sch-IV
Ramphastidae				
20	Brown headed barbet	<i>Megalaima zeylanica</i>	LC	Sch-IV
21	Copper smith barbet	<i>Megalaima haemacephala</i>	LC	Sch-IV
Picidae				
22	Flame back	<i>Dinopium benghalense?</i>	LC	Sch-IV
Dicruridae				
23	Greater racket tailed drongo	<i>Dicrurus paradiseus</i>	LC	Sch-IV
24	Black drongo	<i>Dicrurus macrocercus</i>	LC	Sch-IV
Monarchidae				
25	Indian paradise flycatcher	<i>Terpsiphone paradise</i>	LC	Sch-IV
Hirundinidae				
26	Barn swallow	<i>Hirundo rustica</i>	LC	Sch-IV
Corvidae				

27	House crow	<i>Corvus splendens</i>	LC	Sch-IV
28	Rufous treepie	<i>Dendrocitta vagabunda</i>	LC	Sch-IV
Sturnidae				
29	Common myna	<i>Acridotheres tristis</i>	LC	Sch-IV
30	Brahminy starling	<i>Sturnia pagodarum</i>	LC	Sch-IV
Estrildidae				
31	Scaly breasted munia	<i>Lonchura punctulata</i>	LC	Sch-IV
32	White rumped munia	<i>Lonchura striata</i>	LC	Sch-IV
33	Black headed munia	<i>Lonchura Malacca</i>	LC	Sch-IV
Motacillidae				
34	Grey wagtail	<i>Motacilla cinerea</i>	LC	Sch-IV
35	White browed wagtail	<i>Motacilla maderaspatensis</i>	LC	Sch-IV
Timallidae				
36	Yellow-billed babbler	<i>Turdoides affinis</i>	LC	Sch-IV
Ploceidae				
37	Baya weaver	<i>Ploceus philippinus</i>	LC	Sch-IV
Muscicapidae				
38	Pied Bushchat	<i>Saxicola caprata</i>	LC	Sch-IV
Nectariniidae				
39	Purple sunbird	<i>Cinnyris asiaticus</i>	LC	Sch-IV
Scolopacidae				
40	Wood sandpiper	<i>Tringa glareola</i>	LC	Sch-IV

LC- Least Concern, NT- Near Threatened, EN- Endangered, NE-Not Evaluated, DD -Data Deficient, VU- Vulnerable, IUCN- International Union for Conservation of Nature.

3.10.1.7 Mammals:

Based on the secondary Source information.

Table 3-23: Mammals recorded from the Primary Survey in the Study area and their Conservation Status

S.No	Species name	Common name	IUCN	WPA
1	<i>Mus musculus</i>	Common Mouse	Not assessed	Sch-IV
2	<i>Funambulus pennanti</i>	Palm -Squirrel	Not assessed	Sch-IV
3	<i>Mus rattus</i>	Indian rat	Not assessed	Sch-IV
4	<i>Lepus nigricollis</i>	Indian Hare	Least Concern	Sch-IV
5	<i>Rattus norvegicus</i>	Brown Rat	Least Concern	Sch-IV
6	<i>Felis catus</i>	Cat	Not assessed	Sch-IV

3.10.1.8 Reptiles & Amphibians

Reptiles and amphibian species were prepared secondary information.

Table 3-24: Reptiles & Amphibians recorded from the Primary Survey in the Study area and their Conservation Status

S.No	Species name	Common name	IUCN Conservation Status	
1	<i>Eutropis macularia</i>	Common skink	Not assessed	Sch-IV
4	<i>Rana tigrina</i>	Common yellow frog	Least Concern	Sch-IV
5	<i>Calotes versicolor</i>	Common Garden Lizard	Not assessed	Sch-IV
6	<i>Hemidactylus sp.</i>	House lizard	Not assessed	Sch-IV
7	<i>Ophisops leschenaultii</i>	Snake-eyed lizard	Not assessed	Sch-IV
8	<i>Rana hexadactyla</i>	Frog	Least Concern	Sch-IV
9	<i>Naja naja</i>	Cobra	Least Concern	Sch-I
10	<i>Ptyas mucosa</i>	Rat snake	Least Concern	Sch-I

3.10.1.9 Butterfly Species

Butterfly can also serve as useful indicators of habitat biodiversity. They are responsible for a large part of the complex interconnections that characterize natural ecosystems. The butterfly communities that are present in forests help to maintain crucial ecological processes and preserve biodiversity as a whole. They participate in most of the ecological processes that sustain ecosystems. A totally 10 species belonging to five families of butterflies recorded.

Table 3-25 : Occurrence of butterfly species in buffer zone

Sl.	Zoological Name	Common Name	WPA-1972
1	<i>Danaus chrysippus</i>	Plain Tiger	—
2	<i>Danaus genutia</i>	Striped Tiger	—
3	<i>Ariadne merione</i>	Common Caster	—
4	<i>Ariadne ariadne</i>	Angled Castor	—
5	<i>Acraea terpsicore</i>	Tawny Caster	—
6	<i>Neptis hylas</i>	Common Sailor	—
7	<i>Phalanta phalantha</i>	Common Leopard	—
8	<i>Hypolimnas bolina</i>	Great Egg Fly	—
9	<i>Hypolimnas misippus</i>	Danaid Egg Fly	Sch II
10	<i>Junonia lemonias</i>	Lemon Pansy	—

Source:

List of Birds: Ali, S. (2002). The Book of Indian Birds (13th Revised Edition). Oxford University Press, New Delhi, 326pp.

List of Butterflies: Kehimkar I. The Book of Indian Butterflies. Bombay Natural History Society, 2008, 497.

Evans WH. Identification of Indian butterflies. The Bombay Natural History Society, Bombay, 1927, 32.

List of Mammals: Kamalakannan, M.& P.O.Nameer (2019). A checklist of mammals of Tamil Nadu, India. Journal of Threatened Taxa 11(8): 13992–14009; <https://doi.org/10.11609/jott.4705.11.8.13992–14009>.

List of Reptiles: Aengals, R., Sathish Kumar, V.M., Palot, M.J. & Ganesh, S.R. (2018). A Checklist of Reptiles of India. 35 pp. Version 3.0. Online publication is available at www.zsi.gov.in (Last update: May 2018)

3.10.1.10 Conservation Plan

The project is expected not to cause any impacts to the habitats of the study area or to the local species therein. Despite this, the industry will contribute to conservation of the biodiversity in study area. Various on-site and off-site measures are proposed for conservation of the Schedule – I species as well as other biodiversity and supportive habitats in the study area. No any land from any protected area is being used nor will be used for the proposed project. The details of the onsite EMP measures, biodiversity and habitats conservation plans and CER activities supportive to the same are given below.

The Conservation Plan would focus on conservation of habitats of Schedule-I species identified during the study. We identified 2 IUCN red list species viz.. one butterfly and one bird in the study area i.e. 10 km buffer area.

S.No	Common Name	Species Name	IUCN	WPA 1972
Bird				
1	Indian peafowl	<i>Pavo cristatus</i>	LC	Schedule I
2	Brahminy kite	<i>Haliastur indus</i>	LC	Schedule I
Reptiles				
3	Rat snake	<i>Ptyas mucosa</i>	LC	Schedule I
4	Cobra	<i>Naja naja</i>	LC	Schedule I

• Management plan

- **Capacity Building:** Capacity building program on protection would be of high significance. Creation of awareness among local people as well as employees about the importance of protecting the habitat and foraging grounds.
- **Anti-Poaching Plan:** Poaching being one of the causes for depletion of wildlife in general and it being one of the main reasons for the poor faunal assemblage, it is necessary to increase protection for the RET species. The people living in the surrounding area should be rewarded for timely information about disturbing and/or poaching of the bird more specifically the threatened species.
- **Habitat Improvement:** Sufficient food, water resources, vegetation cover, and breeding sites must be available at the release location.

- **Awareness program:** It will be ensured through regular awareness programs and through publicity by way of signages, posters, bill distributions, public meetings, announcements, student's awareness sessions etc. d) Litter burning will be discouraged strictly.
- Litter burning practices destroy feeding material and removes the cover and nesting materials necessary for shelter and protection from predators.

Good Practices:

- ETTPL will be bound by rules and regulation of Wildlife (Protection) Act, 1972 of India and any others rule and guidelines, stipulated by the State Government.
- ETTPL will not plant any alien and/or invasive species in the project site, which may spread in the forest areas.
- Employees will be made aware of presence of a few threatened and Schedule species in the area and legal consequences of hunting, poaching of animals and harvesting of forest produces.

The proponent has proposed a sum of Rs. 5,40,000/-for the "Schedule – I species" conservation plan under the following heads:

Table 3-26. Conservation plan for five years

S.No	Work or Activity	Approximate Cost. Rs.				
		Year 1	Year 2	Year 3	Year 4	Year 5
1	Plantation-350 tree plants (@ 150/-per plant)	52,500/-	52,500/-	52,500/-	52,500/-	
3	One awareness programme	20,000/-	20,000/-	20,000/-	20,000/-	20,000/-
3	Habitat improvement	1,00,000/-	1,00,000/-			
Total		102500/-	272,500/-	72,500/-	72,500/-	20,000/-

Following Plants will be planted on the periphery of Project are a& along the Approachable Road			
S.No	Botanical name	Common Name	Key future of Tree
1	Albizia lebbeck	Vagai	A middle-sized deciduous tree with a spreading crown.
2	Azadirachta Indica	Vembu	It is adapted to various climate zones.
3	Dalbergia latifolia	Eeitti	It is common on deep loams or clays containing lime.

4	Ficus benghalensis	Allamaram	Nesting and food purpose for wildlife
5	Ficus religiosa	Arasamaram	It is tolerant to various climate zones.
6	Madhuca longifolia	Illupai	A large deciduous shapely, long lived tree
7	Pongamia pinnata	Pungaimaram	Dust reduce
8	Pterocarpus marsupium	Vengai	--
9	Syzygiumcumini	Naval	It is tolerant to temperature resistant.
10	Termanilia arjuna	Maruthu	It is reducing soil erosion

3.10.1.11 A detailed study of fisherman hamlets along the study area:-

Table 3-27: Fisherman hamlets and Fisher flock population along the study area

S. No	Name of the fisher man hamlets	Population
1	Paziyavaram	354
2	Goonankuppam	1181
3	Thirumalainagar	876
4	Lighthousekuppam	620
5	Lighthousenedukuppam	312
6	Arangamkuppam	1335
7	Vairavankuppam	723
8	Sathankuppam	980
9	Koraikuppam	308
10	Kamaraj nagar kattupallai	280
11	Ennorekuppam	710
12	Nettukuppam	1847
13	Thazhakuppam	1958
14	Kathivakkamperiakuppam	369
15	Kathivakkamchinnakuppam	432
16	Ernavorkuppam	362
17	Indiragandhikuppam	241
18	Kasikoilkuppam	3677
19	Kasivisalakashikuppam	271
20	Kasivisvanatherkoilkuppam	969
21	Palagaithottikuppam	427
22	Pattinatharkoilkuppam	1175
23	Thiruvottiyurkuppam	567
24	Ondikuppam	416
25	Thiruchinamkuppam	2642
26	Lakshimipuram	332
27	Nallathanneerodikuppam	1285
28	Poondithanglaammalcolony	77

S. No	Name of the fisher man hamlets	Population
29	Poongavanamkuppam	523
30	Annanagar	1131
31	Nagoorarthottam	3285
32	Pallavannagar & Thideernagar	3713
33	Powerkuppam	1545
34	Pudumanaikuppam	992
35	Kasipuram A Block	1691
36	Kasipuram B Block	2831
37	C.G. Colony	4887
38	YMCA kuppam	1436
39	Vinayagapuram	649
40	VOC Nagar	2625
41	Singaravalaznagar	3363
42	Muthamizhnagar	715
43	Kasimanagar	1154
44	Jeevarathinamnagar	2547
45	AJ Colony	1243
46	Kasithottam	1427
47	Bentlemangardem	644
48	Attapalayam	1486
49	Panaimaraithotty	2114
50	Royapuram	2274
	Total	67001

Table 3-28: Craft wise catches along the study area (Quantity in Tonnes)

Name of the Craft	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001
Mechanical	14716	14831	15372	14970	13557	13949	10456
Non -Mechanical	6000	5057	4571	1760	1528	1359	2022
Motorized	1291	1836	2156	1740	1417	1561	1354
Shore Seine	0	0	0	0	0	0	0
Total	22007	21724	22099	18470	16502	16869	13832

Table 3-29: Catch composition (%) of fishes along the study area for the past seven years

Nomenclature	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
Sharks	2.42	2.81	2.24	2.47	1.61	1.95	2.10
Skates & Rays	6.55	7.01	4.98	4.88	6.11	4.42	4.80
Eels	0.09	0.00	0.00	0.00	0.00	0.06	0.24
Cat fishes	0.82	0.55	0.73	0.28	0.53	0.81	1.08
Chirocentrus	4.65	2.34	3.81	3.61	3.12	3.87	3.65
Oil Sardines	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lesser sardines	11.85	14.14	20.72	22.14	23.46	18.56	18.12
Hilsa Ilisha	0.00	0.00	0.05	0.00	0.00	0.00	0.00
Anchoveilla	1.88	1.91	0.79	1.16	1.70	2.52	2.17
Thrissocles	0.16	0.14	0.33	0.05	0.50	0.37	0.46
Other clupeids	1.96	1.89	1.13	0.76	0.19	0.00	0.01
Harpoden nehereus	0.25	0.20	0.11	0.00	0.00	0.00	0.00
Saurida & saurus	1.87	2.47	2.78	2.50	2.34	1.89	1.90
Hemirhamphus & Belone	0.10	0.01	0.03	0.00	0.00	0.03	0.02
Flying fish	0.00	0.02	0.32	0.00	0.00	0.41	0.68
Perches	6.16	7.16	7.54	5.87	6.69	10.27	9.96
Red Mullet	1.22	0.72	0.74	0.17	0.72	0.85	0.71
Polynemids	0.61	0.62	0.92	0.10	0.80	0.17	0.27
Seiaenids	4.25	3.69	4.45	5.17	6.87	4.07	3.91
Ribbon fish	0.68	0.88	1.38	1.38	0.00	0.05	0.29
Caranx	1.07	0.55	0.25	0.22	0.81	0.90	1.15
Nomenclature	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
Chorinemus	1.55	3.37	3.24	0.84	0.00	0.20	0.30
Trachynotus	0.00	0.69	0.00	0.00	0.00	0.00	0.00
Other carangids	0.00	0.00	0.00	0.00	0.00	0.02	0.03
Elacate	0.13	0.13	0.08	0.25	0.21	0.21	0.17
Silverbellies	0.06	0.17	0.02	5.66	4.33	4.78	4.51
Leiagnathus	4.11	3.96	3.40	0.59	0.00	0.00	0.00
Gassa	0.56	0.88	2.09	0.00	0.00	0.00	0.00
Lactarius	0.61	0.66	0.27	0.00	0.17	0.05	0.07
Pomfrets	1.42	2.28	1.36	0.70	0.56	1.09	1.22
Mackerel	6.49	6.35	4.72	5.70	10.05	7.46	8.05
Seer	8.33	7.54	5.12	5.03	2.35	2.26	2.83
Tunnies	1.94	2.77	1.75	3.01	0.71	1.27	1.41
Sphyreana	0.04	0.09	0.10	0.16	0.00	0.05	0.04
Mugil	0.31	0.20	0.30	0.15	0.55	0.15	0.15
Bregmaceres	0.03	0.00	0.01	0.00	0.01	0.00	0.00

Nomenclature	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
Soles	0.13	0.07	0.13	0.05	0.24	0.12	0.18
Penaeid Prawns	4.30	3.54	4.09	4.94	4.16	5.08	4.90
N.P.Prawns	2.49	1.89	2.10	0.50	0.00	0.68	0.82
Lobsters	0.06	0.11	0.20	0.01	0.01	0.00	0.00
Crabs	3.53	1.48	2.73	4.02	2.15	4.54	4.63
Cephalopods	4.39	3.74	3.30	3.67	1.75	2.38	2.28
Miscellaneous	12.25	11.24	10.69	13.83	17.14	18.28	16.66
Drapane	0.49	1.53	0.74	0.13	0.00	0.00	0.00
Lethrinus	0.00	0.06	0.00	0.00	0.00	0.00	0.00
Sillago	0.13	0.02	0.00	0.00	0.02	0.11	0.17
Balistis	0.07	0.09	0.22	0.01	0.00	0.00	0.00
Turtle	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ora	0.00	0.00	0.00	0.00	0.15	0.08	0.04
Spotted Dory	0.00	0.00	0.04	0.00	0.00	0.00	0.00

Table 3-30: Revenue generated from marine fisheries along Tamil nadu coast

Year	Quantum of fishery (tonnes)	Revenue earned (cores)
1997-98	41052	1220.1
1998-99	45026	1379
1999-2000	43464	1462.7
2000-2001	53005	2264.78
2001-2002	58482	2016.4

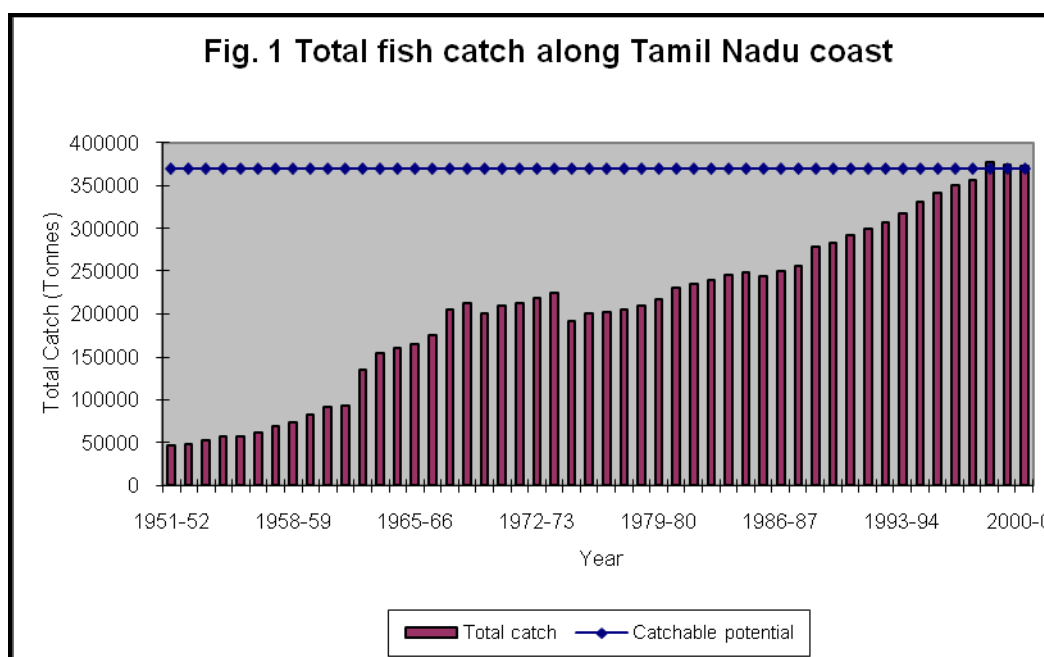


Fig. 2 Fish catch along the study area

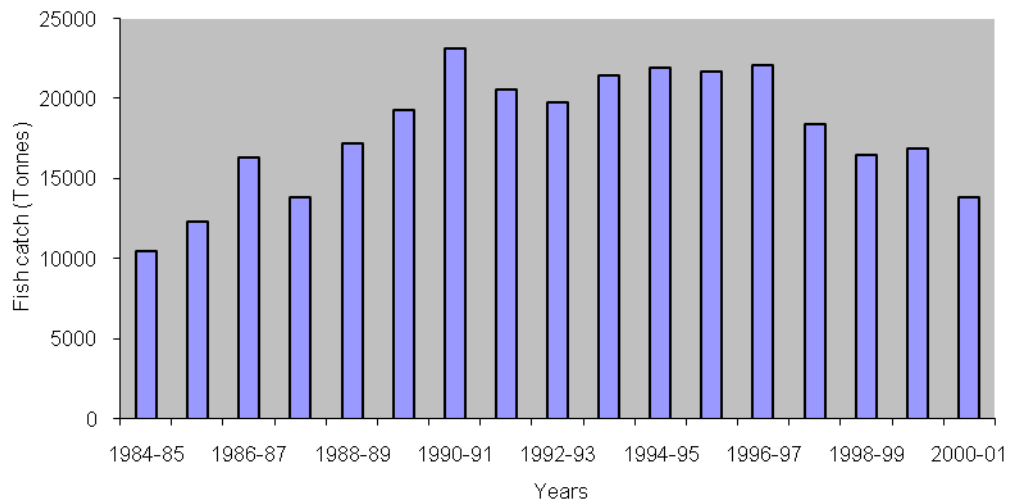


Fig. 3 Comparison of total fish catches in relation to coastal length for the year 1989-90

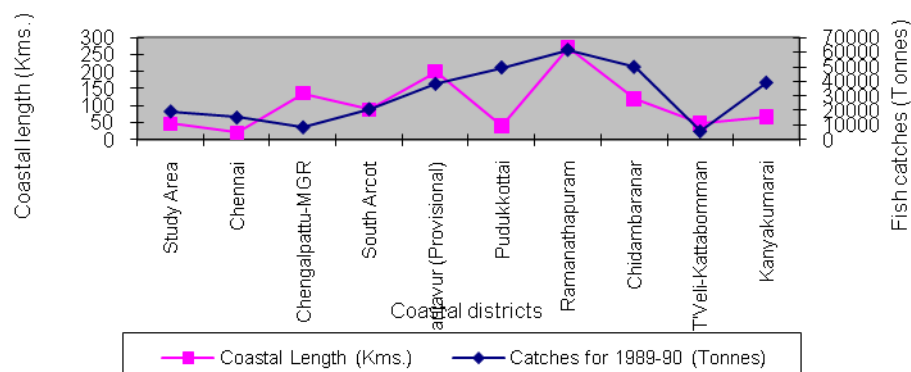


Fig. 4 Comparison of Annual fish catches in relation to coastal length for the year 1990-91

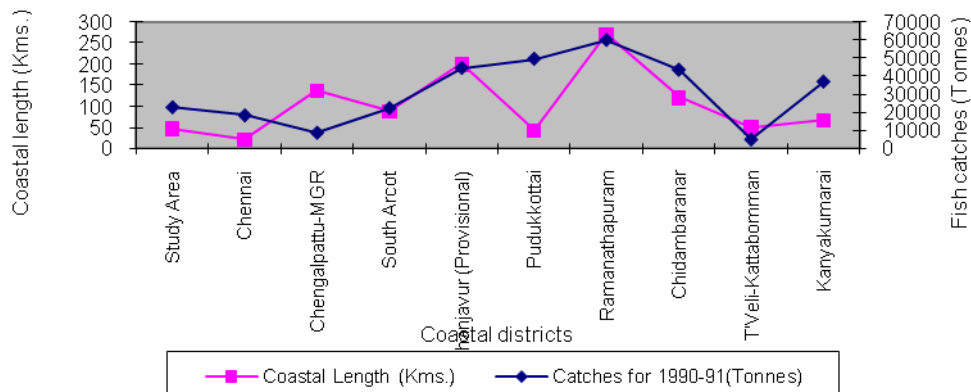


Fig. 5 Comparison of Annual fish catches in relation to coastal length for the year 1991-92

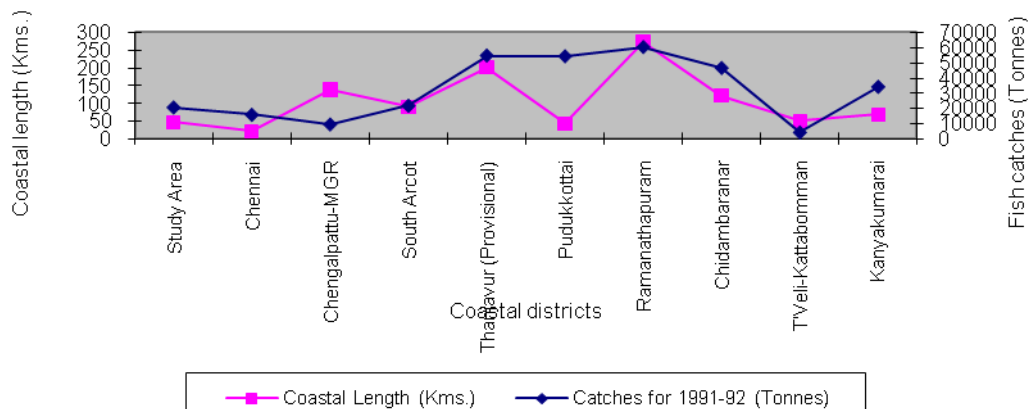


Fig. 6 Comparison of annual fish catches in relation to coastal length for the year 1992-93

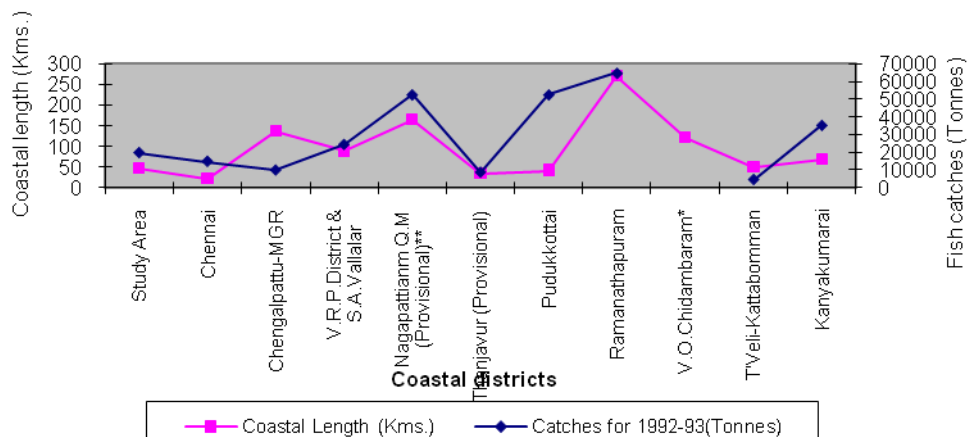


Fig. 7 Comparison of annual fish catches in relation to coastal length for the year 1993-94

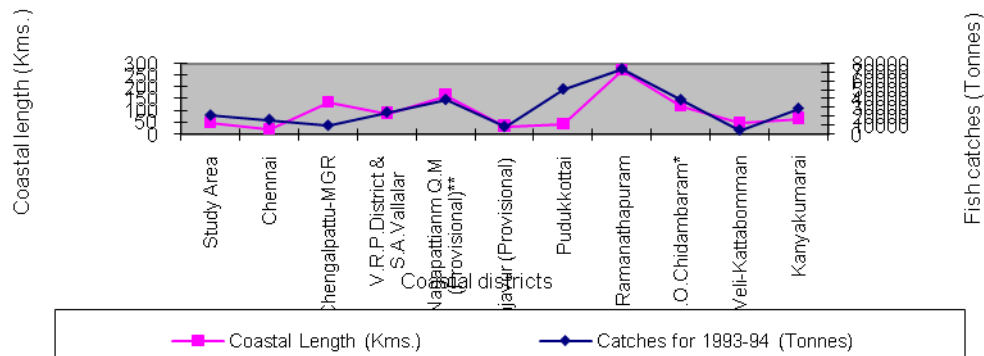


Fig. 8 Comparison of annual fish catches in relation to coastal length for the year 1994-95

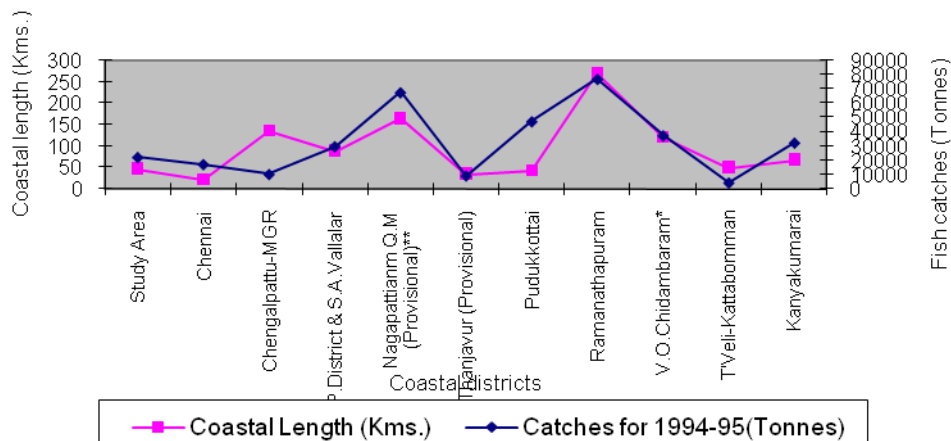


Fig. 9 Comparison of annual fish catches in relation to coastal length for the year 1995-96

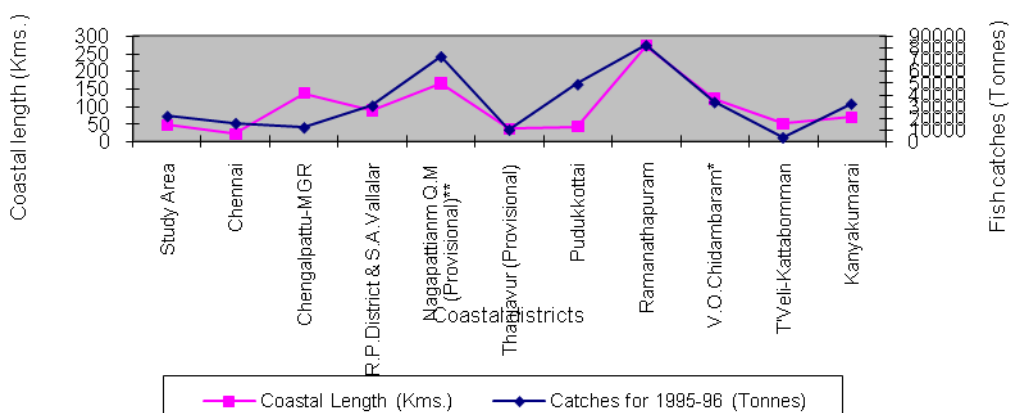


Fig. 10 Comparison of annual fish catches in relation to coastal length for the year 1996-97

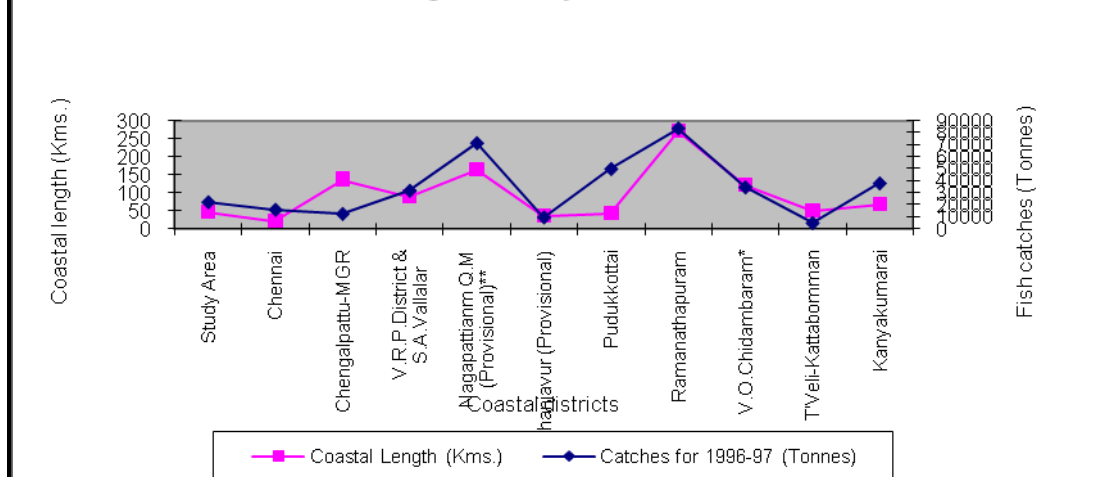


Fig. 11 Comparison of annual fish catches in relation to coastal length for the year 1997-98

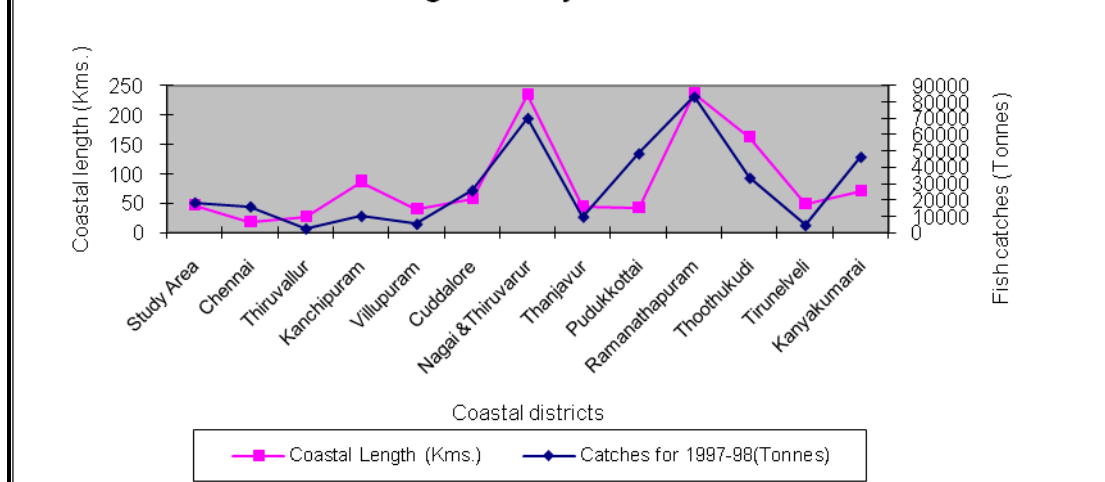


Fig. 12 Comparison of annual fish catches in relation to coastal length for the year 1998-99

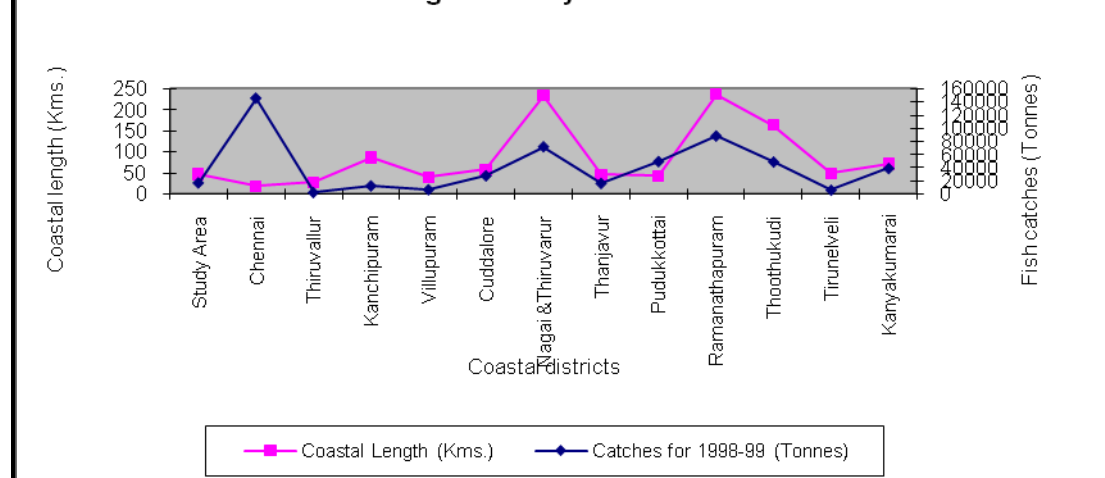


Fig. 13 Comparison of annual fish catches in relation to coastal length of the year 1999-00

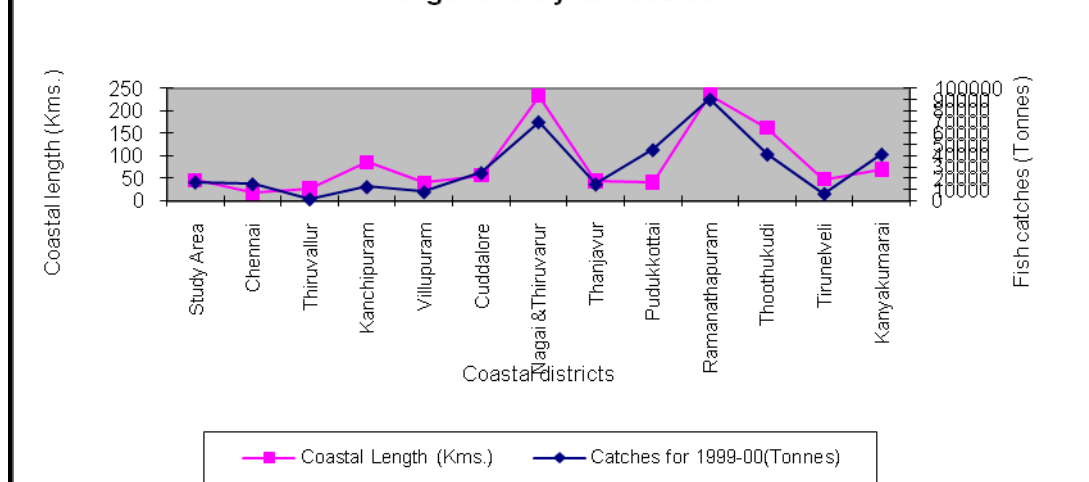
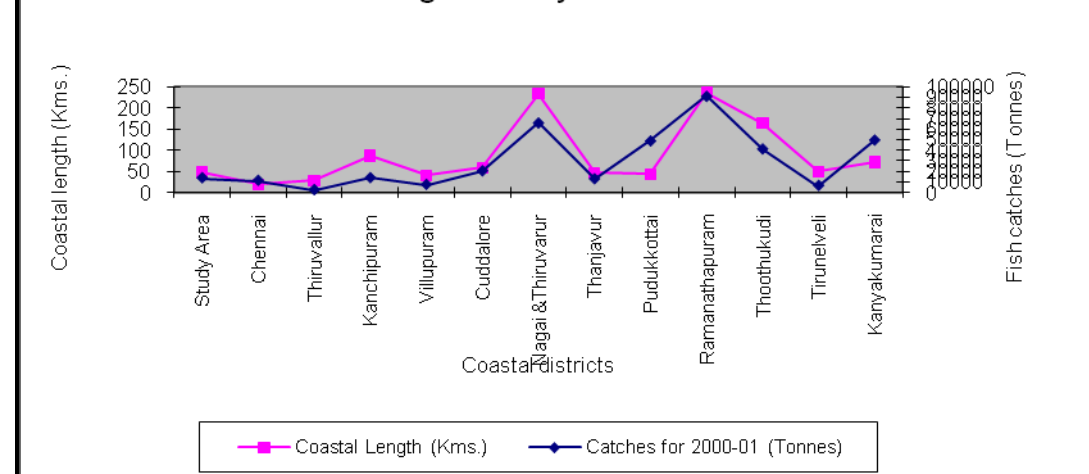


Fig. 14 Comparison of annual fish catches in relation to coastal length for the year 2000-01



3.11 Socio Economic Profile

In 2011, Tiruvallur had population of 3728104 of which male and female were 1,876,062 and 1,852,042 respectively. Literates of Thiruvallur in 2011 were 84.03% of which male and female were 89.69% and 78.32%. The district has a Sex ratio of 987.

Source: <https://acrobat.adobe.com/3c1ff7f8-b774-4e95-903d-6d6e66bf23a1>

(Ref: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Thiruvallur District", Series-34 Part XII-B)

3.11.1 Socio Economic Aspects

A socio-economic study was undertaken in assessing aspects which are dealing with social and cultural conditions, and economic status in the study area. The study provides information such as demographic structure, population dynamics, infrastructure resources, and the status of human health and economic attributes like

employment, per-capita income, agriculture, trade, and industrial development in the study area. The study of these characteristic helps in identification, prediction and evaluation of impacts on socio-economic and parameters of human interest due to proposed project activities and its developments. The parameters are:

- Demographic structure
- Infrastructure Facility
- Economic Status
- Health status
- Cultural attributes

Awareness and opinion of people about the project and Industries in the area. **Table 3-31 Social Indicators of Tiruvallur District** shows some important Social Indicators of Tiruvallur District in Tamil Nadu.

Table 3-31 Social Indicators of Tiruvallur District

S.No	Social Indicators	Tiruvallur District
1	Decadal variation %	35.30
2	Urban population %	65.14
3	Sex ratio	987
4	0-6 age group %	10.88
5	Population density (Persons per square Km)	1098
6	Scheduled caste population %	22.03
7	Scheduled tribe population %	1.26
8	Literacy rate %	84.03
9	Work Participation rate %	41.26
10	Main Workers %	81.14
11	Marginal Workers %	18.86
12	Cultivators %	4.78
13	Agricultural labourers %	17.59

S.No	Social Indicators	Tiruvallur District
14	Workers in household industries %	3.79
15	Other workers %	73.84

Source:http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3301_PART_A_DCHB_THIRUVALLUR.pdf

(Ref: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Tiruvallur District", Series-34 Part XII-B).

3.11.2 Population

Thiruvallur district ranked the 4th in terms of the highest population in Tamil Nadu. Thiruvallur district has the urban population share of 65.14%. In terms of population density, Thiruvallur district has recorded 1098 persons per sq.km. The district Sex Ratio is 987, lower when compared to the State Sex Ratio of 996. The district has recorded higher literacy rate (84.03%) as compared with State literacy rate of 80.1%. The district decadal population growth during 2001 - 2011 was 35.3%.

Source:http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3301_PART_A_DCHB_THIRUVALLUR.pdf

3.11.3 Population Density and Sex Ratio

The sex ratio is defined as number of females to 1000 males. With regards to sex ratio in Thiruvallur, it stood at 987 per 1000 male compared to 2001 census figure of 971. The average national sex ratio in India is 940 as per latest reports of Census 2011 Directorate. In 2011 census, child sex ratio is 946 girls per 1000 boys compared to figure of 957 girls per 1000 boys of 2001 census data.

Source:http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3301_PART_A_DCHB_THIRUVALLUR.pdf

3.11.4 Scheduled Castes and Scheduled Tribes

As per 2011 Census, Total Scheduled Castes (SCs) population reported in the district is 821646 persons, which contributes about 22.03 percent of total population of the district. Total Scheduled Tribes (STs) population reported in the district is 47243 persons, which contributes about 1.26 % of total population of the district.

Source:http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3301_PART_A_DCHB_THIRUVALLUR.pdf

3.11.5 Education & Literacy

As per Census 2011, a person aged 7 years and above who can both read and write with understanding in any language is taken as literates. A person who can only read but cannot write is not literate. It is not necessary that to be considered as literate, a person should received any formal education or passed any minimum educational standard. Literacy could have been achieved through adult literacy

classes or through any non-formal educational system. People who are blind and can read in Braille are treated as literates. The literacy rate of Thiruvallur district is 84.03% in 2011 as against the state literacy rate of 80.1%. The educational infrastructure in the Thiruvallur district is given in **Table 3-32**

Source:http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3301_PART_A_DCHB_THIRUVALLUR.pdf

Table 3-32 Education Infrastructures in the Tiruvallur District

Type of school	Total schools		Rural Schools	
	Government	Private	Government	Private
Primary	941	487	815	252
Primary + Upper Primary	289	60	225	35
Primary + Upper Primary + Secondary + Higher Secondary	33	192	12	55
Upper Primary only	2	1	2	0
Upper Primary + Secondary + Higher Secondary	100	36	69	13
Primary + Upper Primary + Secondary	22	126	11	53
Upper Primary + Secondary	147	18	117	7

(Source: District Information Systems on Education (DISE report card 2016-17))

3.11.6 Employment and Livelihood

Agriculture is the main occupation of the district, but the district is being close to Chennai and the fast industrialization in the district, there is shift in the occupation pattern. Out of the total workers only 4.78% of workers are cultivators and 17.59% of workers are Agricultural labourers. The district's economy is vibrant as 81.14% of working population is belonging to main workers category that means they have regular employment activities more than 6 months in a year. The total coastal area of the district is about 49,803 ha and has a coast line of 80 km for marine fisheries. Prawn/shrimp culture is famous along the coast line of Gummidipoondi and Minjur.

Industrial Scenario

The district is fast growing in Industries. The district has many leading industries like Madras Refineries, Madras Fertilizers, Manali Petro Chemicals, MRF, Ashok Leyland, TI Cycles, Britannia India Ltd, Parry India Ltd. It also boasts of the Ennore Thermal Power Station and the Avadi Tank Factory. The District has 16 Industrial Estates, all in operation: 11 developed by the Government and 5 by Private Organization. This district also has 16940 Small Scale Industries.

3.11.7 Social Economic Profile of the study area

The project area comes under the Ponneri taluk and Madhavaram Taluk of Thiruvallur District in Tamil Nadu. **Table 3-33** provides the details on population profile within study area.

Table 3-33 Population profile within study area

Sl.No	Name	No of Households	Total Population Person	Total Population Male	Total Population Female	Population in the age group 0-6 Person	Scheduled Castes population Person	Scheduled Tribes population Person
0-5 Km								
Tiruvallur District- Ponneri taluk								
1	Kattoor	900	3425	1726	1699	362	2153	132
2	Karungali	58	203	97	106	34	22	101
3	Kalanji	77	260	126	134	45	195	0
4	Kattupalli	534	1911	1096	815	201	856	46
5	Voyalur	1683	6080	3017	3063	662	1483	30
6	Neithavayal	1400	5525	2777	2748	600	3553	137
7	Nandiambakkam	1511	6268	3156	3112	719	2048	549
8	Athipattu (CT)	2762	11034	5623	5411	1257	4505	299
5-10 km								
Thiruvallur District- Ponneri taluk								
9	Medur	878	3144	1559	1585	348	1510	217
10	Pralayambakkam	313	1247	590	657	117	515	2
11	Andarmadam	54	226	109	117	38	223	0
12	Pulicut	4619	17925	8915	9010	2196	2393	1116

Sl.No	Name	No of Households	Total Population Person	Total Population Male	Total Population Female	Population in the age group 0-6 Person	Schedule d Castes population Person	Schedule d Tribes population Person
13	Thangalperumbalam	573	2095	1083	1012	264	454	0
14	Sirupazhaverkadu	124	448	214	234	58	427	0
15	Kadapakkam	302	1126	568	558	163	841	114
16	Thathamaji	217	809	406	403	77	373	86
17	Somanjeri	233	830	405	425	92	490	0
18	Athamanjeri	325	1186	554	632	110	682	4
19	Thiruvellavoyal	532	1998	988	1010	246	886	32
20	Eripillaikuppam	90	279	139	140	25	179	0
21	Velur	451	1498	743	755	147	910	29
22	Kumarasirulapakkam	109	405	193	212	26	17	0
23	Kaniambakkam	452	1651	836	815	186	963	104
24	Kadamanjeri	79	287	144	143	34	187	40
25	Marattoor	168	593	295	298	64	525	2
26	Devadanam	317	1181	578	603	123	422	83
27	Vellambakkam	81	292	150	142	27	122	0
28	Thottakadu	271	1053	532	521	113	343	0
29	Kalpakkam	277	1136	582	554	169	269	0
30	Nalur	1655	6238	3146	3092	684	2794	53
31	Vallur	2993	11935	6089	5846	1309	7803	29

Sl.No	Name	No of Households	Total Population Person	Total Population Male	Total Population Female	Population in the age group 0-6 Person	Scheduled Castes population Person	Scheduled Tribes population Person
32	Seemapuram	477	1876	924	952	182	1061	15
33	Madiyur	84	313	160	153	24	0	13
34	Vellivoyal	820	3511	1758	1753	389	2466	5
35	Minjur (TP)	7048	28337	14168	14169	2960	9374	58
36	Edayanchavadi (CT)	3142	12119	6042	6077	1151	1402	5
Tiruvallur District - Madhavaram taluk								
37	Kattivakkam (M)	9354	36617	18466	18151	4301	2194	2107
38	Tiruvottiyur (M)	63862	249446	125300	124146	26903	13782	13121
Total		108825	424507	213254	211253	46406	68422	18529

Source: http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3301_PART_A_DCHB_THIRUVALLUR.pdf

3.11.8 Employment and livelihood

Economic vibrancy in area is shown by the type and nature of the occupation available in the area. Of the total working population, the majority is the main workers i.e they have steady job more than six months per annum. It is due to the industrialization in the area. The job opportunity is due to the development of Industrial and Service sectors. **Table 3-34** shows the classification of workers within the study area.

Table 3-34 Classification of workers within study area

Sl. No	Name	Total Worker s	Main Worker s	Margina l Worker s	Agriculture Workers				Household Industry Workers		Other Workers	
					Cultivators		Agri. Labourers		Main	Margina l	Main	Margina l
					Main	Margina l	Main	Margina l				
0-5 Km												
Thiruvallur District- Ponneri taluk												
1	Kattoor	1402	1079	323	117	20	601	98	31	5	330	200
2	Karungali	81	23	58	7	4	1	44	0	0	15	10
3	Kalanji	107	28	79	2	0	0	51	0	2	26	26
4	Kattupalli	864	773	91	20	9	3	0	20	0	730	82
5	Voyalur	2688	1612	1076	150	39	307	480	36	13	1119	544
6	Neithavayal	2310	1541	769	55	33	319	362	43	19	1124	355
7	Nandiambakkam	2362	1899	463	89	21	134	8	34	15	1642	419
8	Athipattu (CT)	4072	3397	675	10	5	7	6	81	19	3299	645

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Sl. No	Name	Total Worker s	Main Worker s	Margina l Worker s	Agriculture Workers				Household Industry Workers		Other Workers	
					Cultivators		Agri. Labourers		Main	Margina l	Main	Margina l
					Main	Margina l	Main	Margina l				
5-10 km												
Thiruvallur District – Ponneri taluk												
9	Medur	1488	1133	355	77	22	664	264	9	7	383	62
10	Pralayambakkam	666	294	372	18	21	141	143	3	4	132	204
11	Andarmadam	84	81	3	7	0	44	3	0	0	30	0
12	Pulicut	6552	5649	903	75	29	41	19	60	36	5473	819
13	Thangalperumbalam	816	559	257	31	4	3	150	8	6	517	97
14	Sirupazhaverkadu	260	168	92	1	1	131	84	4	2	32	5
15	Kadapakkam	556	548	8	0	0	459	6	10	1	79	1
16	Thathamaji	340	248	92	33	23	76	53	3	2	136	14
17	Somanjeri	465	454	11	15	0	343	10	2	0	94	1

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RP003-R1

Sl. No	Name	Total Worker s	Main Worker s	Margina l Worker s	Agriculture Workers				Household Industry Workers		Other Workers	
					Cultivators		Agri. Labourers		Main	Margina l	Main	Margina l
					Main	Margina l	Main	Margina l				
18	Athamanjeri	595	465	130	39	0	283	122	3	0	140	8
19	Thiruvellavoyal	863	709	154	18	1	265	10	10	3	416	140
20	Eripillaikuppam	147	116	31	14	0	58	6	0	0	44	25
21	Velur	699	437	262	57	25	185	159	12	7	183	71
22	Kumarasirulapakkam	322	74	248	38	11	14	204	3	25	19	8
23	Kaniambakkam	791	81	710	3	27	5	106	1	12	72	565
24	Kadamanjeri	142	92	50	5	0	3	31	1	2	83	17
25	Marattoor	313	49	264	0	5	1	17	2	3	46	239
26	Devadanam	487	485	2	16	1	122	0	14	0	333	1
27	Vellambakkam	167	102	65	3	7	0	0	21	26	78	32
28	Thottakadu	505	311	194	12	8	57	17	6	0	236	169

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Sl. No	Name	Total Worker s	Main Worker s	Margina l Worker s	Agriculture Workers				Household Industry Workers		Other Workers	
					Cultivators		Agri. Labourers		Main	Margina l	Main	Margina l
					Main	Margina l	Main	Margina l				
29	Kalpakkam	508	472	36	31	5	36	3	28	0	377	28
30	Nalur	2704	2028	676	356	69	205	173	70	65	1397	369
31	Vallur	4617	3662	955	77	39	138	56	117	46	3330	814
32	Seemapuram	849	651	198	62	2	92	109	31	9	466	78
33	Madiyur	116	110	6	50	1	19	4	4	0	37	1
34	Vellivoyal	1340	1299	41	49	6	96	0	5	0	1149	35
35	Minjur (TP)	11392	8624	2768	193	52	130	307	168	772	8133	1637
36	Edayanchavadi (CT)	4219	3495	724	14	1	27	22	54	19	3400	682
Tiruvallur District - Madhavaram taluk												
37	Kattivakkam (M)	13273	10880	2393	17	4	49	20	201	201	10613	2289
38	Tiruvottiyur (M)	94000	81050	12950	451	163	509	136	1568	1568	78522	12039

Drain EIA Report

RP003-R1

Sl. No	Name	Total Worker s	Main Worker s	Margina l Worker s	Agriculture Workers				Household Industry Workers		Other Workers	
					Cultivators		Agri. Labourers		Main	Margina l	Main	Margina l
					Main	Margina l	Main	Margina l				
Total		163162	134678	28484	2212	658	5568	3283	2663	2889	124235	22731

Source: http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3301_PART_A_DCHB_THIRUVALLUR.pdf

3.11.9 Infrastructure within study area

The district has good primary and secondary education infrastructure in urban and rural areas. The people around the study area have well connected to educational infrastructures. Details of Literacy population available in the study area are given in **Table 3-35**.

Table 3-35 Details of Literacy population in the study area

Sl. No	Name	Total Population Person	Literates Population Person	Literates Population Male	Literates Population Female	Illiterate Persons	Illiterate Male	Illiterate Female
0-5 Km								
Thiruvallur District-Ponneri taluk								
1.	Kattoor	3425	2357	1319	1038	1068	407	661
2.	Karungali	203	102	51	51	101	46	55
3.	Kalanji	260	145	73	72	115	53	62
4.	Kattupalli	1911	1196	784	412	715	312	403
5.	Voyalur	6080	3794	2132	1662	2286	885	1401
6.	Neithavayal	5525	3913	2109	1804	1612	668	944
7.	Nandiambakkam	6268	4817	2542	2275	1451	614	837

8.	Athipattu (CT)	11034	8205	4454	3751	2829	1169	1660
5-10 km								
Thiruvallur District - Ponneri taluk								
9.	Medur	3144	1924	1077	847	1220	482	738
10.	Pralayambakkam	1247	754	407	347	493	183	310
11.	Andarmadam	226	124	64	60	102	45	57
12.	Pulicut	17925	11970	6320	5650	5955	2595	3360
13.	Thangalperumbalam	2095	1293	744	549	802	339	463
14.	Sirupazhaverkadu	448	225	127	98	223	87	136
15.	Kadapakkam	1126	630	347	283	496	221	275
16.	Thathamaji	809	523	290	233	286	116	170
17.	Somanjeri	830	437	234	203	393	171	222
18.	Athamanjeri	1186	743	388	355	443	166	277
19.	Thiruvellavoyal	1998	1265	674	591	733	314	419

20.	Eripillaikuppam	279	192	102	90	87	37	50
21.	Velur	1498	939	524	415	559	219	340
22.	Kumarasirulapakkam	405	288	154	134	117	39	78
23.	Kaniambakkam	1651	1082	615	467	569	221	348
24.	Kadamanjeri	287	180	103	77	107	41	66
25.	Marattoor	593	386	226	160	207	69	138
26.	Devadanam	1181	733	407	326	448	171	277
27.	Vellambakkam	292	203	114	89	89	36	53
28.	Thottakadu	1053	671	388	283	382	144	238
29.	Kalpakkam	1136	693	397	296	443	185	258
30.	Nalur	6238	4531	2452	2079	1707	694	1013
31.	Vallur	11935	9101	5040	4061	2834	1049	1785
32.	Seemapuram	1876	1239	676	563	637	248	389
33.	Madiyur	313	235	137	98	78	23	55

34.	Vellivoyal	3511	2399	1292	1107	1112	466	646
35.	Minjur (TP)	28337	22301	11813	10488	6036	2355	3681
36.	Edayanchavadi (CT)	12119	9340	4969	4371	2779	1073	1706
Thiruvallur District - Madhavaram taluk								
37.	Kattivakkam (M)	36617	27279	14692	12587	9338	3774	5564
38.	Tiruvottiyur (M)	249446	197146	103034	94112	52300	22266	30034
	Total	424507	323355	171271	152084	101152	41983	59169

Source:http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3301_PART_A_DCHB_THIRUVALLUR.pdf

3.11.10 Dwelling within study area

Due to industrialization in nearby area and various Government Schemes, the standard of dwelling place has improved.

3.11.11 Health Facilities Within the Study Area

The majority of people visit nearby Hospitals/health services provided by the Government. The area has got good public health facilities at easily reachable distances. There was no major health issues reported in our survey. Even for any minor ailments they contact medical facilities immediately as it is very accessible to them. The local transport facilities and the communication facilities are the main reasons to get immediate medical attention. The emergency medical service facility “108” is very familiar and being used by the people in this area. The incidents of institutional delivery are high due to awareness, education, economic development, proximity to health delivery system. The Infant mortality rate and the maternal mortality rate have significantly reduced. **Table 3-36** shows the health facilities available in the study area.

Table 3-36 Health facilities available in the study area

Sl.No	Type	Numbers
1	Community health centre	1
2	Primary health centre	5
3	Primary health sub-centre	22
4	Maternity and Child Welfare Centre	22
5	TB hospital/Clinic	13
6	Hospital Allopathic	3
7	Hospital Alternative Medicine	16
8	Dispensary Health Centre	17
9	Veterinary hospital	13
10	Mobile health clinic	0
11	Family Welfare Centre	13
12	Non-Government Medical facilities Out Patient	54

Source:http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3301_PART_A_DCHB_THIRUVALLUR.pdf

3.11.12 Summary

The Socioeconomic profile of the study area shows that more than half of people in the study area work in other sector. The average literacy rate of the study area is 76.17%. The people in the study area are well connected to Government primary health centres and Primary health sub-centres.

Table 3-37 Summary of Socioeconomic indicators within the study area

S.No	Particulars	Study Area	Unit
	0-5 Km		

S.No	Particulars	Study Area	Unit
1.	Number of villages and Town in the Study Area	8	Nos.
2.	Total Households	8925	Persons
3.	Total Population	34706	Persons
4.	Children Population (0-6 Years Old)	3880	Persons
5.	SC Population	14815	Persons
6.	ST Population	1294	Persons
7.	Total Working Population	13886	Persons
8.	Main Workers	10352	Persons
9.	Marginal Workers	3534	Persons
10.	Cultivators	581	Persons
11.	Agricultural Labourers	2421	Persons
12.	Household Industries	318	Persons
13.	Other Workers	10566	Persons
14.	Literates population	24529	Persons
15.	Illiterates population	10177	Persons
5-10 km			
16.	Number of villages and Town in the Study Area	30	Nos.
17.	Total Households	99900	Persons
18.	Total Population	389801	Persons
19.	Children Population (0-6 Years Old)	42526	Persons
20.	SC Population	53607	Persons
21.	ST Population	17235	Persons
22.	Total Working Population	149276	Persons
23.	Main Workers	124326	Persons
24.	Marginal Workers	24950	Persons
25.	Cultivators	614	Persons
26.	Agricultural Labourers	645	Persons
27.	Household Industries	3136	Persons
28.	Other Workers	90561	Persons
29.	Literates population	298826	Persons
30.	Illiterates population	90975	Persons

Source:http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3301_PART_A_DCHB_THIRUVALLUR.pdf

CHAPTER 4

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.1 Details of Investigated Environmental Impacts due to project location, possible accidents, project design, project construction, regular operations, final decommissioning or rehabilitation of a completed projected

Environmental impact is any change in the environmental attributes, adverse or beneficial, caused or induced by the proposed action or set of actions. The predicted adverse impacts during each stage of project development are superimposed over the baseline status of the existing environmental quality to infer the scenario of environmental conditions in the post-project stage. The main purpose of identifying the impacts is that it helps in adopting appropriate mitigation measure for the adverse consequences if any.

Identification of impacts leads to quantification and evaluation of impacts and suggestions of mitigation measures. Predicting and evaluating the various significant impacts that are likely to occur. The impacts on the environmental indices viz. air, water, soil, noise, biological and socio-economic conditions are scrutinized methodically and assessed.

4.1.1 General

The outcome of the revalidation of the earlier traffic study in 2010 for the POL, LPG and Chemicals / other liquids indicated a good potential for the development of Marine Liquid Terminal at Kamarajar Port. However, the development of liquid terminal at Kamarajar Port could entail impacts on the environmental components such as air, noise, water, occupational health, etc. These impacts have to be taken into consideration during the planning stages of the project to minimize the same during development and operation.

Keeping this in view, the various impacts on the environmental attributes which are likely to arise due to the development of the Marine Liquid Terminal at Kamarajar Port are broadly discussed in this chapter. The assessment is based on a qualitative approach through review of the past environmental data generated for the Kamarajar Port. Both beneficial (positive) and potential negative impacts are envisaged due to the construction and operation of the terminal. A brief summary of the activities associated with the development of the Terminal are presented to assist in better appreciation of the assessed impacts vis-à-vis the proposed construction and operation. The environmental impacts both for the construction phase and operation phase and for each activity are presented. The details of the mitigation measures to minimize the impacts, which were planned as part of the development of the Terminal or proposed to be adopted are also presented. A broad Environmental Management Plan (EMP) is also presented.

4.1.2 Baseline Environmental Status

The existing environmental scenario in the project area has been established through collection and review of past data and reports on Kamarajar Port together with the information gathered from the site visits and consultations with various agencies / officials. Brief details of the environmental features are presented in the following paragraphs.

4.2 Environmental Impacts – Construction Phase

There is no major construction involved in this project and the scope of modifications of existing facilities are given in the table below.

Table 4-1 Project and the scope of modifications of existing facilities

S.No.	Details	Remarks
1	Modification of Common Manifold to facilitate simultaneous discharge to BPCL	Hooking up lines to 2 x 24" lines of BPCL
2	Modification of 16" dock line to make it suitable for receipt of motor spirit from vessels	Modifications at jetty, common manifold and at exchange pit
3	Modification of 8" SS Dock Line for in line berthing of chemical vessel with POL vessels	Extension of 8" SS Dock line to south side of the jetty for in-line berthing of 2 vessels

The impacts due to the above activities will be for a very short time and insignificant. Hence this report does not address the impacts due to the construction phase.

4.3 Assessment of significance of Impacts - by Matrix method

Water, Air and Land are the most vulnerable environmental attributes in serving the proposed industrial activities. Solid waste is another significant environmental issue from the proposed member industries. More discharges, discards and disposals can be listed to have significant impact on water, air and land environment.

A number of techniques are available for the assessment of impacts. Each of these techniques has their own advantages and disadvantages. The selection of any of these techniques for any particular project depends largely upon the choice of judgment of the analysis. The technique chosen should be comprehensive, easy to understand, systematic and flexible. Considering these criteria, for this project, the matrix method was used, with an impact scale of -4 to +4.

Impact identification and assessment of the site can be assessed by the matrix method, popularly known as Leopold matrix method, which is a universal tool for the EIA studies. The matrix used for the EIA consists of project activities on the x-axis and the environmental components likely to be affected by these activities on the y-axis. Each cell of the matrix represents a subjective evaluation of the impact of the particular components, in terms of magnitude importance. A blank cell indicates no impact of the activity on the component. The magnitude (m) is represented by a number from 1-4 where,

1= Minimal

2= Appreciable

3= Significant

4= Severe

A positive sign indicates a beneficial impact and the negative sign indicates an adverse impact. The impact classification is given below in **Table 4-2**.

Table 4-2 Overall impact classification

S.No	Project impact scale	Magnitude of impact
1	-100 to -75	Severely adverse
2	-75 to -50	Significantly adverse
3	-50 to -25	Appreciably adverse
4	-25 to 0	Low Adverse Impact
5	0 to 25	Minimally beneficial
6	25 to 50	Appreciably beneficial
7	50 to 75	Significantly beneficial
8	75 to 100	Highly beneficial

4.3.1 Impact Scenarios

Impact score for the project was calculated for two scenarios using the matrix method described above. Matrices were prepared to represent each of these scenarios namely

- Project without EMP
- Project with EMP

4.3.1.1 Project without EMP

In this scenario, the proposed Industrial Area development is considered without proposing Environmental Management plans. The magnitude of the environmental components likely to be affected with the values for importance is tabulated in **Table 4-3**

Table 4-3 Project scenario without EMP

S.No	Environmental components likely to be affected		Operation phase					Impact on the components	Remarks
			Transport of men & materials	Emissions from unloading cargo	Water requirement	Waste disposal (solid & liquid)	Chemical storage		
1	Air quality	Magnitude	-3	-3	0	-1	-2	-21	Low Adverse Impact
		Importance	2	3	0	2	2		
2	Noise	Magnitude	-3	-3	0	0	0	-18	Low Adverse Impact
		Importance	3	3	0	0	0		
3	Surface water quantity	Magnitude	-1	-1	-3	-4	-2	-31	Appreciably adverse
		Importance	1	1	3	4	2		
4	Ground water quantity	Magnitude	0	0	0	-4	-1	-17	Low Adverse Impact
		Importance	0	0	0	4	1		
5	Soil quality	Magnitude	-2	-2	0	-4	-2	-28	Appreciably adverse
		Importance	2	2	0	4	2		
6	Flora & fauna	Magnitude	0	-2	-1	-4	-1	-22	Low Adverse Impact
		Importance	0	2	1	4	1		
7	Socio economics	Magnitude	2	-2	-1	-3	-2	-14	Low Adverse Impact
		Importance	2	2	1	3	2		

The impact was found to be – 151 which is Severely adverse

4.3.1.2 Project scenario with EMP

In this scenario, the proposed Industrial Area development is considered with all the Environmental Management plans. The magnitude of the environmental components likely to be affected with the values for importance is tabulated in **Table 4-4**.

Table 4-4 Project scenario with EMP

S.No	Environmental components likely to be affected		Operation phase					Impact on the components	Remarks
			Transport of men & materials	Emissions from unloading cargo	Water requirement	Waste disposal (solid & liquid)	Chemical storage		
1	Air quality	Magnitude	-1	-1	0	-1	-1	-7	Low adverse impact
		Importance	2	2	0	2	1		
2	Noise	Magnitude	-1	-1	0	0	-1	-5	Low adverse impact
		Importance	2	2	0	0	1		
3	Surface water quantity	Magnitude	1	1	1	1	1	7	Minimally beneficial
		Importance	1	1	1	2	2		
4	Ground water quantity	Magnitude	0	0	0	-1	-1	-3	Low adverse impact
		Importance	0	0	0	1	2		
5	Soil quality	Magnitude	1	1	1	1	1	11	Minimally beneficial
		Importance	2	2	4	2	1		

6	Flora & fauna	Magnitude	0	1	1	1	1	5	Minimally beneficial
		Importance	0	2	1	1	1		
8	Socio economics	Magnitude	3	-1	1	1	0	9	Minimally beneficial
		Importance	2	2	3	2	0		

The impact was found to be 17 which are minimally beneficial.

4.4 Operation Phase

The various impacts on the environmental attributes that are likely to arise due to the development and operation of Marine Liquid Terminal at Kamarajar Port are broadly presented. The major activities involved during construction and operation of the Terminal encompass the following:

4.5 Ground Level Concentration Increment

4.5.1 Air Environment

Base line data reveals that ambient air quality in the study area for the Parameters PM, NO_x and CO are well within the permissible Limits as prescribed by the National Ambient Air Quality Standards (NAAQS) for Industrial Area, Residential, Rural & Other areas.

4.5.2 Meteorological Data

The meteorological data for a 3 month, i.e. from 01/03/2024 to 31/05/2024 was considered for the study. Data included for AERMET were daily wind speed, wind direction, temperature, relative humidity, air pressure, precipitation, and solar radiation recorded during the period. AERMET reformats meteorological data so that it can be used as input for AERMOD model. Meteorology considered for modelling is shown below.

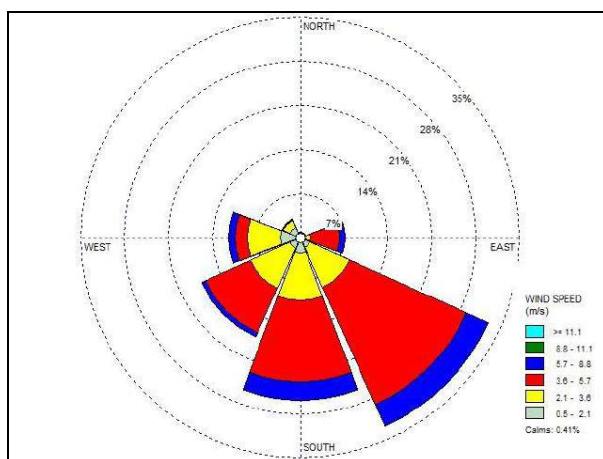


Figure 4-1 Wind rose diagram of Meteorological data considered for Modelling (March 2024 to May 2024)

AERMET Process

For the 3 phase AERMET processing of the meteorological data, specifications of the land use in the area are required to determine the terrain roughness for modelling. The land use was characterized for in and around the site. The surface characteristics for the site and surroundings were selected and used to calculate the Albedo, Bowen ratio and surface roughness parameters.

4.5.3 AERMOD Process

AERMOD Software Version 8.0.5 was used for air dispersion modelling and is applicable to a wide range of buoyant or neutrally buoyant emissions up to a range of 50 km. In addition to more straight forward cases, AERMOD is also suitable for complex terrain and urban dispersion scenarios.

AERMOD is a steady-state plume model. In the stable boundary layer (SBL), it assumes the concentration distribution to be Gaussian in both the vertical and horizontal. In the convective boundary layer (CBL), the

horizontal distribution is also assumed to be Gaussian, but the vertical distribution is described with a bi-Gaussian probability density function (pdf). This behavior of the concentration distributions in the CBL was demonstrated by Willis and Deardorff (1981) and Briggs (1993). Additionally, in the CBL, AERMOD treats “plume lofting,” whereby a portion of plume mass, released from a buoyant source, rises to and remains near the top of the boundary layer before becoming mixed into the CBL. AERMOD also tracks any plume mass that penetrates into the elevated stable layer, and then allows it to re-enter the boundary layer when and if appropriate. For sources in both the CBL and the SBL AERMOD treats the enhancement of lateral dispersion resulting from plume meander. The emissions from proposed stacks are estimated and used for the air dispersion modeling as shown in Table 4.5 respectively. Maximum incremental values for PM, SO₂, NO_x and CO have been represented as pictorial concentration contours and as tabular concentration values in following sections.

Line Source:

Table 4-5 Proposed Expansion project Transportations Emission

S.No	Vehicle Type	No. of Vehicle per day (Maximum Operation Capacity)	Emission Details(g/s)		
			PM	NOX	CO
1	4W	3	3.75E-05	1.04E-03	6.17E-03
2	HW	300	1.67E-03	7.67E-02	6.67E-01
Total(g/s)			1.70E-03	7.77E-02	6.73E-01

Source:

Indian Emission Regulations by the Automotive Research Association of India

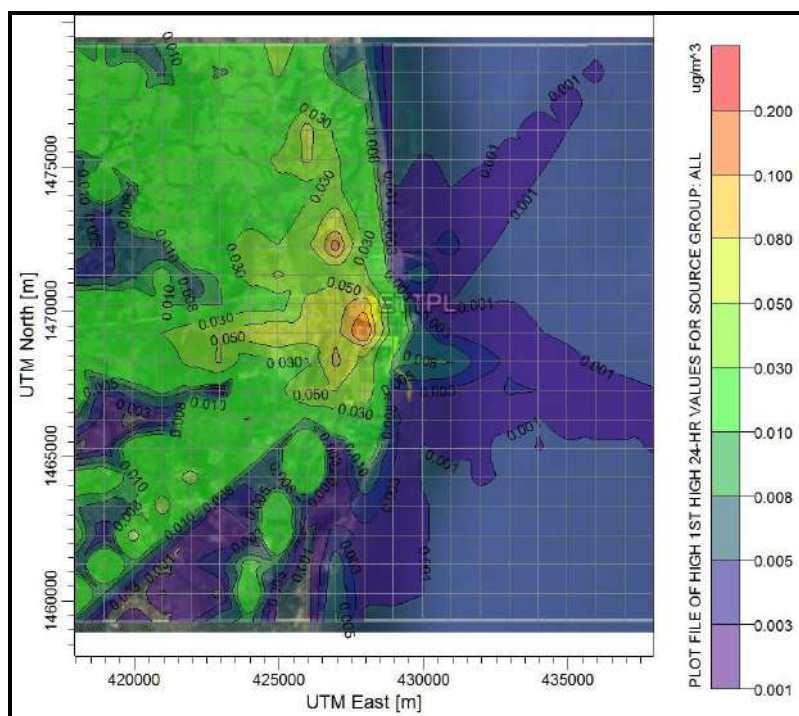


Figure 4-2 Predicted 24-Hrs GLC's of Particulate matter PM within 10 km Radius of the Study Area

Table 4-6 Estimated Top 10 Highest Concentrations of Particulate Matter PM obtained through Modeling

S. No	UTM coordinates (m)		Conc. ($\mu\text{g}/\text{m}^3$)	Distance from Centre of Project Site (~Km)	Direction from Centre of Project Site
	E	N			
1.	427946	1469270	0.13357	Within site	Within site
2.	426946	1472270	0.11585	3.16	NNW
3.	427946	1470270	0.09817	1	N
4.	426946	1468270	0.08937	1.41	SW
5.	426946	1469270	0.07505	1	W
6.	424946	1469270	0.07394	3	W
7.	426946	1470270	0.07169	1.41	NW
8.	425946	1469270	0.06346	2	W
9.	423946	1469270	0.06314	4	W
10.	426946	1473270	0.06223	4.12	NNW

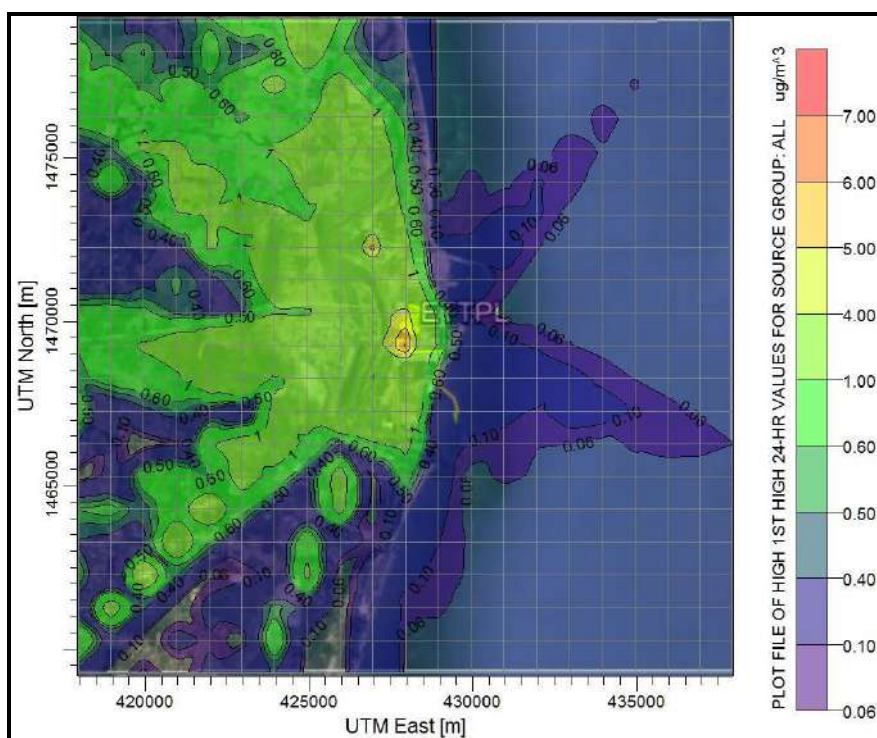


Figure 4-3 Predicted 24-Hrs' GLC's of NO_x within 10 km Radius of the Study Area

Table 4-7 Estimated Top 10 Highest Concentrations of oxide of Nitrogen Obtained through Modeling

S. No	UTM coordinates (m)		Conc. ($\mu\text{g}/\text{m}^3$)	Distance from Centre of Project Site (~Km)	Direction from Centre of Project Site
	E	N			
1.	427946	1469270	6.14108	Within site	Within site
2.	426946	1472270	5.32676	3.16	NNW
3.	427946	1470270	4.51364	1	N
4.	426946	1468270	4.10908	1.41	SW
5.	426946	1469270	3.45061	1	W
6.	424946	1469270	3.39957	3	W
7.	426946	1470270	3.29596	1.41	NW
8.	425946	1469270	2.91773	2	W
9.	423946	1469270	2.90312	4	W
10.	426946	1473270	2.86144	4.12	NNW

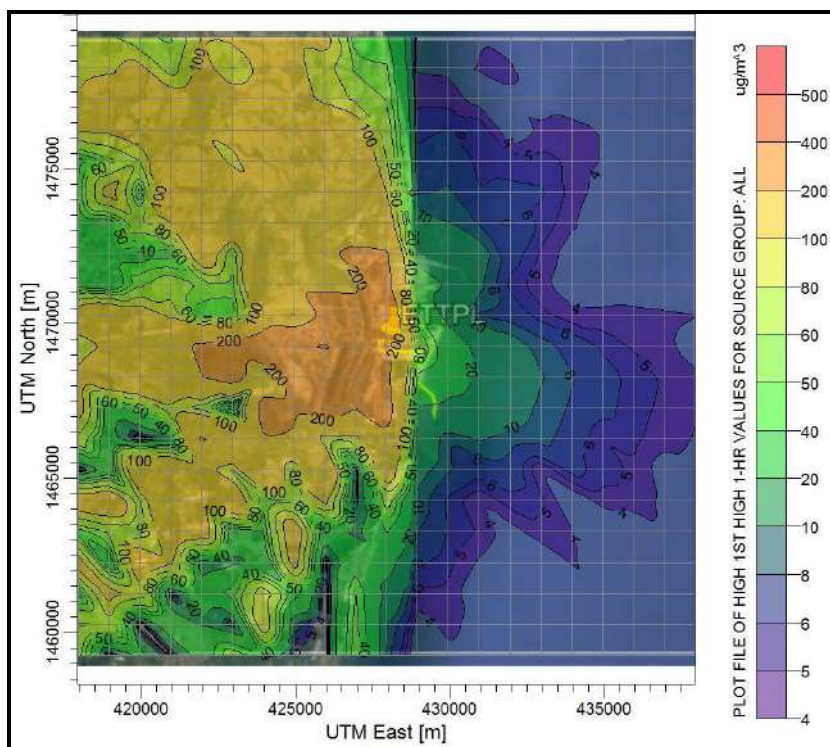


Figure 4-4 Predicted 1-Hrs' GLC's of CO within 10 km Radius of the Study Area

Table 4-8 Estimated Top 10 Highest Concentrations of Carbon Monoxide Obtained through Modeling

S. No	UTM coordinates (m)		Conc. ($\mu\text{g}/\text{m}^3$)	Distance from Centre of Project Site (~Km)	Direction from Centre of Project Site
	E	N			
1.	425946	1469270	417.327	2	W
2.	424946	1469270	366.1593	3	W
3.	427946	1470270	314.545	1	N

4.	426946	1469270	283.6997	1	W
5.	423946	1469270	273.8654	4	W
6.	422946	1468270	262.1737	5.10	WSW
7.	425946	1467270	259.7753	2.82	SW
8.	423946	1467270	248.6369	4.47	WSW
9.	422946	1469270	245.7591	5	W
10.	427946	1467270	243.7865	2	S

4.6 Conclusion

Maximum pollutant concentrations of PM and NO_x observed due to proposed for an 24hr-average period have been and CO observed due to proposed for an 24hr-average period have been studied. The total increase in concentrations above baseline status to estimate the percentage increase and summarized in **Table 4-9**.

Table 4-9 Total Maximum GLCs from the Transportations Emissions

Pollutant	Max. Base line Conc. (µg/m ³)	Estimated Incremental Conc. (µg/m ³)	Total Conc. (µg/m ³)	NAAQ standard (µg/m ³)
PM10	71.29	0.13	71.42	100
NO _x	29.13	6.14	35.27	80
CO	950	417.32	1367.32	4000

Marine-Side Activities

- Product handling
- Movement of vessels

Land-Side Activities

- Product storage
- Inland product movement.

4.6.1 Mitigational Measures During Operational Phase

Due to handling of the product impacts are envisaged in the harbour basin through discharge of sewage, ship waste, oil spills, runoffs from operational areas, etc. To mitigate these impacts, measures proposed are discussed in the following paragraphs.

4.6.2 Marine Environment

The major impact on marine water during the operation of the facility will be due to the spillage of material in land and sea. During the operational phase of the project, frequency of incoming and outgoing ships will increase and hence the chances of spillages and leakages of oil into the sea will be more. This will affect the sea water quality and appropriate care must be taken to ensure that discharges are made to appropriate drainage lines etc. which lead to appropriate treatment facilities. Oily wastes from machinery, spillages and leakages of oil from incoming and outgoing ships into the sea will affect the water quality. This water will have a chance to either drain into the water body, or will seep through the land and contaminate the ground water. This will have floating material on the water surrounding the port. The discharge of bilge water and/or ballast water from the ship may also cause negative impacts on the marine water.

The leaks, accidental release of the materials during the transport of the materials through the pipelines may cause serious soil contamination and will seep through the land and affect the ground water quality. As the area is a reclaimed land and the available groundwater will be affected by the salt intrusion and sea water incursion, it cannot be used for drinking without treatment. However contaminating the available groundwater /marine water with oil or any other materials shall be taken as very serious and all the possible measures to be taken to avoid any kind of spillage of materials during the operations like ship to ship transfer, ship to shore transfer, shore to shore transfer and vice versa.

4.6.2.1 Mitigation Measure of Marine Environment

To mitigate the impacts due to marine water pollution, the following measures would be adopted:

- All the operational areas will be connected with a network of liquid waste collection corridor comprising of storm water, oily wastes, and sewage collection pipelines.
- Oily wastes which are generated from the operational areas would be collected in the effluent network and further treated at the treatment plant.
- Vessels calling at the Terminal would not be permitted to dump the wastes / bilge water during the berthing period.
- Required pollution control facilities for treatment of waste water, solid waste management, etc. will be setup for the terminal.
- Measures would be taken to contain, control and recover the accidental spills of fuel, oil and other product handled.
- ETPL and KPL has prepared Oil Spill Contingency Plan and is attached as **Annexure 16**.

4.6.3 Noise Environment

The impacts of the project on the noise levels of the surrounding areas were assessed. All equipments in the ETPL site has been designed/operated to have a noise level not exceeding 85 to 90 dB (A) as per the

requirement of Occupational Health and Safety Administration Standard (OHSAS). In addition, since most of the noise generating equipment would be in closed structures, the noise transmitted outside would be still lower.

4.6.3.1 Impacts

Major sources of noise generation during operational phase are classified into two categories:

- Stationary sources due to operation of heavy duty machinery at the project site like Vehicles, DG sets, Pumps etc.
- Mobile sources corresponding to mainly vehicular traffic for staff mobilization, material movement, material transportation, liquid fuel transportation to project site, etc.

The impact of vibrations beyond the site would be negligible during normal operation phase. However, the impacts on workers engaged would be considerable due to occupational exposure.

4.6.3.2 Mitigation Measures

- The major noise generating equipment like DG sets, water pumps etc. has been enclosed in an acoustic enclosure designed for an insertion loss of 25 dB (A) and silencers to other equipment etc.
- Major noise generating equipment was designed with 85 dB (A) ensuring cumulative noise at 1.0 m remains at 85 dB (A).
- Acoustic silencers are provided in equipments wherever necessary.
- Use of personal protective equipments/devices such as ear-muffs, ear plugs etc. will be strictly enforced for the workers engaged in high noise areas.
- Ambient noise levels are monitored at regular intervals during operational phase of the project.

4.6.3.3 Traffic and Transport

Approach road to the site is SH-107(Minjur–Kattur–Thirupalaivanam Road)/SH-104(Chennai-Pulicat Rd) which is located at a distance of ~6.58km (WNW) **Table 4-10** gives the existing and proposed vehicular movement due to the project at SH-107(Minjur–Kattur–Thirupalaivanam Road)/SH-104(Chennai-Pulicat Rd) respectively gives the traffic Categorisation.

Table 4-10 Existing & proposed vehicular movement per day SH-107(Minjur–Kattur–Thirupalaivanam Road)/SH-104(Chennai-Pulicat Rd)

S. No	Type of Vehicle	Existing vehicles	Existing PCU	Proposed vehicles	Proposed PCU	Total vehicles after project implementation	PCU Factors IRC (SP 41)	Total PCU after project implementation
1	2 wheelers	3235	2426	0	0	3235	0.75	2426
2	3 wheelers	989	1978	0	0	989	2	1978
3	4 wheelers/ cars	1170	1170	3	3	1173	1	1173

4	Trucks/ Bus/HCV	3616	13379	300	1110	3916	2.2	8615
5	Agricultural tractor	8	32	0	0	8	4	32
6	Light emission vehicle-LCV	996	1394	0	0	996	2.0	1992
Total		10014	20380	303	1113	10317	-	16216

Table 4-11 Traffic Volume after Implementation of the Project

For the Road	Volume of Traffic	Volume (V)	Road Capacity (C)	V/C Ratio	LOS Category*	Traffic Classification
Existing	10014	20380	35000	0.58	“C”	Restricted Flow
After implementation	10317	16216	35000	0.61	“C”	Restricted Flow

*LOS (Level of Service) categories are A-Free Flow, B- Stable Traffic Flow, C- Restricted Flow, D- High Density Flow, E- Unstable flow, F- Forced or breakdown flow

*LOS (Level of Service) categories are:

Level of Service	V/C	Classification
A	<0.35	Free Flow Traffic
B	0.35 - 0.55	Stable Traffic Flow
C	0.55 - 0.77	Restricted Flow
D	0.77 - 0.92	High Density Flow
E	0.92 - 1.0	Unstable Flow
F	>1.0	Forced Traffic Flow

Due to propose project there will be slight increment in the vehicle movement but the level of service (LOS) anticipated will be “Restricted Traffic Flow”.

4.6.3.4 Impact due to Wastewater Generation

- The untreated wastewater if discharged into nearby surface water may affect the surface water and/or if disposed off on land without treatment may pollute the ground and surface water.
- The other impact is water pollution due to disposal of rejects into the sea.

4.6.3.5 Mitigation Measures

- ETP has already been installed to treat the generated effluent. .

- Appropriate drainage facilities have been developed within the site including proper disposal to drains.

4.6.3.6 Impact due to intake, out fall point and marine disposal

There is no marine disposal. So no impacts identified.

4.6.4 Solid waste management

4.6.4.1 Impacts

During operation phase, the solid wastes generated and it can be broadly categorized as Hazardous Waste and Municipal Solid Waste. Further, the generated Municipal Solid Waste segregated into biodegradable, recyclable and inert compounds.

4.6.4.2 Mitigation Measures

- The Source of Municipal waste will be from the domestic use and strict guidelines will be put in place in order to manage the solid waste generation during operation phase.
- Solid wastes will be segregated into organic and inorganic categories. The organic waste will be disposed through village bins and inorganic waste will be sold to authorized vendors. The ship generated solid wastes will be collected, segregated and disposed to approved recyclers/industries for further beneficial use through port engaged contractor.
- Hazardous waste generated will be stored in a separate hazardous waste storage area and properly disposed as per the Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2016.

Table 4-12 Summary of Mitigation Measures and Impact

S.no	Impacts	Mitigation Measures
1	The major air pollution source is the DG set which emits flue gases containing Suspended Particulate Matters, Oxides of Sulphur and Nitrogen that may affect the ground level concentrations.	The DG set has been provided with stacks of adequate height so as to disperse the emanating flue gases containing Suspended Particulate Matters, Oxides of Sulphur and Nitrogen without affecting the ground level concentrations.
2	Combustion process such as diesel engines	Maintenance of diesel power generators to achieve efficient combustion, fuel efficiency and therefore reduce emissions
3	Air borne particulates from soil disturbance during expansion and from vehicle traffic such as trucks and	• Adequate sprinkling of water on soil surface will be carried out. • Vehicle, equipment and machinery used for

S.no	Impacts	Mitigation Measures
	trailers	men and material transfers.
4	Impact due to presence of VOC in the atmosphere	On-line VOC monitoring system has been installed and the same is connected to care air center of TNPCB for real time monitoring of VOC data.
5	Noise pollution due to operation of machineries & equipment; Vehicular traffic; Operation of DG sets and machineries	- Well maintained equipment and vehicles will be used; - All DG sets would be provided with acoustic enclosures; and - Appropriate PPEs (e.g. ear plugs) will be used for by workers while working near high noise generating equipment.
6	Land use change may lead to impact on income and livelihood	Degraded land will be selected on long term lease and reinstate the land after project activity.

4.6.5 Ecology

Air emissions, liquid effluent disposal and solid waste generation are likely to have some impact on terrestrial ecosystem. An ETP of 20 KLD has been installed in the terminal to treat the effluent generated.

The ecology development will be taken care as per KPL's approved Biodiversity Management Plan.

4.6.6 Socio-Economic Environment

The project is likely to have positive impacts on socio economic environment.

4.7 Land-side Activities

4.7.1 Loading and Unloading of Products

The product handling operations will generate noise. It will be ensured that the noise levels do not exceed 75 dB(A) during daytime and 70 dB(A) during night-time.

4.7.2 Inland Product Movement

The transportation of product Tank Farm will contribute to increase in traffic on the existing road network. The increase in traffic might lead to traffic congestion, increase in dust levels, noise levels and risk of accidents. In order to contain these impacts, the following measures would to be taken up.

- Transportation Management Plan will be prepared by ETTPL along with KPL and the movement of product will be planned in line with the same.
- Traffic density studies will be undertaken along the existing road network covering all the roads leading to Kamarajar Port. All the vehicles involved in transshipment of product inland would be checked for valid Pollution Under Control (PUC) certificates. A mobile task force will be formed in co-ordination with local Road Transport Authority (RTA) to check the compliance of vehicle emissions to norms/standards periodically during operation phase used for inland product movement.
- Development of greenbelt along the access roads especially at areas prone to the impacts due to the product movement will be undertaken. This activity will be immediately taken up after the approval to reduce the impacts on air quality and attenuate the excessive noise levels due to the product movement.
- Based on the traffic density / vehicular movements anticipated from the port, parking facilities would be provided.

4.7.3 Green Belt Development

In 1992 the port was conceived as a satellite port to handle coal through two coal berths. Port is continuously developing green belt.

- Port is having a green belt to an extend of 636.14 acres which includes inside and outside custom bound area.
- The total area of the port is 2787.2 acres in that area total green belt is to an extend of 636.14 acres (22.82%) which includes inside and outside the custom bound area.
- Proposed Green belt of 5.01 acres will be developed inside and outside the Tank Farm area.
- The treated wastewater will be reused in the green belt areas to reduce the water requirements.
- The tree species to be used for the green belt development will be in line with the local ecology.



Figure 4-5 Green belt Layout



Figure 4-6 Existing Greenbelt Photographs

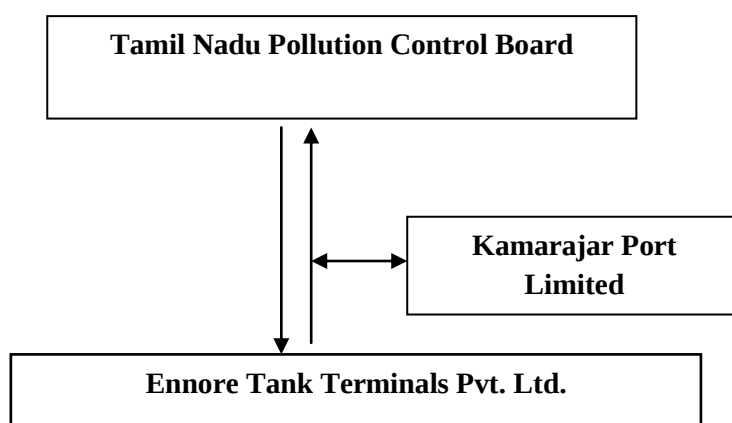
4.7.4 Environmental Monitoring

The mitigation measures suggested in the preceding sections require environmental monitoring of air quality, noise levels, seawater, sediment, groundwater quality, etc. during the operation phase of capacity expansion of ETTPPL. Offshore and onshore environmental surveys will be carried out to meet the monitoring requirements. The monitoring requirements would be carried out through sub-contracting the assignment to an approved agency with capabilities to undertake monitoring of onshore and offshore environmental surveys.

4.7.5 Institutional Mechanism

The effective implementation and close supervision of the environmental monitoring programme to negate the environmental impacts, which are likely to arise due to the development and operation phase of terminal could be achieved through a suitable institutional mechanism. During operation phase of expansion ETTPPL will have an institutional mechanism to ensure proper implementation of the EMP. A broad institutional mechanism for both the phases is presented below

Operation Phase



The implementation of the Environmental Management Plan (EMP) is the responsibility of ETTPPL. The ETTPPL would see that the environmental monitoring works are included in all the contracts. The Contractors would appoint a full-time Environmental Officer to monitor the mitigation measures and keeping a daily record of the same.

The responsibilities of the Environmental Officer would include day to day recording of mitigation measures, planning and execution of environmental monitoring, review of the report submitted by the monitoring agency, checking the compliance of the results with respect to the baseline conditions and also with the relevant standards and preparation of monthly progress reports documenting all the activities.

The Environmental Officer of the contractor would report the monitoring programme to the ETTPPL..

ETTPL would also carry out environmental monitoring on random basis through an independent agency other than the contractor's agency in order to check the compliance of the monitoring results.

Pursuant to the above, 'Rules and Regulations' notified by the MoEF, GOI shall be implemented for:

- a) Hazardous waste and other waste (Management and Trans boundary) (Rules 2016)
- b) Manufacture, Import & Storage of hazardous chemicals (Rules 1989)

Onsite & offsite Disaster Management Plan are prepared and on-site mock drills are being conducted once in a month assuming different scenarios..

Oil spills if any shall be properly collected and disposed as per norms.

CHAPTER 5

ANALYSIS OF ALTERNATIVES

5 ANALYSIS OF ALTERNATIVES

5.1 Introduction

A necessary part of the EIA process is the consideration of alternatives to the proposed activity. Customers evinced interest to discharge multiple products from one or more vessels simultaneously to improve overall turnaround time of the vessels and also intend to increase the throughput volumes through ETPL to cater to the increased market demand. To facilitate this, ETPL is planning to augment its throughput capacity from 3 MMTPA to 6 MMTPA.

5.2 Alternative locations

Since this is an existing project, no alternate sites were proposed.

Advantage of the existing site:

- Greater flexibility in terms of handling multiple products simultaneously
- Handling berthing of two smaller tankers simultaneously.
- The jetty can handle higher level of traffic with minimal waiting time for Tankers
- Customers can import/export in larger parcels and benefit from lower ocean freight
- Help the customers to meet the increased market requirements with higher volumes.
- In the long run, the Port would benefit from higher traffic and hence higher revenues

5.3 Summary of adverse impact of each alternative

Since this is an existing project, no alternate sites were proposed. So no adverse impact in alternative site.

CHAPTER 6

ENVIRONMENTAL MONITORING PROGRAMME

6 ENVIRONMENTAL MONITORING PROGRAMME

6.1 Monitoring plan for effectiveness of mitigation measures

Environmental monitoring is required to protect the public and the environment from toxic contaminants and pathogens that can be released into a variety of media including air, soil, and water. Air pollutants include sulphur dioxide, carbon monoxide, nitrogen dioxide, and volatile organic compounds, which originate from sources such as increased vehicle emissions by road and sea, fugitive emissions, that may occur during the material transfer etc. .

The plan framed for the intended facility will describe:

- The details of the proposed mitigation measures taken for safeguarding the environment at the project site as well as in the vicinity of the industrial site
- Details of management plans (Solid waste management plan etc.)
- Post project environmental monitoring programme to be undertaken after commissioning of the expansion phase of the project.
- The associated cost components of the pollution control systems that will be installed at the site.

For each of the environmental attributes, the monitoring plan specifies the parameters to be monitored, location of monitoring sites, frequency and duration of monitoring and it also denotes the applicable standards, implementation and supervising responsibilities.

6.2 Objectives

- To provide a database this can be used to determine any short or long-term environmental impacts of the Project.
- To verify the environmental impacts predicted in the EIA study.
- To monitor the performance and effectiveness of mitigation measures employed.
- To determine project compliance with regulatory requirements, standards and Government policies.
- To provide an early indication and suggest appropriate additional or remedial measures should any of the environmental mitigation measures or controls fail to achieve the acceptable standards.
- To ensure that the areas of environmental concern identified during EIA process are carried through to, and appropriately considered and incorporated into the detailed design and tender stage of project
- To take remedial action if unexpected problems or unacceptable impacts arise
- To implement water quality, air quality and noise impact monitoring programme during the operational phase
- To conduct regular reviews of monitored data as the basis for assessing compliance with defined criteria

6.3 Environmental Monitoring Programme

The monitoring programme in different areas of the environment has been based on the findings of the impact assessment studies. The post project monitoring programme including areas, number and location of monitoring stations, frequency of sampling and parameters to be covered is summarized in **Table 6-1**.

Table 6-1 Environmental Monitoring Programme –Operation Phase

S. No	Area of Monitoring	Number of Sampling Stations	Frequency of Sampling	Parameters to be Analyzed
1.	Ambient Air Quality	3 Stations (one in up wind and one in downwind and one at site)	Once in a month 24 hourly period	All the 12 parameters as per NAAQ Standards
2.	Noise	2 (one within site and one outside site)	Once in 3 months for 24 hours	Ambient Equivalent Continuous Sound Pressure Levels (Leq) at day and Night time.
3	VOC	4 on the corners of the tank farm area	Once in 6 months	Presence of VOC in the ambient air is analysed on real time basis.
3.a.	Water	Two number of surface and ground water samples near the site	Once in 6 months	All the parameters as per IS 10500:2012 and IS 2296:1992
4	Sea water	One at nearest sea point	Once in 6 months	All the parameters as per IS: 3025 and APHA 23 rd Ed methods
5.	Vehicular Emissions	At site approach	Periodic monitoring of vehicles	Air emission and noise, PCU
6.	Solid waste	Municipal Solid and waste storage area	Twice in a month	Quantity
7.	Soil	Three locations (two within and one outside project site)	Once in 6 months	Physico chemical properties, Nutrients, Heavy metals
8.	Terrestrial and marine Ecology	Within 10km, around the project	Once in three years	Symptoms of injuries on plants
9.	Effluent	Existing ETP	Once in 6 months	All the parameters as per CPCB Norms

Table 6-2 Environmental Monitoring Programme Budget–Operation Phase

Area of Monitoring	Number of Sampling Stations	Frequency of Sampling	Rate per sample (INR)	Total cost / year (INR)
Ambient Air Quality	3 Stations (one in up wind and one in downwind and one at site)	Once in a month 24 hourly period	3000	108000
Noise	2 (one within site and one outside site)	Once in 3 months for 24 hours	1500	9000
VOC	4 on the corners of the tank farm area	Once in 6 months	1000	2000
Water	Two number of surface and ground water samples near the site	Once in 6 months	5000	40000
Sea water	One at nearest sea point	Once in 6 months	4000	8000
Solid waste	Municipal Solid and waste storage area	Twice in a month	600	14400
Soil	Three locations (two within and one outside project site)	Once in 6 months	5500	33000
Terrestrial and marine Ecology	Within 10km, around the project	Once in three years	6000	6000

CHAPTER 7

ADDITIONAL STUDIES

7 ADDITIONAL STUDIES

7.1 Public consultation

As per issued ToR vide File No:10/15/2024-IA.III dated 06.09.2024, Draft EIA report has been prepared and submitted to CPCB for Public Hearing (PH). After completion of Public Hearing, the Final EIA report along with action plan for commitment by the proponent will be submitted for further appraisal of the project and to obtain Environmental Clearance.

7.2 Fire Fighting System

Table 7-1 Fire Fighting System of existing and proposed

Details	Existing	Proposed
Fire Fighting System	1.Fire Fighting Facilities at Jetty • Fire Fighting Facilities as per OISD 156 • Engine driven Fire Fighting Pumps (3 Nos X 360 Cum per Hour and 3 Nos X 750 Cum per Hour) • Motor Driven Jockey pumps(2 x 25 M3 /Hour) • 4 Tower Monitors (2 x 360 M3/Hr & 2 x 180 M3/Hr) capable of fire fighting Jumbo Water Curtain to avoid heat in the Jetty area in case of fire in the Vessel 2.Fire Fighting Facilities at Storage Terminal • Fire fighting system designed as per OISD 117 norms • Fire Water Storage Capacity (2 X 4000 Cum per tank) • Fire Fighting Pumps(5 x 650 Cum per hour) • Foam System • Sprinkler Systems in tanks • Fire Extinguishers as per standard 3.Fire fighting's drawings –Attached as Annexure 7 and 8.	Nil

7.3 Risk Assessment Studies

Risk assessment report has been attached as **Annexure 14**

7.4 Emergency Response Plan

ERDMP acts as a substitute for maintaining good safety standards in the facility. The best way to protect against occurrence of major accidents is by maintaining very high levels of safety standards. The Present report is based on Petroleum and Natural Gas Regulatory Board PNGRB Notification Dated 18th January 2010.

The planning and response strategies for meeting the emergencies caused by major accidents are termed as Emergency Response & Disaster Management Plan (ERDMP). Generally, the following Phases are involved in ERDMP:

Hazard identification and Risk analysis:

An event with an imminent threat of turning into an accident must first be identified and risk associated with it must be observed.

Preventive measures:

Based on the evaluation of available information, a rapid analysis of the severity of the likely accident is done and the best course of action could be identified which would help in eliminating the causes which may lead to the spread of accident.

Preparedness measures:

Preparedness includes all activities necessary to ensure a high degree of readiness so that response to an incident would be swift and effective.

Response Procedures:

Action plan along with roles and responsibilities of employees and external authorities is incorporated in response procedures.

Recovery:

It contains those short and long-term activities, which return all systems to normal operation.

Clean-up and Disposal:

After the accident is effectively contained and controlled, the clean-up of the site of the accident and safe disposal of waste generated due to the accident are undertaken.

Documentation:

All aspects of accidents, including the way it started and progressed as well as the steps taken to contain and the extent of the damage and injury, must be documented for subsequent analysis of accident for prevention in future, damage estimation, insurance recovery and compensation payment. It may be noted that some aspects of documentation, such as, photographs of the site of accident and main objects involved in the accident, survey for damage estimation, etc. may have to be carried out before the clean-up and disposal phase. However, the effort in all cases is to recommence the operation as soon as possible. A detailed report is attached as **Annexure 9**.

7.5 Oil Spill Contingency Plan

- Conduct a spill risk assessment for the facilities and design, process, and utility systems to reduce the risk of major uncontained spills;

- Ensure adequate corrosion allowance for the lifetime of the facilities or installation of corrosion control and prevention systems in all pipelines, process equipment, and tanks;
- Install secondary containment around vessels and tanks to contain accidental releases;
- Install shutdown valves to allow early shutdown or isolation in the event of a spill;
- Develop automatic shutdown actions through an emergency shutdown system for significant spill scenarios so that the facility may be rapidly brought into a safe condition;
- Install leak detection systems
- Develop corrosion maintenance and monitoring programs to ensure the integrity of all field equipment. For pipelines, maintenance programs should include regular pigging to clean the pipeline, and intelligent pigging should be considered as required;
- Ensure adequate personnel training in oil spill prevention, containment, and response;
- Ensure spill response and containment equipment is deployed or available for a timely response
- In case there is a spillage, this will be properly collected in a collection tank & the sludge will be disposed to TSDF after drying.

A detailed report is attached as **Annexure 16**.

7.6 Social Impact Assessment R&R Action Plans

There is no R&R for the proposed operations.

CHAPTER 8

PROJECT BENEFITS

8 PROJECT BENEFITS

8.1 Improvements in the physical infrastructure

- Greater flexibility in terms of handling multiple products simultaneously
- Handling berthing of two smaller tankers simultaneously.
- The jetty can handle higher level of traffic with minimal waiting time for Tankers
- Customers can import/export in larger parcels and benefit from lower ocean freight
- Kamarajar Port is located very close to Manali Industrial Belt and the CPCL and hence can cater to the raw material & finished goods movement of the industries located in this area.

8.2 Improvements in the social infrastructure

- Chennai Port does not have storage facility for handling LPG. Also, there is no storage infrastructure for Class A/B products, which is forcing importers in the hinterland of Chennai to route their import through other ports such as Cochin and Mangalore. Ennore would therefore be an automatic choice for importers and exporters.
- Kamarajar Port is located on the international shipping route. Kamarajar Port is a major port of call for Products, chemicals and vegetable oil tankers. Hence, Ennore is an ideal port of call for ships from the west and from Singapore, Malaysia, Korea and other far-east countries.
- In the long run, the Port would benefit from higher traffic and hence higher revenues

8.3 Employment potential - skilled, Semi- skilled, Un-skilled

The project has a potential to generate employment for unskilled, semi-skilled and skilled manpower

8.4 Other Tangible Benefits

- Both, State Government and Government of India would be benefited.
- Government will earn huge revenue by way of various taxes and levies and transportation through sea route.

CHAPTER 9

ENVIRONMENTAL COST BENEFIT ANALYSIS

9 ENVIRONMENTAL COST BENEFIT ANALYSIS

(Not recommended during scoping stage)

CHAPTER 10

ENVIRONMENTAL MANAGEMENT PLAN

10 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

10.1 Description of the administrative aspects of ensuring that mitigative measures are implemented and their effectiveness monitored

Environmental Management Plan is a plan or programme that seeks to achieve a required end state and describes how activities that have or could have an adverse impact on the environment, will be mitigated, controlled, and monitored.

The EMP will address the environmental impacts during the design, construction and operational phases of a project. Due regard must be given to environmental protection during the entire project. In order to achieve this number of environmental specifications/ recommendations are made. These are aimed at ensuring that the contractor maintains adequate control over the project in order to:

- Minimize the extent of impact during expansion.
- Ensure appropriate restoration of areas affected by expansion.
- Prevent long term environmental degradation.

10.2 Objectives of EMP

As far as this project concerned, EMP covers the likely impact due to the existing activities and the proposed enhancement – Increased material transfer and increased traffic-as well.

EMP ensures that the best available technology is used for the above activities and environmental protection. Effluent waste generated will be collected, handled and disposed as per the standard practice to minimize potential impacts. Resources like water and chemical are used in a way to reduce overall burden on the environment.

10.3 Health, Safety and Environmental Protection

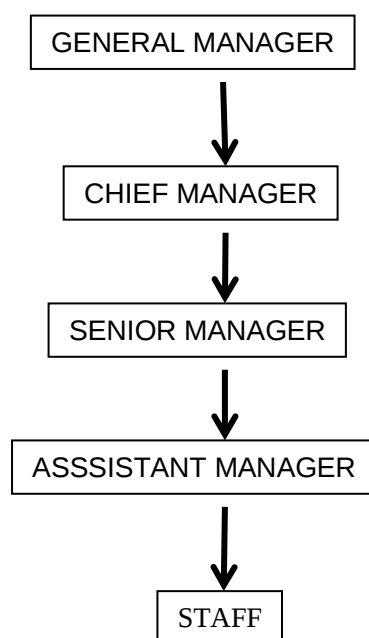
The tank terminal is designed, constructed and equipped with facilities to ensure high level of HSE standards:

- Environmental Clearance granted by the Ministry of Environment and Forests
- Tank Terminal Layout as per OISD norms
- Tanks construction - API 650 & API 620 as applicable
- Tank Terminal Licensed by the Chief Controller of Explosives for storing Class A/B/C products
- Fire Protection System as per OISD
- Cooling water spray system on tanks
- Oil Water Separator
- Effluent Treatment Plant
- Slop Tanks
- Green Belt

10.4 EMP roles and responsibilities

10.4.1 Environmental Management Cell (EMC) of ETTPL

- Each industry should identify within its setup a Department/ Section/ Cell with trained personnel to take up the model responsibility of environmental management as required for planning and implementation of the projects.
- Environmental Cell consisting of General Manager and Chief Manager will be created for efficient management of the environmental activities in the industry.
- The EMC will handle all issues related to different environmental attributes; it will be responsible for overall environmental and social management in project undertaken from investigation level to execution at project level.
- The EMC will be responsible for the technical planning, implementation and monitoring of all environmental mitigation and compensation measures.



This section describes the organizational structure and responsibilities for implementation of the EMP. General Manager of the facility will be responsible for total environmental management.

10.5 EMP for operation phase

10.5.1 Air Quality

Following measures will be adopted to mitigate the impacts of pollutants on the ambient air quality:

No increase in the existing concentrations of air pollutants is expected as the project does not involve any production activity but only Enhancement of the Capacity of the MLT through Augmentation of Existing Facilities

- Concentrations of pollutants in ambient air is expected to remain within the stipulated standards.

APC measures provided are summarized

Details	Capacity	APC	Stack Height(m)
DG Sets (Power kVA)	180 x 1 No.s 250 x 1 No.s 500 x 2 No.s	Nil	6 m AGL

Following measures can be adopted to mitigate the impacts of pollutants on the ambient air quality:

- Vehicular speed will be limited to 20km/hr on areas of unconsolidated or unsealed soil associated with the immediate site work.

Odour control

- No odour / dust will be released while handling materials including sewage and waste.
- Leak detection equipments are installed wherever necessary.

10.5.2 Noise environment

- In addition to the existing machineries, DG and Vehicle/Equipment movement is the primary source of Noise pollution.
- Operation involves transfer of product producing negligible noise or vibration.
- The major source of noise pollution is DG set, compressors and air pumps. Maximum Care will be taken to reduce the noise generation during operation.
- The DG set room, compressors and pump room will be isolated from the outside environment and proper acoustic arrangements will be made to control the noise generated.
- Use of well-maintained machinery and vehicles could considerably help in this matter.
- To prevent the hearing damage to the workers, they will be provided with ear plugs and muffs and job rotation will also be practiced.
- All efforts will be made to maintain the noise level within the proposed premises around 50 dB (A) in day time & 40 dB (A) during night time.

10.5.3 Water and wastewater Management

During operation phase, water requirement of proposed project will be mainly for domestic use, greenbelt, etc. The required water quantity is met from water treatment plant. Hence, no significant impacts are envisaged on the water supply in the region. The treated wastewater will be reused in the green belt areas to reduce the water requirements. Details of water requirement given in **Table 2-17**. Total water Requirement is 15 KLD during Operation phase after expansion to 6 MMTPA.

- Sewage generated is 3.3 KLD during operation phase.
- The domestic waste water generated during operation phase will be routed to the proposed STP. Effluent generated will be treated through existing ETP.

10.5.4 Rainwater Harvesting

The Port has Rainwater Harvesting System in its Administrative Building consists of Open well. The details of the same are furnished herewith as below:

- Submerged RCC ring of diameter 3'- 0" into a pit of 3 m depth.
- Filter chamber of size 0.6 x 0.6 x 0.9 m in brickwork CM 1:5.
- River sand to a depth of 0.15 m • Pebbles to a depth of 0.15 m
- Nylon mesh between river sand and Pebble stone.
- PVC pipes of 110 mm dia connecting terrace, well and filter chamber have been laid.

10.5.5 Solid and hazardous waste management

In India, the average waste generated per capita per day is considered as 425 g (dry weight). This waste will not be allowed to dump into nearby surface water body or stream. The collection, transportation and disposal of the solid waste generated during the operation phase of the proposed project will be done as per the Municipal Solid Wastes (Management & Handling) Rules, 2000 (MSW Rules). These generated solid wastes will be first segregated as plastic, glass, paper and other waste separately and disposed off as per MSW Rule, 2000. The organic waste generated during operation phase will be sent to panchayat bins.

The hazardous waste generated from the process is Used or spent oil only. Hazardous waste materials will be properly disposed as per the Hazardous and Other Wastes (Management and Transboundary Movement) Rules 1989 and subsequent amendment in 2016.

10.5.6 Land environment

Following measures are proposed to mitigate negative impact during operational phase of the project on the land environment.

- Air emissions will be effectively controlled and therefore deposition of air pollutants in and around the premises and surrounding area is not envisaged.
- Solid waste generated will be stored in adequate bins and disposed through Authorized Vendors.
- Sewage will be disposed through Proposed STP.
- Hazardous materials will be prohibited to be drained or dumped in the premises. Accidental spills shall be cleaned, reported and monitored.
- Thus, no impact on land is envisaged due to discharge of gaseous emission, solid waste or liquid effluent from the proposed project.

10.5.7 Ecology

There is no potential source of impact on terrestrial biology during the operational phase.

10.5.8 Socio Economic Environment

Actual requirements of manpower/employment opportunities will be provided. This project is mainly to products through pipeline. Thus indirect beneficial impacts are anticipated.

10.6 Fire protection system

10.6.1 Jetty

This jetty is fully equipped with fire fighting facility as per OISD 156 norms.

- Engine driven Fire Fighting Pumps(3 Nos X 360 Cum per Hour3 Nos X 750 Cum per Hour)
- Motor Driven Jockey pumps(2 x 25 M3 /Hour)
- Tower Monitors (2 x 360 M3/Hr & 2 x 180 M3/Hr) capable of fire fighting
- Jumbo Water Curtain to avoid heat in the Jetty area in case of fire in the Vessel

The fire fighting layout is attached as **Annexure 7**

10.6.2 Pipeline Trestle and Tank Farm

An Approach Trestle is connecting the jetty head from NBW and fire pump room. . The Tank Farm Fire Fighting system has been designed as per OISD 117 consisting of Hydrant System, Medium Velocity Spray System & Foam System. The detailed design & drawings for the Fire Fighting System are attached as **Annexure 4**.

10.6.3 Storage Terminal

- Fire fighting system designed as per OISD 117 norms
- Fire Water Storage Capacity (2 X 4000 Cum per tank)
- Fire Fighting Pumps(5 x 650 Cum per hour)
- Foam System
- Sprinkler Systems in tanks
- Fire Extinguishers as per standard

10.7 Occupational Health and Safety program

ETTPL will provide a safe and healthy work environment to its employees by conducting annual medical check-ups for all the employees. The main objectives are

1. Maintenance and promotion of workers' health and working capacity.
2. Improvement of working environment by following well-being program for its employees.
3. Monitor the workplace to maintain industrial hygiene practices.
4. Development of work culture in a direction which will support health and safety at work and thereby promoting positive social climate for smooth operation that will enhance productivity.
5. Area monitoring is done.
6. Employees undergo annual health check-up.

7. All personnel will be provided with personal protective equipments individually as required.

10.7.1 Operational phase

General functions of the safety committee will be;

1. Conduct routine workplace inspections.
2. Provide Personal Protective Equipment.
3. Develop and implement safe work procedures and rules.
4. Provide on-going safety training & Enforce safety rules and appropriate discipline.
5. Promote safety awareness and reduce the potential for injury/loss.
6. Identify workplace hazards.
7. Enforce of safety rules, measure safety performance & reduce frequency/severity of injuries

10.8 Decommissioning and restoration plan

Not applicable

10.9 Occupational Health Monitoring

10.9.1 Medical Surveillance Program:

Medical surveillance program is essential to assess and monitor employees health and fitness both prior to employment and during the course of work; to determine fitness for duty and to provide emergency and other treatment as needed. Effectiveness of a medical program depends on active involvement of employees. ETTPPL has medical surveillance program which include the following major elements;

1. Developing an OH-IH Medical Surveillance Program.
2. Pre-Employment Examination and Periodic Medical Examinations.
3. Determination of Fitness for Duty.
4. Communications.
5. Emergency Medical Treatment.
6. Medical Records.

Pre-Employment Screening / Examinations - All employees (Contact & Permanent) will be subjected to pre-placement medical examinations to determine their fitness for the jobs on site. Potential exposures to the work environment will be considered before placing an employee on the job.

Periodic Medical Examinations - Periodic medical examination is the same as the pre-employment screening and may be modified according to current conditions, such as changes in the employee's symptoms, site hazards or exposures.

Comparison of sequential medical reports with baseline data is essential to determine biologic trends that may mark early signs of adverse health effects, and thereby facilitate appropriate protective measures. The frequency and

content of examinations are normally one year. Apart from this for workers working in Hazardous area, medical examination is conducted by Doctor Authorized by Factory Inspectorate.

10.10 Corporate Social Responsibility (CSR)

- Kamarajar Port consistently strive to meet the expectations of the society by supporting initiatives for improving infrastructure/quality of life of society/ community without compromising on ecological issues on sustainable basis consistent with the CSR provisions of the Companies Act, 2013; Schedule VII of the Companies Act, 2013.
- The CSR activities of the port during last five FYs are follows.

Financial Year	Amount spent in Crores.(Rs.)
2019-20	8.11
2020-21	8.27
2021-22	5.57
2022-23	9.85
2023-24 (Budgeted)	9.06

- Besides the expenditure incurred by KPL, the terminal operator M/s. Ennore Tank Terminals Pvt. Ltd., is also planned the certain infrastructure creation activities under CSR as below.
- The Terminal operator has planned the following infrastructure creation activities for the FYs 2024-25 & 2025-26.

Sr.No	CSR activity	Amount in Lakhs
1	Providing Bench and Table furniture to Government High School	8
2	Providing sanitation facilities to nearby Government schools	8
Total		16

Corporate Environmental Responsibility (CER)

Kamarajar Port has incurred an amount of Rs.1.68 Crores under Corporate Environmental Responsibility for development drinking water supply and sanitation facilities in the vicinity of the Port. Besides KPL, the terminal operator ETTPL also incurs the funds under CER and CSR activities.

10.11 EMP Budget

Environmental Management Expenditure

Port and its BOT Operators are continuously incurring the expenditure for the better environmental management with regard to Solid Waste management, Consent Management, Environmental Monitoring, Horticulture Development, O&M of STPs and ETPs. The expenditure incurred during the last five years is as below.

S. No	Year	Planned Expenditure	Actual Expenditure in Rs.
1	2021-22	1,10,00,00	1,07,33,263
2	2022-23	1,40,00,000	1,56,12,772
3	2023-24	1,40,00,000	1,37,75,462
4	2024-25	1,50,00,000	Planned.

Besides the above expenditure, the terminal operator ETTPL has planned the below expenditure for execution of environmental management plan of the terminal. The budget will give overall proposed investment on the environmental safeguards for successful monitoring and implementation of control measures. The EMP budget has been prepared considering the following phases of the project. The detailed cost break-up for each well is given in **Table 10-1**.

Table 10-1 Cost for Environmental Protection Measures

S. No	Component	Capital cost Rs.(lakh) (2024-25)	Recurring cost Rs.(lakhs) per Annum (2024-25)
1	Hazardous waste Management	0	15
2	Greenbelt Development	20.84	2.5
3	Environmental monitoring	0	2.5
4	STP of 6 KLD	15	1.5
5	ETP of 20 KLD with UF and UV	0	4
6	Total	35.84	25.5

Planned Expenditure by the Terminal Operator for upgradation of OSR, Fire fighting facilities & green belt

Besides the EMP, CSR and CER expenditure, the terminal operator M/s.ETTPL has planned the following expenditure during the FY 2024-25 for upgradation of OSR, Fire fighting facilities & enhancement of green belt as below.

S.No	Activity	Cost in Lakhs (Rs.)		
		2023-24	2024-25	2025-26
1	Upgradation of- OSR facilities	4.9	5.9	6.4
2	Development of green belt	12.6	17.61	16.8
3	Terminal Fire Fighting System Upgradation	195	500	700
Total		212.50	523.51	723.20
		1459.21		

CHAPTER 11

SUMMARY AND CONCLUSION

11 Summary and Conclusion

11.1 About Project proponent

In 2014, the Ennore Port Ltd. was officially renamed as Kamarajar Port Ltd., originally conceived as a satellite port to the Chennai Port, primarily to handle thermal coal to meet the requirement of Tamil Nadu Electricity Board (TNEB), and was endowed with large chunks of land (about 2,000 acres). The scope was expanded taking into consideration of subsequent developments such as the plan of Government of Tamil Nadu to setup an 1,880 MW LNG power project in association with a private consortium, a large petrochemical park commissioned on 1st February 2001 and a naphtha cracker plant. The port was set up under the Companies Act, keeping it outside the scope of the Tariff Authority for Major Ports, the tariff regulator for 11 of the 12 ports owned by the Indian government. The first phase of the port consisted of two berths for handling coal vessels up to 65,000 DWT, dredging for the approach channel and harbour basin, onshore civil works, navigational aids, and two breakwaters—4 km in the north side and 1 km in the south—close to the NCTPS (North Chennai Thermal Power Station) and the Ennore Creek. The port subsequently acquired additional 440 hectares of land for future expansions.

Ennore Tank Terminals Pvt. Ltd. is a subsidiary of IMC Limited, the largest independent Bulk Liquid Storage Company in India. IMC is in the business of port-based bulk liquid storage and international trading for the last seven decades. India's first independent Bulk Liquid Terminal Project to be developed on BOT basis at a Major Port Promoted by IMC, India's largest independent bulk liquid storage company. Berthing Facility for petroleum, LPG, chemical, gas and vegetable oil tankers. Multiple Pipelines for transfer of cargo between vessel and shore tanks. Storage Tanks inside the port premises – 2,56,636 KL storage capacity for petroleum, chemicals and safe class cargo. Jetty and Storage Tank terminal were fully operational

11.2 Advantages of MLT:

- Offers state-of-the-art facilities with minimal or nil waiting time for vessels.
- Berthing of large product tanker and very large Gas carrier (LPG)
- Simultaneous berthing of two vessels
- Multiple pipelines for simultaneous discharge of cargoes
- Large pipelines for faster vessel evacuation and loading
- Scope for adding pipelines
- Special facilities such as inert gas blanketing, heating, refrigeration, coated tanks, stainless steel tanks shall be provided on specific request
- Availability of Slop Tanks

11.3 Overall justification for implementation of the project

Further, recently customers evinced interest to discharge multiple products from one or more vessels simultaneously to improve overall turnaround time of the vessels and also intend to increase the throughput

volumes through ETTPL to cater to the increased market demand. To facilitate this, ETTPL is planning to augment its throughput capacity from 3 MMTPA to 6 MMTPA.

This additional throughput capacity will have the following advantages:

1. Greater flexibility in terms of handling multiple products simultaneously
2. Handling berthing of two smaller tankers simultaneously.
3. The jetty can handle higher level of traffic with minimal waiting time for Tankers
4. Customers can import/export in larger parcels and benefit from lower ocean freight
5. Help the customers to meet the increased market requirements with higher volumes.
6. In the long run, the Port would benefit from higher traffic and hence higher revenues
7. This will function as the major hub in the east coast for petroleum products, LPG and also petro chemicals catering to the entire hinterland of north TN, south AP and Karnataka.

Table 11-1 Impact and Mitigation measure of Project Site

S.No	Environment	Impact	Mitigation Measure
1.	Air	The major air pollution source is the DG set which emits flue gases containing Suspended Particulate Matters, Oxides of Sulphur and Nitrogen that may affect the ground level concentrations.	The DG set will be provided with stacks of adequate height so as to disperse the emanating flue gases containing Suspended Particulate Matters, Oxides of Sulphur and Nitrogen without affecting the ground level concentrations.
		Combustion process such as diesel engines	Maintenance of diesel power generators to achieve efficient combustion, fuel efficiency and therefore reduce emissions
		Air born particulates from soil disturbance during construction and from vehicle traffic such as trucks and trailers	Adequate sprinkling of water on soil surface will be carried out. Vehicle, equipment and machinery used would conform to applicable emission norms;
2.	Noise	The increase in the noise level may be due to : 1. DG set 2. Vehicular movement for construction material conveyance	Adoption of Acoustic enclosure and provision of adequate protective equipment like ear plugs, ear muffs, noise helmets etc., to the workers. Periodic maintenance of the construction machinery and transportation vehicles will be undertaken to reduce the

			noise impacts. Workers participating in construction operations in the region generating excessive levels of noise shall be supplied with personal protection equipment(PPE), promoting education and public awareness, and exposure control through work rotation.
3.	Land	No land use pattern will be affected	All the Solid and Hazardous waste like spent oil is being disposed as per Hazardous and other wastes Amendment Rules, 2016. Hence, there will be no discharge on land premises
4.	Water	The untreated wastewater if discharged into nearby surface water may affect the surface water and/or if disposed of on land without treatment may pollute the ground and surface water. The other impact is water pollution due to disposal of rejects into the sea.	STP has been installed to treat the generated sewage. Treated sewage is reused for flushing and green belt development. Appropriate drainage facilities have been developed within the site including proper disposal to drains.
5.	MSW	If the solid waste generated is not properly managed and disposed in unauthorised manner, it will impact on soil quality, groundwater and air quality.	The Source of Municipal waste will be from the domestic use and strict guidelines will be put in place in order to manage the solid waste generation during

			Operation phase will be segregated to organic and inorganic wastes. The organic waste will be disposed through village bins and inorganic waste will be sold to authorized vendors. Hazardous waste generated will be stored in a separate hazardous waste storage area and properly disposed as per the Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2016.
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11.4 Conclusion

The baseline study carried out for the study area indicates that all the physical, chemical and biological characteristics of the environmental attributes in the surrounding area are well within the permissible limits.

Based on this environmental assessment, the possible impacts during both pre-project and post-project phase are anticipated and the necessary adequate control measures are formulated to meet the statutory compliances.

With very less negative impacts, the project positively leads to commercial business opportunities, employment opportunities, increased revenue and infrastructural development.

CHAPTER 12

DISCLOSURE OF CONSULTANT

12 Disclosure of Consultant

In order to assess the potential environmental impacts due to the “Capacity Augmentation of existing operational Marine Liquid Terminal (MLT) from 3 MMTPA TO 6 MMTPA at Kamarajar Port Limited, Chennai” by M/s. Kamarajar Port Limited, engaged M/s. Hubert Enviro Care Systems (P) Limited, Chennai to undertake EIA study. The nature of consultancy service rendered covers terrestrial and Marine environmental assessment.

12.1 Brief Profile of Hubert Enviro Care Systems (P) Limited (HECS)

HECS is a total Environmental management company which provides Environmental consultancy services, Analytical testing services, turnkey solutions and Operation-Maintenance services for water and wastewater facilities.

The company provides solutions to several industries like Refineries, Thermal Power Plant, Pharma, R&D Facilities, Electroplating and Manufacturing, IT Parks, Residential Complexes, Mines, Dairies, Food Processing, Textile mills, Breweries, etc.

The company is specialized in executing projects right from concept development, supply, erection, commissioning and operation on turnkey basis. HECS has successfully executed more than 300 environmental engineering projects for various industrial sectors both in India and overseas.

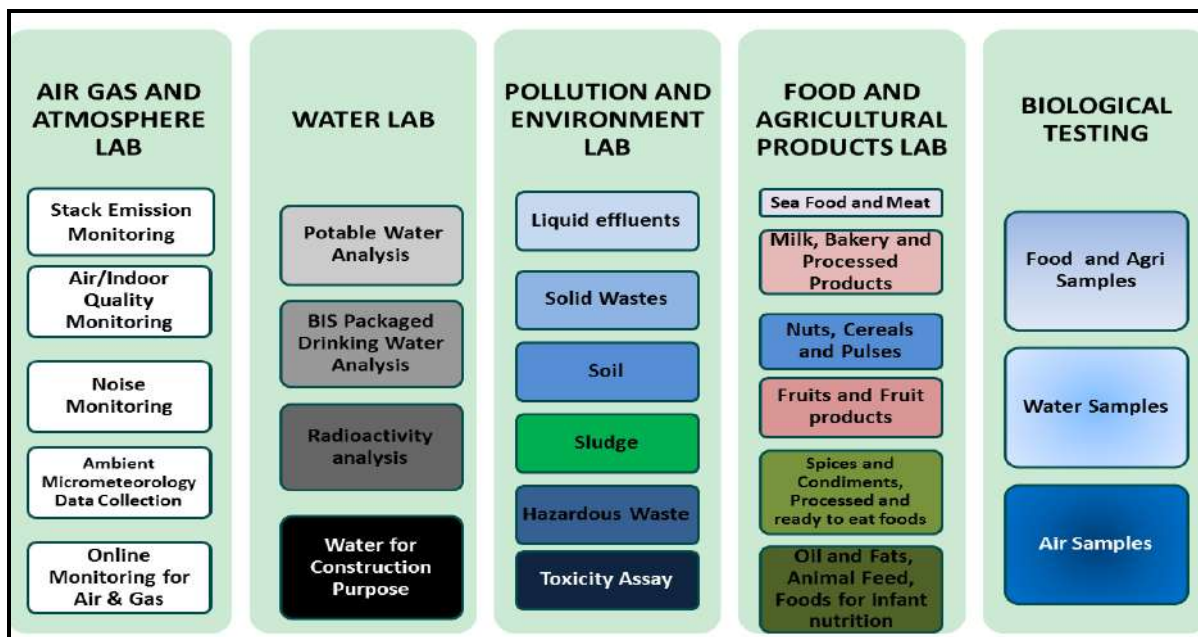
12.2 Consultancy Profile

- ✚ HECS is accredited by QCI-NABET
- ✚ An approved consultant for carryout EIA studies across India
- ✚ India's leading multidisciplinary Environmental Consultancy organization
- ✚ HECS- Consultancy division comprises of technical skilled and competent Team of 40 people. The team consists of Three Doctorates & about thirty postgraduates
- ✚ HECS has industry specific prominent expert to provide solutions & recommendations
- ✚ Serving client more than 25 years & pan India presence in the following sectors:
 - Environmental Clearance
 - Coastal Regulation Zone
 - Risk Assessment, DMP, HAZOP studies
 - Feasibility/ treatability studies
 - Due diligence studies
 - Ground water Clearance
 - DISH, PESO and other statutory approvals
 - Consent to Establish, Consent to Operate
 - Hazardous waste, bio medical waste authorization



- Other environmental approvals

Has an in-house laboratory wherein the following activities are being carried out:



QCI – NABET Accreditation

Consultancy	Hubert Enviro Care Systems (P) Ltd., Chennai
NABET Certificate No	NABET/ EIA/24-27/ RA 0335 Valid up to 31.03.2027
MoEF Reg. Lab	Lb/99/7/2021-INST LAB-HO-CPCB-HO/Pvt./8984 Dated 29.01.2024

National Accreditation Board for Education & Training (NABET) is a constituent board of the Quality Council of India (QCI). QCI, NABET has accredited HECS for carrying out Category ‘A & Category B’ EIA studies in the following sectors:




National Accreditation Board for Education and Training

Certificate of Accreditation

Hubert Enviro Care Systems, Chennai

A-21, III Phase, Thiru Vi Ka Industrial Estate- 600032

The organization is accredited as **Category-A** under the QCI-NABET Scheme for Accreditation of EIA Consultant Organization, Version 3: for preparing EIA/EMP reports in the following Sectors-

S.No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1.	Mining of minerals including opencast / underground mining	1	1 (a) (i)	A
2.	Offshore and onshore oil and gas exploration, development & production	2	1 (b)	A
3.	River Valley projects	3	1 (c)	A
4.	Thermal power plants	4	1 (d)	A
5.	Mineral beneficiation	7	2 (b)	A
6.	Metallurgical industries (ferrous & non-ferrous)	8	3 (a)	A
7.	Cement plants	9	3 (b)	A
8.	Petroleum refining industry	10	4 (a)	A
9.	Pesticides industry and pesticide specific intermediates (excluding formulations)	17	5 (b)	A
10.	Petro-chemical complexes	18	5 (c)	A
11.	Petrochemical based processing	20	5 (e)	A
12.	Synthetic organic chemicals industry	21	5 (f)	A
13.	Industrial estates/ parks/ complexes/areas, export processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes	31	7 (c)	A
14.	Bio-medical waste treatment facilities	32A	7(d a)	B
15.	Ports, harbours, break waters and dredging	33	7 (e)	A
16.	Highways,	34	7 (f)	B
17.	Common Effluent Treatment Plants (CETPs)	36	7 (h)	B
18.	Common Municipal Solid Waste Management Facility (CMSWMF)	37	7 (i)	B
19.	Building and construction projects	38	8 (a)	B
20.	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RAAC minutes dated May 31, 2024, posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no QCI/NABET/ENV/ACO/24/3292 dated June 25, 2024. The accreditation needs to be renewed before the expiry date by Hubert Enviro Care Systems, Chennai following due process of assessment.

Issue Date
June 25, 2024



Mr. Ajay Kumar Jha
(Sr. Director, NABET)



Valid up to
March 31, 2027



Prof (Dr) Varinder S Kanwar
(CEO- NABET)

Certificate No.
NABET/EIA/24-27/RA 0335

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.

Further details may be seen on the following URL: www.hecs.in